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Francesco Alberti · Abraham R. Matamanda · Bao-Jie He · Adriana Galderisi · Marzena Smol · Paola Gallo *Editors*

Urban and Transit Planning

City Planning: Urbanization and Circular Development

Third Edition

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Preface

It is now 50 years since the first world Earth Summit held in Stockholm (1972) and 30 years since the Rio de Janeiro Conference on Environment and Development (1992), whose Declarations played a crucial role in shaping global awareness of sustainability issues and the risks associated with an extractive model of economic development that irreversibly impacts the environment and climate balance of our planet. The notion of sustainable development, i.e., an alternative model of development that integrates the economic dimension with the environmental and social dimensions, and "meets the needs of the present without compromising the ability of future generations to meet their own needs", was formulated and disseminated worldwide by the Brundtland Report *Our Common Future,* published by the UN Commission on Environment and Development some 35 years ago (1987). Starting from these cornerstones, the scientific debate and the political initiatives taken at various levels—international, national, and regional—have been highly articulated and enriched over time with a growing involvement of the media, public opinion, and, recently, a strong assumption of responsibility by the youngest (the "future generations" who have meanwhile been born and clearly see the threats to their future), claiming that these challenges are translated into concrete actions and policies to correct the course followed so far since the Industrial Revolution. And it is in fact to the pre-industrial era that the Paris Agreement (2016) refers in defining as a virtuous target a limit of the global average temperature increase to 1.5° by the end of the current century. An ambitious target (which in any case will not prevent serious consequences on territories and populations worldwide) to be pursued through national and transnational strategies of ecological transition of settlements, economic activities in all sectors (starting with energy production), mobility, and transport (from urban to intercontinental).

As we said, much progress has been made, with peaks of innovation that would bring immediate benefits in many decisive fields, if they became the current standard. But we cannot deny that over the last 50 or 30 years, the awareness of the risks we face has had very little impact on the development trajectories of both the most industrialized and emerging countries. And cities, even those that have developed the most in recent years, are far from achieving the targets set by UN Sustainable Development Goal No. 11—"Sustainable Cities and Communities". Not to mention mobility models, which in developing countries, where the demand for the transport of people and goods increases year after year at the highest rate, usually follow the bad examples of richer countries instead of exploring new, more sustainable paths. This confirms Enrique Peñalosa's remark: "Transport differs from other problems developing societies face, because it gets worse rather than better with economic development. While sanitation, education, and other challenges improve with economic growth, transport gets worse".

So, with each passing day, the challenge for a more sustainable future, instead of diminishing with the accumulated knowledge and awareness becomes greater. There is only one way to face it and make up for past and present mistakes: increase studies, spread knowledge, and good practices, so that they can take root faster. This is the mission that this publication and the series of which it is a part seek to respond to. The selected papers that form the chapters of the book constitute a small but significant repertoire of the best that is being done or could be done in the fields of urban and transport planning.

I sincerely thank all the authors, who, from different corners of the world, share the responsibility to ensure that the 50 years path toward a paradigm shift in our way of being-in-the-world continues, accelerates, and involves more and more fellow travelers, until it becomes a common path.

Florence, Italy Francesco Alberti

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Towards Adaptive Planning of Urban Spaces in the Context of a New Agile Urbanism

Edith Schwimmer and Claudius Schaufler

Abstract

In the face of the COVID-19 pandemic, regulative measures and the consequent change in behavioral patterns had a tremendous effect on the use of urban public spaces. The health crisis has emphasized the shortcomings of traditional urban bureaucracies in terms of their ability to react to a quickly changing satiation, while also demonstrating the potential of supporting change through temporary interventions. Experiments like pop-up bike lanes and additional space for gastronomy have shown the ability of municipalities to adapt to changing conditions. Although such short-term interventions can be performed quickly and with minimal costs, in a normal state of affairs municipalities typically struggle to open public spaces to such adaptive concepts. We argue that removing or adding space for certain uses will be an essential part of future urban planning, temporarily changing functions and infrastructural constellations to cope with ever changing environments. According to (Swilling, Social Dynamics 37:78–95, 2011), there are five different concepts of urbanism, describing different configurations of a city's infrastructures. Ranging from the concept of car-oriented urbanism (splintered) to a more modern understanding of cities as ecosystems (green urbanism) and human-centered urban planning (livable urbanism), Swilling's categorization shall be used to identify further aspects of a new concept we introduce as agile urbanism. Therefore, best practices from ongoing projects are taken into account to evaluate potential measures that are effective in establishing more flexible planning procedures. The considered projects comprise living labs and undertaken interventions in a variety of urban contexts. The research questions thereby are: How can municipal planning departments react to short-term changes in the urban flow of people? What kind of processes work in adapting urban space allocation? How can planning procedures be adjusted to cope with the fast-changing use of infrastructures? The application of tactical urbanism and the establishment of living labs are possible municipal instruments to support adaptive planning of urban space.

Keywords

Agile urbanism • Liveable urbanism • Adaptive urban space • City planning

1 Introduction

Urban systems are highly complex and owned to that high complexity, planning cycles for urban development are very long. For example, the spread of the automobile in the early twentieth century pushed the urban infrastructures at the time to their limits. The roads were designed for mixed traffic of pedestrians, cyclists, and carriages. As cars became the most dominant mode of transport with significantly higher speeds and the consequent risk of traffic fatalities, it became clear that a partition of the road surfaces had to take place. Hence, car-centric urban planning became the most prominent paradigm of urban redevelopment in the 1960s and 1970s. Several decades passed before the urban infrastructure in Germany adapted to technological developments (Diemer et al., 2020). A similar reorientation of public space could occur in the wake of the COVID-19 pandemic. The shift to more flexible working arrangements, the reduction of permanent workplaces, and the establishment of co-working spaces will also have an impact on the needs of urban residents. As a result, the necessity for a change in urban structure will be inevitable. There could be devastating

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impacts in the urban environment if urban infrastructure adjustments take decades to rearrange to new urban challenges again. The municipalities must start to consider a more dynamic and agile urban planning and shorter iteration cycles to preserve and improve the livability of cities. Especially car-centered cities, such as Stuttgart in Germany, should start acting now. Considering the development of autonomous and shared driving the demand for parking lots will decrease enormously. The areas liberated from the parking spaces can have a high potential to be utilized for other functions with broader social, economic, and environmental benefits. For example, the areas could be used for recreation but also for communication and information, including virtual tools, thus initiating a vibrant urban society (Braun et al., 2019).

2 Different Types of Urbanism and Their Expansion

To understand the need of establishing a new urbanism, the categroization by Swilling (2011) of five urbanism concepts is explained first. The different types describe various configurations of a city`s infrastructure, ranging from (1) inclusive urbanism, to car-centered cities, referred to as (2) splintered urbanism; (3) slum urbanism; (4) green urbanism; and (5) liveable, human-centered urbansim. Inclusive urbanism was first established during the victorian era and was characterized by the underlying goal of making infrastrucutre services accessible to everyone. Due to high maintenance costs and ecologically questionable consumption of ressources, inclusive urbanism found its end as a planning principle in the late 1960s. But the idea of infrastructure for everybody continues to exist. The urbanism following is splintered urbanism, which is known for a car-centered and informational city system. Urban infrastructure is undergoing extensive commercialization, with state-funded infrastructure being sold to private investors at low prices in recent decades. Private investors started building high-tech infrastructure and connecting cities globally. It was the beginning of innovation and decentralized solutions within the urban ecosystem. Whereas slum urbanism has his own structure, or rather no structure in comparison to other forms of urbanism. In 2014, every third urban resident lived in slums. Unlike other forms of urbanism, where access for all has been a central principle of planning, slum urbanism is a silent intervention by the poorer residents that is consolidated over the years and doesn't follow any planning principles. Starting in the early 2000s, the green urbanism became more and more established. Energy-efficient renovation of existing buildings was started, and investments were also made in renewable energies. Furthermore, an expansion of local and long-distance public transport was planned in large cities. It is an attempt to green up the established splintered urbanism and make it more sustainable. Based on the four urbanisms described, Swilling has called for the launch of a new form of urbanism, the liveable urbanism. Liveable urbansim encourages the poor to be part of the city through including them in new ways of production and consumption, such as local food production and direct sale opportunities to the customer without intermediaries (Swilling, 2011). In this paper not only the forms of urbansim help to understand the need of a new form of planning, but also the types of urban expansions are taken into account.

Urbanization is one of the megatrends of the twenty-first century that is influencing both policy and economic discourses. Although most of the political interests and goals lie in the future, it is essentially important to understand the rich history of cities, in which ways they evolved and what kind of reasons led to the urban design that can be found today.

One such model on different patterns of urbanization was developed by Forman (Forman, 2008) who studied 38 small-to-large cities worldwide, resulting in a diverse set of different types of urban expansion. Depending on speed, shape and direction, proximity to the core of the city, and development along transport routes, the model provides five types of urban outward expansion (Forman, 2014) (Fig. 1):

- **Bulges**: Urbanization in planned or unplanned patches at the urban fringe, in different directions.
- **Concentric rings**: Growth occurs at equal rates in all directions.

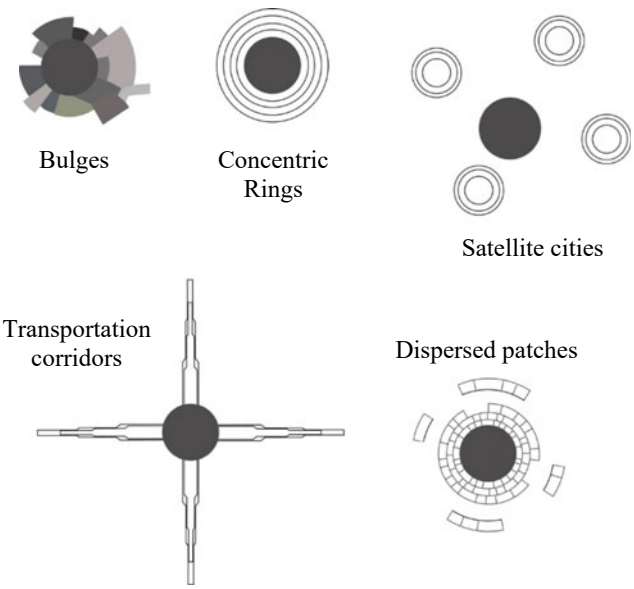

Fig. 1 Five types of urban expansion, own illustration. *Data source* Forman (2014)

- **Satellite cities**: A few satellite cities grow apart the fringe of the city, separated from the urban core.
- **Transportation corridors**: Urbanization follows transportation routes, like railway lines, forming ribbon development along defined corridors.
- **Dispersed patches**: Separate small sites sprawl around the urban fringe, in increasing distance to the center.

In reality, cities are never just tied to one of the five types of expansion, they rather expand in different ways over time. London, for instance, grew in bulges from the medieval time to 1830 (Forman, 2014). Later on, since about 1980, suburbanization lead to a more dispersed growth pattern due to the need for residential areas for recreation that were developed far from where jobs are located. In the meantime, further business districts, like Canary Wharf or Croydon, were built as satellites for large-scale office space without any mixed uses. When it comes to sustainability, Forman (2014) also used 14 environmentally related variables to measure the impact of the four different types of expansion on nature. Compared to the transportation corridor and dispersed patch types of expansion, concentric rings turned out to have a much lower impact on the environment due to their dense design and short distances between work, mostly based in the center, and leisure activities. Based on those findings, Forman (Forman, 2014) recommends to turn away from the currently predominant pattern of dispersed patches towards denser, concentric developments around the urban core, actively limiting outward sprawl.

To achieve this, having a look back in the past can help to understand the long-lasting changes and urban infrastructure problems. Slight changes years ago can have an huge impact in the present. One issue can lead to very diverse effects in the future, these are usually not predictable and are often viewed differently from the present than they then developed (Urry, 2008). Failure to consider potential developments and their impact on the urban ecosystem can throw it out of balance several years later and make efficient and agile urban planning complicated.

So there might be some interventions that may change the system rapidly but there will also be others which just bounce back to the niche level. One of the most popular examples of the impact of technologies on urban development is the evolution of the car. Cars, which ran on petrol, were originally developed for only a small number of vehicles, but demand grew and so the original small-scale production increased and had a major impact on urban infrastructure to date. But with a petrol-ran car further related actions in other industries started, and thus the path dependency rose and became continuously more complex. This clarifies that it is not the invention of the car that has caused this development to car-centered cities, but mainly the required supply system that has influenced this. Implementing innovations not only urban infrastructure should be considered, all the other aspects of an urban system should rely on this as well, such as organizational structures or user experience (Geels, 2012). Taking this into account, living labs turned out to be a good way in testing short-term interventions in urban systems.

3 Methodology

To analyze the challenges and obstacles of current urban planning, 12 interviews were conducted with experts. The interviews were made at different times with different focuses depending on the background of the interviewee. The content of the interviews ranged from the analysis of urban challenges, to legal constraints, to potentials for the implementation of innovative projects in an urban context. The points mentioned were considered from different perspectives depending on the expert, including urban planners, public authorities, mobility planning, climate adaptation measures, and from the perspective of those who implement the projects. Additionally, a workshop with ten experts to discuss the future needs for an efficient and sustainable planning was organized. This event was the only way to get a comprehensive impression of several actors involved in the planning of an urban project (Schwimmer et al., 2019). In addition, two surveys were conducted, one community and one citizen survey. 60 municipalities participated in the community survey, which were questioned by Fraunhofer IAO (Schaufler et al., 2021). On top, 1.200 citizens were asked to participate in a survey about their needs in the urban context (GfK, 2020). To complement the findings of the interviews and surveys, best practices in the field of urban innovation were also considered.

4 Expert Interviews and Workshop

In the following, the results of the expert interviews were described. The first part of the interviews focused on the urban challenges and potentials of integrative planning, the workshop thus defines a look into the future. The second part of the interviews considers legal barriers in Germany and the possibilities of implementing innovative construction projects in an urban context.

The first interviewees said that in addition to the current challenges, such as in the area of mobility, resource efficiency and continuous digital planning is also becoming an increasingly important issue. China, for example, consumed more cement in between 3 years (2011–2013) than the USA did during the entire twentieth century. This fact illustrates how much consumption is increasing, especially in the construction industry due to the high demand for housing in

cities. Pervasive use of resource-efficient infrastructure technology could reduce impacts on energy, water, land, as well as metal and steel consumption by 24–47% (Swilling et al., 2018). The separation of disciplines and usages in the planning of urban projects is also cited as one of the greatest challenges by the interviewees.

One of the main finding of the workshop was an essential establishment of continuous digital processes in the future to capture the complexity of urban space. Furthermore, the following recommendations were made by the experts for more flexible and adaptive planning: Mobilization of previously site-specific functionalities, interface functionality in multidimensional hubs, area redistribution of transport infrastructure, floor plan adaptivity, informative and reactive building techniques, load-adapted and bionic material use, and the use of utilization synergies in the placement of hubs. But all these recommendations can only be handled by using the benefits of digital planning (Schwimmer et al., 2019).

The second round of interviews focused on legal barriers in Germany. Hence, various challenges were named in the current tendering process, but also with regard to the planning and implementation phase. Among other things, they criticized the fact that it is a linear process from idea to implementation without feedback loops; moreover, there is no cooperative process and incentive systems are lacking. Hence, the desire for an iterative process arose. In addition, regulations and the tender descriptions limit the creativity of the planners. It is demanded that the call for tenders should not dictate the result but should provide certain parameters and thus support parametric planning and dynamized models. Particular attention was also paid to the tendering process, as this determines the subsequent uses. The interviewees demanded that in the future some criteria continue to be anchored in tenders, instead of criteria of how to fit the regulations and the aim of the project (path criterion) criteria that only define a target but not how to achieve it (target criterion) should be formulated. An example of this is the achievement of emission savings; it should not be stipulated that this is to be achieved through a reduced volume of traffic (path criterion), but rather that there should be, for example, 40% fewer emissions in 10 years compared to today (target criterion). Further examples of such an approach could take place in surface sealing, e.g., no new areas should be sealed, but the aim should be to unseal 5% of the total area or to implement appropriate compensatory measures. In addition, transferability to other locations was seen as an important criterion. At the same time, however, local-specific properties should also be considered. Moreover, there is a lack of possibilities for temporary interventions in the open space because in Germany urban development projects always have to be approved first, and this issue often takes several months.

5 Community and Citizen Survey

In order to understand municipal as well as social needs in designing future-proof public spaces, Fraunhofer IAO conducted two surveys to generate an overview of the needs and current challenges. Besides 61 municipalities, 1.200 citizens from all over Germany were asked what kind of urban offerings they would like to see in their respective environments (GfK, 2020). The topics of vacancy, current space requirements, future space requirements, digitalization, and relevant megatrends were the main focus. The results of the municipal survey form an useful basis for identifying, from the perspective of the demand side, which focus topics should be placed and which challenges should be considered in further research.

Current building-related spatial needs are particularly found in the commercial and residential sectors. Figures 2 and 3 show current and future increased demand for residential space. The need for commercial and bicycle space in the municipalities also remains high. With a view to future demand, this is supplemented by areas for climate protection and adaptation measures, areas for social and community needs, and dwell areas (Fig. 2). In contrast, areas for automobile traffic and stationary retail are less relevant. In the context of the COVID-19 pandemic, there are also short-term land requirements, especially in the areas of outdoor gastronomy, trade, and bicycle traffic (Schaufler et al., 2021).

Activating needed space is often a challenge in municipalities. The biggest obstacles are above all the ownership structure. Furthermore, limited financial resources and the existing building law, followed by rising land and real estate prices that make it difficult for municipalities to activate land for forward-looking urban development. However, some cities see an opportunity to meet this challenge by improving the financial resources available to municipalities. Digitization in the municipalities is progressing rather inhomogeneously in comparison. Few of the municipalities are pursuing a digitization strategy or have already implemented their own model projects. The needs are clearly placed in the areas of administration and educational institutions. On the part of the municipalities, the digitization needs of retail, public spaces, and gastronomy play a subordinate role. However, there is an awareness that fields of action such as mobility and transportation, tourism and city marketing, retail trade, and city center and downtown have enormous potential through digitization. The influences of current megatrends on the urban fabric and thus also on the city center will be of central importance in the future. Municipalities are aware of this and are addressing the challenges and opportunities of these trends for the city. This awareness is also evident from the fact that more than half of the municipalities surveyed are currently implementing or

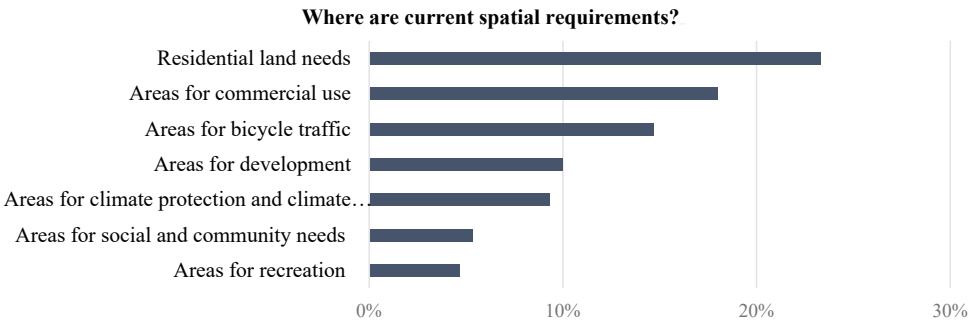

Fig. 2 Current space needs of municipalities, n = 60, multiple responses allowed, here the seven most frequent mentions

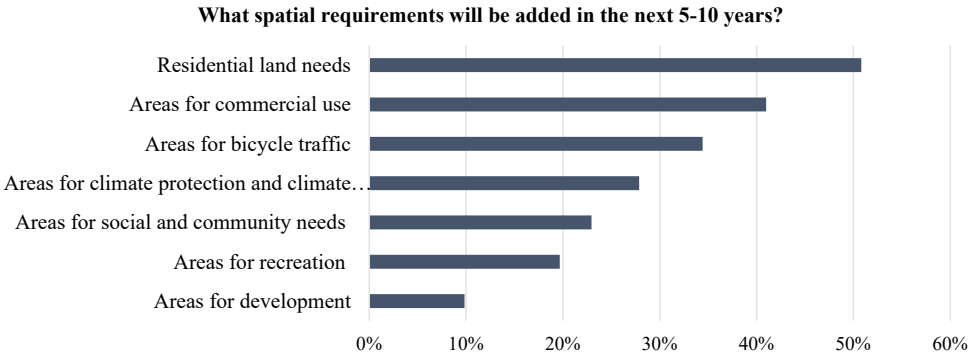

Fig. 3 Future space needs of municipalities, n = 60, multiple responses allowed, here the seven most frequent mentions

initiating projects that will have a significant impact on the city center. The topics of demographic change, changing working environments, urbanization, environmental and climate impact, and digital transformation are particularly relevant (Schaufler et al., 2021).

In summary, it can be seen that the demand for space and the availability of space (in the form of vacancies) largely co-exist. However, a sensible conversion of vacancies in favor of municipal land requirements still often fails due to the ownership situation and the financial resources. It is important to consider these areas of conflict in the context of this study and to include future land requirements for residential, commercial, and bicycle traffic in the process of a more adaptive public space, hence agile urbanism.

6 Best Practices—Faster Innovation Through Transformative City Development

The following examples will show temporary interventions in public space as well as city planning concepts for faster innovation to underline the importance of such concepts towards an agile urbanism. The examples are mainly from Germany because this is the actual observation area considering legal restrictions in the establishment of more urban innovation and iterative processes.

7 Schanigarten, Munich, Germany

First mentioned in the middle of the eighteenth century in Vienna, Austria, Schanigarten has become a popular urban intervention in the time of COVID-19. A Schanigarten is kind of pavement café, which is temporaly installed and an additional extension of the outdoor area of a restaurant. In Munich, they were introduced during the COVID-19 pandemic so that restaurants could comply with the outdoor distance requirements while not having to reduce the overall number of seats. The city used this method to support the gastronomy and to contain the economic impact of the pandemic. In 2020, the city received over 1000 permit requests for Schanigarten. It quickly became clear that the increased quality of stay in the public space also greatly increases the livability of citizens otherwise restricted by the pandemic. As a result, the city decided that now, regardless of the pandemic situation, catering businesses would be

allowed to operate Schanigarten from April to September, subject to successful approval. What started as a short-term intervention has now become an established process and a permanent part of the cityscape (Landeshauptstadt München, 2021).

CeM—Connected Campus with emission-free Mobility—DHBW Stuttgart, Germany

The Baden-Wuerttemberg Cooperative State University in Stuttgart made a concept for their Connected Campus with emission-free mobility. The reason for the project was the new building of the faculty of technology, which is already completed and was intentionally planned without parking spaces, as well as the new building for the Faculty of Economics, which is to be built from 2030. The area of the future location of the Faculty of Economics opposite the new Faculty of Technology is currently a brownfield site and therefore offers the possibility to temporarily build a Mobility and Living Hub. Six elements will be included in the hub: smart parking, E-mobility and sharing, mobility station with info point, grocery pick-up station, packing station, waste station and sanitary facilities, bike area, dual living for 44 students in 22 residential modules, and urban open space as a communication and meeting space and interface between the city and the university. Ideas for corresponding living labs have already been co-developed for all six elements. In addition, there have already been discussions with the Department for Urban Development, Housing, and the Environment and the Building Law Office, which are positively opposed to the project. A cooperation partner has already been found for the technical implementation of the dual housing units, and the plans all comply with the applicable state building code Baden-Wuerttemberg, Germany. The goal of the project is to become a showroom and pioneer for other municipalities; the aspect of temporary land use and thus the deconstructability of the hub should be emphasized (Ramert et al., 2019).

Pop-Up Bike Lanes

Pop-up bike lanes are temporary bike lanes on areas, which are actually assigned to motorized traffic. As a result of the COVID-19 pandemic, part of the population has switched to cycling, which has led to an increased volume of bicycle traffic in German city centers. To cope with this development, temporary bike lanes have been installed in several German cities, including Berlin, Hamburg, and Stuttgart. The pop-up bike lanes were tested in 2020 and mostly deconstructed for the winter months. According to the Office of Public Order of the City of Stuttgart, the greatest advantage is to review and adjust planning. For example, during the test phase of the bike lane on a major road, a disadvantage for public transportation arose. This showed that the planning had to be reconsidered, the process was thus made more dynamic and possible planning errors were avoided. In other cities, pop-up bike lanes have been such great successes that they are now being converted into permanent bike lanes. Here, it becomes clear how important temporary and agile concepts are for sustainable urban system engineering (Adam et al., 2020).

Österreichischer Platz, Stuttgart, Germany

In December 2017, the Committee for Environment and Technology of the City Council of the City of Stuttgart decided to terminate the lease agreement with the parking lot operating company at Österreichischer Platz. The city of Stuttgart made the vacated space in the form of a 2-year "experimental area". The management of the space was left to the non-profit association "Die Stadtlücken" (The City Gaps), which took on the role of mediator and advisor to citizens over the duration of the project. Stuttgart accompanied the action and provided 40,000 euros in each of the 2018 and 2019 budget years for the realization of individual projects in the action area. The vacancy and interim use management of the city's economic development department was primarily responsible. The aim of the project, which ran from 2018 to 2020, was to to achieve reconquest of the city by the citizens and revitalization of the public space (Schaufler et al., 2020).

One-Minute City

In contrast to the 15-minute city planning concept, the concept of the 1-minute city focuses on the concerns of the population of the street, the direct residents, and not of the whole neighborhood. Transportation networks, such as public transport, are not taken into account. Instead, the local population has the opportunity to work out in workshops how they would like to design the street. These are flexible and deconstructible concepts, which are implemented and can also be redesigned after a certain time. In this way, adaptive planning is created on site depending on the current needs of the residents. Last year, Stockholm started the 1-minute city on four streets and in this year Gotheburg and Malmo, also Umea, a far-norhern city, is in discussion to show that livability is possible separate from weather conditions (O'Sullivan, 2021).

8 New Agile Processes for an Evolving Infrastructure Design

The best practices show the potential of modular infrastructures in city centers that can significantly increase the flexibility of locally offered services and their adaptivity to

changing environmental impacts. In the German context, such innovative applications need new regulatory frameworks that need to be implemented by several institutions from the municipal to the national level.

Starting at the municipal level, recommondations to be implemented in the short term are, for example, an increased use of urban development contracts. Therefore, it is important to not only tendering mobility concepts, but to define agile goals, which are still relevant and contemporay at the moment of completion and the start of the operating phase. The usage of target criterion can also be helpful by developing resilient infrastructure and urban space. Both in the planning of building structures and in the planning of public spaces, after-use concepts should be considered; ideally, adaptive planning should be done from the beginning. As shown in the best practices, such as pop-up bike lanes, it is essential to include living labs and experimentation clauses in planning processes. On the medium- to long-term view, the integration of performance criterion in the call for tenders should be included. Partly already possible in the short term, provided that the framework conditions of the development plan and the land use plan are not violated. Another recommondation is to allow and encourage functional integration of public services into private buildings. However, through this functional integration, it is possible to recognize and use the structure and possibly its facade as a part of the urban system.

For the building authorities, it is recommended to simplify the living lab processes or facilitating experimentation clauses as soon as possible. Only then will there be a variety of real experiments in the urban context and will agile urbanism be able to establish itself. The medium- to long-term recommendations for building authorities require a relaxation and adjustment of legal framework and regulations. An example for relaxation could be the introduction of use-neutral areas in the land use plan, without restrictions on the type and extent of building use. So there are spaces, where agile and temporarly applications establish. Furthermore, digital simulations for impact analysis as a fixed component of planning as a new standard for development limits and thus removal of restrictions by floor area ratio and floor space ratio. But the most important required change is the rethinking of the whole processes, starting to think from the goal, not from the regulatoriy process in an urban development. In the future, it must be possible in progressive planning, for example, in object planning, to break through rules that were previously defined in area planning. This new definition is then fed back from object planning into area planning. Only then, an establishment of iterative processes and shortening of long development cycles for more agile urbanism is possible.

All stakeholders, bottum-up as well as top-down, should work on shortening the cycles of urban planning, so it can be guaranteed that planned projects are still innovative and adapted to current urban needs during implementation. The achievement of this goal should be supported by the redesign of iterative planning processes and establishing continous digital planning processes. For more innovation on all planning and construction levels, representatives from the three levels of state, federal, and local government must work together with the target to simplify processes.

In addition, further steps should be initiated, such as setting up a statewide observatory to advise and record practical challenges faced by municipalities and others in bidding for and implementing innovative urban planning projects. Consequently, this group could develop topic-specific action guidelines based on ongoing projects, to derive a frame of reference. Atop a state-owned test site for demonstrations and testing of new technologies and innovative concepts should be created.

9 Conclusion

The interviews and the surveys underlined the desire of the urban inhabitats for social and adaptive urban space. Especially areas for social and community needs as well as for recreation will be more important than ever in 5 to 10 years. The best practices showed how easily municipal planning departments could react to short-term changes in the urban flow of people, if they are willing to do so. The principles of tactical urbanism could be a transforming method for planning procedures. Tactical urbanism starts with simple methods and is kind of do-it-yourself urbanism. It starts with ordinary ideas, following into urban interventions, just as Schanigarten or Pop-Up Bike Lanes, and ends up in a consolidation for urban processes. This can also lead to a changed division of road areas and shift the focus on liveability (Lydon, 2012). Hence, in Germany, establishing living labs and areas for experimental innovations must continue and the legal restrictions must be exposed on this designated areas. Living labs have the advantage that they only last for a predetermined time, which gives the municipalities the opportunity to test and redesign ideas for urban innovation processes. After all, by living labs cities become agile. Being agile starts with tendering, so the tendering should also be agile. Therefore, it would be useful to define modular requirements, differentiated in obligatory and optional components. One example of a must requirement could be end-to-end digital planning and the introduction of short iteration cycles. Possible flexible design components could include various target definitions, for example, with

regard to land sealing or flexible conversion, tailored to the current needs of the local population. In summary, there are already good approaches for establishing agile urban planning through adaptive planning, but in Germany legal restrictions still often stand in the way, and this must be changed and flexibilized in the near future.

References

Adam, E., & Herrmann, D. (2020). Pop-up-bike-lanes nominiert für Landesauszeichnung. Stuttgart. https://www.stuttgart.de/service/aktuelle-meldungen/november-2020/pop-up-bike-lanes-nominiert-fuer-landesauszeichnung.php.

Braun, S., Schatzinger, S., Schaufler, C., Rutka, C.-M., & Fanderl, N. (2019). Autonomes Fahren im Kontext der Stadt von morgen [AFKOS]. Stuttgarthttp://publica.fraunhofer.de/dokumente/N-543668.html.

Diemer, A., & Nedelciu, C. E. (2020). *System dynamics for sustainable urban planning*.

Forman, R. (2008). *Urban regions: Ecology and planning beyond the city*. Cambridge University Press.

Forman, R. (2014). *Urban ecology: Science of cities*. Cambridge University Press.

Geels, F. W. (2012). A socio-technical analysis of low-carbon transitions: Introducing the multi-level perspective into transport studies. *Journal of Transport Geography, 24*, 471–482.

GfK. (2020). *Growth of knowledge*, Bevölkerungsumfrage. Nürnberg.

Landeshauptstadt München. (2021). Novellierung der Sondernutzungsrichtlinien und der Sondernutzungsgebührensatzung. https://www.ris-muenchen.de/RII/RII/DOK/SITZUNGSVORLAGE/6567837.pdf.

Lydon, M., Bartman, D., Woudstra, R., & Khawarzad, A. (2012). Tactical urbanism: Short-term action II Long-Term Change.

O'Sullivan, F. (2021). Make way for the 'One-Minute City': While the "15-minute city" model promotes neighborhood-level urban planning, Sweden is pursuing a hyper-local twist: a scheme to redesign every street in the nation. https://www.bloomberg.com/news/features/2021-01-05/a-tiny-twist-on-street-design-the-one-minute-city.

Ramert, D., & Kraus, D. (2019). CeM—Connected campus with emission-free mobility: Ideenwettbewerb „Mobilitätskonzepte für den emissionsfreien Campus". https://www.dhbw-stuttgart.de/fileadmin/dateien/Forschung/Forschungsschwerpunkte_Technik/Brosch%C3%BCre_CEM.pdf.

Schaufler, C., Vrhovac, B., & Ruess, P. (2021). *Future of public space*. Stuttgart.

Schaufler, C., & Staffa, A. (2020). *Meilensteine der Verstetigung*. Stuttgart.

Schwimmer, E., Schaufler, C., Braun, S., & Schatzinger, S.: *Leichtbau im urbanen System*.

Swilling, M. (2011). Reconceptualising urbanism, ecology and networked infrastructures. *Social Dynamics, 37*(1), 78–95.

Swilling, M., Hajer, M., Baynes, T., Bergesen, J., Labbé, F., & Jea, M. (2018). *The weight of cities: Resource requirements of future urbanization*.

Urry, J. (2008). Governance, flows, and the end of the car system? *Global Environmental Change, 18*(3), 343–349.

A Study of Urban Size Control in the Japanese Understanding of Garden Cities in Early 1900s

Junko Sanada

Abstract

Despite the importance of compact cities in Japan, suburban development has flourished from the early days of urban planning to this day, making it difficult to achieve compact cities. Therefore, this study focuses on the philosophy of urban planning around 1919, when the City Planning Law was first made, as the root of the current situation. Just at that time, the garden city movement, the origin of the compact city, was occurring in Japan, and this study clarified how the garden city was interpreted in the early 1900s, focusing on the expansion of the city. The materials used were journals and academic books published between 1907, when the garden city was first introduced, and 1927, when the subject of urban planning shifted to park systems. To ensure that the articles were written by experts of the time with some sort of argument, so translated articles, visits, and textbooks are eliminated, and 29 discourses are used for analysis. The survey found that many experts gave little weight to Howard's theory in their articles describing garden cities, and often referred to Letchworth, Bourneville, and Port Sunlight. This fact was because they saw the concentration of population in the cities and the resulting densification as the problem, not the expansion of the cities. Garden cities were seen as a solution to these problems, and so garden suburbs were favorably received as embodying the ideals of the garden city. Moreover, the green areas surrounding the garden city were understood to be places where people could enjoy the richness of nature. This is why the garden city did not lead to the compact city, but to the solution of developing residential areas in the suburbs.

Keywords

Garden city • Compact city • Urban expansion • Urban sprawl • Green belt

1 Introduction

The concept of the compact city has been attracting attention from the perspective of sustainable and natural resources. Because it may contribute to walkability that can reduce fossil fuels. But in Japan, suburban development is still thriving, causing the problem of hollowing out of the city center. The idea of a compact city does not seem to be widespread in Japan. However, the garden city movement in the early 1900s, which was the period around 1919s first city planning law was enacted. Since its first introduction in 1907, the garden city has been featured in many journals and books.

In reality, however, the Garden City movement landed as a suburban residential development. It can be said that the idea of the garden city, which originally started as a denial of enlargements of cities, resulted in the expansion of the city. If looking at the books and articles on the time that mentions the garden city, the phrases "Bochou" and "Kadaika" are frequently used. They are words that describe the growth or expansion of cities. Why, nevertheless, did the interpretation of the garden city result in the promotion of urban expansion? To promote compact cities in Japan, it is important to clarify the thinking of the early days of statutory urban planning in Japan. Therefore, this study clarifies how the garden city was interpreted in the early days of urban planning in Japan, focusing on the urban expansion.

Many studies have been published on the understanding of the garden city. In "A Study of the Japanese Garden City (1)," Shunichi Watanabe mentions the Garden City Corporation and says that what this company developed was "not the Howardian garden city" (Watanabe, 1977). And in

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"A Study of Japanese Garden City (2)," he refers to the work "The Garden City" written by volunteers from the Ministry of Home Affairs' Regional Bureau, and points out that it was based on Sennett's work, not Howard's (Watanabe, 1978).

Akinobu Murakami has also conducted many studies on the Japanese understanding of the garden city. In addition to research on the understanding of Howard's theory by Tokitaka Yokoi (Murakami, 1996) and Kazumi Iinuma (Murakami, 2000), he has also conducted research on the background to the translation of Howard's "Garden City" as "Denen Toshi (in Japanese means rural city)" by the Regional Bureau of the Ministry of Home Affairs (Murakami, 1999). Murakami says that the Home Ministry volunteers used the term "Denen Toshi" as a term to describe "the trend of Western countries," and points out that they did not necessarily try to understand Howard's theory. These studies, however, attempt to clarify the Japanese understanding by highlighting the differences with Howard's garden city theory.

Yasuo Nishiyama, in his review of the pre-World War II Japanese literature on the garden city, points out that the garden city was understood as a countermeasure against rural exhaustion, a development measure for suburban areas, a housing design, and a district design method (Nishiyama, 1981), but he does not clarify how this understanding led to the expansion of the city.

2 Materials and Methods

To clarify how the garden city was understood in the context of urban planning, this thesis analyzes the discourses that explain the garden city with some views. In other words, the discourses in which experts who had some kind of claim on urban planning, explained or introduced the garden city. For this reason, articles and books that were directly translated from Western articles, visits to garden cities, and books that were positioned as textbooks that comprehensively dealt with the theories of the same period were excluded.

The materials used were technical journals and academic books published between 1907, when volunteers from the local bureau of the Ministry of the Interior published The Garden City, and 1927, when the tide of urban planners' interest turned in favor of park system planning (Table 1).

In Sect. 3, to clarify why the experts of the time were dealing with "the garden city," the focus was on what they regarded as "the garden city." The results show that they were more interested in the cities that were actually built than in Howard's theory. If they regarded the garden city as a way of improving urban conditions, then it seems that the Japanese understanding of the garden city was heavily influenced by Japanese urban problems of the time.

In Sect. 4, the focus was therefore on the urban problems that were behind the explanation of the garden city. In Sect. 5, the position of garden suburbs, which seems to be strongly related to urban enlargement, is analyzed in terms of whether and what is written about the differences between garden cities and garden suburbs. In Sect. 6, the analysis is made of how the surrounding agricultural land, which can also be positioned as a green belt and is related to the control of urban enlargement, is referred to.

In this thesis, when the term garden city or "the garden city" is used without any specific explanation, it means what the experts of the time considered a garden city, and not necessarily the garden city itself as proposed by Howard.

3 The Relationship Between Garden City and Howard's Theory

3.1 Cities Regarded as "Garden City"

First, the study focused on what experts of the time regarded as the garden city when they described it (the third and fourth column in Table 2). Many articles which explain Howard's Garden City Theory (HGCT), but there are also articles, which only mention its existence, and articles that explain the garden city without mentioning Howard's theory. For example, in 1919, Kanich Miyake's commentary in his book "Housing Problems and the Garden City" does not mention Howard's theory, and proceeds by citing examples such as Letchworth, Bourneville, and Port Sunlight. In the late 1920s, there was an increase in the number of articles of the garden city, citing the definition of the Garden City Association (GCA). In most of the articles, the actual cities are used to describe the garden cities. Many refer to Letchworth, the first rural city, but others use Bourneville, Port Sunlight, and other pre-Howard cities, and factory villages such as Krupp and Pullman, as examples of garden cities. This fact suggests that experts of the time were more interested in actual cities than Howard's theory.

3.2 The Position of Haward's Garden City Theory

Therefore, the position of Howard's garden city theory in each discourse was focused on (the fifth column in Table 2). As a result, the following three points can be identified.

(i) Positioning HGCT as the "ideal"
Article 1 says that the days of design and planning are gone, now it's time to implement. Article 17 similarly says that the days of discussion are over and the days of implementation are upon us. Article 4 says that

Table 1 Materials list

Year	No.	Title of articles or books	Author
1907	1	Garden city	Volunteers of the ministry of the interior
1908	2	A study of cities	Iwao Miyake
1912	3	Visits to Europe and America, fine people and relief	Takayuki Namae
1913	4	Urban planning and garden city	Hajime Seki
1914	5	Planning of new urban districts	Ougai Mori
1916	6	A study of modern city	Yasushi Kataoka
1919	7	Residencial problem and garden city	Kanichi Miyake
1921	8	Residencial policy and urban planning in England	Hajime Seki
1922	9	Residencial management theory	Hiroshi Ikeda
	10	Mountain city	Ryotaro Kurotani
	11	Residences and land	Ichitaro Ogawa
1923	12	Cities	Shichiro Yumiie
	13	Residencial problem and urban planning	Hajime Seki
1924	14	General theory of landscape architecture	Keiji Uehara
	15	About the garden city	Usaburo Takahashi
	16	Early modern city development and urban planning	Hajime Seki
	17	City or countryside?	Makoto Kono
1925	18	Recent developments in western cities	Seinosuke Hashimoto
	19	Appreciation of the countryside and ruralisation of the city	Shinzo Kikuchi
	20	About the garden city	Seigo Takahashi
	21	The ideal of the city as expressed in the theory of the garden city	Kazumi Iinuma
	22	The necessity of urban planning	Kazumi Iinuma
	23	Development of the garden city	Hisomu Shigenaga
	24	Introduction to Landscape architecture	Tsuyoshi Tamura
	25	Urban policy general theory	Daikichiro Tagawa
	26	The garden city movement in England	Shitiro Yumiie
1926	27	About the garden city	Daikichiro Tagawa
	28	Garden city ideal	Iehisa Kuwahara
1927	29	Theory and legislation of urban planning	Kazumi Iinuma

HGCT is too "idealistic." Article 11 says that HGCT was an "ideal" and Letchworth was its realization. The same is true of Articles 3 and 18. And Articles 8 and 16 are more clearly "it is difficult to realise" they say. Originally, the word "ideal" in Japanese has a negative meaning of being unrealistic and is used in this sense in these discourses. This meaning and the fact that they used "realized" cities to illustrate their descriptions suggest that experts of the time were interested in the garden cities as information to be applied to real cities.

(ii) Understanding that the garden city existed before HGCT
The experts who used Bourneville and Port Sunlight in their commentaries on the garden city thought that HGCT was not his invention. In Article 13, for example, HGCT made the garden city famous, as did articles 10, 13, 14, 15, 20, 25, and 26. Many experts considered that the garden city and its ideas existed before Howard's proposal.

(iii) Putting the HGCT in the process of history
Article 8 says that HGCT led to the later UK Housing, Town Planning. &c. Act. Similarly, in Article 16 by Seki Hajime and Article 9 by Ikeda Hiroshi, they said that the garden city movement was connected with UK Housing, Town Planning. &c. Act. It is thought that they see HGCT and garden city movement as a process of the development of city planning technology.

To sum up the position of Howard in relation to the garden city, it can be assumed that most experts did not feel the

Table 2 The relationship between garden city and Haward's theory

Year	No.	Cities regarded as "Garden city"	Mention about HGCT	The position of Haward's garden city theory (HGCT)
1907	1	Bournville, Port Sunlight, company towns of Krupp and Pullman, Serrières (Chocolate factory village of Suchard) *This book was written based on "Garden City in Theory and Practice, 1905" by A. R. Sennett	Yes	The days of design and planning are gone, now it's time to implement
1908	2	Letchworth, Bournville, Port Sunlight, company towns of Pullman and Krupp (as good practices of garden cities)	Yes	–
1912	3	Letchworth (as reason of garden citiy's viablity.)	Yes	– HGCT is an allegorical novel – (Explaining about Lechworth) The reality is quite different from the theory
1913	4	Letchworth	Yes	HGCT is great ambitions but too much idealism
1914	5	Letchworth, Earswick, Harbor, Hellerau	No	–
1916	6	(Garden city association)	Only existence	–
1919	7	Letchworth, Bournville, Port Sunlight, Serrières, company town of Pullman	No	–
1921	8	Letchworth	Only existence	– HGCT is difficult to realize the ideals of the garden city theory as they are – The HGCT later led to the UK Housing, Town Planning,&c. Act1909
1922	9	Letchworth, Welwyn. Hampstead, Bournville and Port Sunlight are categorized in garden cities in a broad sense	Only existence	The garden city movement grew and lobbied the parliament, leading to the UK Housing, Town Planning, &c. Act 1909
	10	Bournville, Port Sunlight	Only existence	Howard's ideals had been realized at Bourneville and Port Sunlight
	11	Letchworth	Yes	HGCT is the ideal, and Letchworth is the realization
1923	12	Letchworth, Bournville, Port Sunlight, Hampstead, Noisiel (company town of Chocolat Menier), company towns of Pullman and Krupp, Forest Hills Gardens by the Russell Sage Homes Foundation	Yes	–
	13	Bournville, Port Sunlight, Letchworth	Only existence	HGCT is the opportunity for the garden city to become famous
1924	14	Letchworth, company town of Krupp, Garden City on Long Island in New York, Hellerau	Yes	What we call the garden city predates Howard's proposal
	15	Bournville, Port Sunlight, Letchworth	Yes	The garden city was even earlier than HGCT
	16	Letchworth, Welwyn	Yes	– HGCT is an ideal, and one that would be difficult to implement widely – It is a fact that after the garden city movement, the idea of the garden city approach was introduced into the town planning in the UK
	17	Letchworth, Welwyn	Yes	The days of discussion are over and the days of implementation are upon us

(continued)

Table 2 (continued)

Year	No.	Cities regarded as "Garden city"	Mention about HGCT	The position of Haward's garden city theory (HGCT)
1925	18	Letchworth, Welwyn, Hampstead, and many new towns in England	Yes	While HGCT is an ideal, there has been an increasing focus on the creation of garden suburbs to remedy the deficiencies of the present cities
	19	Letchworth, Welwyn	No	–
	20	Letchworth, Welwyn, company town of Krupp, Bournville, Port Sunlight	Yes	HGCT is one of the most important works of the garden city philosophy that began in Germany and England at the end of the nineteenth century
	21	Letchworth, Welwyn	Yes	–
	22	Letchworth, Welwyn	Definition of GCA	–
	23	–	Definition of GCA	The practice of the factory village became a preparation for the HGCT
	24	The new town in Leipzig, factory town of Krupp	No	–
	25	Bournville, Port Sunlight, company town of Krupp, Garden City on Long Island, Letchworth, Hampstead, Hellerau	Yes	The garden city movement is best known for Howard's, but it existed in Britain, Germany, and the USA before that
	26	Letchworth	Yes	– Howard gave the movement its name, but Robert Owen started it in the first instance – Letchworth is very different from HGCT – The First Garden City Ltd. was created realistically, without the fanciful aspects of HGCT
1926	27	–	Definition of GCA	–
1927	28	Letchworth	Yes	–
	29	Letchworth, Welwyn	Yes	–

need to faithfully understand Howard's theory, but wanted to know the latest practices of "garden city" as a method of city planning or urban problem-solving.

4 Interpretation of Urban Expansion

4.1 Meaning of "Bochou" and "Kakudai"

If the garden city has been understood as a method of city planning, it has also been understood as a method for solving urban problems. Therefore, in this chapter, the focus is on what is considered an urban problem when writing about the garden city. The words "*Bochou*" or "*Kadaika*" were used frequently (the third column in Table 3). It can be seen that out of 29 discourses, the words "*Bochou*" or "*Kadaika*" are used in 20 discourses. The word "*Bochou*" means swelling, while "*Kadaika*" means becoming too large.

Next, what exactly is meant by *Bochou* and *Kadaika* and what are deemed the problems of the city were read. In the fourth column of Table 3, the typical words are quoted, but in the analysis the intention of the whole article is read. Looking specifically at "*Bochou*" and "*Kadaika*," it is found that the terms are used in the following four points: (i) urban densification and the consequent deterioration of the living environment; (ii) the imbalance between urban and rural populations; (iii) unplanned urbanization of the suburbs; and (iv) expansion of urban areas. The details are described below.

(i) urban densification and consequent deterioration of the living environment
This has been described in many articles as the main urban problem. The deterioration of living conditions caused by crowding is described as unsanitary, increased mortality, immorality, crime, and chaos. These are the urban problems of the condition of people living in congested cities. Additionally, traffic congestion and housing difficulties (shortages and rising prices) are also cited as problems caused by densification. With this understanding, experts see in the garden city the function of solving the problem of deterioration of living conditions inside the city. Note that Articles 9 and 26 use *Bochou* in a positive sense, in the sense of development, but consider the above phenomena a problem.

Table 3 Problem and spacial size of cities

Year	No.	*Bochou, Kadaika*	Problems caused by *Bochou* or *Kadaika*	Notions about spacial size of city
1907	1	*Bochou*	– Harmful effects of dense population; immoral and unhealthy – Imbalance between urban and rural populations	–
1908	2	–	– Harmful effects of dense population and dirty smoke; unsanitation and immorality in slums	–
1912	3	*Bochou*	– Cities swell morbidly, villages decline year by year – Dense population; unsanitation, immorality and crimes	–
1913	4	*Bochou*	– Small and unhygienic houses; harmful effects for education, morality, and sanitation	Land speculation encourages the construction of shabby houses, destroying natural beauty and historical heritage
1914	5	–	– Harmful effects of overcrowding residence	–
1916	6	*Bochou*	– Gradually having a negative impact on hygiene and public morals – Insufficient housing	–
1919	7	*Bochou*	– Poor hygiene caused by dense urban living – Uncontrolled expansion	Remember that it is impossible to expand in all directions, but there are certain directions of expansion Facilities and means should be provided to bring the suburbs into development
1921	8	*Bochou*	– The evils of unplanned urban settlement	(In the explanation of garden suburb) Recognizing the need to make certain plans for urban expansion
1922	9	*Bochou*	– Urban swelling and development – Causing miserable urban life and corruption of the residents – Increased mortality	The development of suburban areas is effectively an expansion of the city, but Letchworth was built on low-cost farmland, far from the city
	10	*Bochou*	– Small and unhygienic houses; Triggers for crime and tuberculosis – Traffic chaos	–
	11	–	– Too much dense population; poor sanitary conditions – Insufficient housing	–
1923	12	–	– Miserable urban dense life – Increased mortality	–
	13	*Bochou*	– Uncontrolled sprawl	(in the explanation of garden suburb) Recognizing the need to make certain plans for urban expansion
1924	14	–	– Poor hygiene and immorality caused by dense urban living	–
	15	*Bochou*	– Negative effect of dense urban living; a breeding ground for fears, ugly fights, and crimes	The garden city is large enough to allow for social activities, accompanied by industry
	16	*Bochou*	– Poor hygiene – Urban diseconomies due to population growth	The garden city is an ideal for the eradication of big cities
	17	*Bochou*	– The unfortunate dense conditions of the city – Unnatural urbanization of the suburbs	–

(continued)

Table 3 (continued)

Year	No.	*Bochou, Kadaika*	Problems caused by *Bochou* or *Kadaika*	Notions about spacial size of city
1925	18	*Bochou*	– Urban population growth – The chaos and confusion caused by dense living – Poor hygiene and unhealth – Inhuman traffic complications	–
	19	*Bochou*	– People are too far removed from nature	When expansion and development are unavoidable, they should be guided to a healthy and orderly development. Small cities are to be developed like satellites in the metropolis
	20	*Bochou*	– Imbalance between urban and rural populations – The crowded lives of workers	–
	21	*Kadaika*	– Long commuting times are uneconomical – People are too far away from nature	The garden suburb has the disadvantage of making an already large city even larger The suburban house may be superior to the tenement house. But it is too far from the center of the city
	22	*Bochou*	– Unsuitable increase in traffic and congestion	There is a limit to the size of a city. It must not grow uncontrollably
	23	–	– Currents away from the countryside – Overcrowding residence	–
	24	–	– Poor hygiene is shortening life expectancy	–
	25	–	– Crowded, inconvenient, and uneconomic conditions – Unsanitary life – Ugly suburbs and destruction of the natural landscape – Negative effect of land speculation	–
	26	*Bochou*	– The temptation of depravity – Harmful effects of overcrowding residence – Soaring land prices	There are certain limits to the size of a city, which do not allow for infinite expansion
1926	27	–	– Dense population; unsanitation, immorality – Soaring land prices	–
1927	28	–	– Over-population – The hustle and bustle of the city, unsanitary	–
	29	*Bochou*	– Long commuting times are uneconomical – People are too far away from nature – Disparity of wealth	Garden cities must be a city of a certain limited size (using the definition of GCA) It must be large enough for the full enjoyment of social life, but not larger than that

(ii) the imbalance between the urban and rural populations

Articles 1, 3, and 20 fall into this category. They include the imbalance between urban and rural population in the meaning of *Bochou*. They believe that the creation of garden cities in rural areas can save the rural areas from decline.

(iii) the unplanned urbanization of the suburbs

The unplanned urbanization of the suburbs is referred to as *Bochou* in Articles 7, 8, 13, 17, and 25. In these articles, the problem is that unplanned development is creating unfavorable living conditions and destroying the natural landscape of the suburbs.

(iv) the spacial growing of the urban area

It is Articles 19, 21, and 29, written by Shinzo Kikuchi and Kazumi Iinuma, that refer to the problem of cities growing in spacial size. They were administrative bureaucrats in the Ministry of Home Affairs, whereas most of the other experts were technical specialists in urban planning, architecture, and green spaces. It can be said that the idea of the problem of cities growing in spacial size was limited to a few positions.

4.2 The Spacial Size of City

Although it has been stated that few articles address the problem of urban spacial size, 13 of 29 articles look at *Bochou* from the perspective of area expansion (the fifth column in Table 3). More than half of the articles dealing with the garden city does not mention the spacial size of the city. The articles that do mention it are (iii) and (iv) above; therefore, the following is a closer look at these.

(i) the unplanned urbanization of the suburbs
Articles 7, 8, 13, and 17 refer to the suburbs in terms of area expansion of the city. Article 7 is by Kanichi Miyake, a businessperson of a land development company. His main argument was that suburban expansion was necessary to alleviate urban overcrowding, and that this expansion should be 'not indiscriminate east-west or north-south expansion, but expansion by a fixed system' (Miyake, 1919). To achieve this, it is important to systematically build garden cities in areas with good transport links.
Articles 8 and 13 are by Seki Hajime, who was the Mayor of Osaka. He says that the ideas of the garden city movement led to the development of garden suburbs, which led to the UK Housing, Town Planning &c. Act 1909. He says that this prevented "the promiscuous development of areas of extension around the city" (Seki, 1923). Throughout the discourse is shown that the garden city is a way of systematically expanding the city. There is no mention of a limit to the size of the garden city.
Article 17 is by urban planner, Makoto Kono. He says that the suburbs of Tokyo and Osaka have an "unnatural expansion," which is "a mere expansion of the unhealthy land of the inner city." As a solution, he cited the UK's GCA, and said that the current town planning is to "convert the periphery of the city into a garden city," that is, to "correct the unfortunate dense condition of the city and prevent the devastation of the countryside" (Kono, 1924). It can be read as an assertion that it is important to develop the periphery of the city properly. He also does not mention the size of the garden city.
Thus, in the discourses on the problem of unplanned urbanization of the suburbs, it can be seen that the intention was not to suppress the area of the city, but to expand it systematically.

(ii) the spacial growing of the urban area
The discourse on the spacial size of the city as an urban problem is contained in Articles 19, 20, and 29 by Kikuchi Shinzo and Iinuma Kazumi. Kikuchi was Director of the Planning Division of the Bureau of Reconstruction (for the reconstruction of the Great Kanto Earthquake of 1923), and Iinuma was Administrative Vice-Minister for Home Affairs, both of whom were connected with the Ministry of Home Affairs. In arguing that there should be a limit to the spacial size of cities, they cited the lack of nature as a reason, as follows. "The remedy for the deficiency of greenery in the metropolis is the main aim of urban policy, and the solution of this deficiency will enable families to live in peace and ease the class struggle. People have left nature too far behind. It is necessary to return to nature as much as possible (Kikuchi, 1925)."
This view is echoed in Iinuma's Articles 21 and 29. He argues that the larger the area of the city, the longer it takes workers to commute, and that this is an economic waste. He also said that most big cities are dusty, noisy, and ugly, and that they are extremely far from nature, which is essential for both aesthetics and hygiene (Iinuma, 1925a, 1925b). He said that the problem of big cities is the distance from nature.

4.3 *Bochou* and *Kakudai* in the Articles on Garden City

In the above, it has been focused on the meaning of the words "*Bochou*" and "*Kadaika*" that mean urban swelling and becoming too large when describing the garden city. As a result, the following four points have become clear:

- The words "*Bochou*" and "*Kadaika*" are found in about two-thirds of the articles describing the garden cities, and some of them use them positively to mean "development."
- The meaning of *Bochou* often referred to the concentration of population in cities and the resulting dense conditions.
- In some articles, *Bochou* was linked to the expansion of the urban area, but in half of them the expansion of the urban area itself was not the problem, but the unplanned urbanization of the expanded area.
- Iinuma and Kikuchi, officials of the Ministry of Home Affairs, were concerned with the size of the urban area, but this was because of the time wasted commuting (Iinuma) and distance from nature (Iinuma and Kikuchi).

5 Positioning of Garden Suburbs

It is not difficult to imagine that the tendency to focus on the problem of densely populated urban areas and the uncontrolled urbanization of the suburbs, and not on the expansion of the city area, led to the solution of the garden suburbs. Therefore, this chapter focuses on the difference between the garden suburbs and the garden city in the narrow sense of the word, and tries to understand how the garden suburbs were actually positioned. In Table 4, the sentences are quoted which symbolically express the article's thoughts on the position of the garden suburb.

Table 4 Positioning of garden suburb

Year	No.	Positioning of garden suburb
1907	1	(Not mentioning the difference)
1908	2	(Not mentioning the difference)
1912	3	– The thing applied the spirit of the Garden City (about Hampstead Garden Suburb)
1913	4	– Even though it is not possible to prevent the decline of the rural population, there is a great need to create garden suburbs in large cities where the negative effects of dense living are felt
1914	5	(Only garden city)
1916	6	– The management of the garden city is better in the so-called garden suburbs, which develop under an organized plan in the suburbs of a large city, than in a separate and isolated area, which is a natural development
1919	7	(Not mentioning the difference)
1921	8	– New phenomena applied the spirit of the Garden City (about Hampstead Garden Suburb) – HGCT, difficult to realize in its entirety, led to the garden suburbs and to UK Housing, Town Planning,&c. Act
1922	9	– An interesting suburban development scheme that embraces the garden city ideal
	10	– The need to make the existing cities into a garden cities led to the planning of a garden suburbs
	11	– In addition to the garden city, another method of artificial dispersion is the garden suburb
1923	12	(Not mentioning the difference)
	13	– New phenomena applied the spirit of the Garden City (about Hampstead Garden Suburb)
1924	14	– Not a garden city as a complete city, but something like it (about Hampstead Garden Suburb)
	15	– Strictly speaking, there is a difference between garden city and garden suburb, but in a broader sense they can be interpreted as the same thing
	16	– Today, it is very important to develop the suburbs of our country's cities and to carry out urban planning in the style of the garden city, exemplified by the garden suburbs of Hampstead
	17	– The idea related to garden city – Projects that seek to transform the outskirts of cities into garden cities
1925	18	– Efforts were made to create a kind of Hampstead housing estate to hastily remedy the real defects of large city life
	19	– The garden city has the factory as its main element. This is the difference between the garden suburbs and the garden cities, which are only dormitories for the big cities
	20	– Garden suburbs are not garden cities because they do not solve the decline of rural areas. They are simply cultural villages
	21	– The garden suburb has the disadvantage of making an already large city even larger
	22	(Only garden city)
	23	– Garden suburbs have been developed on the basis of urban planning ideals to ensure the healthy development of established cities
	24	(Not mentioning the difference)
	25	– Residential areas in the suburbs do not have the same security and street lighting costs as the city center. This is probably the reason why the cities competed with each other to develop the suburbs
	26	– It is not the preference of the garden city theorists to refer to garden residential areas or garden suburbs as garden cities – However, the garden cities in the broadest sense are widespread throughout the UK – Garden suburbs solved the UK's housing problem
1926	27	– There is a distinction between garden cities and garden suburbs, but the essence is the same
1927	28	(Not mentioning the difference)
	29	– The garden suburb has the disadvantage of making an already large city even larger

5.1 Positioning and Role of Garden Suburbs

Looking at the discourse, there were two discourses that did not mention garden suburbs, and six discourses that spoke of garden suburbs that had actually been built, without mentioning the differences between them and the narrower definition of a garden city.

Others describe garden suburbs with an awareness of the difference between garden suburbs and narrowly defined garden cities. Many of them see the garden suburbs in a positive light: "the thing applyed the spirit of the Garden City (article 3)," "new phenomena applyed the spirit of the Garden City (article 8)," "an interesting suburban development scheme that embraces the garden city ideal (article 9)," "the garden cities in the broadest sense (article26)." These are interpreted as being the same in aim, although differences are acknowledged. As for the role of the garden suburbs, they were seen as a way of adapting to the existing city, as can be seen from the following: "The need to make the existing cities into a garden cities led to the planning of a garden suburbs (Article 10)" and "Efforts were made to create a kind of Hampstead housing estate to hastily remedy the real defects of large city life (Article 18)." In these discourses, the urban problem was seen as unhygienic and immoral due to the dense population, so it is likely that the garden suburbs were understood to be in the spirit of the garden city, in the sense that the composition of the city was achieved with more space on the site.

Articles 19, 20, 21, and 29, on the other hand, take a negative view of rural suburbs and do not allow them to be called garden cities. Firstly, Article 20 is concerned with the migration of the rural population to the big cities, so looks negatively at the garden suburbs that do not encourage the settlement of the rural population. Iinuma's discourse, which was concerned with the size of the city in terms of area (Articles 21 and 29), denies the garden suburbs from the aspect of encouraging the expansion of the city, as explained in the section on the spacial size of the city (4.2.ii). On the other hand, Kikuchi's discourse (Article 19), which was also concerned with the spacial size of the city, takes a negative view of the garden suburbs as a whole, but only points out the difference between the rural cities, whose main element is the factory, and the garden suburbs, which are the "boarding houses of the metropolis," and does not mention the problems of the garden suburbs.

5.2 The Spacial Size of City and Garden Suburb

Because of the above focus on garden suburbs and garden cities in the narrower sense, the following three points have become clear:

- About 20% of the articles referred to the garden suburbs as "garden cities" without differentiating between garden suburbs and garden cities in the narrower sense.
- About 70% of the discourses pointed out the difference between garden suburbs and garden cities in a narrow sense, but most of them regarded garden suburbs as a positive planning method for existing cities, based on the idea of garden cities.
- Iinuma's discourse was the only one which looked negatively on the garden suburbs, citing the expansion of the urban area as the reason.

6 Positioning of Agricultural Areas

In the previous chapter, we have seen that many discourses on the garden city at that time did not deny the expansion of the city in terms of area. By the way, the rural city proposed by Howard has as its component the agricultural land around the urban area, which later became the green belt to limit the size of the urban area. In this chapter, how these farmlands, which were closely related to the size of the city, were explained will be examined (Table 5).

When looking at how agricultural land around the city is explained in the description of the garden city, five articles do not mention agricultural land and six only mention it in the description of the layout of the garden city, of which three do not mention that it is around the city. Of the 18 discourses explaining the significance of peri-urban agricultural land, 11 attributed the significance to the ability to enjoy the goodness of nature itself, the ability to interact with nature through home gardens, and the ability to make a profit from the sale of agricultural produce.

However, Articles 19, 21, 22, and 29, which concern the territorial expansion of cities, explain that they are intended to limit their size.

In addition, Articles 23 and 26 give a positive view of garden suburbs, but quote the definition of the Garden City Association, which states that cities should be surrounded by farmland.

7 Conclusion

In order to clarify how the garden city was interpreted in the context of urban expansion, articles about the garden city were used as data and read with a focus on the expansion of the city. As a result, the following points became clear:

(i) Many of the commentaries on the garden city focused on the actual cities that had been built; in the early 1920s, some used the word "ideal" which also means

Table 5 About agricultural areas

Year	No.	About agricultural areas
1907	1	– The landscape and environment around the city are for the health and hygiene of the urban population
1908	2	(surface area only/not mentioned that it is surrounded)
1912	3	– It is a spiritual pleasure to be able to cultivate the land in a family
1913	4	(Placement instructions only)
1914	5	(Not mentioned)
1916	6	– The idealists of the garden city want to encourage the artisan class to take up agriculture alongside their professions, to enjoy flowers and to grow vegetables
1919	7	– Surpluses of vegetables, flowers, fruits, among others obtained from the affiliated land can be sold, and the life of the inhabitants is extremely wealthy and peaceful
1921	8	– The farmland not only promotes the health and well-being of the citizens, but can also supply the city's markets with vegetables – The role of segregation between cities (quoting Unwin and referring to satellite cities)
1922	9	(Placement instructions only)
	10	(Not mentioned)
	11	– A small city surrounded by fields – The ideal garden city is in contact with nature
1923	12	(Placement instructions only)
	13	– The farmland not only promotes the health and well-being of the citizens, but can also supply the city's markets with vegetables
1924	14	(Surface area only/not mentioned that it is surrounded)
	15	– The urban area is permanently surrounded by land of sufficient size to retain its countryside character – City residents have a direct view of the agricultural area from the city center and can hear the farmers singing and the birds soaring in the sky
	16	– (In explaining the recommendation for rural suburbs) It is good for cities to expand with a certain amount of open space, rather than continuously as in the past. (However, it is not related to the agricultural land of the rural city.)
	17	(Not mentioned)
1925	18	– The benefits are twofold: access to fresh food and the health benefits of working in agriculture
	19	– Permanent distinction between large cities by agricultural parks, among others with a width of one mile or more
	20	(Only as a component/not mentioned that it is surrounded)
	21	– The area to be used as housing land is restricted, while the rest is permanently reserved as agricultural land (about Welwyn)
	22	– All cities must be surrounded by agricultural areas. It must be strictly avoided that it is sloppily connected with other cities (using the definition of GCA)
	23	– Cities should be permanently surrounded by agricultural and parkland areas (using the definition of GCA)
	24	– A kind of field where urban residents can get acquainted with gardening and farming
	25	(Not mentioned)
	26	– Cities are surrounded by farmland. (using the definition of GCA) – The area between cities shall be permanently preserved as parkland or agricultural land (mentioning satellite cities)
1926	27	(Not mentioned)
1927	28	– Urban dwellers enjoy and benefit from agriculture and horticulture
	29	– The garden city is a distinct urban unit because it is surrounded by land permanently preserved as agricultural land, with factories and houses inside – Subsistence food production – In many cases, the endless expansion of the city has swallowed up smaller cities, but the garden cities are surrounded and protected by the fields

unattainable to discribe Howard's garden city theory. On the other hand, the fact that the idea of the garden city was reflected in the UK Housing, Town Planning, &c. Act. and the actual creation of new cities and suburbs was of interest to experts as a "practice."

(ii) Since these articles explain the garden city as a method of town planning, they inevitably refer to urban problems. Most of the urban problems mentioned in these articles were "*Bochou*" and "*Kadaika,*" but most of them were mainly about the concentration of population in the cities and the resulting dense conditions.

(iii) The garden suburb was often understood as a continuation of the idea of the garden city.

(iv) The agricultural land around the city, which is a component of the rural city, also functions to control the expansion of the urban area. However, about a third of the discourses did not mention the existence of farmland itself, or only described it as a component, while many others saw it as a place where people could enjoy the richness of nature and where farmland could be used for production.

From the above, the following considerations are made:

- It is likely that the professionals of the time focused on the garden city, not to learn Howard's garden city as a theory, but to learn a viable urban planning method that had already been put into practice.
- It is thought that the garden city was accepted as a solution to the concentration of population in cities and the resulting dense conditions.
- In addition to the meaning of a solution to a dense population, it can be considered that the fact that the agricultural land around the city was interpreted as a place where people could enjoy the richness of nature led to the solution of a low-density suburban city with many opportunities for contact with nature.

It can be said that the reason for the expansion of cities at the at the early stage of city planning was that "quality of the part" as the living condition was more important than the city itself.

If this review is to be applied to today's urban planning, it must be based on the fact that the Japanese were not very concerned with the size of the urban area. Some historic towns developed along roads and many cities did not have a center as in the West. The fact that the image and history of the "city" was different from that of Europe may have led to a uniquely Japanese interpretation of the garden city. In Japan, therefore, it may be necessary to consider not only compact cities in terms of area but also new "compact cities" in terms of compact energy consumption and use of natural resources.

References

Hashimoto, S. (1925). *Saikin oubei toshi no hattatsu* [Recent Developments in Western Cities]. Tokyo: Shin-sei sya.

Iinuma, K. (1925a). Den-en toshi ni arawaretaru toshi no riso [The Ideal of the City as Expressed in the Theory of the Garden City]. *Jiti Kenkyu, 1*(1), 87–95.

Iinuma, K. (1925b). Toshi keikaku no hitsuyo [The Necessity of Urban Planning]. *Toshi Koron, 8*(9), 6–17.

Iinuma, K. (1927). *Toshi keikaku no riron to housei* [Theory and Legistlation of Urban Planinng]. Tokyo: Ryosyo fukyu kai.

Ikeda, H. (1922). *Toshi keiei ron* [Residencial Manegement Theory]. Tokyo: Toshi kenkyu-kai.

Kataoka, Y. (1916). *Gendai toshi no kenkyu* [A Study of Modern City]. Tokyo: Kentiku kougei kyoukai.

Kikuchi, S. (1925). Den-en raisan to toshi no den-en ka [Appreciation of the Countryside and Ruralisation of the City]. *Tiho Gyosei, 33* (10), 413–420.

Kono, M. (1924). *Toshi ka Den-en ka* [City or Countryside?]. Tokyo: Matsuyama-bo.

Kurotani, R. (1922). *San-rin toshi* [Mountain City]. Nagoya: Seinen toshi kenkyu-kai.

Kuwahara, I. (1926). Den-en toshi no riso [Garden City Ideal]. *Zoen Gaku Zassi, 2*(6), 28–52. https://doi.org/10.5632/jila1925.2.416

Miyake, I. (1908). *Toshi no Kenkyu* [A Study of cities]. Tokyo: Jitugyo nihon-sya.

Miyake, K. (1919). *Jutaku mondai to den-en toshi* [Residencial Problem and Garden City]. Tokyo: Urban Matters Research Association.

Mori, O. (1914). *Shingai zousetsu no keikaku [Planning of New Urban Districts]. Eisei Shin-pen* (5th ed.). Nan ko do shoten.

Murakami, A. (1996). Tokiyoshi Yokoi's vision on town and country planning and garden city theory of Ebenezer Howard. *Journal of the Japanese Institute of Landscape Architecture, 60*(5), 447–450. https://doi.org/10.5632/jila.60.447

Murakami, A. (1999). The acceptance of Howard's Garden City theory by the bureau of home affairs, the ministry of interior in the Meiji Era. *Journal of Rural Planning, 18*, 13–18. https://doi.org/10.2750/arp.18.18-suppl_13

Murakami, A. (2000). Kazumi Iinuma's vision on Garden City theory. *Journal of Rural Planning, 19*, 193–198. https://doi.org/10.2750/arp.19.19-suppl_193

Namae, T. (1912). *Oubei shisatsu saimin to kyusai* [Visits to Europe and America, fine people and relief]. Tokyo: Hakubun-an.

Nishiyama, Y. (1981). Garden City theory and Japanese city planning before WWII. *Quarterly Garden City, 2*(1), 120–125.

Ogawa, I. (1922). *Jutaku oyobi toti mondai* [Residences and Land]. Osaka: Mainichi sinbun-sya.

Seki, H. (1913). Kaen toshi to toshi keikaku [Urban Planning and Garden City]. *Hogaku Sinpo, 23*(1), 21–40.

Seki, H. (1921). Eikoku jutaku seisaku oyobi toshi keikaku [Residencial Policy and Urban Planning in England]. *Kokumin Keizai Zasshi, 31*(5), 1–19.

Seki, H. (1924). Kinsei toshi no hattenn to toshi keikaku [Early Modern City Development and Urban Planinng]. *Toshi Koron, 7*(12), 2–22.
Seki, H. (1923). *Jutaku mondai to toshi keikaku* [Residencial Problem and Urban Planning]. Kyoto: Kobundo-shobo.
Shigenaga, H. (1925). Den-en toshi no hattatsu [Development of the Garden City]. *Toshi Koron, 8*(10), 21–28.
Tagawa, D. (1925). *Toshi seisaku han-ron* [Urban Policy General Theory]. Tokyo: Haku you sya.
Tagawa, D. (1926). Den-en toshi ni tsuite [About the Garden City]. *Dai Osaka, 2*(3), 16–22.
Takahashi, S. (1925). Den-en toshi ni tsuite [About The Garden City]. *Tiho Gyosei, 33*(10), 396–411.
Takahashi, U. (1924). Den-en toshi ni tsuite [About The Garden City]. *Toshi to Koen.* Tokyo: Narumi-do syoten.
Tamura, T. (1925). *Zoen-gaku gairon* [Introduction to Landscape Architecture]. Tokyo: Narumi-do syoten.
Uehara, K. (1924). *Zoen-gaku han ron* [General Theory of Landscape Architecture]. Tokyo: Rinsen-sya.
Volunteers of the Ministry of the Interior. (1907). *Den-en Toshi* [Garden City]. Tokyo: Hakubun-an.
Watanabe, S. (1977). A Study on Japanese Garden City (1). *Journal of the City Planning Institute of Japan, 12*, 151–156. https://doi.org/10.11361/journalcpij.12.151.
Watanabe, S. (1978). A Study on Japanese Garden City (2). *Journal of the City Planning Institute of Japan, 13*, 283–288. https://doi.org/10.11361/journalcpij.13.283.
Yumiie, S. (1923). *Toshi no hanashi* [Cities]. Tokyo: Sekai sityou kenkyu-kai.
Yumiie, S. (1925). Igirisu ni okeru den-en toshi undo [The Garden City Movement in England]. *Toshi Mondai, 1*(1), 66–85.

Energy Efficiency and Building's Envelope: An Integrated Approach to High-Performance Architecture

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Abstract

One of the significant categories that profoundly influence global warming is the building industry. Many measures have been considered to reduce the building industry's impacts on the environment, one of which is utilizing a sustainable building envelope to increase the energy efficiency of construction. However, there are still too many problems, especially in implementing the sustainable building envelope. Thus, in the following research, to find the problem in this field, five green architecture principle categories have been analyzed on the 70 different projects with sustainable envelopes, chosen randomly around the world. Moreover, this article illustrates the impacts of green architecture indicators in both existing and designed buildings to find available capacities in various sectors for improving the building industry. As a result, the lack of proper plans for these green initiatives has resulted in arbitrary measures. Therefore, authorities should establish decisively and implement rules to lead the building industry to prioritize sustainable principles. Their significant potentials have been missed since projects that concentrated on sustainable regulations were only designed and built based on a few green features.

Keywords

Building envelope • Conserving energy • Green architecture • Shell • Sustainable building

1 Introduction

Controlling the amount of energy consumption, waste emission, and environmental damage in architectural fields is used to characterize a technology with a lower impact on environmental problems (Grierson & Moultrie, 2011) as future uncertainties such as climate change may worsen the condition (Bazazzadeh et al., 2021a). Indeed, sustainable development can be considered continuous development in financial, natural, and human resources. It could provide sustainable economic, social, and cultural development (Mahdavinejad et al., 2014; Poodineh, 2017; Bazazzadeh et al., 2020) and even bring flexibility to buildings (Bazazzadeh et al., 2021b). However, although considerable progress has been made in technology and science related to sustainable development, there are many restrictions on the building implementation section, especially in developing countries. And this has slowed down the sustainable architecture process. In this article, to find the high-performance buildings' limitations, sustainable principles have been investigated on the selected projects according to the five main ideas mentioned below (Yardimil et al., 2020):

- Optimization of energy consumption principles on the selected projects.
- Design principle regard to climate land to take advantage of the natural elements and factors such as sun angles and shading (Mansourimajoumerd et al., 2020).
- Reducing the consumption of new resources by minimizing the waste in the construction process and reusing or recycling materials and the resources which are used in the construction phase (CGB, 2009).

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- User needs to consider occupants' satisfaction and productivity in the building.
- Condition of sites in design to reduce the impact of development on the natural environment, such as using wind patterns to shape the building form (Ragheb et al., 2016; Peters, 2017).

In this paper, those factors have been analyzed on buildings envelope. Moreover, the building envelopes have been used as a shelter, security, solar and thermal control, indoor air quality control, moisture control, daylight access, and cost-effectiveness (Bolin, 2019). Hence, conserving energy by building envelopes could foster the energy efficiency of the building industry. Furthermore, a building envelope can enhance the efficiency of the building that is planned to construct, and meanwhile it can improve the existing construction condition by decreasing their energy consumption (Bano & Sehgal, 2019). However, sustainable building envelope design is a complicated process involving many factors explained individually in the following paragraphs (Wu et al., 2016).

Besides these elements, building envelopes act as a barrier between the building and the external environment and have a significant role in providing comfort conditions and energy demand (Kheiri, 2018; Acar et al., 2021). These elements not only have an active role in the sustainability of structures (Tabrizikahou et al., 2021a), even for historic buildings (Javanmardi et al., 2021) but also have the capacity for improvements through retrofitting strategies (Tabrizikahou et al., 2021b).

That is why an optimized building envelope can directly affect the capacity of a building's system, such as HVAC systems. The potential of the building envelope is so high that it has been reported that it can save energy demand of the building between 32 and 58%. It can also save up to 85% energy demand in the late evening, achieving delays peak (Alalouch et al., 2019). While envelopes of buildings traditionally characterized by a significant thermal resistance prevent their overheating, optimized ones tend to control the indoor condition with new solutions (Zachar & Daoutidis, 2018). To this end, this paper aims to study the impact of optimizing the building's envelopes on buildings' energy consumption.

2 Methodology

This study involves a four-stage methodology: (1) reviewing the literature for gathering the information, (2) selecting 70 different projects worldwide, (3) searching and collecting data about them, (4) classifying the finding in various categories and analyzing them to achieve the result. Also, in this study, data collection is divided into two categories: primary data and secondary data (Fig. 1).

- Primary data are raw data that have been collected for the first time, and they have been gathered by questionnaire. A questionnaire is written systematically to understand issues and problems and find intervention strategies by asking specific questions with a particular direction.
- Secondary data is information that has already been gathered and tested, such as building envelopes function.

Selecting case studies has been done through a random selection of projects among a long list of possible projects. A random method of selection has been used without any specific criteria to help generalize the research concept and have an unbiased overview of the quality of buildings worldwide in terms of sustainable architecture principles.

2.1 The Proportion of Selected Countries

Identifying 70 different projects from the developed and developing countries except for Iran until in another study, information on this article can be compared with Iran's data to find the best alternative for beneficial investments. The number of projects in each country: USA 38, Germany 6, Canada 3, China 6, Dubai 2, Italy 4, U.K. 2, Australia 2, Greek 1, Russia 2, Japan 1, Switzerland 1, South Korea 1, and Turkey 1.

2.2 Construction and Design's Stage

Due to the implementation limitations of some innovative ideas, such as having a shell with various functions in a building, most of the cases did not reach the construction stage. Hence, that would be best to separately discuss and compare the constructed projects and projects that remained in the design phase.

Furthermore, more than half of the projects in this essay did not build (by over 57 percent), while only 42.9% did construct. It means, from 70 under investigation buildings, 30 of them were built, and the other 40 remained in the design section.

2.3 Frequency of the Zones' Functions

Green building principles make no restriction for building functions: thus, those factors can be considered in any building, hospital, school, etc. (Ragheb et al., 2016). However, this essay's randomized selection of projects leads to

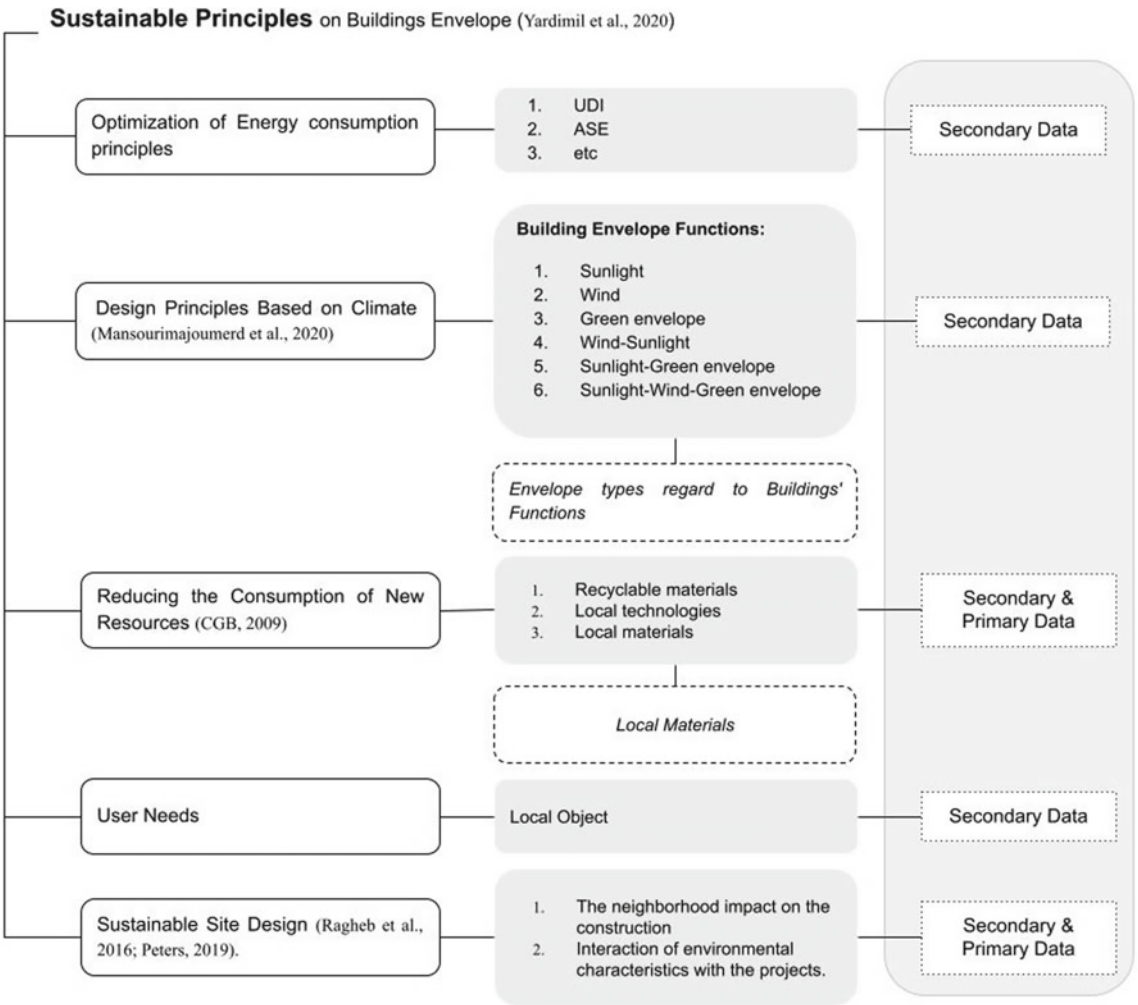

Fig. 1 Sustainable priciples

an unequal number of constructions in each function. Hence, it is necessary to determine each function's frequency until study on the obtained data. Figure 2 illustrates the frequency of each zones' function within the case studies. It should be noted that in this section, the main function of the building is not the case, but in this section, the function of different zones is concerned. In this way, for example, in a multi-complex center, there might be five different functions. That is why the number of zones' function is 137 while the number of buildings is 70.

It is evident in Table 1 among 137 surveyed projects, the highest zones' functions frequency with 32 cases belongs to administrative constructions (over 23.4% of total). After that, there are Cultural-Educational (such as schools, museums), Commercial places, Residential, and Services buildings with 19%, 16.8%, 11.7%, and 11%, respectively. Finally, the lowest percentage among various construction types was approximately 5.8% for sport and religious places.

3 Findings

One promising approach for enhancing environmental health is simultaneous, architectural design, and sustainable design, which can also lead to an accurate investment (Solkiewicz-kos, 2017). In fact, green architecture strives to minimize endangered resources to reduce the building industry's harm to the natural environment (Ragheb et al., 2016).

In the following essay, green architecture principles will be investigated in chosen projects until the impacts of its various features in different buildings are determined. Moreover, it is essential to note that the obtained data will lead to finding green architecture approaches' weaknesses and strengths. It will also guide architecture to find functional methods for a diversity of constructions. Also, each of the tables and figures is sought to find sustainable building

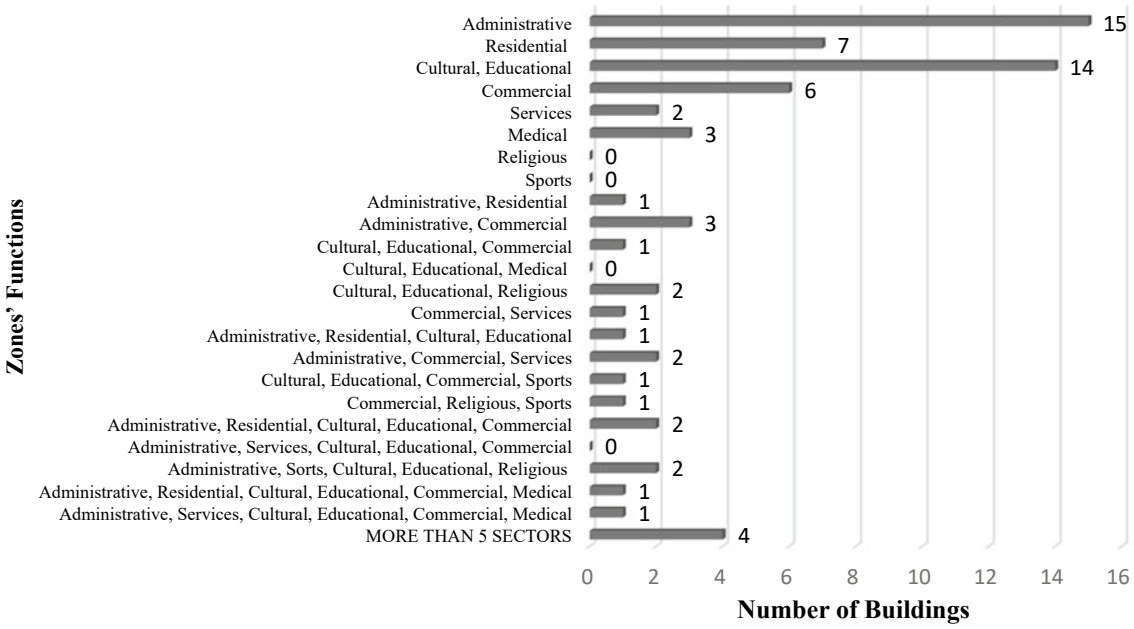

Fig. 2 Zones' functions

Table 1 Frequency of the function of zones in case studies

Percent	Frequency	Zones' function
23.4	32	Administrative
11.7	16	Residential
19	26	Cultural_educational
16.8	23	Commercial
6.6	9	Medical
11	15	Services
5.8	8	Sports
5.8	8	Religious
100.0	137	Total

indicators' average impacts on selected projects regarding their function and status.

3.1 Optimization of Energy Consumption Principle on Buildings Envelope

The efficient design of building envelopes according to the sustainable architecture to control energy consumption is a highly complex optimization problem (Yang et al., 2017). However, it can bring energy efficiency with the least changes, which is very important for some built environments such as cultural heritage (Bazazzadeh, 2020). Optimizing energy consumption in the building has been an ongoing subject in various fields (Tabrizikahou & Nowotarski, 2021).

Hence, it is a priority to find the sustainable factors that have been considered in the buildings or designs to detect the issue. Thus, the given chart represents how much architects have used optimization energy consumption principles in the buildings. It is necessary to cite that these numbers in Fig. 3 have dedicated one point for each of the dependent variables related to the energy consumption in the building. Such as maximizing useful daylight illuminance (UDI), minimizing annual sunlight exposure (ASE), minimizing total load (heating load, cooling load, and daylighting), etc. Although increasing the number of dependent variables raises the level of complexity of the analysis, their results are more reliable with fewer errors in reducing building energy.

In the given bar chart below, among the built buildings, the Medical category has the highest optimization energy

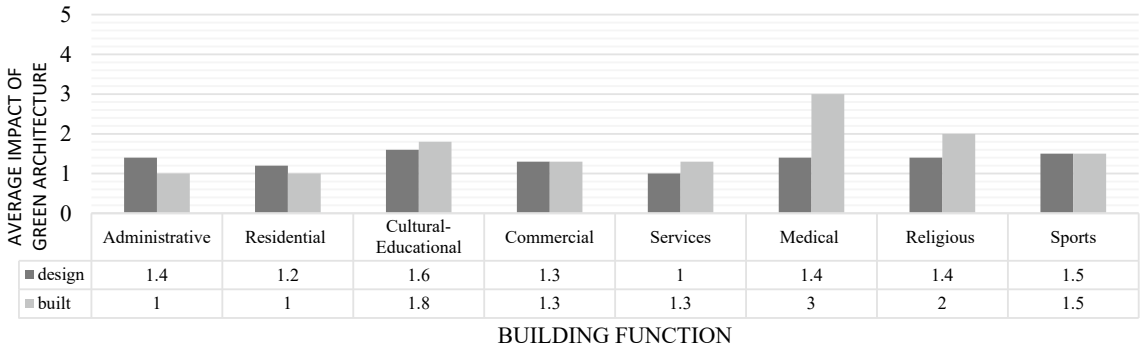

Fig. 3 The average impact of optimization energy consumption principle on building

consumption effects in their sector by 3. By comparison, Administrative and Residential buildings with 1 unit have minor impacts on green architectural approaches. Also, there is no enormous difference between various building types' average influence among the designed structures. It ranges from 1 to 1.6, with Services being the lowest and Cultural-Educational the highest. As a result, the amount of attention in projects to the principle of energy conservation, in most cases, is below the average. Thus, improving factors related to energy consumption could be the right alternative for saving energy if a return on investment is one of the projects' concerns.

3.2 Design Principles Based on Climate

Building energy consumption improvement requires practical approaches that can occur by increasing the concentration on each region's climate conditions (EXXON MOBIL, 2016; Bazazzadeh et al., 2021c). Moreover, one of the beneficial ways to have sustainable buildings according to the building climate zone is using environmental-friendly shells (solar envelope, wind envelope, green wall). Thus, the envelopes' performance has been studied according to the weather conditions in Table 2.

It is clear that most of the envelopes, in 93 projects out of 137, control the sunlight radiation. However, only in one project, the envelope has controlled the sunlight, wind, and at the same time it is a green envelope. In addition, 13 of the building envelopes are represented as Missing data. Because they do not fit in any of the table's primary functions, and they are used for other aspects like decoration. As a result, a study about the project's climate conditions could lead to a higher performance building; to accomplish this, there is a need for the same attention to different types of building envelopes.

3.2.1 Envelope Types Regard to Zones' Functions

This bar chart depicts various kinds of envelopes used in buildings with eight different functions (Fig. 4). The first and second ranked have belonged to the administrative section with 22 projects and Cultural-Educational with 21 projects affected by sunlight radiation. Also, there are two building envelopes in each administrative, Cultural-Educational, and Service buildings that control sunlight and wind. The next noticeable point is that only two building envelopes in the Residential sector have been affected by wind.

However, rarely can we find buildings that are influenced by other shell types, especially those with multi-sustainable features. Furthermore, the sunlight-green envelope has been

Table 2 Building envelope functions

Percent	Frequency	Building envelope functions
67.9	93	Sunlight
4.4	6	Wind
2.2	3	Green envelope
6.6	9	Wind-sunlight
8	11	Sunlight-green envelope
0.7	1	Sunlight-wind-green envelope
9.5	13	Missing
100	137	Total

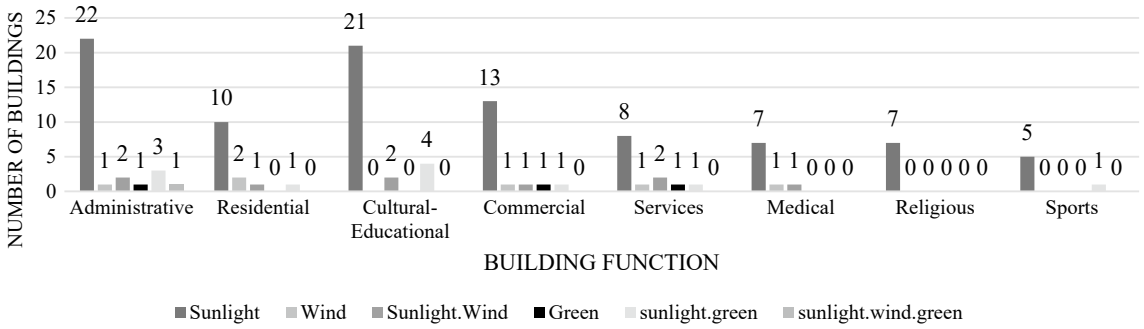

Fig. 4 Envelope type regarded to the zones' function

used more than other categories among the shell types with more than one feature.

3.3 Reducing the Consumption of New Resources

To reduce the adverse effect of building activities on the environment and the ecosystem, enforcing sustainability principles should prioritize in the construction industry (Olanipekun et al., 2017; Chel & Kaushik, 2018). Since in this approach, a large amount of material will be reused, and non-recyclable resources will be replaced with renewable materials. Figure 5 displays the Projects' frequency on reducing the consumption of new resources. The measurements' units were divided into three categories: 1. recyclable materials, 2. local technologies, and 3. local materials. The information in this figure depicts number one as a project which uses only one of the given features, and numbers 2 and 3 show usage of two and all features, respectively. Moreover, Fig. 5 depicts the number zero if projects did not have any of the given reasons.

In terms of reducing new resource consumption, most building investors ignore this factor, although it can be beneficial. However, among the projects with one of the said features, the Administrative buildings have the highest number. Moreover, the projects that provided envelopes with all features were limited between 1 and 4 in the presented functions.

3.3.1 Local Material

Reducing energy consumption could happen by utilizing the local materials (Chel & Kaushik, 2018). Indeed, many buildings' life-cycle assessments can be improved significantly if the material is selected from the building's environment (Zhang & Wang, 2015; Diker & Yazicioglu, 2020). For instance, less carbon dioxide will be emitted because it takes less time to transport materials to the construction site. Table 3 gives information about local materials used in the building envelope. Overall, 13 out of 137 buildings (9.5%) have been built with local materials.

3.4 User Needs

One approach to having sustainable constructions is to provide suitable conditions for beneficiaries' satisfaction (Cross et al., 2017). In this context, local objects represent the traditional aspect of architecture and enhance user comfort. For instance, the concept of Al Bahar Towers

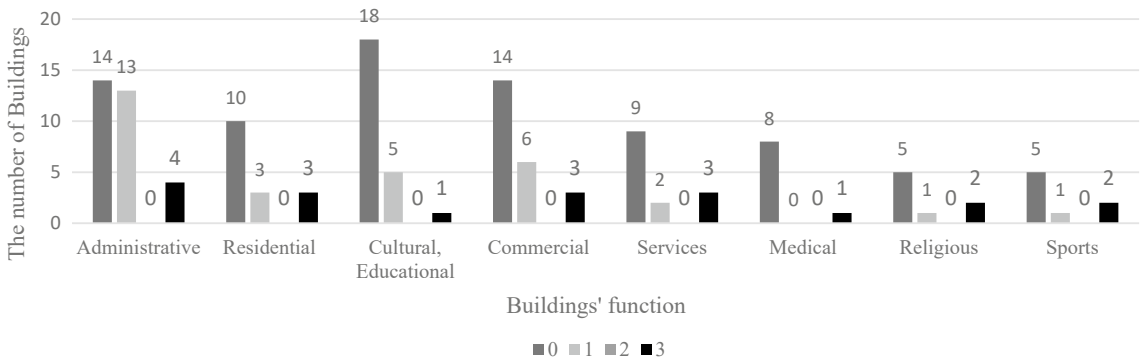

Fig. 5 The Project's frequency on reducing the consumption of new resources

Table 3 Local materials used in building envelopes

Percent	Frequency	Surveyed variables
9.5	13	Number of projects with Local Materials
100.0	137	Number of projects in Total

Table 4 Local objects used in building envelopes

Percent	Frequency	Surveyed variables
6.57	9	Number of projects with Local Objects
100.0	137	Number of projects in Total

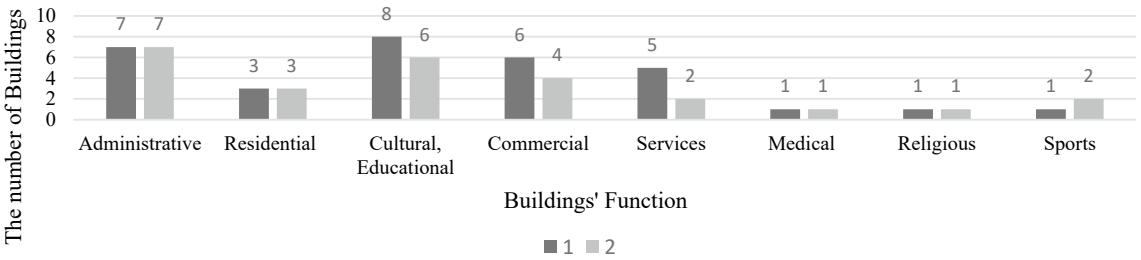

Fig. 6 Projects' coordination level with site features

Responsive Façade was based on Mashrabiya, a traditional Islamic lattice shading device as a responsive façade (Cilenton, 2019).

3.4.1 Local Object

The energy-efficient buildings in the first step must be practical for their occupants, and a comprehensive understanding of the sustainable factors could increase the level of residents' satisfaction (Peters, 2017; Tang et al., 2019). One of the sustainable indicators that can raise beneficiaries' comfort is using local objects in the buildings. That can make a deep connection between users and the environments where they live. For instance, using the Shanasheel[1] devices (Haraty et al., 2018) in the building's balcony can preserve part of Iran culture and control the sunlight. Table 4 shows the building's frequency under this title; 9 out of 137 buildings (6.57%) have been designed and built according to local objects.

3.5 Sustainable Site Design

The green building design process begins with a comprehensive understanding of the site's potential, such as weather conditions and the site's topology (Ragheb et al., 2016). Therefore, the graph below shows the projects' coordination level with site features in three different subjects: (1) climate conditions of the site, (2) the neighborhood impact on the construction, (3) interaction of environmental characteristics with the projects. However, only two last categories will be analyzed in the next section because the first one has already been studied in the previous parts.

It is clear, 69 out of 137 projects had at least one of the features cited in the preceding paragraphs. Furthermore, number 1 is dedicated to projects that follow one of the upper features, and number 2 belongs to two of them. Also, Cultural-Educational and Administrative buildings have the highest number of buildings by 14 (Fig. 6).

3.6 The Average Usage of the Sustainable Principle

Achieving zero energy buildings according to sustainable principles' factors in architectural projects is usually complicated. This study analyzes the impact of sustainable principles on projects that have an envelope to improve energy conservation.

Figure 7 illustrates the information about five sustainable principles that were analyzed in this essay, and these subjects are divided into 14 subcategories. Regarding these subcategories, the average usage of sustainable principles in the presented functions is between 4 and 5 out of 14. As a result, although conserving energy in most projects was one of their main architectural concepts, a large number of projects only concentrate on a few features of sustainable principles.

[1] The Shanasheel are lattice windows made up of wood circular balusters placed in a beautiful and sophisticated geometric pattern at certain regular intervals.

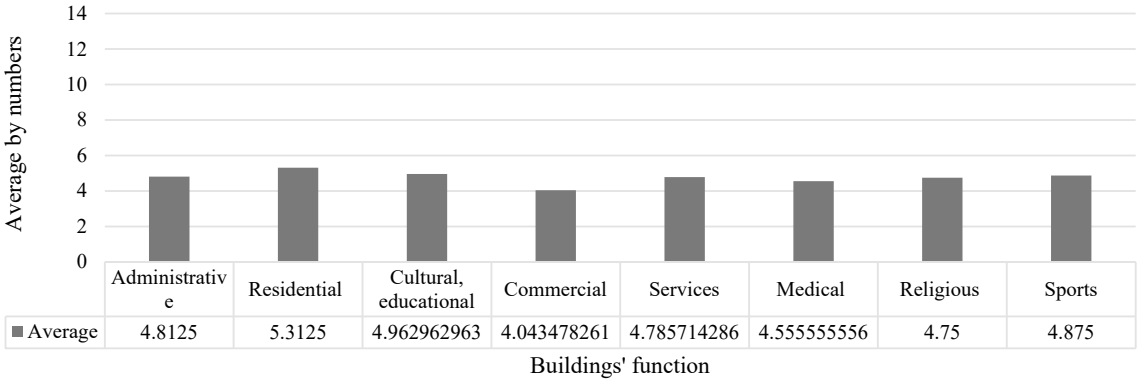

Fig. 7 Average usage of sustainable principles in different functions

4 Conclusion

The building industry is one of the major categories that have a considerable impact on global warming. That is why many alternatives have been suggested to reduce the effect of the construction industry on the environment. However, it can be noted that there is still plenty of problems that have to be measured in this field.

Based on the findings, by considering the effects of the green architecture principles in the construction and design stage, the following data were achieved: (1) The rate of considering sustainable principles both in the construction section and design stage is lower than the average by 4.467 and 5.069 out of 14, respectively. (2) The average stability in the design section is greater than the implementation by 0.602.

Consequently, a zero energy building is only achievable with a comprehensive analysis of existing projects until the weaknesses are distinguished. Moreover, these sustainable architectural principles should be established as a law for all buildings with various functions to accelerate the process of having sustainable constructions. Also, an organization must deeply put all its attention to sustainable principle aspects of constructed buildings.

References

Acar, U., Kaska, O., & Tokgoz, N. (2021). Multi-objective optimization of building envelope components at the preliminary design stage for residential buildings in Turkey. *Journal of Building Engineering, 42*, 102499. https://doi.org/10.1016/j.jobe.2021.102499

Alalouch, C., Al-Saadi, S., AlWaer, H., & Al-Khaled, K. (2019). Energy saving potential for residential buildings in hot climates: The case of Oman. *Sustainable Cities and Society, 46*, 101442. https://doi.org/10.1016/j.scs.2019.101442

Bano, F., & Sehgal, V. (2019). Finding the gaps and methodology of passive features of building envelope optimization and its requirement for office buildings in India. *Thermal Science and Engineering Progress, 9*, 66–93. https://doi.org/10.1016/j.tsep.2018.11.004

Bazazzadeh, H., Nadolny, A., Attarian, K., Safar ali najar, B., & Hashemi safaei, S. sara. (2020). Promoting sustainable development of cultural assets by improving users' perception through space configuration; Case study: *The industrial heritage site. Sustainability*, *12*(12), 5109. https://doi.org/10.3390/su12125109.

Bazazzadeh, H., Pilechiha, P., Nadolny, A., Mahdavinejad, M., & Hashemi safaei, S. sara. (2021a). The impact assessment of climate change on building energy consumption in Poland. *Energies*, *14* (14), 4084. https://doi.org/10.3390/en14144084.

Bazazzadeh, H., Mehan, A., Nadolny, A., & Hashemi Safaei, S. (2021b) The importance of flexibility in adaptive reuse of industrial heritage: Learning from Iranian cases. *International Journal of Conservation Science,12*(1).

Bazazzadeh, H., Nadolny, A., & Safaei, S. S. (2021c). Climate change and building energy consumption: A review of the impact of weather parameters influenced by climate change on household heating and cooling demands of buildings. *European Journal of Sustainable Development, 10*(2), 1–12. https://doi.org/10.14207/ejsd.2021c.v10n2p1.

Bolin, R. (2019). Sustainability of the building envelope. *The Internet Journal of WBDG National Institute of Building Science*. https://www.wbdg.org/resources/sustainability-building-envelope.

CGB. (2009). Center for green building, "Building the Green Garden State," *New Jersey Municipalities Magazine*, *86*.

Chel, A., & Kaushik, G. (2018). Renewable energy technologies for sustainable development of energy efficient building. *Alexandria Engineering Journal, 57*(2), 655–669. https://doi.org/10.1016/j.aej.2017.02.027

Cilenton, K. (2019). Aedas: Al Bahar Towers responsive facade, Abu Dhabi, UAE. *The Internet Journal of ArchDaily*. https://www.archdaily.com/270592/al-bahar-towers-responsive-facade-aedas.

Cross, J. E., Shelley, T. O. C., & Mayer, A. P. (2017). Putting the green into corrections: Improving energy conservation, building function, safety and occupant well-being in an American correctional facility. *Energy Research & Social Science, 32*, 149–163. https://doi.org/10.1016/j.erss.2017.06.020

Diker, B., & Yazıcıoğlu, F. (2020). A research on Straw Bale and traditional external wall systems: Energy and cost-efficiency analysis. *A/z : ITU Journal of Faculty of Architecture, 17*(1), 95–103. https://doi.org/10.5505/itujfa.2019.65882

EXXON MOBIL. (2016). Global fuel demand in 2040—Projection. In the Outlook for Energy: A View to 2040. *Slide presentation*, *57*. http://cdn.exxonmobil.com/ ~ /media/global/files/outlook-for-energy/2016/2016-outlook-for-energy.pdf .

Grierson, D., & Moultrie, C. (2011). Architectural design principles and processes for sustainability: Towards a typology of sustainable building design. *Design Principles and Practices: An International Journal—Annual Review*, *5*(4), 623–634. https://doi.org/10.18848/1833-1874/cgp/v05i04/38118.

Haraty, H., Raschid,Y., Mohd YUNOS, M., & Utaberta, N.(2018). Exploring architecture patterns of Iraqi traditional courtyard houses from an Islamic perception. In *1st International Conference on Religion, Social Sciences and Technological Education*. https://insighteighteen18.wixsite.com/insight18.

Javanmardi, A., Ghaedi, K., Huang, F., Hanif, M. U., & Tabrizikahou, A. (2021). Application of structural control systems for the cables of cable-stayed bridges: State-of-the-art and state-of-the-practice. *Archives of Computational Methods in Engineering*. https://doi.org/10.1007/s11831-021-09632-4

Kheiri, F. (2018). A review on optimization methods applied in energy-efficient building geometry and Envelope Design. *Renewable and Sustainable Energy Reviews, 92*, 897–920. https://doi.org/10.1016/j.rser.2018.04.080

Mahdavinejad, M., Zia, A., Larki, A. N., Ghanavati, S., & Elmi, N. (2014). Dilemma of green and pseudo green architecture based on LEED norms in case of developing countries. *International Journal of Sustainable Built Environment, 3*(2), 235–246. https://doi.org/10.1016/j.ijsbe.2014.06.003

Mansourimajoumerd, P., Mahdavinejad, M., Niknia, S., & Shirvani, M. (2020). Comprehensive strategies for optimization e-Energy system in different climate zone. In *The 4th International Conference on Architecture, Arts and Applications*, 4–5.

Olanipekun, A. O., Chan, A. P. C., Xia, B., & (P., & Ameyaw, E. E. (2017). Indicators of owner commitment for successful delivery of green building projects. *Ecological Indicators, 72*, 268–277. https://doi.org/10.1016/j.ecolind.2016.08.017

Peters, T. (2017). Interconnected approaches to sustainable architecture. *Architectural Design, 87*(2), 6–15. https://doi.org/10.1002/ad.2147

Poodineh, H. (2017). Principles of sustainable architecture in sistan architecture (Case study: Ghale Nov Village). *International Journal of Applied Engineering Research, 12*, 2162–2170.

Ragheb, A., El-Shimy, H., & Ragheb, G. (2016). Green architecture: A concept of sustainability. *Procedia—Social and Behavioral Sciences, 216*, 778–787. https://doi.org/10.1016/j.sbspro.2015.12.075

Sołkeiewicz-Kos, N. (2017). Sustainable architecture in the context of regional activities. *IOP Conference Series: Materials Science and Engineering, 245*, 052055. https://doi.org/10.1088/1757-899x/245/5/052055

Tabrizikahou, A., & Nowotarski, P. (2021). Mitigating the energy consumption and the carbon emission in the building structures by optimization of the construction processes. *Energies, 14*(11), 3287. https://doi.org/10.3390/en14113287

Tabrizikahou, A., Kuczma, M., Nowotarski, P., Kwiatek, M., & Javanmardi, A. (2021a). Sustainability of civil structures through the application of smart materials: A review. *Materials, 14*(17), 4824. https://doi.org/10.3390/ma14174824

Tabrizikahou, A., Hadzima-Nyarko, M., Kuczma, M., & Lozančić, S. (2021b). Application of shape memory alloys in retrofitting of masonry and heritage structures based on their vulnerability revealed in the BAM 2003 earthquake. *Materials, 14*(16), 4480. https://doi.org/10.3390/ma14164480

Tang, Z. W., Ng, S. T., & Skitmore, M. (2019). Influence of procurement systems to the success of sustainable buildings. *Journal of Cleaner Production, 218*, 1007–1030. https://doi.org/10.1016/j.jclepro.2019.01.213

Wu, M. H., Ng, T. S., & Skitmore, M. R. (2016). Sustainable building envelope design by considering energy cost and occupant satisfaction. *Energy for Sustainable Development, 31*, 118–129. https://doi.org/10.1016/j.esd.2015.12.003

Yang, M.-D., Lin, M.-D., Lin, Y.-H., & Tsai, K.-T. (2017). Multiobjective optimization design of green building envelope material using a non-dominated sorting genetic algorithm. *Applied Thermal Engineering, 111*, 1255–1264. https://doi.org/10.1016/j.applthermaleng.2016.01.015

Yardımlı, S., Güleç Özer, D., & Shahriary, A. (2020). Sustainable street architecture and its effects on human comfort conditions: Yazd Iran. a/z. *ITU Journal of Faculty of Architecture, 17*(2), 113–122. https://doi.org/10.5505/itujfa.2020.70188

Zachar, M., & Daoutidis, P. (2018). Energy management and load shaping for commercial microgrids coupled with flexible building environment control. *Journal of Energy Storage, 16*, 61–75. https://doi.org/10.1016/j.est.2017.12.017

Zhang, X., & Wang, F. (2015). Life-cycle assessment and control measures for carbon emissions of typical buildings in China. *Building and Environment, 86*, 89–97. https://doi.org/10.1016/j.buildenv.2015.01.003

Mapping Social Cohesion and Identity in Intercultural Public Spaces: The Case of Germantown

Chitsanzo Isaac and Olaitan Awomolo

Abstract

Across the world, the ongoing Covid-19 pandemic has challenged urban systems and structures, highlighting societal vulnerabilities within cities, and uncovering systemic inequalities among their communities. At the same time, the measures enacted in response to the pandemic revealed the important role of social interactions and cohesion in supporting resilient communities during challenging times. We know that strong social ties among various communities, particularly in intercultural cities can promote civic engagement and participation. However we do not know enough about the mechanisms, processes, places, and tools that create these social ties. We need more insight on how people create opportunities for equitable planning and recovery from unexpected and potentially catastrophic events.

This chapter examines the role of urban public space in developing and maintaining social ties, focusing on intercultural communities during the ongoing Covid-19 pandemic. Our focus on interculturalism is influenced by Levrau and Loobyuck's (2018) definition, which gives special attention to the contact between people of different backgrounds and shared community memberships. Interculturalism creates a new paradigm based on the idea of interpersonal contact as a tool to create a stronger sense of societal belonging. To this end, we pose the following question: can social interactions, identity, and cohesion in public spaces be mapped spatially as a means to document and identify community resilience in the intercultural urban context? This will help us understand how public spaces support the people and communities around them, as places of gathering, well-being, and civic expression. This work will shed light on the role of public space in developing and maintaining strong social ties in intercultural communities at the neighborhood level.

Keywords

Social resilience • Space and culture • Urban public space • COVID-19 • Interculturalism

1 Introduction

The pandemic caused by the Covid-19 virus has significantly impacted all, particularly those in low income and minority communities. In addition to experiencing higher prevalence rates of infection (Truong & Asare, 2021), people living in these communities have less access to high quality healthcare, and a higher prevalence of high-mortality diseases like obesity and diabetes. In New York City the mortality rate from Covid-19 was twice as high for Black and Latino residents than for White residents (Wade, 2020). On a global scale, age-old issues of inequality in health and healthcare access were exposed, along with the need for more conversations around the role of social and community resilience in dealing with and recovering from the effects of the pandemic.

We know that the pandemic, and strategies to reduce the spread of the pandemic, have strained mental health for all (Kumar & Nayar, 2021). Public spaces like parks, plazas, public squares, played a significant role in creating much-needed opportunities for social interactions and connections during long periods of isolation. Mental and physical health benefits obtained through access to green space and engagement in physical activity were useful tools in maintaining people's health and well-being during these times (Slater et al., 2020). However, there are still a lot of unknown barriers and opportunities surrounding the impact of the use of public spaces as vehicles for social cohesion and connection. For instance, research shows that both

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children and adults who visit parks are more likely to gain physical and mental health benefits and meet the recommended frequency, type, and intensity guidelines for physical activity (Flowers et al., 2019). We would like to know how the use of these spaces fosters social interaction and strengthen community ties.

Urban public spaces allow people to mingle, interact, and connect, providing both social and mental benefits and strengthening community ties (Cattell et al., 2008). The pandemic fractured this balance in city living and created barriers to the social norm by initially keeping people indoors and reducing their use of neighborhood parks and outdoor public spaces (Kumar & Nayar, 2021). In addition to these barriers, people were either unwilling or unable to spend time in parks or engage in physical activity to prevent disease infection—an attitude that might linger long after the pandemic ends (Volenec et al., 2021).

Social theories including the similarity-attraction principle posit that higher social cohesion occurs between individuals with high similarities. This theory states that people are attracted to those like themselves and prefer to be with other individuals they find similar values and beliefs (Stahl et al., 2010). The agreement of individuals on these values and beliefs reinforces positive attitudes. While individuals' attraction to others like themselves has a positive effect between similar units, the lack of attraction to dissimilar individuals has a negative effect on integration (Lichtenstein et al., 1997).

The negative relationship between diversity and social cohesion in the similarity-attraction principle is supported by Tajfel's social identity theory (Stahl et al., 2010; Tajfel, 1974). The Social Identification and Categorization Theory states that individuals belong to a group based on their perceptions of how they fit within the group and their perceptions of similarities between group members (Stahl et al., 2010; Tajfel, 1974).

Social Identity is described as the self-identification or self-categorization an individual places on themselves to situate themselves within a team or a group. People categorize themselves into groups based on similar social identities and exclude themselves from other groups based on dissimilar social identities. The belief in shared values between members of the same identity groups promotes favorable behaviors between team members (Stahl et al., 2010; Tajfel, 1974).

Our particular interest in public spaces in intercultural communities is inspired first by our experiences living and working in diverse communities. Our prior work in examining the diversity of backgrounds and experiences: as a facilitator rather than a barrier to social cohesion in communities, also contributes to this interest. Although the theories described above tell us that there should be weaker social ties in cities with diverse populations, we believe that diversity of backgrounds drives social cohesion and community resilience. We are interested in the spaces and places that support and foster intercultural interactions. Interculturalism "gives special attention to social interaction, contacts between people of different backgrounds and shared membership, creating a new paradigm based on the idea of interpersonal contact as a tool to create a stronger sense of belonging together" (Levrau & Loobuyks, 2018). Interculturalism differs from multiculturalism, which has been the main focus of western research and has received backlash since the 90's due to policies and rhetoric reflecting anti-immigrant sentiment (Levrau & Loobuyks, 2018). Multiculturalism is hyper-focused on cultural difference, thereby disregarding common values that are present across different cultures. Interculturalism poses "a remedy, being allegedly well-suited to address some shortcomings of the multicultural approach" (Levrau & Loobuyks, 2018).

This chapter examines the role of urban public space in the development and maintenance of social ties in intercultural communities during the ongoing Covid-19 pandemic. Identifying the reasons behind social interactions and the use of public spaces in intercultural communities requires the use of social theories and methods. These provide multi-level strategies that can, in part, address present day challenges of social and community resilience. These include equity building, catalyzing communities, and improving the health and well-being of people in society. To achieve the set goals, we use a mixed-method approach that includes observations, target area mapping, survey, and analysis of the secondary literature. Drawing on these sources, we examine the data of the selected case study and we analyze the results obtained. We conclude by summarizing our findings and their implications in the discussion section.

2 Our Research Approach

In identifying a community to study, we considered neighborhoods that presented a variety of factors including a diversity of demographics—race, ethnicity, age, and income levels, and included a mix of both long-term, established residents and newer residents. We applied Cantle's definition as selection criteria to several neighborhoods in Philadelphia. Cantle describes a cohesive community as one where there is a common vision and a sense of belonging for all communities (Cantle, 2012). We borrow from and extend his description to our view of intercultural communities, as communities where the diversity of people's different backgrounds and circumstances are appreciated and positively valued. Having similar life opportunities is used to form bonds regardless of background, and strong positive relationships are developed between people in the community.

An important selection criterion was the presence of strong community ties. We used the presence of community groups and organizations, as well as the number and range of community-led initiatives as an initial indicator of social cohesion and social ties. From this analysis, we selected Germantown as our study neighborhood.

2.1 The Germantown Case Study

Germantown is a historically significant community in Northwest Philadelphia. Lenni Lenape indigenous inhabitants were victimized and displaced by negotiations with William Penn and other European colonists (Ghuru & Ortiz, 2020). By the end of the seventeenth century, the Lenape had been replaced by Europeans of several religious backgrounds. Founded in 1683, Germantown Township comprises present-day Germantown, Mount Airy, and Chestnut Hill (Fig. 1). The township is noted for its abolitionist movements and religious tolerance which were present during the colonial period.

Germantown Settlement

We selected Germantown as an intercultural community because it presents high levels of social interaction and shared membership between people of many backgrounds. This diversity has been evident throughout its history. As Ghuru & Ortiz (2020) write: "While Africans were forcibly brought to the area during the slavery era, there were also two waves of African American migration from the South to the North, from circa 1910 and 1930, and again from about 1940 to 1973. The twentieth-century migrations of African Americans and European groups led to a racially diverse and integrated population" (Ghuru, 2020). Figure 2a and b show the breakdown of ethnicities in Germantown in 1970 and 2018, respectively.

Breakdown of Ethnicity in Germantown

Today, Germantown remains a diverse community with strong community ties as evidenced by its wealth of community space and events, and rich social infrastructure that caters to all residents regardless of demographic or social-economic status. Figure 3 shows a map of Germantown highlighting the variety of community spaces that create opportunities for social interaction among residents of the neighborhood.

Community Inventory map

Community-led spaces in Germantown including parks, community food pantries, and urban gathering spaces, catalyze and activate social engagements. Combined with the rich histories of people and place, these spaces allow all people to become involved in and feel ownership in the neighborhood regardless of age, race, and economic status. We view this as an indicator of strong bonds and positive relationships between people in the community.

2.2 Research Methods

Our study of Germantown was guided by the following research question: can social interactions, identity, and cohesion in public space be mapped spatially as a means to document and identify community resilience in the intercultural urban context? We applied a mixed-methods approach that included observations, target area mapping, and a survey to study several public spaces that were dynamic places of gathering, of well-being, and of civic expression and support to the people who live and work in Germantown. Our goal was to shed light on how these spaces support the development and maintenance of the strong social ties present in the community. These methods were chosen because they have the potential to address the exploratory questions posed in this chapter and generate rich descriptions and insights into complex social practices.

A neighborhood survey was designed and distributed to a sample of Germantown residents. The design of the questionnaires was based on demographics, the participants' sense of belonging in their community, their perception of social cohesion of the neighborhood, and the participants' relationship to the physical public space surrounding them. The survey aimed to shed light on: (a) Community members' perceptions of the culture and diversity in Germantown, and the values they place on diversity in the community; (b) Community members' sense of community cohesion, (i.e., what makes people feel a sense of belonging in their community), how they show up for each other, and the spaces that fuel that connection; and (c) Community members use of community-led or public open space during the pandemic, and their perceptions of the impact of these spaces on their sense of belonging and community cohesion.

Survey respondents were asked to complete four sections: (a) section 1 elicited information on basic demographics, such as location, ethnicity, age, and languages spoken; (b) secton 2 asked respondents to identify the extent of diversity in their neighborhood with questions focusing on relationships and interaction between neighbors; (c) section 3 asked respondents to gauge the range of cohesion within the neighborhood, how included they felt in their neighborhood, and how involved they were in the happenings of the neighborhood; (d) section 4 asked respondents about how they used the public space available to them during the pandemic, and in addition, whether that space provided a means to social cohesion and mental wellness.

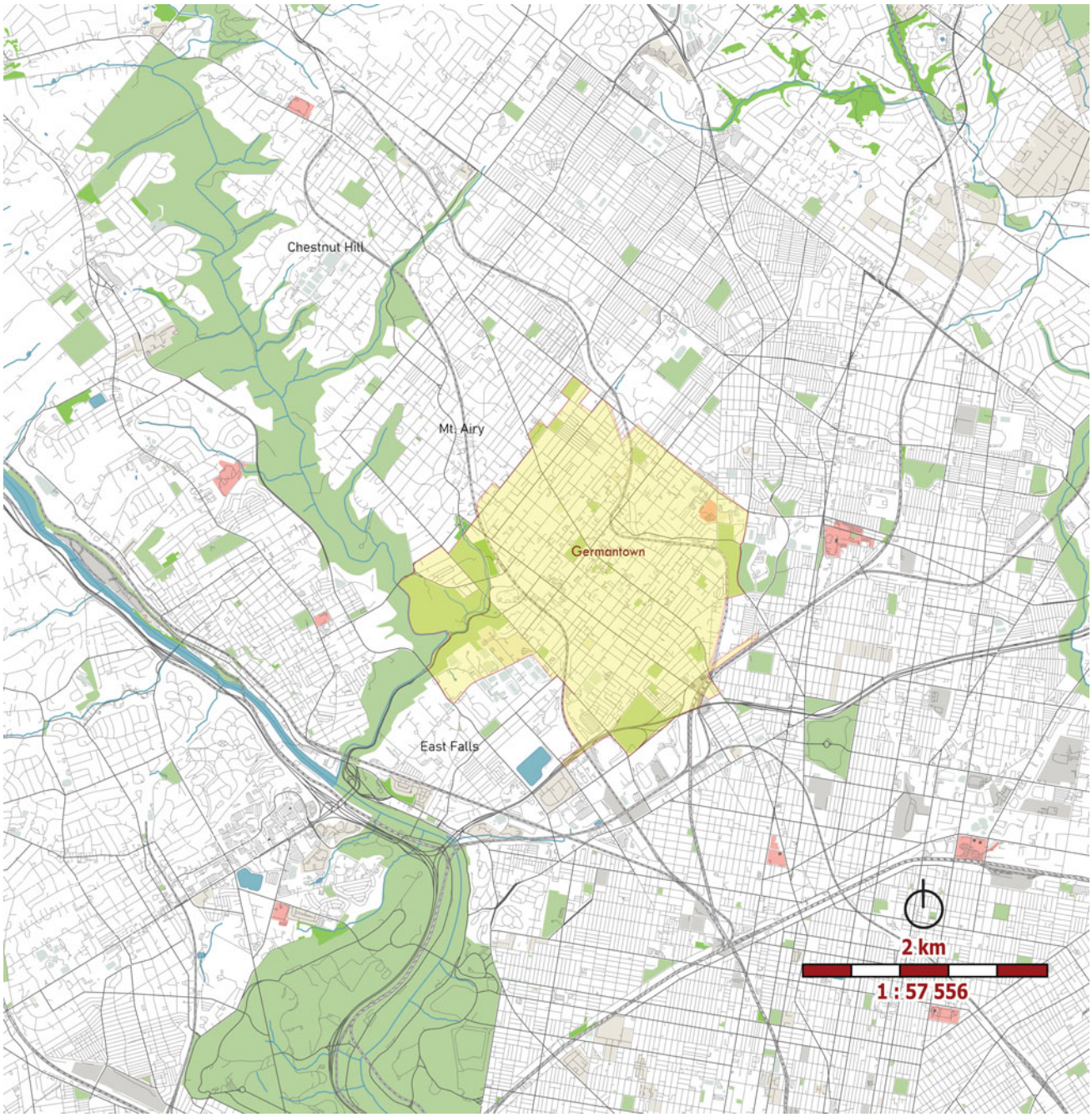

Fig. 1 Map of Germantown showing surrounding neighborhoods, Germantown, Mt Airy, Chestnut Hill

The survey questionnaire was developed using Google forms and shared widely with Germantown residents through a community Facebook page called "Living in Germantown: All Together," and by word of mouth through community organizations and friend groups. While this approach of soliciting survey respondents had the potential of introducing confirmation bias in the responses, as people who join neighborhood groups online are likely to be involved or engaged in the community, it served as a means to widely share the survey and get a large and diverse pool of respondents representative of the residents of Germantown.

As a follow-up to the survey, we selected 3 Germantown public spaces as study sites to further examine the findings from our survey data and, observe people's use of the spaces, and how the spaces support the Germantown community at large. The spaces selected were Vernon Park, Market Square, and Maplewood Mall (Fig. 4).

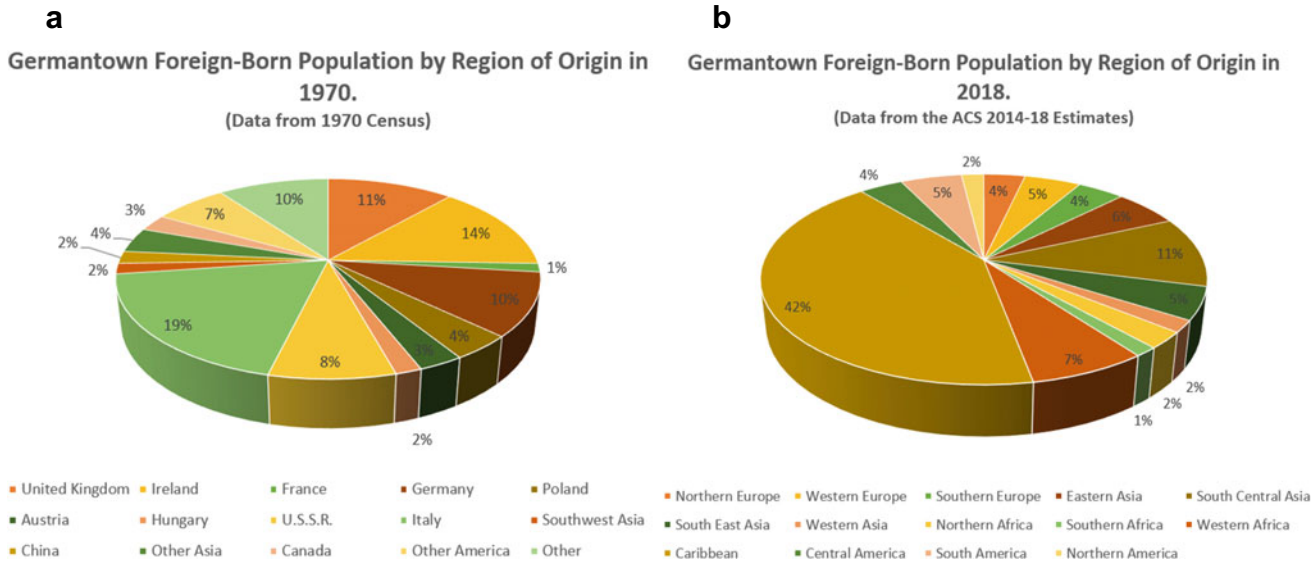

Fig. 2 **a** Chart of Germantown Population by Race/Ethnicity in 1970, **b** Chart of Germantown Population by Race/Ethnicity in 2018

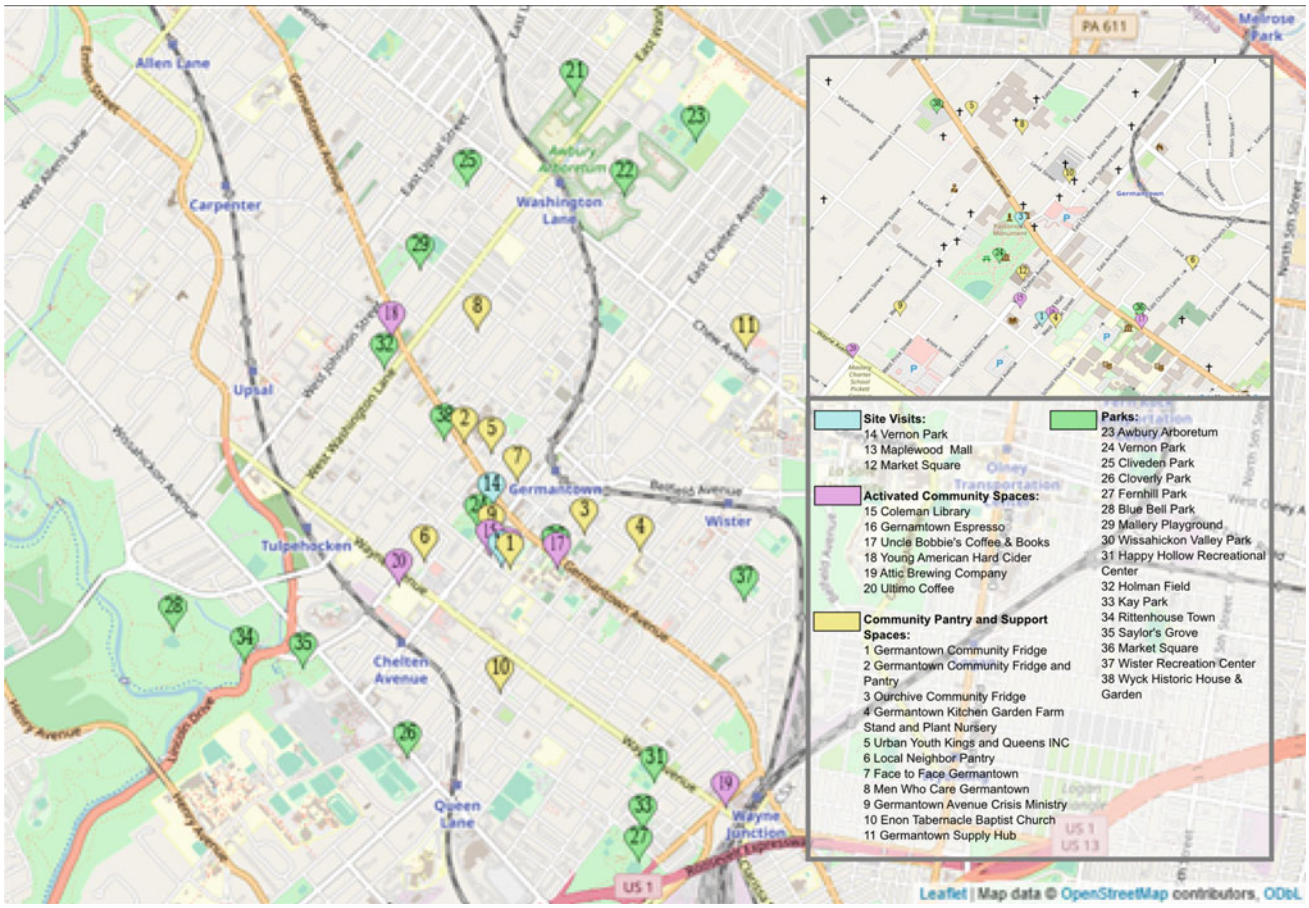

Fig. 3 Map of Germantown showing community amenities and spaces

Fig. 4 **a** Image of Vernon Park, **b** Image of Market square, **c** Image of Maplewood Mall

Images of Germantown Public

These three spaces were selected as they offered a range of space scales, community usage, and surrounding building types.

Vernon Park is an 8-acre neighborhood public park in Germantown that is home to the Black Writers Museum, and the Center in the Park which provides a range of services for senior community members. The park includes a playground, a baseball field, exercise equipment, and a little free library. According to the founder of the Black Writers Museum, Supreme D. Dow, Vernon Park hosts a variety of public events, including a neighborhood flea market in the spring and fall, movies, and concerts in the summer. The park is surrounded by a mix of religious, civic, residential, and commercial buildings.

Market Square, a public plaza at the center of Historic Germantown has long been the neighborhood's economic. The first Quaker anti-slavery protests lead by the settlement's founder Francis Daniel Pastorius occurred here following the 1688 Germantown Quaker Petition Against Slavery (Meggitt, 2013). This tradition of protest at the Square has continued, most recently in 2020 as a result of George Floyd's murder. We observed that Market Square is surrounded by a community cafe, church, child daycare, and a mix of commercial and historic buildings.

Maplewood Mall is a one-block pedestrian street that was created in the 1970s as part of the City's expansive urban renewal effort. The length of the street is lined with local businesses and apartments. Between 2011 and 2012, the Maplewood Mall renovation was identified as a priority in the planning process for the Central Germantown Beautification Plan. According to Germantown CDC, on June 15, 2013, the City announced $3.3 million in funding for the reconstruction project. The new renovations, which were completed in 2020, include updated paving and demarcation of space for public use and street seating for the local businesses (Blumgart, 2018).

We created target area maps of each space to document the amenities and features present in and surrounding each space. The target area maps were used as an observational tool during our site visits when we documented where the features in the spaces that attracted people and allowed them to gather were located. We conducted observations on the weekends to ensure that the spaces were visited when they would be busy and we could document the behaviors of people in the spaces. We used the "My Maps Mapcustomizer" application of Google Maps to create larger amenities maps of the Germantown area and the *Statistical Atlas*, a data accessing and mapping tool to collect data. To evaluate historical data of Germantown, we studied a local newspaper, *The Germantown Courier,* published by Ghuru and Ortiz in the Germantown Crier (2020).

3 Results

3.1 Description of Survey Results

Overall, we collected data from 63 survey respondents who represented various communities in the Germantown neighborhood (Fig. 5).

Google Forms Chart Showing Survey Responses

Findings from the first section of the survey on demographic information showed that almost all of the respondents (95%) thought that they lived in a diverse community with a different culture than their own (Fig. 6a). About three-quarters of respondents (74%) stated that their community is a place

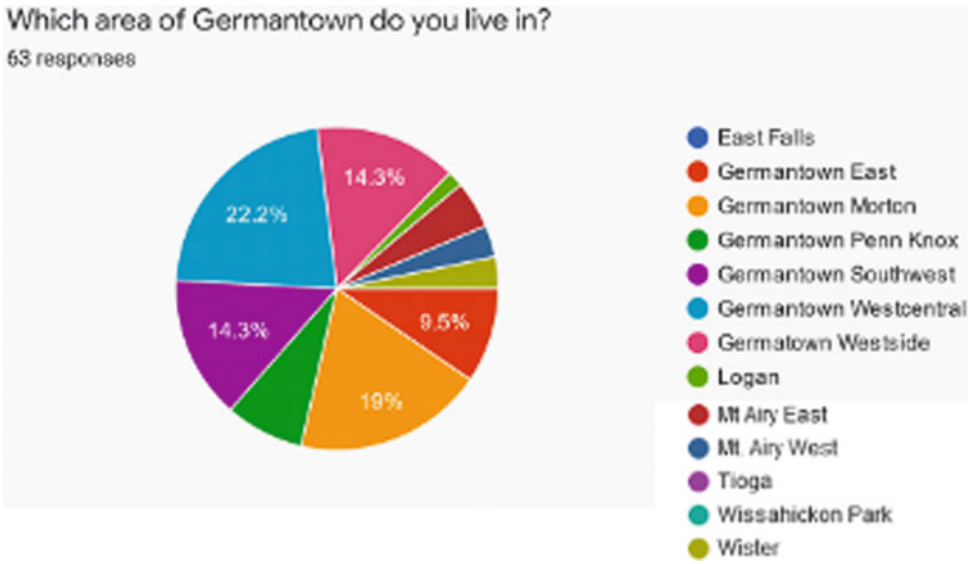

Fig. 5 Chart showing the number of respondents and their location in Germantown

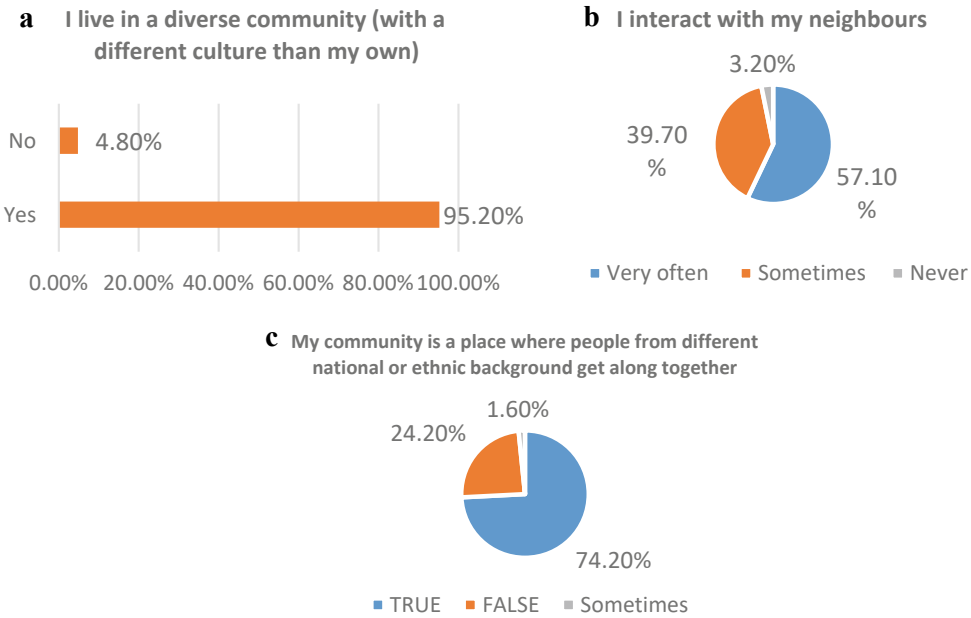

Fig. 6 **a–c** Charts showing responses from survey questions

where people from different national and ethnic backgrounds get along together (Fig. 6c), and a little more than half (58. %) reported that they interact with their neighbors (Fig. 6b).

Google Forms Chart showing Survey Responses

Findings from the second section of the survey on diversity and relationships with neighbors showed that most respondents identify with living in a diverse neighborhood, and that most feel a sense of community in Germantown. Figure 7 shows the breakdown of the participants' opinions on the most important issues facing Germantown today. It is apparent from this chart that the majority of respondents have prevalent concerns regarding gentrification and the development of the neighborhood, followed by a lack of housing and lack of community empowerment. One individual stated that "Germantown lacks community empowerment, since it seems like developers run the show here." Another respondent commented "Less development and more open spaces." The findings present some interesting insights. Firstly, it suggests a link between social ties and physical space: as the issues that were most important to the respondents involve both the social and physical fabric of the community. Secondly, it suggests that diversity alone is

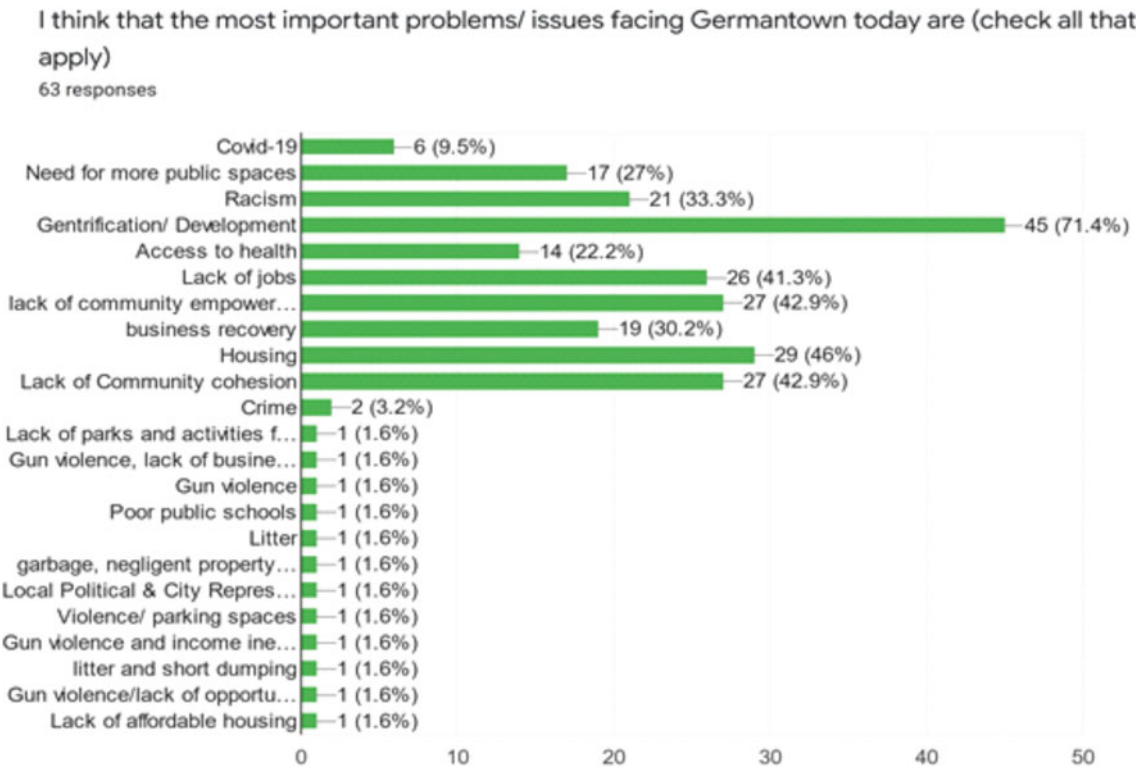

Fig. 7 Chart showing survey respondent opinion of most important problems facing Germantown

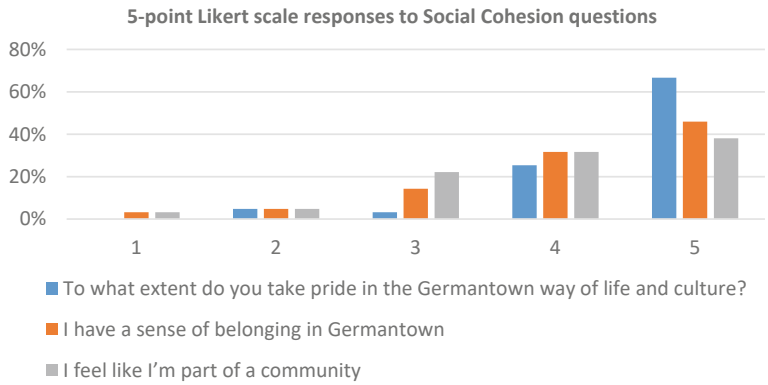

Fig. 8 Chart showing survey responses on relationships and interaction between neighbors

not enough to create cohesion—as there was still the perception of a lack of community cohesion even with the extent of diversity among the participants.

Google Forms Chart Showing Survey Responses

Findings from the third section of the survey on the range of cohesion indicated that community participation in the neighborhood was high (Fig. 8). This high level of community engagement is reflected in the various community resources utilized. In addition to those findings, when asked "to what extent they take pride in the Germantown way of life and culture," the overall response to this question was very positive. About two-thirds (67.7%) expressed that they took full pride in their neighborhood while fewer than 6% responded negatively.

When asked whether they have a sense of belonging in Germantown 79% of the respondents responded that they did while 8% responded that they did not. Many (71%) who were interviewed indicated that they feel like part of a community. The statement: "People in my neighborhood are willing to help their neighbors," elicited a range of responses, with 50% agreeing and 32.3% strongly agreeing while 11.3% remained neutral and the rest disagreed.

Fig. 9 Map of Germantown showing volume of use of public spaces during the pandemic

Survey Response Chart to Questions on Social Cohesion

Finally, findings from the fourth section of the survey on public spaces showed that respondents used several public spaces closest to them during the past 18 months, with the most used being Vernon Park and the Wissahickon Park followed by Cloverly Park. Figure 9 presents the locations and volume of use by participants. When asked how frequently they used the public spaces, 30.5% said that they visited a few times a week, 25.4% visited once a week, 15.3% visited once a month, 22% visited once in a while, and 6.8% did not visit at all.

Map of Public Open Space Used

The activities that the respondents stated they performed in these spaces were predominantly enjoying the outdoors; simple recreation, and spending time with family. When participants were asked about the extent to which public space benefited them during the pandemic, 81% reported that it helped their mental health and well-being. 55.7% reported that public space allowed for safe interaction with neighbors and friends, while 36.1% stated that it provided a safe play space for their children.

The results further reveal that 67.4% of respondents found that interacting with their neighbors during the pandemic helped with their mental well-being. When asked whether they value their neighbors and community more today, 55% of the respondents reported that they did, and 16.7% did not. Surprisingly, only 53.3% of respondents expressed that they wished they had more access to public space during the pandemic.

3.2 Description of Observation Results

The target area maps we developed were used as an observational tool during our site visits to document features in the space that served as attractors for people, allowing them to gather and interact. An example of the target area maps we developed for each space is shown in Fig. 10.

Map of Vernon Park

In Vernon Park (Fig. 11), we observed that there were several attractors for people to engage with each other. There were several seating options including park benches, picnic tables, a playground, and a little free library. The park host several programs and events including an exercise classes that were ongoing when we conducted our site visits.

Images of Vernon Park

Similarly in Market Square (Fig. 12), we observed several features both in the square and surrounding the square that served as attractors for people to interact and engage. The

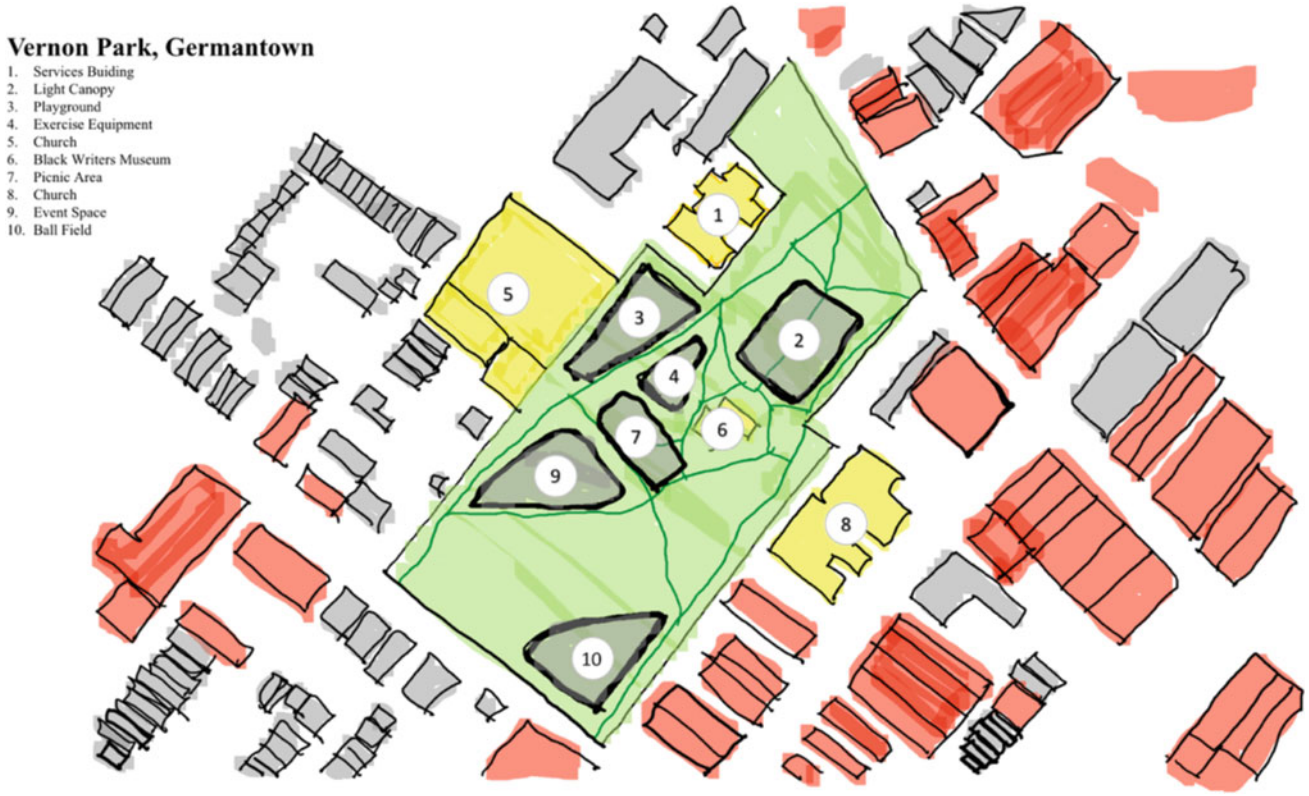

Fig. 10 Sketch map of Germantown showing the use of space in Vernon Park

Fig. 11 **a** Image of Playground, **b** Image of Baseball Field, **c** Image of the Black Writer's Museum

Fig. 12 **a** Image of Main Sidewalk, **b** Image of Historic Buildings Opposite the Square, **c** Image of G.A.R Civil War Monument

main attractors in the square were the farmers market, the bus stop and wide pedestrian walkway, the availability of comfortable bench seating, the mix of business types, culturally significant institutions, and monuments.

Buildings surrounding the square included a mix of residential and commercial buildings, a church, and the Germantown Historical Society. The square is also home to the weekly Germantown farmers market. This variety of activities around the square meant that while it is small, it is a very active space. We observed people of all ethnicities and physical activities interacting in and around the square. The presence of benches and low wall ledges provided a lot of seating opportunities and we observed people gathering around them. Another attractor was the presence of the G.A.R. Civil War monument, a culturally significant monument that we observed several people stopping photograph the monument. There were also a lot of interactions around the bus stop, and when people walked through the square, they often stopped to greet each other.

Images of Market Square

Unlike Vernon Park and Market Square, Maplewood Mall (Fig. 13) did not have a lot of activity when we observed it. We wanted to keep it as a study site to compare against our findings from the first two sites. The location had several features that should serve as activators, including the availability of outdoor seating, a performance plaza with seating, and a mix of residential and commercial building types, at the times we visited, there was not a lot of use of the space. The few people we observed were visiting the businesses in the area, rather than spending time in the mall. One possible reason for this might be the reconstruction of the mall, which was only recently completed in 2020. Another possible reason based on a comparison with the other two spaces we visited is the lack of programming available in the mall. Vernon Park and Market Square both had programs such as the farmers market and the pop-up gymnastics class that served as activators of interaction. We see this as an indicator that combining programmed activities with public spaces serves as a means to foster social and community cohesionand presents an opportunity for future research.

Images of Maplewood Mall

4 Discussion

Prior studies have noted the importance of interculturalism as a necessary framework for a socially cohesive society to thrive. This study set out to examine the role of urban space in the development and maintenance of social ties during the Covid-19 pandemic Through a case study of Germantown, adverse community in Philadelphia, USA.

On the question of urban space as a catalyst for social interaction, cohesion, and resilience, this study found that public space in the Germantown neighborhood of the City of Philadelphia played a major role in the maintenance of social ties. Another important finding was that community members value public space and their neighbors more now than they did before the pandemic. Surprisingly, contrary to our

Fig. 13 **a** Image of Entrance and Plaza Space, **b** Image of Outdoor Seating for Local Business, **c** Image of Sidewalk by Plaza Space

initial hypothesis, when community members were asked if they wish that they had more access to public open space during the pandemic, only 54.1% responded yes.

From the findings, we have identified the following themes and present a discussion of their significance, implications for policy and practice, as well as opportunities for future research.

Finding 1: Covid-19 and public spaces for connection and interaction

During the Covid-19 pandemic, public space contributed to the development of social ties despite the need for community members to practice social distancing. The community developed virtual social ties to complement those established in public spaces. The public spaces provided safe places to interact with friends, neighbors, and family and for children to play. Social distancing and mask-wearing enabled these outdoor interactions even though the pandemic was active. Most respondents stated that these interactions with neighbors helped them cope mentally and that 55.7% of participants value their community and neighbors more today compared to prior to the pandemic.

These findings raise intriguing questions regarding the nature and extent of public space and its relationship to community well-being and resilience. Opportunities for future research may lie in exploring the relationship between public space design and community resilience and mental health.

Finding 2: Interactive community spaces

Community members interacted frequently through in-person exchanges and virtual community social networks. In some cases, public space served as a vessel for community interaction through contactless interventions such as Free Little Libraries and food pantries. Many of the respondents (63.7%) donated to a food pantry or community fridge during the pandemic, and 45.5% distributed food. Public space was the backdrop for other community activities, such as an Art and Culture Program in Maplewood Mall and Fernhill Park, community voter mobilization for the 2020 Presidential election, Covid-19 awareness campaigns, and children's activities. These findings indicate the ways that public spaces promote social cohesion and the intangible benefits of community.

Finding 3: Third spaces as community activators

On the question of community resilience, we propose that while public green spaces are critical for the quality of life in any area, "third spaces" play an important role in strengthening community ties. Community members identified these "third spaces" as extremely important for the community. Spaces included are the Germantown Free Library, Maplewood Mall, and several local businesses (Germantown Espresso, Attic Brewing, Uncle Bobbie's Coffee, and Young American Cider to name a few). According to community members,"…they have become places to meet up and connect with others by offering the opportunity to safely gather, provide music and entertainment, culture and literacy, food and drink." These spaces have been equally as important as the parks and playgrounds for reinforcing community ties. This finding has important implications for including "third spaces" as agents of community resilience during times of crisis in future decisions about development.

Finding 4: Challenges and limitations

The most interesting finding was that despite 42.9% of survey participants citing lack of community cohesion as one of the most important issues facing Germantown, 82.5% were willing to help their neighbors. An implication of this willingness to help others is that a sense of community connection possibly helped create resilience in the face of Covid-19. Community resilience is one of the keys to sustainable development (United Nations, 2021), and it is possible that social cohesion models can be further studied and developed based on intercultural communities like Germantown.

In reference to physical space, almost half of the respondents (54.51%) stated that they wished to have more access to public open space. The lack of adequate public space maintenance, planning, and real estate development may be a possible explanation for these results. Most respondents (71.4%) cite gentrification as the biggest threat to Germantown.

The study was conducted during an ongoing pandemic and this impacted access to our subject pool. The word-of-mouth nature of the survey allowed for possible bias in our findings.

5 Conclusion

The study aimed to explore the relationship between urban public space and social cohesion within intercultural communities. These research findings suggested a positive correlation between areas with increased public space usage and the Germantown community's social cohesion. This is achieved through developing and maintaining strong social ties in the community at the neighborhood level. We suggest the findings from this research be extended to inform sustainable urban development and space planning for resilient communities in line with the 2030 United Nations Sustainable Development Goals. In addition, the research findings

shed light on the important role of open and public spaces as coping mechanisms in times of collective traumatic events such as pandemics.

References

Blumgart, J. (2018). $3.3M Maplewood Mall remake to break ground in 2019. WHYY. Retrieved November 20, 2021, from https://whyy.org/articles/3-3m-maplewood-mall-remake-to-break-ground-in-2019/

Cantle, T. (2012). *Interculturalism: The new era of cohesion and diversity*. Palgrave Macmillan.

Cattell, V., Dines, N., Gesler, W., & Curtis, S. (2008). Mingling, observing, and lingering: Everyday public spaces and their implications for well-being and social relations. *Health & Place, 14*(3), 544–561.

Flowers, E. P., Timperio, A., Hesketh, K. D., & Veitch, J. (2019). Examining the features of parks that children visit during three stages of childhood. *International Journal of Environmental Research and Public Health, 16*(9), 1658.

Gemantown Community Development Corporation. (2021). Maplewood mall reconstruction. Retrieved November 20, 2021, from https://germantownunitedcdc.org/real-estate-development/maplewood-mall-reconstruction/

Ghuru, A., & Ortiz, M. (2020). Migration and immigration trends in Germantown from 1970–2018. *Germantown Crier, 70*(2), 45–61.

Kumar, A., & Nayar, K. R. (2021). COVID 19 and its mental health consequences.

Levrau, F., & Loobuyck, P. (2018). Introduction: Mapping the multiculturalism-interculturalism debate. *Comparative Migration Studies, 16*(13)

Lichtenstein, R., Alexander, J. A., Jinnett, K., & Ullman, E. (1997). Embedded intergroup relations in interdisciplinary teams: Effects on perceptions of level of team integration. *The Journal of Applied Behavioral Science, 33*(4), 413–434.

Meggitt, J. J. (2013). Early Quakers and Islam: Slavery, Apocalyptic and Christian-Muslim encounters in the seventeenth century. Swedish Science Press

Slater, S. J., Christiana, R. W., & Gustat, J. (2020). Peer reviewed: Recommendations for keeping parks and green space accessible for mental and physical health during COVID-19 and other pandemics. *Preventing chronic disease, 17*.

Stahl, G. K., Maznevski, M. L., Voigt, A., & Jonsen, K. (2010). Unraveling the effects of cultural diversity in teams: A meta-analysis of research on multicultural work groups. *Journal of International Business Studies, 41*(4), 690–709.

Tajfel, H., & Turner, J. (1979). Social identity theory. dikutip dari www. learning-theories. com, diakses, 20.

Truong, N., & Asare, A. O. (2021). Assessing the effect of socio-economic features of low-income communities and COVID-19 related cases: An empirical study of New York City. *Global Public Health, 16*(1), 1–16.

United Nations. (2021). Make cities and human settlements inclusive, safe, resilient and sustainable. Retrieved November 20, 2021, from https://sdgs.un.org/goals/goal11

Volenec, Z. M., Abraham, J. O., Becker, A. D., & Dobson, A. P. (2021). Public parks and the pandemic: How park usage has been affected by COVID-19 policies. *PLoS ONE, 16*(5), e0251799.

Wade, L. (2020). An unequal blow. *Science, 368*(6492), 700–703.

The Power of Long-Term Residents in Consensus Building for Reconstruction of the Housing Complex Area: Case Study on Tama City, Tokyo

Yuno Tanaka

Abstract

The development of housing complexes in Japan began around the 1950s, and today there is a stock of around 2 million units, mainly in the suburbs. In recent years, there has been a need to discuss the renovation and reconstruction of these housing complex areas, but coordinating the rights of the many people involved has been a challenge. In the case of Suwa 2-chome housing in Tama New Town in Tama City, Tokyo, however, the reconstruction project was approved by 92% of the residents. This study aims to clarify the process of consensus building among the residents of Tama New Town and acquire insight for future housing complex regeneration projects that require consensus building among residents. The Suwa 2-chome housing area was developed as part of a new town in the suburbs of Tokyo in 1971 with 640 units, and a reconstruction with 1,249 units was completed in 2013. The reconstruction of the Suwa 2-chome housing area involved a project promotion consultant, a design and construction supervisor, and a construction company, all of which formed the reconstruction association. In addition, the Reconstruction Promotion Subcommittee was formed to build consensus among the residents. The Reconstruction Promotion Subcommittee was an unofficial group of women who lived in the housing complex area as long-term residents and were able to act as intermediaries between the residents and the companies. The subcommittee paid attention to the residents' concerns and worked to relieve fears about the reconstruction. Informal activities are not recorded in official documents; however, the existence of the local community in a housing complex area can wield significant power when the area must revise the future.

Keywords

Unofficial activity • Resident • Reconstruction • Apartment housing • Consensus building • Interview

1 Introduction

1.1 Background

In Japan, many housing estates have been developed since the 1950s, and today there is a stock of about 2 million dwelling units, of which around half are more than 25 years old (Ministry of Land, Infrastructure, Transport and Tourism, 2015). Due to the aging of buildings and stricter requirements of earthquake resistance standards, renovation and reconstruction are often discussed, and a manual for the regeneration of housing complexes has been prepared by the government (Ministry of Land, Infrastructure, Transport and Tourism, 2010). However, according to the Ministry of Land, Infrastructure, Transport, and Tourism (2015), the number of completed reconstructions was only 12,700 by 2015. Ooki (2019) points out three problems that prevent the reconstruction of housing complexes: (1) the legal system, (2) homeowners and management associations, and (3) economic burden. In this study, I paid particular attention to problem (2) and conducted a specific case study.

1.2 Purpose of the Study

The Suwa 2-chome housing area in Tama New Town in Tokyo was rebuilt with the approval of 92% of the residents. This study aims to clarify the process of consensus building among the residents in this case and to obtain knowledge for the future regeneration of housing complex areas in Japan and beyond. In this paper, the background and history of this reconstruction project are summarized using official

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documents in Chap. 2. Chapter 3 then clarifies the contents and significance of unofficial resident activities through interview surveys with the members of the informal activity group and a member of a consultant company. Furthermore, it is clarified in this chapter that members involved in unofficial activities retained motivation even if their voluntary work represented a burden for them.

Although the legal framework for housing complex reconstruction differs in each country, clarifying the role of unofficial organizational activities by residents in the consensus building process can produce useful knowledge for reconstruction and renovation projects of housing complexes not only in Japan but also overseas. This information will also contribute to Sustainable Development Goal (SDG) target 11.3 to enhance inclusive and sustainable urbanization and capacity for participatory, integrated, and sustainable human settlement planning and management in all countries.

1.3 Previous Studies

Concerning the challenges facing housing complex reconstruction in Japan, Saito and Hasegawa (2001) summarized the issues in consensus building during the initial period of reconstruction projects. Meno (2004) showed a conceptual model of the consensus building process in the reconstruction of an aging condominium and showed that construction was started by going back and forth instead of going straight through the four stages of the process. In addition, Hasegawa (1999) pointed out the following factors for a successful completion of reconstruction: (1) ample floor area ratio, (2) location and marketability, (3) effectively dealing with homeowners who find it difficult to afford reconstruction costs (4) a small number of homeowners, (5) appropriate support by the developer, and (6) leadership of the promotion organization between homeowners and companies for the implementation of the reconstruction project. From this viewpoint, clarifying unofficial activities by the residents can be useful in more concretely understanding factor (6).

The reconstruction of the Suwa 2-chome housing area has been mentioned in some official reports (such as Suwa 2-chome Housing 40-year History Editing Committee, 2012; Suwa 2-chome Housing Reconstruction Association, 2016; Suwa 2-chome Housing Reconstruction Project Questionnaire Implementation Experts & Researchers Team, 2017) so far. They mainly describe official activities, and there is limited reference to unofficial activities that make use of the networks among residents. However, Yamada (2006) pointed out the effectiveness of an approach method in which housing owners are autonomously involved in the consensus building process in large-scale housing complexes.

2 Official Activities in the Reconstruction Project of Suwa 2-chome Housing Area

2.1 Basic Information on the Suwa 2-chome Housing Reconstruction Project

In 1965, large-scale development of a residential area was planned in Tama City where access to the city center is relatively easy by train. This new town was comprised of 23 blocks located around elementary schools and junior high schools. It was planned to have 3,011 ha of site area and 110,000 housing units for over 400,000 people by the Tokyo Metropolitan Government, Japan Housing Corporation, and Tokyo Metropolitan Housing Supply Corporation. Specifically, the Suwa 2-chome housing area in Tama New Town, the target area of this research, has 23 5-story condominiums (approximately 640 units). Residents began moving into these units in 1971. After new earthquake resistance standards were adopted in 1981, a preparatory committee for reconstruction was established in 1988, and a reconstruction committee was established in 1989. After the economic downturn and the revision of the legal system for reconstruction, a reconstruction resolution was made in 2010, and the new condominiums were completed in 2013. Figures 1, 2, and 3 show the area before reconstruction (2011), after reconstruction (2013), and in its present state (2019). After reconstruction, the area grew to seven buildings with fourteen or eleven floors (1,249 units). Additionally, various common spaces were designed as lounges (Fig. 4), children's playrooms (Fig. 5), guest rooms, a community cafe, garden allotments (Fig. 6), and dog runs.

2.2 Official Community Activities Related to the Reconstruction Project

Table 1 shows the history of Suwa 2-chome housing area and the official activities of the residents related to the reconstruction project mentioned in the project report written by the Suwa 2-chome Housing Reconstruction Association (2016).

3 Unofficial Community Activities Related to the Reconstruction Project

3.1 Research Methodology

The organization of Suwa 2-chome housing reconstruction project involved a business promotion consultant company, a design and construction supervision company, and a construction work company as a reconstruction association.

Fig. 1 Suwa 2-chome housing area before reconstruction (2011). *Source* Suwa 2-chome Housing Reconstruction Association (2016)

Fig. 2 Suwa 2-chome housing area after reconstruction (2013). *Source* Suwa 2-chome Housing Reconstruction Association (2016)

Fig. 3 Façade of the residential building after reconstruction (2019). *Taken by* Y. Tanaka

Fig. 4 Lounge on the first floor of the residential building (2019). *Taken by* Y. Tanaka

Fig. 5 Children's playroom in the residential building (2019). *Taken by* Y. Tanaka

However, forming a smooth consensus was challenging with only the official activities of the reconstruction process. Therefore, in 2007, the consultant company formed an unofficial "Reconstruction Promotion Subcommittee." This was an organization in which women living in the residential area played a leading role in communication between residents and official organizations.

Since records of informal activities are not kept in official documents, the activities of the Reconstruction Promotion Subcommittee are instead summarized from interviews with the members of the subcommittee and a member of the consultant company, and activity record materials kept by the interviewees. First, an interview was conducted with one key member of the subcommittee (interviewee 1). Then, using the snowball sampling method, another key member of the subcommittee and one person at the consultant company, who was most engaged in the establishment and activities of the subcommittee, were interviewed individually. Additionally, a group interview with nine subcommittee members, including the two key members mentioned above, took place. Table 2 shows the basic information of the interviewees. The subcommittee started with about 10 members (according to interviewee 2), and the number of participants slightly increased and decreased subsequently. The exact number of participants is not known as they did not make a list. The interviews were semi-structured and the interviewees' comments were organized using the KJ method.

3.2 Background of the Establishment of the Reconstruction Promotion Subcommittee

According to interviewee 10, it is not possible to discuss the reconstruction in light of factors such as residents' personal matters, economic situations, and health conditions through the official meetings of residents and the consultant company alone. Therefore, an unofficial team was launched as an intermediary for creating a situation in which residents and formal organizations could communicate with each other in a positive and supportive atmosphere. The intent of this activity was not to persuade residents to agree with the reconstruction but to ask them to consider the possibility of reconstruction and to reduce distrust of the consultant company.

Fig. 6 Garden allotments in front of the residential building (2019). *Taken by* Y. Tanaka

Table 1 History of the reconstruction project of Suwa 2-chome housing area

Year	History and official activities in Suwa 2-come housing area
1971	First residents began moving in. Development was still underway just after occupancy and the nearest subway station was built three years later. In order to resolve inconvenience during this time, residents adopted the habit of helping one another. For example, resident-led maintenance and management of the lawns and plants in the housing area began. Then, local events such as Bon Odori and Mochi-tsuki (traditional seasonal festivals in Japan) were planned by residents and continued for 40 years. Through meetings for planning these events, the organizational foundation for residents' self-government was born and led to subsequent activities
1984	Voluntary management associations began to operate because residents could reduce management fees and other expenses by running their own management associations, and this continued until the reconstruction of the building
1988	A voluntary group was set up to consider the possibility of adding more rooms to the buildings to make the houses larger for growing children. Later on, it was decided that it would be necessary to consider the cost-effectiveness of improving the houses, with a view toward rebuilding in the future. Through this discussion, the "Reconstruction Review Preparatory Committee" was established
1989	The "Reconstruction Review Committee" was established, and practical study of reconstruction began
1990	The name of the committee was changed to the "Reconstruction Promotion Committee," and the cost of commissioning a study was allocated. The Housing and Urban Development Corporation was commissioned to carry out this work, and a draft of the basic plan was prepared
1991	As a result of the reconstruction proposal being accepted, the "Reconstruction Committee" was formed to consider reconstruction more specifically
2008	Reconstruction became a reality, and the "Reconstruction Resolution Realization Committee" was established to conduct activities aimed at reconstruction resolutions. Because many residents pointed out temporary housing and moving as concerns about reconstruction, the "Temporary Residence and Moving Review Committee" was established as an advisory body of the residential apartment association board
2010	The reconstruction resolution was passed and the "Suwa 2-chome Residential Apartment Reconstruction Association" was launched
2011	Relocation became a practical stage, and the "Temporary Residence and Moving Review Committee" was progressively reorganized into the "Temporary Residence and Moving Executive Committee"
2013	The reconstruction project was completed

Table 2 Basic information of the interviewees

Individual(I) or group(G) interview	No	Belonged to	Year moved to Suwa 2-chome housing area
I, G	1	Reconstruction Promotion Subcommittee	1980
I, G	2		1975
G	3		1992
G	4		1976
G	5		2005
G	6		1971
G	7		1971
G	8		1971
G	9		1993
I	10	Consultant company	-

3.3 Activities of the Reconstruction Promotion Subcommittee

The Reconstruction Promotion Subcommittee's activities began with a meeting in a community room in the original apartment complex held every Wednesday until 2008. The main activities of the subcommittee included providing a place for residents to communicate about reconstruction, holding a pre-meeting with the consultant company before the official meeting with residents, discussing new housing unit plans with the planning company, and chatting on the street with neighbors to understand their feelings about reconstruction. Because the subcommittee had gained insight into the neighbors' needs through the above activities, they voluntarily established an official support team, the "Temporary Residence and Moving Executive Committee," when reconstruction began to find and relocate to temporary residences. The details of the activities of the interviewees are described below.

(1) In order to make everyone aware of the existence of the subcommittee, a meeting place was opened every Wednesday from 15:00 with tea and some sweets. There were around ten visitors each time, and they talked not only about reconstruction but also their daily lives. The main results are as follows.
   a. Mediation of communication from residents to the consultant company
      The subcommittee gave easy to understand information about reconstruction to the residents. When professional issues that could not be solved by members of the subcommittee alone came up, they contacted a consultant company and supported the communication between the consultant and the residents.
   b. Mediation of communication from the consultant company to residents
      Members of the consultant often joined the weekly meetings alongside residents. Because it was necessary to explain architectural terms for residents at official meetings, the members of the subcommittee advised on how to explain the terminology from the viewpoint of a nonprofessional.
   c. Mediation of communication from residents to planners
      During the design stage of the new condominiums, residents' demands were communicated to planners by members of the subcommittee, and the housing unit plan was adjusted to be more suitable for living.

(2) In addition to the Wednesday meetings, the subcommittee talked with neighbors from the local area about what residents thought about the reconstruction project and about the concerns of those who disagreed with the project.

(3) In 2010, when the reconstruction resolution was decided, the Temporary Residence and Moving Executive Committee was launched and operated until 2011 when moving was completed. The 19 members were divided into the "temporary residence finding team" and the "relocation support team." These activities were supported by two consultant members.

The members of the "temporary residence finding team" held a briefing session for residents to provide information on temporary residences. They also negotiated with various housing suppliers to provide temporary residence and gave this information to the residents. If a particular household did not prepare a temporary residence, the subcommittee members confirmed their status of preparation individually. The members of the relocation support team became the

contact persons for oversized garbage, arranged for the special collection of recyclable waste, and created a garbage separation and disposal chart. They were also voluntarily responsible for cleaning up any improperly disposed of garbage.

3.4 Residents' Activities as Seen by the Consultant

According to interviewee 10, when the subcommittee was set up, it was expected to act as an intermediary between residents and official organizations. However, in addition to this, many initiatives were realized due to opinions made by members of the subcommittee, and they evolved ideas for the project. Interviewee 10 also pointed out that when economic conditions worsened beyond predictions due to the Lehman shock, residents and consultants were able to work together to solve problems rather than being adversaries. The members of the subcommittee played an active role in this process.

Meno (1998) defines the group of people who play central roles in a reconstruction project as a promotion group, and describes it as having a "proposing role," "requesting role," and "coordinating role." According to Meno, the promotion group is supposed to be composed of officers of the management association or the residents' association; however, based on interviewee 10's comments, it is supposed that the unofficial activity organization can fulfill the above three roles more quickly and flexibly than the official organization by conducting frequent consultation meetings and neighborhood networking activities.

Interviewee 10 mentioned that construction costs dropped after the resolution and the Great East Japan Earthquake in 2011, which caused people to rethink their ways of living and the importance of social community. This shift reiterated that their decision was not wrong. At the same time, Interviewee 10 pointed out that it is difficult to achieve this intentionally, as it depends on the timing of the social situation.

3.5 Motivation to Continue Unofficial Community Activities and Difficulties

3.5.1 Motivation to Continue Unofficial Community Activities

Even if unofficial community activities can successfully promote reconstruction projects, they would not be able to do so if the members did not have personal motivation for conducting their activities. Here I will look at the reasons why the members of the Reconstruction Promotion Subcommittee began their voluntary activities as well as their reasons for continuing these activities.

From the interviews, it is clarified that the main actors of the Reconstruction Promotion Subcommittee had husbands who held positions related to the management of the housing area when the subcomittee started their activity. Therefore, it was relatively easier for them to obtain official information and to have an interest in the management of the housing area. After the main actors decided to participate in the subcommittee, they asked their friends and acquaintances to join them, and the subcommittee expanded. As shown in Table 1, the Suwa 2-chome housing area has had neighborhood association activities since the first residents moved in, and such activities were an opportunity to form local connections and community groups.

Regarding reconstruction, interviewee 2 said, "If we do not rebuild our buildings, we will have problems of aging of buildings and residents, earthquake resistance and introducing barrier-free. If the buildings are reconstructed, the area will be activated, and young people will come. I can feel a cheerful atmosphere. I wanted to realize the reconstruction because I could feel more energy." The motivation for continuing the subcommittee activities was stated as "I was just solving problems that emerged from one to the next. It was tough, but also fun. Besides, I had to do something because other team members were working hard. There was a pleasant goal (reconstruction), so the process was also pleasant" (comment from the group interview). In addition, interviewee 10 pointed out that the members of the subcommittee look like people with social consciousness, ideals, and a keen interest in social issues for the people, and that there was a friendly atmosphere in the team activities. From the above comments, it can be said the members themselves recognized the importance of reconstruction and enjoyed the process of realizing it together.

3.5.2 Difficulties in Carrying Out the Activities

Several points related to the relationships between residents were pointed out as difficulties in conducting the subcommittee activities. For example: "It was a tough time when I had to listen to negative opinions from residents who disagreed with the reconstruction nearly one hour" (group interview). Or: "I was so worried about what to do if the neighbors said after the reconstruction that she agreed with the reconstruction because of me, but the reconstruction was a wrong decision. But actually, the reconstruction was completed better than we imagined. I am relieved now because I see everyone who was against the reconstruction project at that time is now smiling" (interviewee 1). Even though it was not an official activity, subcommittee members took on a sense of responsibility for the reconstruction through their communication with other residents, meaning that they carried some psychological burdens during this time. However, interviewee 1 said, "It was hard to do one thing with people in different fields, but it was so much fun."

This comment shows that the member got a sense of accomplishment from their activities despite the difficulties.

3.5.3 The Importance of Communication Within the Community

One of the things the subcommittee members were careful about during their activities was the way they communicated with residents. "It was a job to encourage the feelings of the residents" (interviewee 2). "If the residents do not know the jargon related to reconstruction and are anxious that they might be deceived, I would like to help them by thinking together. For example, reassuring such as money problem by showing the concrete figures one by one. Give a feeling of safety" (interviewee 2). "The important thing is patience. Ask the residents what they are worried about and explain if they do not have enough information" (interviewee 2). "Hear the other person's opinion. I think it is better to rebuild, but the others have their situation. If I do not consider that, the problem will not be solved" (interviewee 1). "Communicate with them one by one" (interviewee 1). "I did not ask the residents whether for or against the reconstruction. When I ask them what they are worried about, I can understand what they think about the reconstruction. I heard their opinion and thought about how to solve it" (group interview). These statements show that the members were attentive to the feelings of the residents and responded individually to their concerns and questions about the reconstruction.

Regarding communication between the subcommittee members, the interviewees said things like: "We contacted each other quite often" (interviewee 2), and, "We never said bad things about somebody. Even if there was a mistake, we absolutely did not criticize them and did not say who was wrong" (interviewee 2). This shows that care was taken to maintain good relationships within the subcommittee.

3.5.4 Helpful Attributes for the Activities

Although none of the members of the subcommittee were experts in architecture or law, their personalities and skills were put to good use in the activities. For example, one of the members had experience being a group leader at work, and another person skilled at pastry making prepared homemade sweets for the weekly meetings. The fact that the subcommittee's activities did not follow a set structure or tasks list but rather had an atmosphere that allowed for spontaneous suggestions created opportunities for the members to make use of their own personalities and skillsets.

3.5.5 Relationships with Other Organizations

IN the interviews, one of the interviewees said of the consultant: "He followed up on things like expertise that are difficult for residents to understand. When I felt weak, he encouraged me to do our best together, and was my mental support" (interviewee 1), confirming the collaborative relationship between the subcommittee and official organizations. In addition, the members of the Reconstruction Promotion Subcommittee overlapped with the members of the Reconstruction Resolution Realization Committee and the Temporary Residence and Moving Review Committee, and there was some confusion about their activities during the interviews. This suggests that while the official and unofficial organizational frameworks were maintained, the actors overlapped between organizations. This could explain the mutuality of activities between the different groups.

3.5.6 After the Completion of the Activities

As a response from the neighbors to the activities, an interviewee said, "It was not evaluated at all in the residents of Suwa 2-chome. When an outsider came to hear the story of reconstruction later, they highly evaluated our activities. Then, I realized that we had done something very challenging. Just recently, sometimes the neighbors thank me" (group interview). This comment shows that the subcommittee members received little or no positive evaluation of their activities from the neighbors during the reconstruction process, but that they never complained about this lack of vocal support. It could be said that the members might not have expected evaluation from the residents until reconstruction was realized and the residents were satisfied with the results. In other words, in order to maintain the motivation of members for the activities of the subcommittee, each member had to recognize the importance of the activity on their own without external validation. Further, regarding when the reconstruction work first started, one interviewee said, "When the original apartment where I had been lived was demolished, I was asked if I was sad, but I said I did not feel like that at all" (group interview). Demolishing a residential building is sometimes spoken of negatively as letting go of history; however, it is impossible to maintain and preserve all existing buildings. This comment indicates that after careful consideration of the future of buildings and residents, residents can decide on reconstruction and move forward to a new environment with positive emotions.

In addition, it was pointed out that, "some points were not going well after the reconstruction. For example, a community cafe in the new building was closed and difficult to find a new tenant" (interviewee 2). Ongoing activities are needed to solve problems and improve the living environment even after the completion of the reconstruction project.

4 Conclusion

In the interviews with the members of the unofficial subcommittee, it was highlighted that they paid attention to the concerns of their neighbors and focused on relieving fears

about reconstruction through their activities. This means that the subcommittee members held themselves responsible for the reconstruction project while building trusting relationships with other residents. The reasons for engaging in these activities with such a sense of responsibility can be: (1) a personal sense of the importance of reconstruction, (2) a sense of group encouragement in working together with colleagues, (3) cooperation with official organizations involved in the reconstruction, and (4) a low level of resistance to the activity due to the tradition of self-government.

Informal activities are less likely to be recorded in official records, but they contribute to consensus building within the neighborhood and collaboration between different organizations by raising residents' awareness about the reconstruction process and mediating between residents and professionals. When implementing a housing regeneration project that involves many stakeholders, the participation of long-term residents who can build cooperative relationships with various actors and assume responsibility for their activities can be a significant driving force.

Since voluntary activities by residents are unofficial, they can change their activities quickly and flexibly according to the situation at hand. In addition, since all members live in the residential area, they can continuously participate in activities for improving the living environment of the area beyond the reconstruction project (Fig. 7).

Through daily self-government of the living environment and the realization of major projects such as the reconstruction of residential areas, residents themselves can share their own visions for their homes and take action to achieve those goals. This process makes the house a "home" for residents. If we can renew our current way of life with a view toward the future that involves living in harmony with others, an inclusive and sustainable vision of the future of residential areas can be created for older residential areas as well.

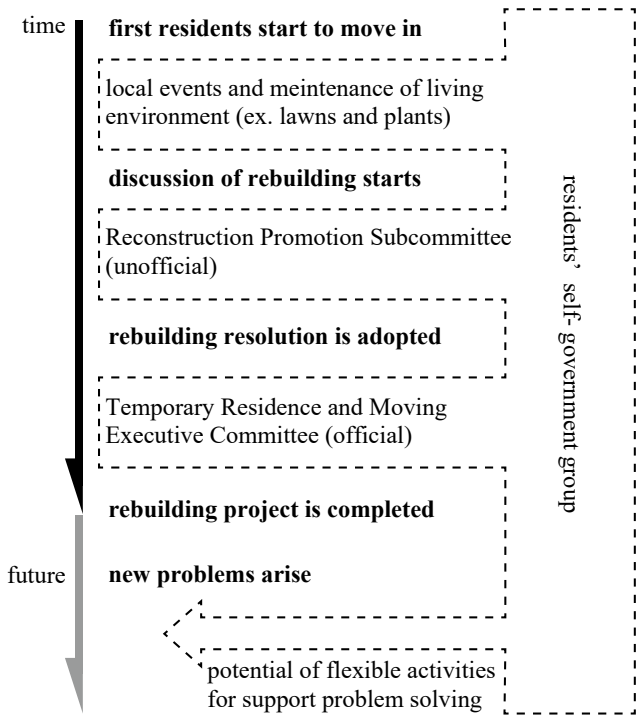

Fig. 7 Flexibility of the residents' self-government group in Suwa 2-chome housing area

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References

Hasegawa, H. (1999). Countermeasures for problems in condominium reconstruction projects. *Journal of Architecture and Planning, 64* (523), 235–242. (in Japanese).

Meno, F. (1998). A study on the process of consensus building on reconstruction of condominiums: Case studies in the metropolitan area. *Journal of Architecture and Planning, 63*(505), 151–158. (in Japanese).

Meno, F. (2004). Characteristics of consensus building in reconstruction projects of deteriorated condominiums: Structure of consensus building process in condominium reconstruction Part 1. *Journal of Architecture and Planning, 69*(582), 117–123. (in Japanese).

Ministry of Land, Infrastructure, Transport and Tourism. (2010). *Manual for the regeneration of housing complexes.* (in Japanese). Retrieved from https://www.mlit.go.jp/jutakukentiku/house/content/001374073.pdf.

Ministry of Land, Infrastructure, Transport and Tourism. (2015). *Document No.3 of the 7th study group on the regeneration of housing estates.* (in Japanese). Retrieved from https://www.mlit.go.jp/common/001111931.pdf.

Ooki, Y. (2019). Challenges in the rebuilding of condominiums and management issues that emerge from the process of rebuilding. *The Japanese Journal of Real Estate Sciences, 33*(1), 71–75. (in Japanese).

Saito, H., & Hasegawa, H. (2001). A study on process of consensus-building in initial stage of condominiums reconstruction project and its problems: Case of large-scale condominiums in the suburb. *Journal of Architecture and Planning, 66*(543), 239–245. (in Japanese).

Suwa 2-chome Housing 40-year History Editing Committee. (2012). *Suwa 2-chome housing 40-year history.* (in Japanese)

Suwa 2-chome Housing Reconstruction Association. (2016). *Suwa 2-chome housing reconstruction project: project magazine.* (in Japanese)

Suwa 2-chome Housing Reconstruction Project Questionnaire Implementation Experts and Researchers Team. (2017). *Suwa 2-chome Housing Reconstruction Project Questionnaire Analysis Report: The Pulse of a New Era in Tama New Town.* (in Japanese)

Yamada, T. (2006). Analysis and development of consensus building issues in condominium reconstruction: With reference to the consensus building process in the haginaka housing reconstruction project. *Urban Renewal Review of Japan, 22*, 80–88. (in Japanese).

Urban Regeneration Through Climate Adaptive Design for the Mediterranean Area

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Abstract

Seventy percent of cities globally are already dealing with Climate Change, and studies and research have proven various harmful effects on urban and human health due to extreme weather conditions (Heaviside et al., 2017). The global and European goals for 2030 and 2050 aim at becoming a climate-resilient society by strengthening and promoting the adoption of solutions that protect nature and biodiversity while ensuring a just, healthy, and environmentally friendly environment (United Nations, 2030 Agenda for sustainable development, 2015; European Commission, Paris agreement. EUR-Lex, 2017; European Commission, European green deal. EUR-Lex, 2019). Facing these challenges is complex and requires a holistic approach, raising the question: How can we create adaptive strategies and solutions that simultaneously tackle environmental, functional, and societal issues while assessing climate change's effects on public space? The article explores this question through a case study of a square redevelopment in Florence, Italy, with the aim to demonstrate how systems thinking methodology can increase the resilience of the public spaces located in the Mediterranean area. The article examines the redevelopment of a currently degraded and underused urban area by implementing Nature-based Solutions (NbS) and equipping it with new functions (such as art, education, play, and recreation) that contribute to heat stress reduction at a micro-urban scale and improve social inclusion and biodiversity in the urban context. To tackle this challenge and ensure an integrated approach, we applied the Symbiosis in Development (SiD), a practical framework based on systems- and design-thinking.

Keywords

Urban regeneration • Nature-based solutions • Climate adaptive design • Design thinking • Systems thinking

1 Introduction

Climate Change (CC) continues to be a severe challenge for communities worldwide. Cities are particularly vulnerable to the effects of the CC, with the risk of extreme weather conditions, such as floods and heatwaves increasing every year (World Economic Forum, 2021). Seventy percent of cities worldwide are already dealing with the effects of CC, and studies and research have proven various direct and indirect harmful effects on urban and human health due to extreme weather conditions (Heaviside et al., 2017). Air pollution, loss in biodiversity, and ocean acidification are just some of the indirect effects of the CC on human health, while direct effects, heatwaves, and floods, create additional socio-economic effects (European Commission, 2020).

With CC among the primary causes of the Urban Heat Island (UHI) and flooding in cities, designers and planners are urged to address the related issues to mitigate its effects and create adaptive solutions. The response of urban planning to UHI-related risks includes approaches to neighborhoods and streetscape design such as Nature-based Solutions (NbS), Ecosystem services (ES), Blue-green infrastructure (BGI) (European Commission, 2015; European Environment Agency, 2020; Except Integrated Sustainability, 2019).

Besides the CC, population growth, rapid urbanization, resource depletion, economical and sanitary crisis have a tool on cities, public space, and the quality of life (Gebalska, 2017). Creating a climate-resilient urban environment is becoming one of the crucial aspects of architecture and urban planning and one of the global and European Goals for 2030 and 2050 (United Nations, 2015; Paris Agreement, 2017; European Green Deal, 2019).

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As a response to these megatrends, there is a visible change in city development approaches towards a more human and nature centered-approach (walkable cities, inclusive cities, healthy cities, green cities, smart cities, etc.) and the importance of putting the human right to both health and a healthy environment at the center of the debate (Carlarne, 2021). Reaching these ambitious goals and achieving a truly integrated sustainability capable of answering all the challenges requires a new way of thinking, analyzing, and designing our cities. Moving from a linear way of thinking towards Systems Thinking (ST) allows the shift from simplistic approaches that tackle one or just a few challenges to understanding the core causes of the problems and their interdependencies. Applying a systemic view allows the designers to integrate environmental, social, economic, and ecological aspects (Gonella, 2021). It has never been so important and necessary to look at a city from a holistic perspective and re-design our living environment in close collaboration with all stakeholders within a trans-disciplinary team.

This article aims to demonstrate how Systems Thinking methodology can help tackle complex challenges and increase the resilience of the public spaces through Symbiosis in Development (SiD) approach, a practical framework based on Systems- and Design Thinking, applied to a case study in the Mediterranean area.

The paper is organized as follows: firstly, a description of the SiD framework and presenting some of its main components: (a) SiD Process; (b) SiD Method; and (c) System Mapping. Secondly, the case study area to which the framework is applied is introduced. Thirdly, results comparing two meta-design proposals are presented and discussed. Finally, potential future work is presented, followed by the conclusions.

2 Methodology

In this work, the Symbiosis in Development (SiD) framework is applied to develop a meta-design proposal to redevelop a public square in the residential neighborhood "Isolotto" in Florence, Italy. To evaluate and ensure the climate-adaptive effectiveness of the scenarios, the analysis with ENVI-met software was executed to simulate climate conditions in the urban setting and assess the effects of atmosphere, nature, built environment, and materials.

2.1 Symbiosis in Development (SiD) Framework

Symbiosis in Development (SiD) is an integrated sustainability framework developed by Tom Bosschaert. It is supported by the Except Integrated Sustainability consultancy and design office in The Netherlands. SiD is both a tool and a common language for trans-disciplinary teams. As previously mentioned, SiD marries two approaches: Systems Thinking (ST) and Design Thinking (DT). ST allows us to examine and understand the complexity through the system mapping and gives multiple perspectives to the process. At the same time, DT enriches the process with iteration, a step-by-step method, and involves stakeholders from the beginning to the end. Merging these two approaches allows facing complex sustainability issues manageably and straightforwardly. It provides insight into how, when, and where interventions can be implemented to make the system at hand more sustainable (Bosschaert, 2019). SiD can be applied to any field or type of project, and it can be used by a team or an individual for a small student project or big city development projects.

SiD has four main components: (1) SiD Theory; (2) SiD Method; (3) SiD Process; (4) SiD Tools.

SiD Theory creates the foundation for the framework, and it includes the SiD sustainability definition and set of indicators for three levels of impact: object, network, and system level. SiD Tools is a collection of various instruments that can be used in different stages of the SiD process, such as LCA, System Mapping, Principles of Circular Economy, Biomimicry, Stakeholder Analysis, Maslow Hierarchy of Needs, BREEAM/LEED/WELL, and ENVI-met. However, this paper does not touch upon these framework components but instead focuses on explaining the SiD Process, SiD Method, and System mapping. The components are presented in the order of their importance for the showcase of the framework's application to the case study presented.

2.2 SiD Process

A process is "*a series of actions or steps taken to achieve a particular result*." The SiD process is equivalent to a project management tool that guides the project from beginning to end. As shown in Fig. 1, the main phases of the process are (1) Preparation; (2) SiD Intelligence; (3) SiD Solution cycle; (4) Execution phase. The SiD Framework characterizes the SiD Intelligence Phase, where scientific analysis is performed, and the SiD Solution Cycle Phase (creative group session), where the SiD Method is executed.

SiD Intelligence Phase consists of: (1) Trend analysis; (2) Precedent Research; (3) Stakeholder analysis and stakeholder involvement; (4) Data collection.

In this phase, all the knowledge is collected and analyzed. It is a crucial step executed before the creative group session. The material gathered is a prerequisite for the next phase—the SiD Method, as it offers the basic knowledge needed for the iterative co-creative process. The intelligence collected at this phase can further be elaborated and updated, as SiD

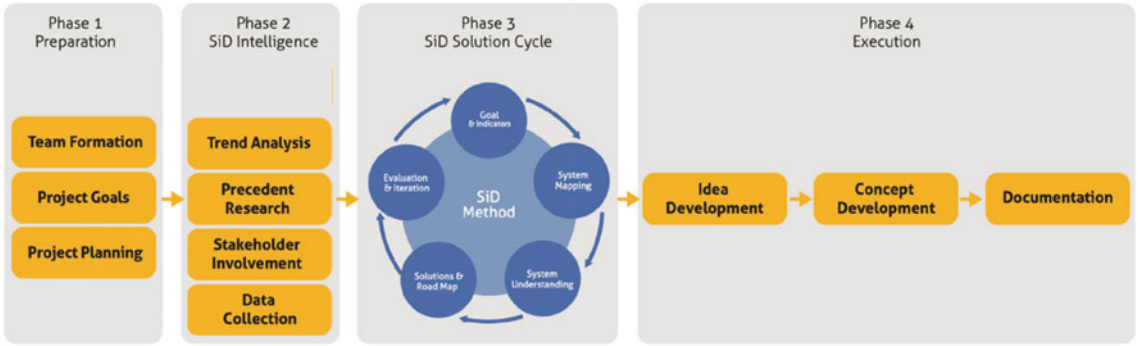

Fig. 1 Example of SiD process with SiD method. *Image credits* Except Integrated Sustainability

Process does not have a linear and rigid structure. Often it is necessary to come back and integrate added knowledge based on the outcome of the SiD Method.

2.3 SiD Method

SiD Method consists of five steps: (1) Setting goals and indicators; (2) Mapping the system; (3) Synthesizing knowledge to understand the system; (4) Designing solutions and mapping possible routes; (5) Evaluating the results (in this step, we can use the indicators set from step one to measure the success).

It is an iterative step-by-step process, and it can be started at any point and have a different order. The key is to go through all the steps at least once. Each cycle refines the solutions and helps with the integration of the solutions. The SiD Method is the moment that allows one to dive deep into mapping and to understand the system and its dynamics. At the same time, its co-creative nature enables the integration of all perspectives from different disciplines. The SiD Method is shown in Fig. 1 as part of the SiD Process.

2.4 System Mapping

The SiD framework is based on system mapping. What is a system, and how can we map it? The system is defined as a "*dynamic set of interconnected actors, relationships, and objects*." The system needs to be analyzed to understand these inter-connections and the system's dynamics. SiD identifies three different steps to do so:

1. Analyze through Time, Space, and Context,
2. Analyze these dimensions through different scales (from small to big),
3. Analyze in Full spectrum.

The Full spectrum analysis investigates all system levels (object, network, and system level). Different sets of indicators for each level examine the system's performance. A complete overview of the indicators for each level is shown in Fig. 2, where ELSI (short for Energy, Life, Society, Individual) indicators are used as a categorization tool on the object level. Network indicators reveal and test the complex system interactions finding the object level drivers behind them, while system indicators define the sustainability level. On the network level, there are three different sets of indicators. Each group of indicators corresponds to one of the three system-level indicators RAH (Resilience, Autonomy, and Harmony). The SiD indicator hierarchy shows the relationship between the three levels, their parameters, and their application in a project. It is essential to keep in mind that not all indicators are used in all situations; choosing the right indicators is very important for the success of the evaluation.

3 The Case Study: Carlo Dolci Square in "Isolotto" Neighborhood, Florence, Italy

The case study presented is the large area of Carlo Dolci square located in the city of Florence in the Isolotto district, southwest of the city center (Figs. 3 and 4). It is an area of approximately 2.820 m^2, well connected to the center by public roads and by public transport. It is a mainly residential urban area, with few commercial activities on the street front. Carlo Dolci square is adjacent to *Don Milani* Primary School and *Bruno Ciari* kindergarten.

The square is currently an asphalted area reserved for car parking, which does not make it an attractive place for the neighborhood residents and children attending school. Despite the presence of public and private green areas nearby, Piazza Carlo Dolci does not take advantage of their inter-connections to derive their intrinsic benefits.

The solar radiation of the hottest months and the rainfall of the wettest period cause high temperatures and localized flooding. Furthermore, the total lack of public facilities, the

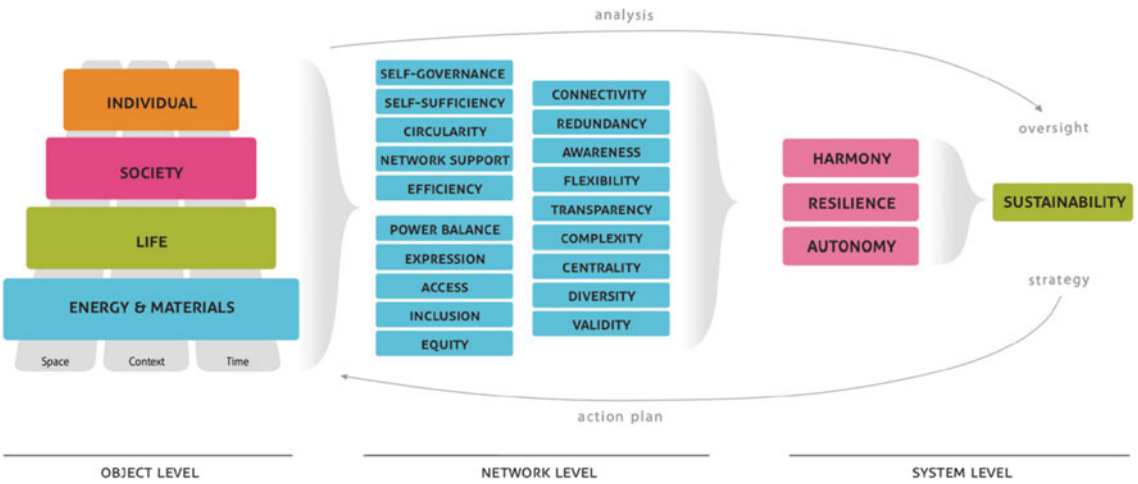

Fig. 2 Simplified layout of the three levels and indicators hierarchy. *Image credits* Except Integrated Sustainability

Fig. 3 Carlo Dolci square in "Isolotto" neighborhood. *Source* Google Maps

impermeable paving, and the lack of natural shade makes it an uncomfortable place to stay. The project area is thus a "non-place," anonymous, non-functional, and unattractive. This work examines the redevelopment of a currently degraded and underused urban environment by implementing Nature-based Solutions (NbS) and equipping it with new functions (such as art, education, play, and recreation) that contribute to heat stress reduction at a micro-urban scale and improve social inclusion and biodiversity in the urban context.

4 SiD Framework Applied to the Case Study

As described earlier, the SiD process was applied to the case study as follows: (1) SiD intelligence phase with Trend Analysis, Precedent Research (state of the art), Stakeholder Analysis, Data Collection, and ENVI-met analysis of the case study; (2) Two complete cycle of the SiD Method; (3) First concept development; (4) Evaluation with ENVI-met of the scenarios and documentation.

Fig. 4 Aerial photo of the case study area. *Source* Google Earth

4.1 SiD Intelligence Phase

The global, regional, and local Trend Analysis and what their impact and importance are for the chosen case study allowed the identification of the central tendency for this case: climate change, resource depletion, circular economy, biodiversity loss, green and healthy city, aging population, decentralization, servitization, and urban commons.

During the Precedent Research, examples of urban climate adaptation strategies and solutions that tackle climate change's effects by adopting Nature-based Solutions (NbS) were collected. The collected material was categorized from small (urban furniture with integrated vegetation —Fig. 5) to big scale (climate-adaptive redevelopment projects of the public space). The selected examples were further analyzed to identify the added value of the NbS in

Fig. 5 Example of the datasheets. *Image credits* Humankind

terms of ecosystem services; and the programmatic value they add to the public space, such as meeting spaces, market, and library).

For the Data Collection, the following data were analyzed: (1) Climatic data (average temperatures, prevalent winds, sun path diagram); (2) Microclimatic indicators for the outdoor comfort (air temperature, relative humidity, wind speed, mean radiant temperature); (3) Urban and building features (material physical properties, urban morphology); (4) Features of the existing urban vegetation (typologies, albedo properties); (5) Analysis of urban geometry; (6) Spatial occupancy of the open space; (7) Demographics data.

Stakeholders Analysis identified the direct users of the square (residents, school students, teachers, families) and the indirect actors that influence and/or have interest in this case study, like local municipalities, local shops, and cultural sports associations.

4.2 Cycling Through the SiD Method

Based on the output from the SiD intelligence phase, two complete cycles of the SiD Method were executed step by step in the following order: (1) Goal settings (Table 1); (2) System mapping and system understanding (Fig. 6); (3) Solutioning and Roadmap; and (4) Evaluation. Cycling through the method gave greater insight, resulting in the improvement and shift of the direction of the meta-design proposal.

The objectives presented in Table 1 are the second set of goals elaborated after the first system mapping and understanding phase. Figure 6 shows the matrix of the mapping analysis of the "Carlo Dolci square system" through three dimensions and in three different scales: (1) Time mapping: occupancy habits of different user profiles through 24 h, one week, and different seasons; (2) Space mapping: pedestrian habits and patterns, connectivity to the social and cultural services, and the green areas in the neighborhood; (3) Context mapping: stakeholders, the circular potential of the neighborhood (material flow diagram), and connectivity and activity map.

Network analysis was done in the second SiD Method cycle, and it allowed the critical evaluation of the first concepts and goals to further elaborate and refine both. Network Analysis was executed using the following indicators: Circularity, Connectivity, Flexibility, Diversity, Accessibility, Inclusion, Equity, and Efficiency. These indicators helped explore the current state of the Carlo Dolci square.

In the final step of the second cycle, the same Network parameters were used to evaluate the validity of the meta-design proposal and the success of the proposed interventions. Furthermore, at this step, ENVI-met software was used to assess the final climatic conditions of the meta-design proposals.

5 Results

The Trends Analysis and system mapping showed the importance of using the local resources and the flexibility of the solutions that allow the change over time to best support the changing conditions and meet the users' needs. One of the obstacles to the quick and effective implementation of climate-adaptive solutions is the economic pressure on the Municipalities. Furthermore, there is a slow shift in the ownership domain of the public space with a rise of bottom-up initiatives.

Based on the presented reflections, a new question arose: Is it possible to obtain positive results in climate adaptation and improvement of outdoor comfort with a flexible pop-up design that allows fast implementation, lower economic costs, and flexibility in the long term? Based on the SiD Intelligence Phase and system mapping output, a roadmap has been created with two meta-design proposals (Fig. 7).

Table 1 Sub-objectives divided per ELSI categories

Energy and materials	Ecosystem and species	Culture and economy	Health and happiness
Increase sources of renewable energy	Increase the local biodiversity	Add diversity in activities and space	Increase social connectivity
Improve pavement permeability	Increase ecosystem connectivity	Stimulate local economy	Stimulate slow traffic and reduce the air pollutants
Reduce flooding and create a water management system	Reduce UHI	Create short-term benefits with low economic impact	Improve outdoor comfort

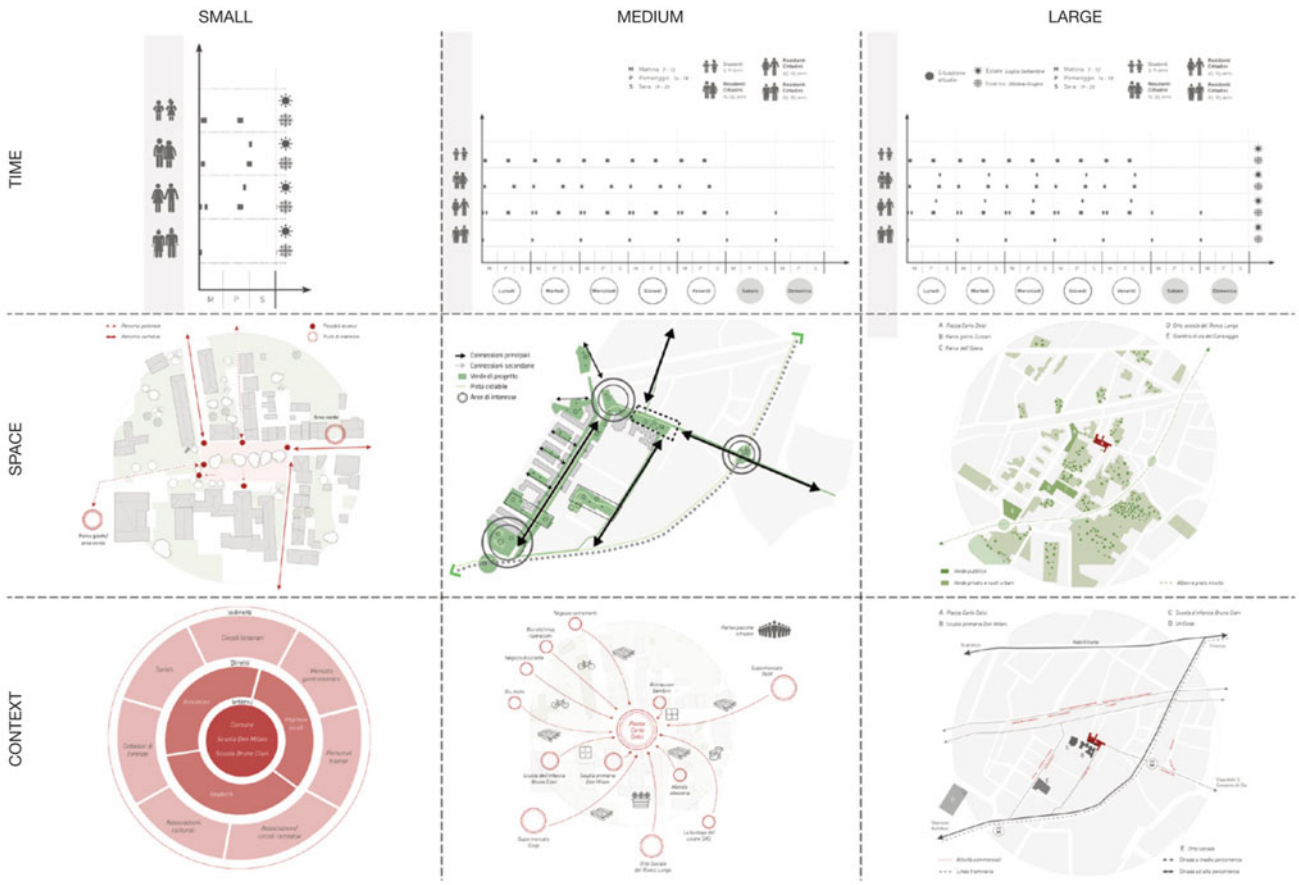

Fig. 6 System mapping through time, space, and the context in three different scales (3 × 3 matrix)

5.1 Road Map and Meta-Design Proposals

The roadmap proposes a step-by-step process: (1) Active participatory process with the stakeholders; (2) Mapping the local material and waste flows to identify possible materials for the construction of the first temporary solutions; (3) Realization of the temporary, flexible spaces that integrate the NbS within the space improving the outdoor comfort, adding various social, economic, and educational activities to the square; (4) Testing the solutions; (5) Verifying the second design proposal based on the lessons learned from the proof period; (6) Implementing the final design.

The different scenarios presented (Fig. 7) examine the redevelopment of a currently degraded and underused urban area by implementing Nature-based Solutions (NbS) that contribute to heat stress reduction at a micro-urban scale and equipping it with new functions (such as art, education, play, and recreation) that improve social inclusion and biodiversity in the urban context.

Scenario 1: The emphasis of the design is on improving the climate conditions in the shortest time possible with the least economic effort, using local resources. The modularity of the proposed design solutions allows the flexibility and interaction of the potential users with the elements in space, enabling them to change the layout to their preferences and needs. Proposed design solutions are the water elements and a series of flexible and temporary structures, such as portable green areas, meeting spaces made from pallets, educational and social gardens, and playgrounds, and placing them on the existing pavement of the square. NbS presented in this design are water tanks and a portable green garden with trees.

Scenario 2: This design aims to transform the temporary solutions into permanent ones and further improve the square's climate conditions by introducing NbS permanent solutions (green surfaces, rain gardens, water square, green corridors). The design strategy aims to replace the existing pavement with natural and porous materials, expand the water elements and green areas, and expand social and cultural activities (market, library).

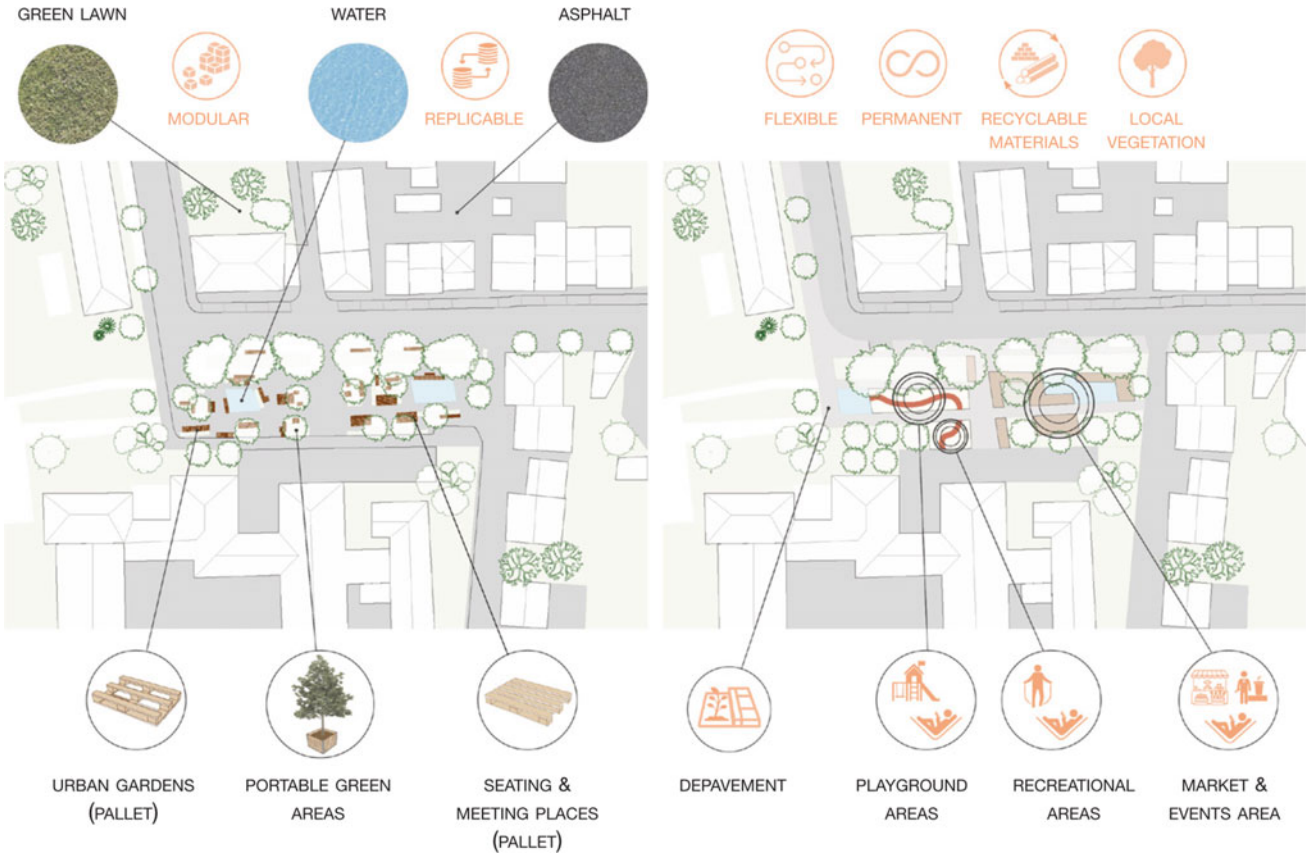

Fig. 7 Two meta-design proposals. The first scenario (on the left) shows short-term temporary solutions, while the second scenario (to the right) shows a long-term vision for Carlo Dolci square

5.2 ENVI-Met Software Evaluation and Results

ENVI-met software was used in both the SiD intelligence analysis and evaluation step to verify climate adaptation strategies and confront the two meta-design proposals. Climate analysis of the Carlo Dolci square has identified the 20th of July as the hottest day of the year. Based on this, all simulations (ex and post-ante) were started on the 20th of July 2018 at 13:00 h and are based on the physical parameters of a senior male (75 years old, 1.75 m, 75 kg, Clo: 0.40, Met 2).

The "ex-ante" microclimatic analysis highlighted an elevated state of discomfort for the users of Carlo Dolci square, highlighting the critical points and the opportunities for future redevelopment. Due to the almost total absence of shading and the presence of asphalt as the predominant material, the radiant temperatures are very high (31–32 °C), increasing the perceived temperature and the sensation of heat.

The "post-ante" microclimatic analysis showed improvements in climatic conditions and outdoor thermal comfort in both meta-design proposals. From scenarios comparison, it has emerged that the second one brings more significant benefits from a climate point of view. However, there is still a visible improvement in the outdoor comfort temperature in the first meta-design proposal, especially in the proximity of the trees that create shade (Fig. 8).

The ENVI-met simulations shown in Fig. 8 can be summarized as follows:

- Current state: The maximum Mean Radiant Temperature in the analyzed area is approximately 62.40 °C, while the minimum one, recorded in the shaded area in the proximity of the trees, is approximately 49.34 °C. The PMV index (Predicted Mean Vote) has lower values in the proximity of shaded and green areas of about 4.84, while the values grow to 5.7 in the asphalted areas without shade.
- Scenario 1: There is a general decrease in temperature values, mainly in the proximity to the new trees. In the hottest, asphalted area, the Mean Radiant Temperature shows a reduction of approximately 2 °C in comparison to the existing situation, while the PMV index decreases from 5.7 to 4.7.
- Scenario 2: Presents an overall improvement of the outdoor comfort and a lower percentage of the area within

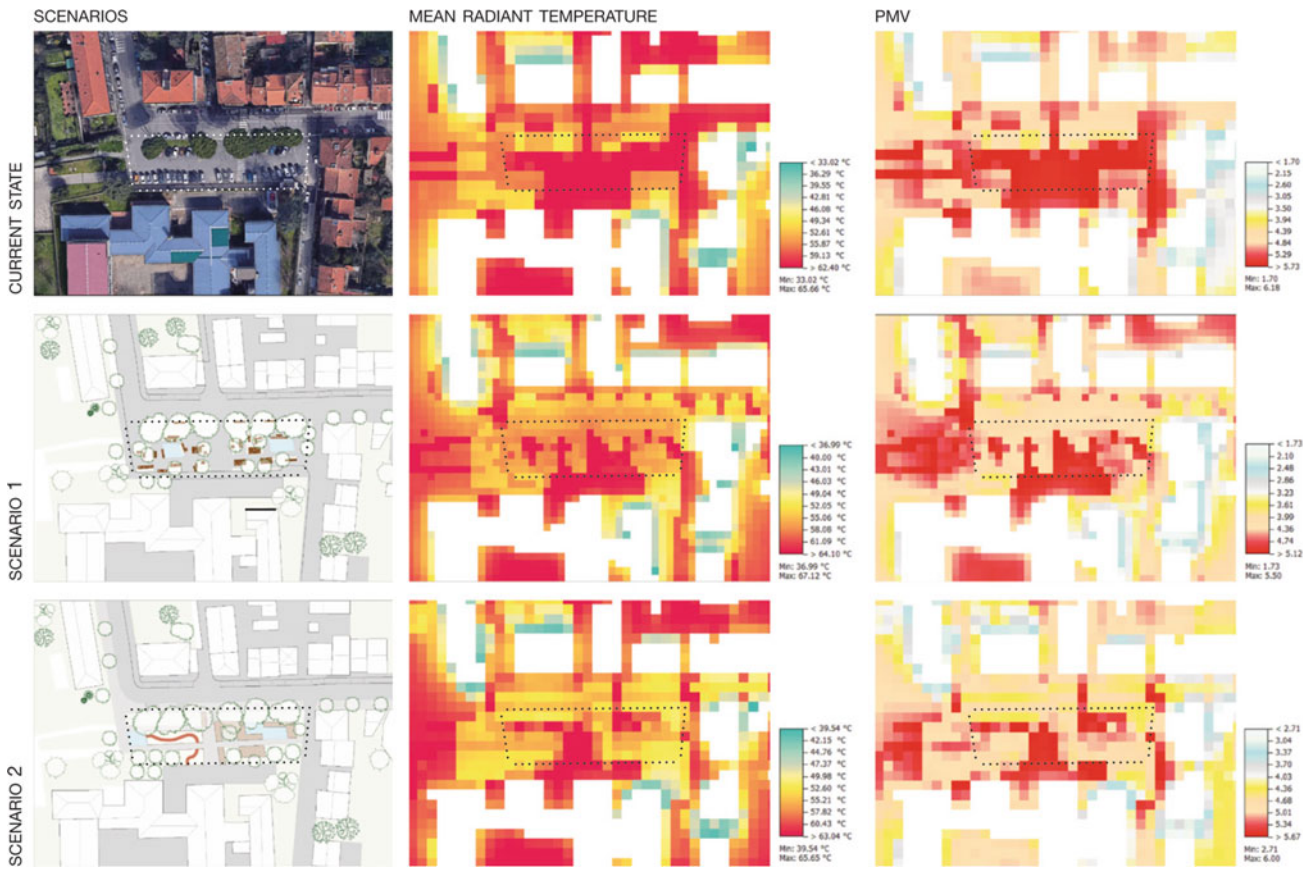

Fig. 8 ENVI-met analysis, from left to right: Scenarios, Mean Radiant Temperature, PMV; from top to bottom: Current state, Scenario 1, Scenario 2. The area of the intervention is within the dotted line. Date and time of simulations: 20th July 2018, at 13:00 h

the square with high temperatures. Compared to Scenario 1, both, Mean Radiant Temperature and PMV Index show further decrease. The Mean Radiant Temperature reduces by approximately 2 °C in comparison to scenario 1, while the PMV index, at this stage, shows a smaller decrease from 4.7 to 4.5.

6 Conclusions and Future Developments

The quality of urban development depends on many aspects, such as microclimatic conditions and the social and programmatic value that it offers. In the past few decades, climate change and its effects have been one of the most discussed topics, together with the attention on greening our cities and redeveloping public spaces. Nevertheless, the implementation of both adaptation and mitigation strategies is relatively slow due to economic and political challenges. However, improving outdoor comfort and lowering the outdoor temperatures in the summer period is one of the main challenges, specifically in Mediterranean cities.

Furthermore, designing and re-designing public space nowadays implies many challenges of a complex nature that require a multidisciplinary approach and close collaboration with all stakeholders. Applying a holistic approach to tackle city resilience challenges and ensuring incorporating solutions is of great importance. Symbiosis in Development (SiD) framework is an approach developed to meet these needs and support multidisciplinary teams in reaching integrated systemic solutions; it allows flexibility in applying and integrating various tools, such as ENVI-met for the simulation and valuation of the microclimatic conditions. The Full spectrum analysis has helped evaluate all aspects of Carlo Dolci's system and highlight the opportunities and the challenges that were not visible at first sight. One of the interesting points that came out of the first analysis is related to the temporality and the improvement of the climate-adaptive solutions, consequently leading to the reflection on the modality of the implementation and the flexibility of the proposed meta-design solutions.

The presented study shows that urban outdoor comfort can be improved in the short term with small interventions that combine the NbS with urban furniture enriching the

public space with social activities. In addition, the simulations with ENVI-met confirm the benefits of the proposed solutions in terms of improved climatic conditions and outdoor comfort for pedestrians due to the introduction of vegetation and water elements. In addition, the application of both systems and design-thinking approach through the SiD framework has shown as a handy tool able to tackle complex challenges, and it can become a valuable framework for inter and multidisciplinary teams. Finally, the quality of the process has contributed to increasing the cognitive understanding and maturity of the designers and students, allowing them to integrate the knowledge from other disciplines and perspectives.

6.1 Future Developments

At this research stage, the SiD framework was applied within an interdisciplinary team, instead of a multidisciplinary one, with a limited number of iterations. Although the stakeholder analysis was performed, there was no direct or indirect stakeholder involvement. The results presented are at the conceptual stage and need further iterations and elaborations. Future studies aim to expand the "systems" boundary from Carlo Dolci square to the neighborhood scale and carry on with both design and analysis starting from the current results presented in this paper. In the future steps, the SiD Process and SiD Method cycle will be repeated with a more diverse team to obtain more integrated and elaborated solutions with stakeholder involvement. Furthermore, ELSI tools will be used to define the KPIs to evaluate the proposals.

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References

Bosschaert, T. (2019). *Making new futures possible*.

Carlarne, C. P. (2021) Climate change, human rights, and the rule of law. *UCLA Journal of International Law and Foreign Affairs. Forthcoming, 25*, 1. https://doi.org/10.2139/ssrn.3761842.

European Commission. (2015) *Towards an EU research and innovation policy agenda for nature-based solutions & re-naturing cities. Final report of the Horizon 2020 expert group on 'Nature based solutions and re-naturing cities'*. Retrieved from https://op.europa.eu/en/publication-detail/-/publication/fb117980-d5aa-46df-8edc-af367cddc202.

European Commission. (2017) *Paris agreement. EUR-Lex*. Retreived from https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=CELEX:22016A1019(01).

European Commission. (2019). *European green deal. EUR-Lex*. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN.

European Commission. (2020) *Adaptation to health effects of climate change in Europe*. Retrieved from https://op.europa.eu/en/publication-detail/-/publication/e885e150-c258-11ea-b3a4-01aa75ed71a1.

European Environment Agency. (2020). *Urban adaptation in Europe: How cities and towns respond to climate change*. Retrieved from https://www.eea.europa.eu/publications/urban-adaptation-in-europe.

Except Integrated Sustainability. (2019). *Roadmap for the BGI manual*. Retrieved from http://media.except.nl/media/uploaded_files/asset_files/BGI_Report.pdf.

Gebalska, B. A. (2017). Using global trends as catalysts for city transition. *Procedia Engineering, 198*, 600–611. https://doi.org/10.1016/j.proeng.2017.07.114

Gonella, F. (2021) A gentle introduction to systems thinking and its application in the context of regenerative city patterns. In *A guidebook for regenerative implementation: interactions, tools, platforms, metrics, practice*. *RESTORE* (pp. 25–30).

Heaviside, C., Macintyre, H., & Vardoulakis, S. (2017). The urban heat Island: implications for health in a changing environment. *Current Environmental Health Reports, 4*. https://doi.org/10.1007/s40572-017-0150-3.

United Nations. (2015). *2030 Agenda for sustainable development*. Retrieved from https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf.

World Economic Forum. (2021). *The global risks report 2021 (16th Edition)*. Retrieved from http://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2021.pdf.

A City's Image and Compact Cities

Understanding Place Attachment Process Through Instagram Narratives and Imagery of Historic Urban Places

Tugce Ertan Meric, Norsidah Ujang, and Jamie MacKee

Abstract

With the rapid urbanization and globalization of cities, sustaining place identity has become a significant challenge. Historic city centers encapsulate place identity that holds special memories and meaning for those who attached to those places. The conservation effort in most cases focuses on the physical transformation, which has undermined the importance of the psychological sense of place embedded in the people's attachment and memories captured in their minds. Regarding the psychological process of place attachment as an integral part of place identity, the meaning and memory of a place will be valued and relived in the revitalized centers. This paper explores the dynamics of human perception through understanding the place attachment concept and dimensions in the context of place imagery using Instagram as a new and highly used social media tool. The aim of this paper is to review the theories related to the destination image, place involvement, collective memory, and place attachment to develop a theoretical model that explains how Instagram usage affects the psychological process of visitors' place attachment to revitalized historic places. The theoretical model is established by an extensive literature review and provides significant insight to the process of place attachment to revitalized historic city centers underpinning relevant concepts, deepening the urban research paradigm and generating a guide for further studies.

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Keywords

Place attachment • Historic city center • Urban revitalization • Instagram

1 Introduction

A city's identity relies significantly on the stages of memorable past events, points of daily gatherings, and urban places that were once venues of collective memory. Such places are generally historic urban centers or buildings. These urban spaces nestle tangible and intangible collective memorable elements. Therefore, they are crucial in the formation of urban character and city identity. Nevertheless, cities rapidly urbanized after World War II and the industrial revolution. They changed for better standards and improvement, but negative consequences also emerged, which had an impact on the social, physical, and cultural components of the cities. Urban centers shifted to new places while the old centers went through decay and abandonment. This not only resulted in physical deterioration but also safety issues. Most importantly, the main elements of the cities' identities commenced fading away. Modern cities are going through identity loss and weakening because of uniform planning strategies and rapid urbanization (Saleh, 1998). This results in placelessness (Relph, 1976). Local authorities, governments, and urban design practitioners have faced with the challenge of preserving the historical heritage sites to sustain the unique identity of place (Rypkema, 2003). Maintaining the character and meaning of place is essential since they are also fundamental elements of sense of place, community, and self-identity (Hull et al., 1994). Place attachment dimensions can help to restore place identity in cities (Ujang, 2010). However, in restoring urban identity, urban design research mostly focused on the physical aspect of the place; rather than paying attention to

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the psychological dimension embedded in place attachment (Ujang, 2010).

Comprehensive historic city center revitalizations cannot be based only on physical enhancements, instead they are challenging and complex processes that have to take cultural, social, economic, and historical elements into consideration. Sense of belonging and place attachment may help bridging these complex processes based on the understanding that attachment to place is an encompassing psychological concept that binds people and places. In the context of development, to have a sustainable conservation strategy in urban historic places, the concept of sense of place and place attachment should be applied (Martokusumo & Zulkaidi, 2015). In historically significant urban locations, place attachment ensures sense of belonging and continuity over time (Scannell & Gifford, 2010). This way urban places that hold substantial elements of city identity can be conserved and revitalized simultaneously and stay alive as part of the users' daily lives. Preservation should be focusing on the sense of place and identity of the place, which is a major step in heritage studies (Yeung, 2013).

To prevent urban identity loss, significant historic city centers that have experienced decay should be rehabilitated by restoring the sense of place that could incorporate purpose and meaning in people's daily lives (Chu & Uebegang, 2002). The revitalization process requires both locals and visitors to perceive these centers as attractive and actively use them so that they can stay alive and also indirectly contribute to the residents' socio-economic well-being. Place attachment occurs stronger in attractive destinations, which leads to significantly higher national income (Dredge, 2010). Therefore, the visitors' place attachment toward historic city centers is especially important.

How a person perceives the outer environment depends on the information s/he gathers. In today's world, media tools provide most of the information about experiences and events outside an individual's immediate environment. People's perceptions are significantly influenced by the information they get from the media. Electronic media affects the way people perceive a place and its authenticity, and the way people form social bonds (Houghton, 2010). Due to the popularity of social media tools such as Instagram and Facebook in the last decade, almost everybody acts as an information source. There are more than 2.5 billion social media users as of 2018 (Statista, 2019) and Instagram is the fastest growing place-based social media tool. Social media usage is growing in the South East Asia Region by 34% each year (Kemp, 2017). Therefore, the amount of social media users in urban areas is significant (Duggan & Brenner, 2013). Instagram is a fast-grown social media network with one billion monthly users, and more than 500 million of them use the network daily (Clarke, 2019). Instagram is a more location-based; in other words, place-based social media application among other social media applications. Therefore, Instagram is the social media tool that will be the main interest of this study. Consequently, the shared information with the help of social media has an impact on other people. When it comes to places, ideas, and visuals about places that are shared via popular social media tools shape visitors' image of a place. Today, the impact of ever-evolving information and communication technology on place perspective is evident, but putting this into use in urban planning practices is still a debate (Dameria et al., 2018).

Memory can simply be put as people's ability to remember past experiences or revive their thoughts (Ardakani & Oloonabadi, 2011). An attraction point in an urban setting has an essential role in forming collective memory due to people's shared meaningful past experiences in that place. Sharing such meaningful memories with other people has become easy today due to the increasing usage of smart devices and hence, social media. By the use of these tools, an urban space's users and visitors, sometimes even individuals that have never actually visited that place, can interact and form a collective memory, a kind of place attachment for that place. The actual visitors of the place have the opportunity to show their emotional attachment via these social media instruments, at the same time, the audience forms an indirect emotion toward the place during this process.

The way people perceive a place and form place attachment has been transformed irreversibly due to the direct and indirect interaction between places and people via social media tools. These practices also changed the meaning and identity of places. However, there is limited research about the effects of popular social media tools in the urban context and specifically on place attachment about urban heritage sites even though there is a considerable amount of discussion for new technologies' impact on place (Dameria et al., 2018; Van der Hoeven, 2019). There is a lack of knowledge about social media's effects on visitors' bonds to places, and in some cases, this led to the creation of less memorable and less meaningful places (Felasari et al., 2017). In that regard, the aim of this paper is to review the theories of Instagram usage, destination image, place involvement, collective memory, and place attachment to build better-developed revitalization approaches for historic city centers by establishing a theoretical model that explains the effect of Instagram usage on place attachment process.

2 Methodology

This paper uses a research strategy conducting literature review to explain the concepts of Instagram usage, place attachment, destination image, place involvement, collective

memory, and their interrelations. The information was collected via articles, books, document analysis, and Internet content. The researcher used descriptive analysis sand content analysis to establish the connections between the main concepts. After forming a preliminary framework investigating the individual relationships of main concepts with each other, a comprehensive theoretical model was developed to explain the complex nature of the place attachment process and how it is affected by Instagram usage over time.

3 Literature Review

3.1 Place Attachment

Space is a three-dimensional physical area in a geographic location. Space becomes a place when it is experienced personally (Tuan, 1977). A place nestles significance and value (Gieryn, 2000), and it incorporates both physical and social dimensions. Due to this nature, people generate psychological bonds with places. Place attachment is an emotional bond established between people and a specific place that they have experienced (Hernandez et al., 2007). In general, people focus on their emotions and affection when they refer to a place (Low & Altman, 1992). For example, an affective assessment of a place may be an emotional response to a place finding it as attractive, likable, pleasant, and satisfying (Brocato, 2006). In the early days of place attachment studies, affection and emotions were found to be the main aspects of place attachment. However, place attachment is a more complex phenomenon with affective, functional, and cognitive dimensions (Stedman, 2002).

There are different studies about place attachment dimensions, but the most widely accepted ones in literature are place dependence and place identity (Williams & Roggenbuck, 1989). Place dependence focuses on functional attachment to place whereas place identity refers to the affective attachment to place (Gross & Brown, 2008). Place dependence is the ability of a place to fulfill functional needs (Williams et al., 1992). Place identity, on the other hand, refers to memories, perceptions, emotions, and ideas about a specific setting (Yuksel et al., 2010). It can be described as the relationship between a place and a person's identity (Proshansky, 1978). Therefore, places play an essential role in certifying people's identities (Kyle et al., 2005). The two dimensions of place attachment, namely, place identity (Proshansky et al., 1983) and place dependence (Moore & Graefe, 1994; Williams & Vaske, 2003), are widely used in most research fields including tourism and environmental psychology (Kyle et al., 2005; Yuksel et al., 2010). Although affective place-person bonds are directly associated with place identity, it is necessary to mention affective attachment dimension separately. Affective attachment is solely based on emotion, and it is beyond judgment and cognition (Jorgensen & Stedman, 2001). It tends to deepen over time, and as the place experience gets deeper (Relph, 1976).

In addition to the three dimensions stated above, Kyle et al. (2005) brought social bonding to attention as a new dimension of place attachment. A place becomes significant when it hosts meaningful relationships that commence and flourish there since it gives these relationships a chance to exist (Kyle et al., 2005). The social bonding dimension has two tiers of significance; first, the social relation between a place and a person; second, people's sense of belonging to a place (Chen et al., 2014). A powerful social bond may become a robust emotional bond to a place due to repeated interaction with place (Kyle & Chick, 2007).

Place interaction may also result in attaining meaning to a place and eventually building human-place bonds (Milligan, 1998). According to Milligan (1998), experiencing a place emerges two place attachment dimensions, which are interactional potential and interactional past. Since experiencing and hence interacting with a place results in meaningful memories, it is possible to generate place attachment based on a significant interaction with a place (Chen et al., 2014). Place attachment can be grounded in strong memories or small daily life interactions with place (Chen et al., 2014). Due to the possibility of reinterpreting memories over time, the interactional past dimension has the opportunity to act dynamically (Katovich & Hintz, 1997). Interactional potential, on the other hand, is a person's expectations from a place that is developed by the information gathered about that place. This is related more to the physical aspects of the place because it is easier to set interaction expectations based on physical features (Milligan, 1998). Interactional past and interactional potential dimensions are rooted in place experience, or rather the interaction between a person and a place (Stamboulis & Skayannis, 2003). People–place bonds can strengthen based on personal experience of place (Chen et al., 2014). Although different disciplines consider various measures of place attachment, many concur that emotional and functional place attachment dimensions differ in nature (Lin & Lockwood, 2014).

Scannell and Gifford (2010) proposed a comprehensive conceptual model for place attachment dimensions. In defining the concept, three dimensions that are person, place, and process (three P's) constitute place attachment. Person dimension consists of collective or individual bonds to place; the process dimension focuses on the psychological evolution of person-place connection in the cognitive, behavioral, and affective context; and lastly, place dimension is concerned with the physical and social components of place that are related to place attachment.

Scannel and Gifford's tripartite place attachment model, as seen in Fig. 1, can be regarded as a comprehensive model

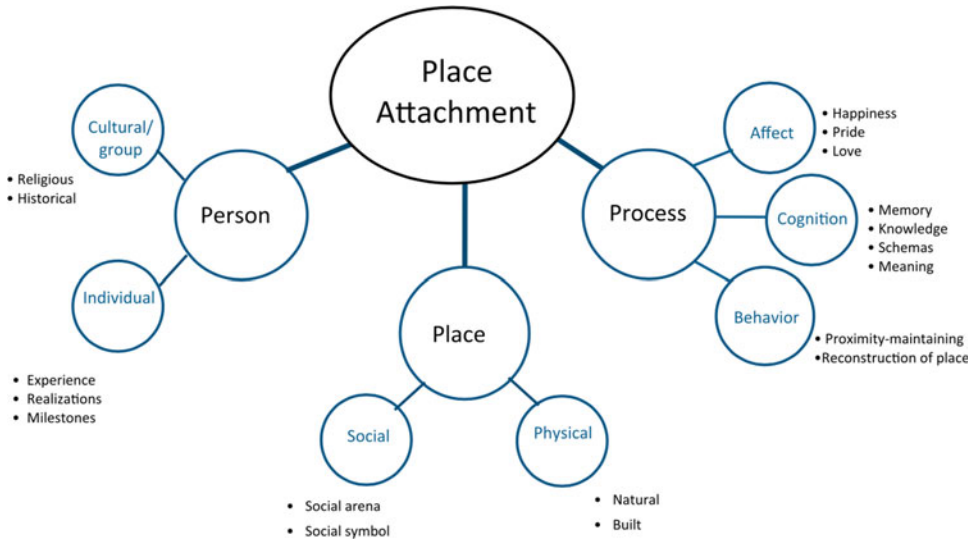

Fig. 1 Tripartite conceptual model for place attachment (Scannell & Gifford, 2010)

to represent concepts established by previous authors. Additionally, place dependence, place identity, social bonding, affective attachment, and interactional past and potential dimensions are considered when theoretical concepts are operationalized because they are smaller components of place attachment psychological process.

It is worthy to note that, even though place attachment tightly knits with locals who live there, visitors can also generate sturdy place attachment, too (Kaltenborn & Williams, 2002). Other theoretical discussions and empirical studies support the fact that visitors form strong affective bonds to places (Brown & Raymond, 2007). They also attribute significance and meaning to places and consider them as special places (Brown & Raymond, 2007). However, visitors and locals have different types of bonds with places because locals regard the place as home, whereas visitors perceive it as a temporary space. Therefore, visitors' bond with the place is more complicated than that of the locals (Zhou & Xu, 2009). Based on the above discussions, we can gather that place attachment is a rather complex psychological phenomenon yet to be explored further due to the lack of studies that focus on the relationship between place identity, place attachment, and everyday social media tools.

3.2 Place Identity

Meaning, activity, and form are primary components of place (Montgomery, 1998). A place's identity involves meaning and people–place bonds, in addition to its physical elements (Ujang, 2010). A person's affective attachment and functional dependence on place influence that place's identity (Bott et al., 2003).

People–place bonds consist of overlapping layers that are emotions, meaning, and opportunities (Hull, 1992). These layers build up the significance of place, which leads to place attachment (Bott & Banning, 2008). Place identity is closely related to the bond between people and urban places, and it is one of the essential components of place uniqueness (Sepe, 2013). Nevertheless, urban settings are profoundly transformed by rapid urban development, and an identity crisis has emerged due to the uniformity of urban places (Sepe, 2013).

In this context, conserving historic city centers let future generations learn about their city's history and identity and, thus very valuable (Mohamed & Salim, 2017). The main reasons for conserving a historical place are "memory, identity, and continuity." Stability is maintained by continuity in an ever-changing world; historic places nestle memories that enhance the individual and collective identity (Mayes, 2013). A person's identity is based on its ability to identify with a place's identity (Norberg-Schulz, 1979). To sustain the uniqueness of place, it is a must to preserve the historical heritage sites in cities (Rypkema, 2003). Place attachment is, therefore, a crucial aspect to be considered in historic urban conservation projects since it is fundamental for sustaining place identity.

3.3 Temporal Process

Experiences take place in a space during a time frame (Zakrisson & Zillinger, 2011). Generally, a bond with a specific place starts to form after visiting that place, but on some occasions, attachment-related emotions might arise before visiting the place (Lee, 1999; Moore & Graefe, 1994). Craig-Smith and French's theory of the three-staged

temporal process can be useful in investigating this notion (Jennings & Nickerson, 2006). According to this theory, the three phases of the temporal process are the anticipatory phase, experiential phase, and reflective phase.

The stage before visiting a place is called the anticipatory phase, and at this stage, one collects information about that particular place to shape his/her time there. The experiential phase describes the duration of the visit where the visitor interacts with the place and experiences the cultural, social, and physical environment (Jennings & Nickerson, 2006). An important thing about this stage is that place engagement is personal, and changes from individual to individual (Pine & Gilmore, 1999). Lastly, the reflective phase takes place after the visit, and at this stage, the individual recalls memories from the trip (Meng, 2006). It is common for people to collect souvenirs or photos for storing memories of their visit (Ritchie & Hudson, 2009). Visitors also share their memories and experiences via social media channels in this period (Buhalis, 2003), and they interact with other users' social media posts about the same place.

As mentioned before, place attachment can form even before visiting a place (Halpenny, 2006). In the anticipatory phase, people get information about a place from television, family and friends, social media channels such as Instagram, etc. In the experiential phase, in other words, during the visit, physical and emotional interaction with place happens, leading to place attachment. In the reflective stage, the memory takes action (Ek et al., 2008). In this last phase, people reinterpret their memories by sharing them with other people in physical environments, or they can utilize social media for this purpose.

In all the three stages, Instagram has an impact on place interaction, hence on place attachment. Even before visiting a place, individuals start their interaction with a place on Instagram via other people's shared memories on the platform. At this stage, their image of that place begins to form, and bonding commences. In the experiential phase, interaction with the place partly happens while using Instagram. This social media tool contributes to the place experience by creating a richer and more compelling way of interaction with the place. Visitors can develop narratives on Instagram out of their memories of the place, or even sometimes, they create memories just for Instagram. This increasing interaction and involvement with place enhance the place experience. After the visit, in the reflective phase, people share and remember their memories about a place with the help of Instagram. Such social media tools can serve as a virtual diary for people by indexing their place memories.

The previous sections reveal that Instagram narratives have an effect in every stage of place interaction, thus having an impact on place attachment. Therefore, the next sections explain the interrelation between place attachment and destination image, place attachment and involvement, and place attachment and memory.

3.4 Interrelation Between Destination Image and Place Attachment

Destination image is the sum of emotions, thoughts, and impressions of an individual about a particular place (Baloglu & McCleary, 1999). According to previous literature, destination image affects visitors' place attachment to a destination (Veasna et al., 2013), and it is one of the elements that result in place attachment (Prayag & Ryan, 2011). Especially, place identity and place dependence dimensions are affected by the image of a destination on visitors' minds (Fan et al., 2014).

As mentioned before, generating place attachment in the anticipatory phase is possible, and people consider mental imagery significantly when they are planning a visit to a certain place (MacInnis & Price, 1990). A destination's image that has been shaped in an individual's mind affects emotions since mental imagery imitates the real-world events (Holmes & Mathews, 2005). Mental imagery allows potential visitors to experience places before actually going there, and determine if that place will fulfill their goals and values (Plunkett, 2013). Sense of being in a place relies mostly on the richness of media (Klein, 2003), and in forming a destination image, the primary source can be the media (Gold, 1994). Non-residents of a place, namely, visitors, tend to embrace a place's media image as that place's real character (Avraham & Ketter, 2008).

In the anticipatory phase, digital media lets people experience a place visual and auditory terms and, therefore, significantly influences place perception of people (Zook et al., 2004). Even though this can never replace experiencing a place physically in the real world, it can strengthen affectionate bonds with the place (Lemos, 2008). Other forms of more conventional media such as radio and television also offer virtual experiences for places. Still, social media is a much more personalized and free platform that allows users to create and consume information (Zook et al., 2004). Therefore, it is argued that the relationship between destination image based on social media and emotional bonds toward places can be used to investigate how Instagram affects the formation of place attachment in the anticipatory phase. How a place is represented by Instagram imagery and the impact it has on people's place attachment should be investigated further.

3.5 Interrelation Between Place Involvement and Place Attachment

Understanding a place's meaning happens through experiencing it (Cresswell, 2004). Personal meaning of a place is enhanced by interacting with it, and this contributes to place attachment. Activity involvement has been seen to be affecting place attachment positively, especially in heritage sites (Hwang et al., 2005). Also, in touristic places, place attachment is directly proportional to the level of activity involvement (Bricker & Kerstetter, 2000). Both concepts of activity involvement and place attachment are constituted by cognition, affect, and behavioral components (Kyle et al., 2005). Other concepts that are tightly knit with involvement are centrality (value), self-expression (identity), and attraction (Kyle et al., 2005).

Visitors' involvement with a place is directly related to place attachment (Mowen et al., 1997). In today's world, experiencing physical places have another layer of social media; people live through social media. Almost everyone is present on social media, and they regularly share their ideas about places or place-based memories on social media platforms such as Instagram. Sharing the experience on Instagram is even sometimes the sole reason to experience or visit a specific place. "Instagram worthy" places are often created by tourist attractions to draw visitors. It is discussed that taking a photo of a place generates a form of emotion toward that place as well (Hanan & Putit, 2014).

Experiencing the physical place through the eyes of social media and committing the activity of sharing on social media right at the spot is a fulfilling activity involvement on a personal level. As a result, this paper argues that involvement with the place is increased due to Instagram because allows the people to show their identification with a place in the experiential stage.

3.6 Interrelation Between Collective Memory and Place Attachment

Memories help people store their past (Boyer, 2009). They make our experiences meaningful and thereby add meaning to places that we experience (Lim, 2000). Individual memory is a personal concept, yet memories can also be collective. Collective memory occurs when a group of people remembers a shared experience or a past event (Lewicka, 2008). It is as strong as the number of people who remember the past experience (Lavenne et al., 2005). Collective memory has a social nature because it is mainly formed in social life (Paez et al., 1997).

Since a place can be briefly described as a space with meaning, memory is an important aspect because it differentiates one place from another. Such memorable places sometimes constitute an urban setting's identity. It is often the historic places that are the core of a city's identity because they nestle collectively formed memories (Misztal, 2003). These memorable historic places are generally the gathering points for city dwellers, and they act as essential components of daily city life. These past events are meaningful for people, and they enhance people's emotions toward their cities; thus collective memory is an essential element for the city identity (Borden et al., 2002). Places act as bridges between the past, present, and future and therefore, collective memory is a vital tool in historic urban setting revitalizations because it helps people embrace the urban environment's meaning (Trancik, 1986).

When memory is cherished collectively, the identity of the place that it took place is also valued (Hague, 2005), and this contributes to place attachment. Today, forming memories collectively about places and sharing them is an everyday activity due to the ever-increasing Internet and smart mobile device usage. The popular social media tool Instagram is almost a place-based visual archive of collective memories. Moreover, Instagram users also interact with each other about shared places and memories on the platform, which helps create social bonds as well. This is very important in the context of contributing to the meaning of place and, thus the level of place attachment.

3.7 Interrelation Between Instagram Usage and Place Attachment

People–place bonds have been investigated in literature for a long time, but they mostly focus on non-mediated physical places. Nevertheless, in today's context, reality or experiencing a place is not only on the physical level but it co-exists with a virtual layer. Digital media has had an irreversible impact on the way we perceive reality and, therefore, on the perception of place. Digital space and physical space are not two separate things anymore but instead mutually linked dependent realities that are experienced by people (Graham, 2004). As a result, people experience the physical world through a digital perspective (Miller & Horst, 2013). Social media tools are one of the most common digital media tools that affect people's ideas about places by giving them impressions about those places.

Instagram is a free to use social media application; it has a billion active users and an incredibly large user-generated visual database (Statista, 2018). Instagram users can share photos and videos instantly on the platform, and they can tag their visuals with a location and digital hashtags (Hanan & Putit, 2014). Users can categorize their shared visuals according to hashtags or location tags as well as sharing their

content on Facebook, too (Criswell & Canty, 2014). The platform also allows users to interact with other users by liking their images or commenting on them.

The process of telling a story via photos, videos, and texts on Instagram can be described as narratives. Social media narratives are composed of people's experience layers (Cauchi-Santoro, 2016). Most Instagram narratives express a thought or an emotion, which also affect the viewers' feelings. It also acts as a collective remembering tool by letting people exchange memories related to historic urban places (Simon, 2012). During all three temporal phases, Instagram can have a generating or altering role for emotions about places. Therefore, it's a valuable asset to investigate in the context of place attachment. It provides a convenient environment for place attachment improvement due to the social interaction between the users and its location-based nature (Tussyadiah & Fesenmaier, 2009).

Instagram's role in the context of place can be listed as:

- It documents memories.
- It contributes to collective memory.
- It helps to envision places.
- It helps to envision emotions.
- It contributes to the interaction between people who are tied to a particular place.
- It contributes to place interaction.
- It offers an activity purpose to the visitor.
- It makes the visitor feel like s/he left a mark in that place.
- It helps emotions to emerge toward a place based on other people's reflections about that place.

People use Instagram to collectively store their memories about specific places and events by sharing their ideas and emotions devoted to that place. Therefore, it has a direct and indirect influence on person-place bonds. In some cases, this practice may create indirect memories about a place, or it may push people to generate memories solely for sharing them on Instagram. The visitor's relationship with the place is directly affected while it influences other Instagram users' bonds with places indirectly. Interacting with a place and its other users on this level on social media also has an impact on the place meaning and inevitably on the place identity (Coyne, 2010). This interaction's role in the urban context should be better understood specifically for the historic city center revitalization processes since place attachment is duly vital in such projects. This paper argues that Instagram strengthens place attachment. Therefore, it proposes a theoretical model to investigate how Instagram affects the three temporal phases of place experience, leading to place attachment in the case of revitalized historic city centers.

4 Discussion and Proposed Theoretical Model

This paper has reviewed the theories of destination image, place involvement, and collective memory to establish a link between Instagram usage and the place attachment theory. Additionally, since place attachment is a process that happens in a timeframe, temporal process theory is also reviewed to understand the three phases of place interaction, which are pre-visit, during visit and after visit. The aim of this paper was to explain the causal link between visitors' place attachment to revitalized historic city centers and Instagram usage in the context of the current use of social media tools.

The most comprehensive and recent study that explains place attachment is the tripartite (Place, Person, Process) model (Scannell & Gifford, 2010). It builds upon the previous and complex literature of place attachment and summarizes the concept in a simple but integrated theoretical model. This tripartite model is deemed appropriate in understanding the link between Instagram narratives and visitors' place attachment. This stand is due to the understanding that the personal or collective bonds to place are encapsulated in the person dimension, whereas process dimension is concerned with how bonding happens between a person and a place in the cognitive, affective, and behavioral context. A practical framework should emphasize the importance of the process of place attachment formation. Thus, building upon this tripartite model, by drawing from literature, the psychological process of visitors' place attachment could be clarified further by exploring the smaller dimensions of place identity, place dependence, affective attachment, social bonding, and interactional past and potential.

Since place attachment happens as a psychological bonding process, the temporal process theory can be used to understand this timeframe. In the anticipatory stage, in other words, pre-visit phase, people form a destination image about a place in their minds, and Instagram narratives are highly influential on their thoughts and feelings at this stage. During the visit (experiential phase), the visitors physically experience the place and sharing Instagram narratives offer them an improved place involvement via meaning-making practices. Finally, at the reflective phase, which is after the visit, Instagram narratives contribute to remembering and collective memory, thus influences place attachment. This paper states that Instagram usage has a considerable effect on the place attachment process through destination image, place involvement, and collective memory within the temporal timeframe of engaging with a place. This theoretical framework can be seen in Fig. 2.

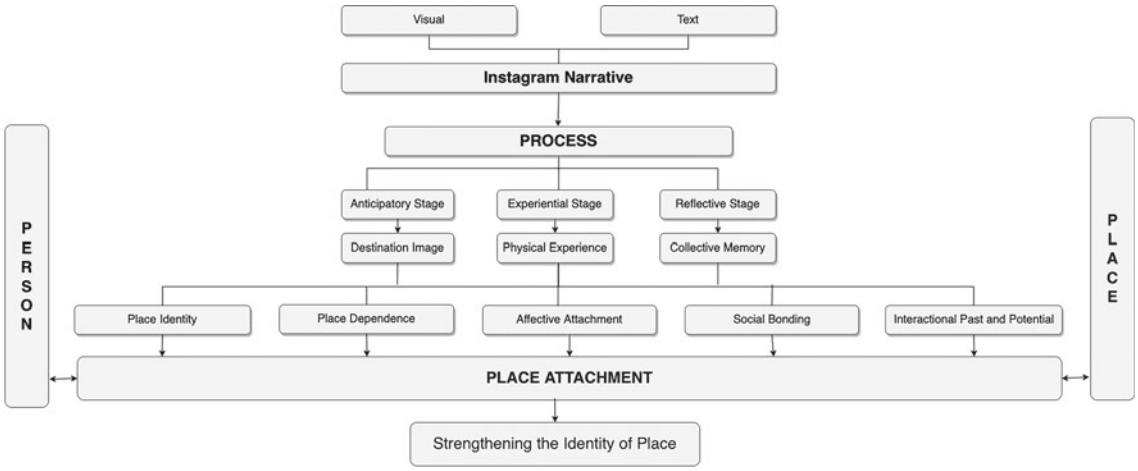

Fig. 2 Theoretical framework, by the author

5 Conclusion

New opportunities for interacting with places are emerging due to the increasing usage of digital social media, especially Instagram, which makes it compulsory to research the effects of such tools in the urban context. The proposed theoretical model is a step forward understanding the role of Instagram narratives in place attachment formation.

The conceptual model draws from the literature and proposes a way to explain the causal interrelations between destination image, place experience, collective memory, and place attachment. Urban practitioners can utilize the model in the context of revitalized historic city centers to strengthen the identity of place and keep the city's identity alive. The proposed model should be explored further to investigate the in-depth relations between its components and their influence on the identity of the place. It can be applied to most urban historical revitalizations but the local concepts should be incorporated and issues should be handled case by case.

The understanding and framework could be applicable to current heritage revitalization approaches that are focused on physical dimensions to move forward and incorporate the psychological process of place attachment. Furthermore, this model can enlighten how individuals perceive their environments in the new age of the Internet, which is very valuable for urban practice. Since the ultimate goal of urban design is to create meaningful places, this model provides a valuable basis for integrating the increasing social media usage to urban practices.

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References

Ardakani, M., & Oloonabadi, S. (2011). Collective memory as an efficient agent in sustainable urban conservation. *Procedia Engineering, 21*, 985–988.

Avraham, E., & Ketter, E. (2008). *Media strategies for marketing places in crisis: Improving the image of cities, countries and tourist destinations*. Butterworth Heinemann.

Baloglu, S., & McCleary, K. (1999). A model of destination image formation. *Annals of Tourism Research, 26*(4), 868–897.

Borden, I., Kerr, J., Pivaro, A., & Rendell, J. (2002). *The unknown city: Contesting architecture and social space*. The MIT Press.

Bott, S., & Banning, J. (2008). The use of psychometric scales to measure spirit of place relevance to heritage conservation efforts from Ninewa Province, Iraq. In *16th general assembly and scientific symposium of ICOMOS*.

Bott, S., Cantrill, J., & Myers, O. (2003). Place and the promise of conservation psychology. *Human Ecology Review, 10*(2), 100–112.

Boyer, P. (2009). What are memories for? Function of recalling cognition and culture. In P. Boyer & J. Wertsch (Eds.), *Memory in mind and culture* (pp. 3–33). Cambridge University Press.

Bricker, K., & Kerstetter, D. (2000). Level of specialization and place attachment: An exploratory study of whitewater recreationists. *Leisure Sciences, 22*(4), 233–257.

Brocato, E. (2006). *Place attachment: An investigation of environments and outcomes in a service context*. The University of Texas at Arlington.

Brown, G., & Raymond, C. (2007). The relationship between place attachment and landscape values: Toward mapping place attachment. *Applied Geography, 27*(2), 89–111.

Buhalis, D. (2003). *ETourism: Information technology for strategic tourism management*. FT Prentice Hall.

Cauchi-Santoro, R. (2016). Mapping community identity: Safeguarding the memories of a city's downtown core. *City, Culture and Society, 7*(1), 43–54.

Chen, N., Dwyer, L., & Firth, T. (2014). Conceptualization and measurement of dimensionality of place attachment. *Tourism Analysis, 19*(3), 323–338.

Chu, C., & Uebegang, K. (2002). *Saving Hong Kong's cultural heritage*. Civic Exchange.

Clarke, T. (2019). 22+ Instagram stats that marketers can't ignore this year. [Blog] *Hootsuite*. Retrieved April 09, 2019, from https://blog.hootsuite.com/instagram-statistics/.

Coyne, R. (2010). *The tuning of place: Sociable spaces and pervasive digital media*. MIT Press.

Cresswell, T. (2004). *Place: A short introduction*. Wiley-Blackwell.

Criswell, J., & Canty, N. (2014). Deconstructing social media: An analysis of Twitter and Facebook use in the publishing industry. *Publishing Research Quarterly, 30*(4), 352–376.

Dameria, C., Akbar, R., & Natalivan Indradjati, P. (2018). Whose sense of place? Re-thinking place concept and urban heritage conservation in social media era. In *IOP Conference Series: Earth and Environmental Science*, 158.

Dredge, D. (2010). Place change and tourism development conflict: Evaluating public interest. *Tourism Management, 31*, 104–112.

Duggan, M., & Brenner, J. (2013). *The demographics of social media users—2012*. Pew Research Center. Retrieved April 09, 2019, from https://www.pewinternet.org/2013/02/14/the-demographics-of-social-media-users-2012/.

Ek, R., Larsen, J., Hornskov, S., & Mansfeldt, O. (2008). A Dynamic framework of tourist experiences: Space-time and performances in the experience economy. *Scandinavian Journal of Hospitality and Tourism, 8*(2), 122–140.

Fan, J., Qiu, H., & Wu, X. (2014). Tourist destination image, place attachment and tourists' environmentally responsible behavior: A case of Zhejiang tourist resorts. *Tourism Tribune, 29*(1), 55–66.

Felasari, S., Setyabudi, H., Budiyanto Setyohadi, D., & Dewi, S. (2017). Exploring collective memory and place attachment using social media data. *IOP Conference Series: Earth and Environmental Science, 99*, 012015.

Gieryn, T. (2000). A space for place in sociology. *Annual Review of Sociology, 26*(1), 463–496.

Gold, J. (1994). Locating the message: Place promotion as image communication. In J. Gold & S. Ward (Ed.), *Place promotion: The use of publicity and marketing to sell towns and regions* (pp. 19–37). John Wiley. Retrieved May 08, 2018, from https://www.academia.edu/6033468/Gold_J.R._1994_Locating_the_Message_place_promotion_as_image_communication_in_J.R._Gold_and_S.V._Ward_eds._Place_Promotion_the_use_of_publicity_and_public_relations_to_sell_towns_and_regions_Chichester_John_Wiley_19-37.

Graham, S. (2004). Beyond the 'dazzling light': From dreams of transcendence to the 'remediation' of urban life. *New Media & Society, 6*(1), 16–25.

Gross, M., & Brown, G. (2008). An empirical structural model of tourists and places: Progressing involvement and place attachment into tourism. *Tourism Management, 29*(6), 1141–1151.

Hague, C. (2005). Planning and place identity. In C. Hague & P. Jenkins (Eds.), *Place identity, participation and planning* (pp. 2–14). Routledge.

Halpenny, E. (2006). *Environmental behaviour, place attachment and park visitation: A case study of visitors to Point Pele National Park*. University of Waterloo.

Hanan, H., & Putit, N. (2014). Express marketing of tourism destination using Instagram in social media networking. *Hospitality and tourism* (pp. 471–474). Taylor & Francis Group.

Hernández, B., Carmen Hidalgo, M., Salazar-Laplace, M., & Hess, S. (2007). Place attachment and place identity in natives and non-natives. *Journal of Environmental Psychology, 27*(4), 310–319.

Holmes, E., & Mathews, A. (2005). Mental imagery and emotion: A special relationship? *Emotion, 5*(4), 489–497.

Houghton, K. (2010). Augmenting public urban spaces: The impact of the digital future on the design of public urban spaces. *Queensland Planner, 50*(4), 19–23.

Hull, R. (1992). Image congruity, place attachment and community design. *Journal of Architectural and Planning Research, 9*(3), 181–192.

Hull, R., Lam, M., & Vigo, G. (1994). Place identity: Symbols of self in the urban fabric. *Landscape and Urban Planning, 28*(2–3), 109–120.

Hwang, S., Lee, C., & Chen, H. (2005). The relationship among tourists' involvement, place attachment and interpretation satisfaction in Taiwan's national parks. *Tourism Management, 26*(2), 143–156.

Jennings, G., & Nickerson, N. (2006). *Quality tourism experiences*. Elsevier Butterworth Heinemann.

Jorgensen, B., & Stedman, R. (2001). Sense of place as an attitude: Lakeshore owners attittudes toward their properties. *Journal of Environmental Psychology, 21*(3), 233–248.

Kaltenborn, B., & Williams, D. (2002). The meaning of place: Attachments to Femundsmarka National Park, Norway, among tourists and locals. *Norsk Geografisk Tidsskrift - Norwegian Journal of Geography, 56*(3), 189–198.

Katovich, M., & Hintz, R. (1997). Responding to a Traumatic event: Restoring shared pasts within a small community. *Symbolic Interaction, 20*(3), 275–290.

Kemp, S. (2017). *Digital in SouthEast Asia in 2017*. Special Reports. Retrieved April 09, 2019, from https://wearesocial.com/special-reports/digital-southeast-asia-2017.

Klein, L. (2003). Creating virtual product experiences: The role of telepresence. *Journal of Interactive Marketing, 17*(1), 41–55.

Kyle, G., & Chick, G. (2007). The social construction of a sense of place. *Leisure Sciences, 29*(3), 209–225.

Kyle, G., Graefe, A., & Manning, R. (2005). Testing the dimensionality of place attachment in recreational settings. *Environment and Behavior, 37*(2), 153–177.

Lavenne, F., Renard, V., &Tollet, F. (2005). Fiction, between inner life and collective memory. *The New Arcadia Review*, *3*.

Lee, C. (1999). *Investigating tourist attachment to selected coastal destinations: An application of place attachment*. Clemson University.

Lemos, A. (2008). Mobile communication and new sense of places: A critique of spatialization in cyberculture. *Revista Galáxia, 16*, 91–108.

Lewicka, M. (2008). Place attachment, place identity, and place memory: Restoring the forgotten city past. *Journal of Environmental Psychology, 28*(3), 209–231.

Lim, W. (2000). Memories and urban places. *City, 4*(2), 270–277.

Lin, C., & Lockwood, M. (2014). Forms and sources of place attachment: Evidence from two protected areas. *Geoforum, 53*, 74–81.

Low, S., & Altman, I. (1992). Place attachment. In: S. Low & I. Altman (Ed.), *Place attachment. Human behavior and environment (Advances in Theory and Research)*. Springer

MacInnis, D., & Price, L. (1990). An exploratory study of the effects of imagery processing and consumer experience on expectations and satisfactions. *Advances in Consumer Research, 17*, 41–47.

Martokusumo, W., & Zulkaidi, D. (2015). Some notes on area-based conservation: Lesson learned from Bandung. *International Journal of Built Environment and Sustainability*, 2(2).

Mayes, T. (2013). Why do old places matter? An introduction. [Blog] *Saving Places*. Retrieved April 09, 2019, from https://forum.savingplaces.org/blogs/forum-online/2013/11/13/why-do-old-places-matter-an-introduction.

Meng, F. (2006). *An examination of destination competitiveness from the tourists' perspective: The relationship between quality of tourism experience and perceived destination competitiveness*. Virginia Polytechnic Institute and State University.

Miller, D., & Horst, H. (2013). *The digital and the human: A prospectus for digital anthropology [1]*. UCL Anthropology. Retrieved May 08, 2018, from http://www.ucl.ac.uk/anthropology/people/academic-teaching-staff/daniel-miller/mil-27.

Milligan, M. (1998). Interactional past and potential: The social construction of place attachment. *Symbolic Interaction, 21*(1), 1–33.

Misztal, B. (2003). *Theories of social remembering*. Open University Press.

Mowen, A., Graefe, A., & Virden, R. (1997). A typology of place attachment and activity involvement. In H. Vogelsong (Ed.), *Proceedings of the 1999 Northeastern Recreation Research Symposium* (pp. 335–338). USDA Forest Service.

Mohamed, B., & Salim, N. (2017). Preserving sense of place at historic waterfronts in Malaysia. In *7th International Conference on Local Knowledge*.

Montgomery, J. (1998). Making a city: Urbanity, vitality and urban design. *Journal of Urban Design, 3*(1), 93–116.

Moore, R., & Graefe, A. (1994). Attachments to recreation settings: The case of rail-trail users. *Leisure Sciences, 16*(1), 17–31.

Norberg-Schulz, C. (1979). *Genius Loci*. Rizzoli International Publishers.

Proshansky, H. (1978). The city and self-identity. *Environment and Behavior, 10*(2), 147–169.

Paez, D., Besabe, N., & Gonzalez, J. (1997). Social processes and collective memory: A cross-cultural approach to remembering political events. In J. Pennebaker, D. Paez, & B. Rime (Eds.), *Collective memory of political events: Social psychological perspectives* (pp. 147–174). Psychology Press.

Pine, B., & Gilmore, J. (1999). *The experience economy: Work is theatre and every business is a stage*. Harvard Business School Press.

Plunkett, D. (2013). *Examining the impact of media content, emotions, and mental imagery visualization on pre-trip place attachment*. Arizona State University.

Prayag, G., & Ryan, C. (2011). Antecedents of tourists' loyalty to Mauritius. *Journal of Travel Research, 51*(3), 342–356.

Proshansky, H., Fabian, A., & Kaminoff, R. (1983). Place-identity: Physical world socialization of the self. *Journal of Environmental Psychology, 3*(1), 57–83.

Relph, E. (1976). *Place and placelessness*. Pion.

Ritchie, J., & Hudson, S. (2009). Understanding and meeting the challenges of consumer/tourist experience research. *International Journal of Tourism Research, 11*(2), 111–126.

Rypkema, D. (2003). The importance of downtown in the 21st century. *Journal of the American Planning Association, 69*(1), 9–15.

Saleh, A. (1998). The integration of tradition and modernity: A search for an urban and architectural identity in Ar-Riyadh, the capital of Saudi Arabia. *Habitat International, 22*(4), 571–589.

Scannell, L., & Gifford, R. (2010). Defining place attachment: A tripartite organizing framework. *Journal of Environmental Psychology, 30*(1), 1–10.

Sepe, M. (2013). *Planning and place in the city*. Routledge.

Simon, R. (2012). Remembering together: Social media and the formation of the historical present. In E. Giaccardi (Ed.), *Heritage and social media: Understanding heritage in a participatory culture* (pp. 89–106). Routledge.

Stamboulis, Y., & Skayannis, P. (2003). Innovation strategies and technology for experience-based tourism. *Tourism Management, 24*(1), 35–43.

Statista. (2018). *Instagram: Active users 2018 | Statista*. Retrieved March 10, 2019, from https://www.statista.com/statistics/253577/number-of-monthly-active-instagram-users/.

Statista. (2019). *Social media users worldwide from 2010 to 2021 | Statista*. Retrieved March 10, 2019, from https://www.statista.com/statistics/278414/number-of-worldwide-social-network-users/.

Stedman, R. (2002). Toward a social psychology of place predicting behavior from place-based cognitions, attitude, and identity. *Environment and Behavior, 34*(5), 561–581.

Trancik, R. (1986). *Finding lost space: Theories of urban design*. John Wiley & Sons.

Tuan, Y. (1977). *Space and place: The perspective of experience*. E. Arnold.

Tussyadiah, I., & Fesenmaier, D. (2009). Mediating tourist experiences access to places via shared videos. *Annals of Tourism Research, 36*(1), 24–40.

Ujang, N. (2010). Place attachment and continuity of urban place identity. *Asian Journal of Environment-Behaviour Studies, 11*, 41–74.

Veasna, S., Wu, W., & Huang, C. (2013). The impact of destination source credibility on destination satisfaction: The mediating effects of destination attachment and destination image. *Tourism Management, 36*, 511–526.

Van der Hoeven, A. (2019). *Historic urban landscapes on social media: The contributions of online narrative practices to urban heritage conservation*. Culture and Society.

Williams, D., Patterson, M., Roggenbuck, J., & Watson, A. (1992). Beyond the commodity metaphor: Examining emotional and symbolic attachment to place. *Leisure Sciences, 14*(1), 29–46.

Williams, D., & Roggenbuck, J. (1989). Measuring place attachment: Some preliminary results. In: *NRPA Symposium on Leisure Research*. Retrieved May 05, 2018, from https://www.fs.fed.us/rm/value/docs/nrpa89.pdf.

Williams, D., & Vaske, J. (2003). The measurement of place attachment: Validity and generalizability of a psychometric approach. *Forest Science, 49*, 830–840.

Yeung, H. (2013). *Rethinking the role of sense of place in heritage conservation: A case study of Cattle depot artist village*. University of Hong Kong.

Yuksel, A., Yuksel, F., & Bilim, Y. (2010). Destination attachment: Effects on customer satisfaction and cognitive, affective and conative loyalty. *Tourism Management, 31*(2), 274–284.

Zakrisson, I., & Zillinger, M. (2011). Emotions in motion: Tourist experiences in time and space. *Current Issues in Tourism, 15*(6), 505–523.

Zhou, H., & Xu, C. (2009). A logical thinking on the forming system of tourist's place attachment. *Journal of Beijing International Studies University, 2009*(1), 165.

Zook, M., Dodge, M., Aayoma, Y., & Townsend, A. (2004). New digital geographies: Information, communication, and place. In S. Brunn, S. Cutter, & J. Harrington (Eds.), *Geography and technology* (pp. 155–176). Springer.

Future Study of Regional Spatial Structure in Iran (Horizon 2040)

Haniyeh Asadzadeh and Afshar Hatami

Abstract

Spatial injustice is the main feature of Iran's spatial organization. The consequences of injustice are the socio-economic and spatial inefficiencies that have led to the polar development of the Iran regions. The current research with the use descriptive-analytic method intends to perform scenario planning toward spatial justice in Iran regions. The key factors of the research were extracted from field studies. The non-probability sampling method was used to select the experts (30 N). MICMAC software was used for data analysis. The results showed that political and spatial power concentration, management and planning concentration, and top-down planning are the three most important influencing factors in spatial injustice in Iran. Scenario analysis indicates that in the most desirable scenario the optimal conditions (Regional balance and spatial justice) are superior to the current situations. In the second scenario important key factors are superior to the static condition. In the third scenario key factors are in intermediate conditions, but in the fourth scenario the unfavorable conditions prevail to the medium and desirable situations. Overall, it can be concluded that the current trend of spatial justice in Iran is based on third and fourth scenarios.

Keywords

Spatial structure • Futures studies • Regional imbalances • Scenario planning • Iran

1 Introduction

Foresight is the presentation of wise statements about the future and the interpretation of those statements in a way that facilitates the process of current conscious behavior and collective learning and response to future challenges. There is no suitable situation for a country that does not have a vision for the future. Futures studies are one of today's competitive advantages, as decision-makers and managers can have long-term visions and willingness to develop and take action on a variety of national and international needs. An examination of the existing literature on Iran's spatial planning system shows that during the period of development plans (first development plan (1948–1954) and second development plan (1955–1961)), investment priority was given to areas with development potential. In the third development plan (1962–1967) the approach of the growth poles was used for the economic development across the country (Tehran, Isfahan, Tabriz). The polar hierarchies of the region formed a hierarchical spatial organization in Iran.

According to the growth pole theory, inequality increases initially, and in the long run, as capital flows to the peripheral areas, inequality decreases. Thus, the growth pole had consequences. The first is the emergence of economic poles and the last is the emergence of population poles. The latter also required time to set up the effect of capital flows to the peripheral areas, which had been effectively disrupted in Iran by the arrival of the Islamic revolution (1978–1979). After the revolution, the development plan was transformed into a socio-economic development plan. In practice, However, no essential adjustments have been made to the development plans. Centralization, lack of suburban investment, lack of power regulation, structural and top-down planning not only disrupt the development process, but also lead to many other problems. So, after four decades, the spatial balance in Iran has really deteriorated.

Regional spatial structure of Iran has been created based totally on the natural, financial, and political characteristics.

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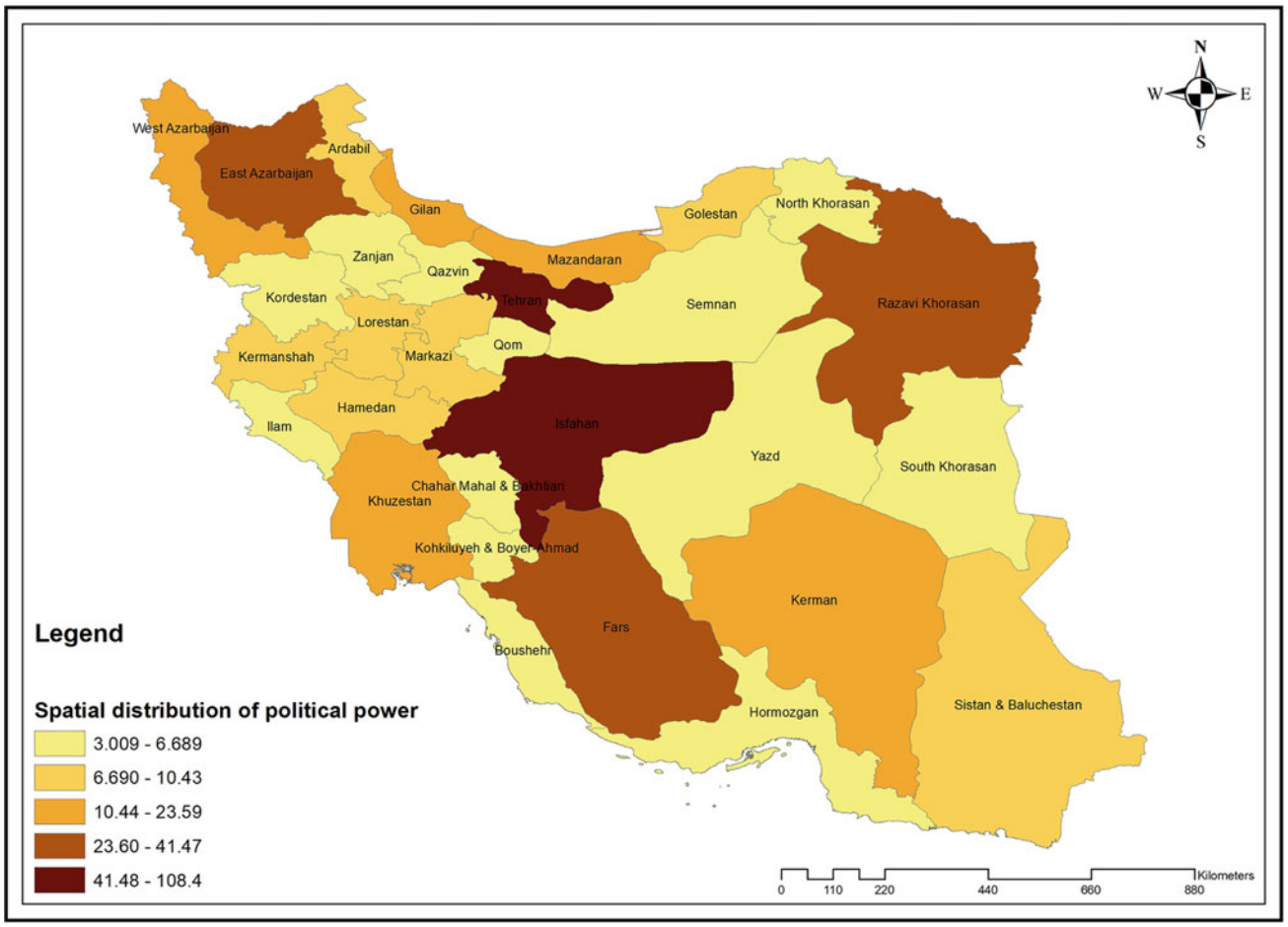

Fig. 1 Imbalance in the distribution of political power in Iran regions

But the most necessary component used to be political factors (Fig. 1). Assessing the spatial distribution of political power between Iran regions indicates that the most of ministers in the most of administrations and the high number of parliament members were from the Tehran and Isfahan (Central Regions) (Iran Program and Budget Organization, 2000).

The concentration of political power in the central regions and the adoption of a strategy to create development poles and the priority allocation of resources to certain regions (central regions) in the past have polarized the development of regions in Iran (Fig. 2). Several major poles such as Tehran, Isfahan, Khorasan-Razavi, Fars, and East Azerbaijan have a large volume of population and economic activity and have created widespread imbalances in the regional spatial structure of Iran (Madani Kashani & Kabiri, 2008).

An examination of the spatial structure of the regions of Iran in terms of labor indicates that there is a kind of division of labor between regions. The poles, regions, and axes that currently have significant national expertise are:

- Tehran is a leader in a wide range of service and industrial activities, especially in the automotive and machinery industries;
- Khuzestan region in oil industry, sugar production, chemical and petrochemical industry, port services and maritime transport;
- Isfahan as an industrial center with a wide range of industrial activities, especially the production of base metals;
- Azerbaijan region to the center of Tabriz industrial hub in the fields of mechanical engineering, grain and cotton cultivation, livestock breeding, and commercial services;
- North Khorasan and Pole region of Mashhad in food industry, horticultural products, grain, sugar beet, and cotton;
- Markazi industrial center for mechanical engineering and aluminum industry;
- Gilan and Mazandaran in rice production, electronics industry, and tourism;

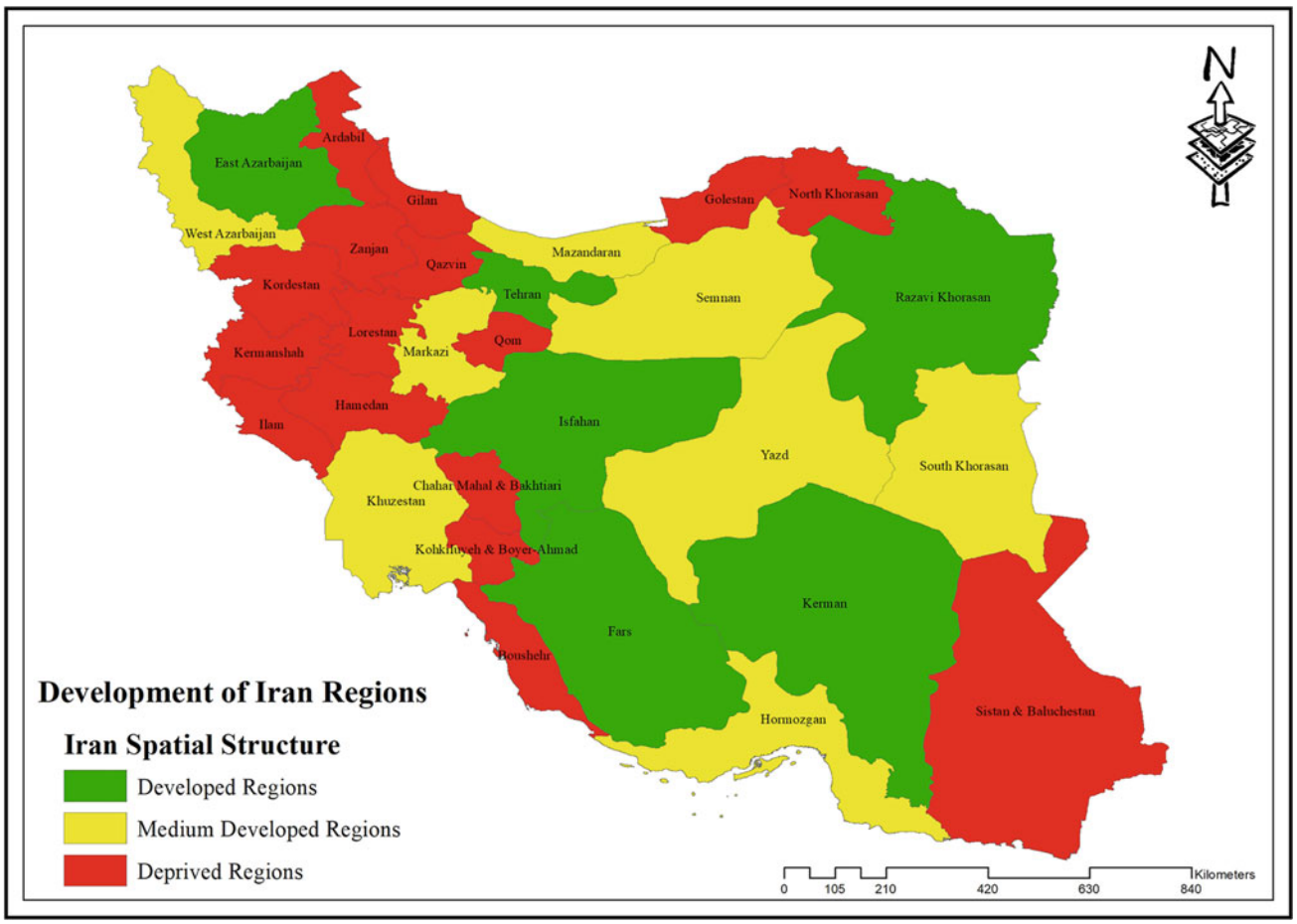

Fig. 2 Development imbalances in Iran regional spatial structure

- Kerman axis in copper and related industries and other areas of the province in the production of pistachios and dates, citrus, and jalizi products;
- The country's southern coastal axis in port services, maritime transport, and fisheries.

However, the lack of understanding of the capacities of different regions has reduced their role in the national workforce. Government policies aimed at developing regions based on their political power. This situation has led to disregarding other areas with potential for growth, which causes an imbalance in the spatial structure of the regions (Iran Budget and Program Organization, 2000). The causes of low efficiency and the problem of labor division by region specialization are also due to the following factors:

1. Inadequate scale of specialized activities in relation to the economic structure of the regions;
2. Lack of equipment and necessary support for specialized activities in the regions;
3. Lack of regulation based on regional specialties.

Therefore, in order to take the right steps forward, it is necessary to identify and analyze the factors affecting the regional spatial structure of the Iran. Due to the importance of regional spatial structure, characterizing the key factors in spatial structure is an important aspect of the domain of future studies. This article aims to characterize the key factors affecting the regional spatial structure to propose future scenarios of regional spatial justice in Iran. For this purpose, regional spatial structure of Iran and factors affecting spatial injustice in Iran are explained.

2 Literature Review

2.1 Spatial Structure

Geographical space is the result of human interaction, place, and activity. The study of human distribution, human places and activities, shapes the spatial structure. Spatial structure can be studied both mathematically and geographically. In the study from a mathematical point of view, the spatial

structure indicates the existence of a nodes, and in the study from a geographical point of view, the spatial structure consists of social, economic, and political factors, which show how the spatial structure is arranged and connected (Dadashpoor & Alidadi, 2017).

A review of the theoretical literature shows that there are four main approaches to spatial structure. The positivist approach (before 1960) is based on the strategy of inductive reasoning and the use of quantitative methods. In this approach, the components of the spatial structure are analyzed in the form of mathematical and geometric models such as Walter Christaller's Central places theory (1933) and Growth pole theory (1960) (Christaller, 1966; Fearon, 2006). New positivist approach (1960–1990) believes that the city or region under study should be considered as an open system. This approach seeks to identify the factors that make up the spatial structure such as Center-Periphery theory of Friedman (Friedmann, 1967). The interaction approach (1990–2010) believes that in order to identify the spatial structure, the relationships in the system should be examined. The result of this approach was the emergence of the theory of communication planning and network planning on an urban, regional and global scale (Habermas, 1998; Taylor et al., 2010). The critical approach (since 2010) also believes that the shortcomings of previous theories must be constantly corrected in order to present a new theory. This approach believes that in the study of spatial structure, an interaction should be established between social theories and planning theories (Angel & Blei, 2016).

2.2 Spatial Justice

Over the last half-century, the focus of justice struggles has become increasingly broad, with social, environmental, and racial justice activities overlapping and strengthening one another. Edward W. Soja presents a strong case for embracing spatial justice as a comprehensive alternative to conceiving justice in Seeking Spatial Justice, describing the theoretical and practical roots of his creation of a notion of justice from a "critical spatial perspective." The term "spatial justice" refers to legal battles about how space is used and how decisions about the usage and design of specific areas are made (Nordquist, 2013). Spatial justice investigates justice from the viewpoint of geography in different regions of a country (Philippopoulos-Mihalopoulos, 2014). Injustice in space may be a risk to countrywide protection and evolution in vital areas. Spatial injustice refers back to the imbalanced distribution of treasured political, social and monetary power, wealth, infrastructures, and possibility resources. Because geographic imbalance emerges from unequal access to power, income, and resources on multiple scales, the idea of addressing spatial justice is rooted in state renewal (Harvey, 2010). In certain settings, unequal distribution of civil and revenue allotments may increase inequality and the gap between regional entities (Ghaderi Hajat & Hfeznia, 2020). David Harvey as one of the important neo-Marxist believes that the discipline of geography for understanding spatial processes which increased inequality needed to answer questions about how the construction of regions impeded the development of a country. Harvey addressed to this question with injustice in different sections such as urban societies or regions. According to Harvey the distribution of wealth should be at the needs of people within each region and resources allocation should maximize regional effects and finally surplus resources should be distributed in the favor of overcoming to special problems between regions (Rawls, 2020). Soja (2013) in his book (Seeking Spatial Justice) developed the theory which discussed earlier by David Harvey, Henry Lefebvre, and Michel Foucault. Soja tried to link the relation between space, society and exclusion and suggested spatial justice as a complement to the concept of environmental justice and social justice. Soja believes that spatial justice or injustice contextualized in three levels of geographical view. The first one rises from political organization of space such as apartheid in Africa. The second one emerges from the distributional inequalities created through decisions by government and institutions such as zoning to different sections. The last one is more regional and came back to the injustice related with geographically uneven development. Uneven development gives attention to the formation of spatial injustice at different scales from local to global. Therefore, seeking spatial justice in here included regional coalition and democracy. However, justice and other related concepts tries to assure the spatial aspects of justice. Spatial justice includes fair and equal distribution of resources and investments between different regions of a country (Williams, 2018).

3 Research Method

The research method process is indicated in Fig. 3, but the technique used in this study is cross-impact or structural analysis in the MICMAC platform. Structural analysis is an effective method of ranking system elements and is one of the famous tools in future studies since its first application in 1974 by Godet and Duperrin. Structural analysis, through describing the system elements in a matrix, enables the identification of key factors that are essential to the system's evolution. The method has the advantage of stimulating reflection within the group of practitioners, including considerations of aspects that are sometimes counterintuitive. This method includes three stages as follows (Coates & Godet, 1994):

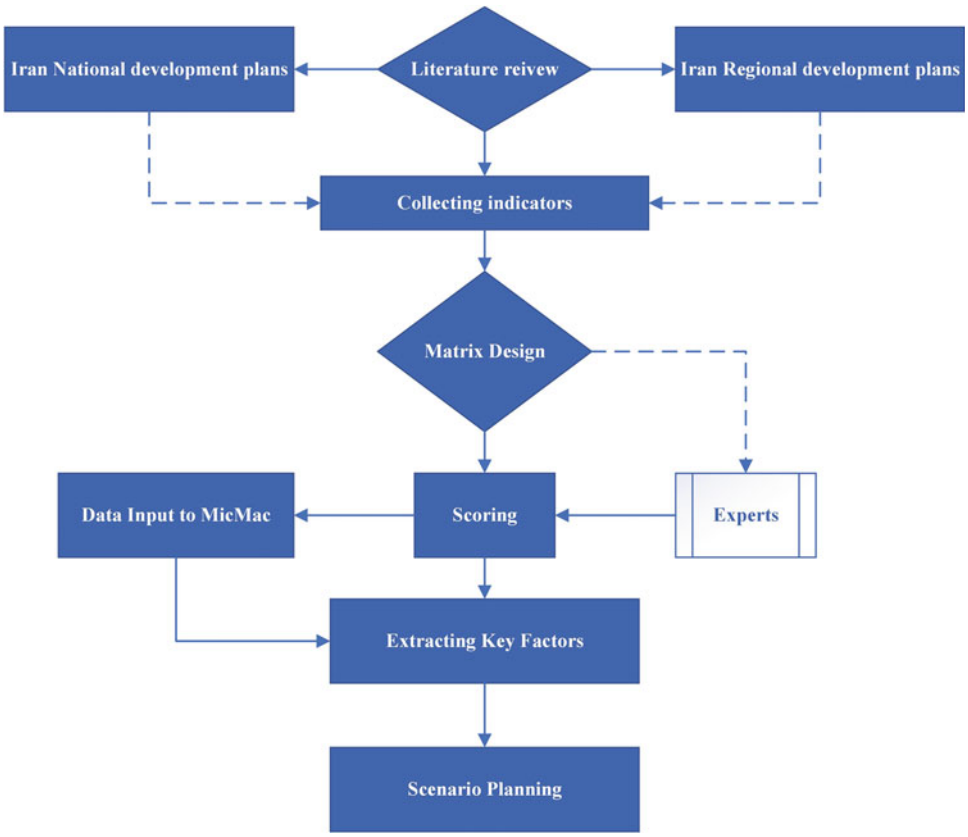

Fig. 3 Research method process

Stage 1: Identifying factors/variables: This phase consists of creating an inventory of variables that characterize the system under study, as well as its internal and external environment (Table 1). In this study key factors are gathered through literature review from Iran national economic development plans.

Stage 2: Describing the relationships among factors/variables: In a systemic context, a variable exists only in relation to others which is expressed in a two-dimensional matrix called a "Structural Analysis Matrix". The process of filling in the matrix is qualitative. For each pair of variables, the following questions are posed: Does a relation of direct influence exist between variable i and variable j? If the response is negative, then one assigns a 0 to this cell. If the response is positive, then one assigns a 1 if the relationship is weak, a 2 if the relationship is average, a 3 if the relationship is strong, and finally a 4 if the relationship does not yet exist, but has the potential to exist in the future (Fig. 2).

Stage 3: Identifying key factors/variables: This phase consists of identifying and re-ranking the key variables, i.e., those essential to the evolution of the system. These newly ranked key variables (indirect classification) are derived from a sophisticated matrix calculation MICMAC (Glenn & Gordon, 2009).

Stage 4: Scenario planning: in this phase most important key factors in stage 3 have been used in four kinds of future (desired trend, current trend, bad and worst trend) to define Iran's spatial structure.

4 Results and Discussion

4.1 Data Inputs

Each matrix should reach a reasonable degree of stability after a few rotations (usually 6 or 7 rotations for a matrix of size 30). In the absence of fixed mathematical criteria, the effectiveness of the entire direct influence's matrix depends on the number of shifts (bullet classification). The evaluation of usefulness and optimality of the matrix of direct influences after 5 rotations corresponds to 100% (Table 2) and shows the high stability of the questionnaire and its answers.

4.2 Identifying Relationships

Table 3 indicates the overall records of rows and columns for each of the variables directly and indirectly for the influences and for the dependencies with their net score. The

Table 1 Selected key factors

R	Aspect	Factor	Code
1	Managerial-Political	Political and spatial concentration of power	Var01
2		Concentration of management and planning	Var02
3		Multiple decision centers	Var03
4		Top-down planning	Var04
5		Sectorial planning	Var05
6		Spatial and political dispersion	Var06
7		Polarization of regions	Var07
8		Transparency in government structure	Var08
9		Good governance	Var09
10		Spatial approach in management and planning	Var10
11	Economic	Radial budget allocation	Var11
12		Regional competitiveness	Var12
13		Concentration of government revenue and monopoly resources	Var13
14		Being a single product	Var14
15		Reducing the agricultural sector	Var15
16		Private sector and foreign investment	Var16
17		Infrastructural centralism	Var17
18		Banking, business, investment monopoly	Var18
19		Capital flow to the center	Var19
20		Employment concentration at the poles and unemployment in deprived areas	Var20
21	Social	Migration of active and young population from villages and small towns	Var21
22		Private and civil sector participation	Var22
23		Balance in the distribution of the urban system in terms of size and population	Var23
24		Security and military factors in border areas	Var24
25		Participation of regions in decision-making and planning	Var25
26	Environmental	Drought	Var26
27		Dust storm	Var27
28		Groundwater level reduction	Var28
29		Water resources transfer and dam construction	Var29
30		Enjoyment of natural resources	Var30

Table 2 The summary of matrix scores

Indicator	Value
Matrix size	30
Number of iterations	5
Number of zeros	520
Number of ones	164
Number of twos	162
Number of threes	54
Number of P	0
Total	900
Fillrate	42.22%

Table 3 The sum of the rows and columns of the matrix has direct and indirect effects

R	Factors	Direct			Indirect		
		Sum		Net value	Sum		Net value
		Row	Column		Row	Column	
1	Political and spatial concentration of power	43	22	21	25,891	12,022	13,869
2	Concentration of management and planning	32	19	13	21,405	10,551	10,854
3	Multiple decision centers	24	18	6	13,132	9900	3232
4	Top-down planning	33	24	9	20,383	12,908	7475
5	Sectorial planning	32	21	11	19,910	11,529	8381
6	Spatial and political dispersion	9	32	−23	6365	17,253	−10,888
7	Polarization of regions	46	26	20	25,217	14,118	11,099
8	Transparency in government structure	9	12	−3	2964	4971	−2007
9	Good governance	20	19	1	6248	7677	−1429
10	Spatial approach in management and planning	24	24	0	5907	10,432	−4525
11	Radial budget allocation	30	22	8	14,963	11,992	2971
12	Regional competitiveness	38	25	13	17,803	11,877	5926
13	Concentration of government revenue and monopoly resources	38	23	15	24,373	12,463	11,910
14	Being a single product	34	23	11	17,339	13,036	4303
15	Reducing the agricultural sector	8	31	−23	1072	16,746	−15,674
16	Private sector and foreign investment	19	15	4	6318	7706	−1388
17	Infrastructural centralism	30	25	5	20,717	13,565	7152
18	Banking, business, investment monopoly	20	22	−2	15,118	12,081	3037
19	Capital flow to the center	36	28	8	23,104	14,267	8837
20	Employment concentration at the poles and unemployment in deprived areas	36	26	10	19,488	14,039	5449
21	Migration of active and young population from villages and small towns	12	29	−17	4096	16,035	−11,939
22	Private and civil sector participation	14	19	−5	3833	8406	−4573
23	Balance in the distribution of the urban system in terms of size and population	9	17	−8	3084	6826	−3742
24	Security and military factors in border areas	7	22	−15	4483	11,078	−6595
25	Participation of regions in decision-making and planning	11	21	−10	3849	8392	−4543
26	Drought	14	10	4	3539	5636	−2097
27	Dust storm	2	19	−17	1005	9527	−8522
28	Groundwater level reduction	6	20	−14	560	10,760	−10,200
29	Water transfer and dam construction	8	28	−20	672	14,618	−13,946
30	Enjoyment of natural resources	6	8	−2	1307	3734	−2427

classification of the scores shows that the factors (political and spatial concentration of power, Concentration of management and planning, top-down planning, sectoral planning, polarization of regions, radial budget allocation, concentration of revenue and state monopoly resources, being a single product, the concentration of employment at the poles and unemployment in deprived areas, and infrastructural centralism) had highest and positive influence value. These factors are the most important in the study of Iran's spatial structure. Other factors with negative values are the dependence factors (Table 3).

4.3 Factors Zoning

The method of distribution of key factors in the scatter plot indicates the degree of stability and instability of the system. In the stable systems, the distribution of variables is L shape in English, which means a few variables have an excessive effect. In the volatile system, the variables are scattered across the diagonal axis of the scatter and frequently have an intermediate situation (Godet, 2000).

Figure 4 indicates that the regional spatial structure of Iran is unstable. The distribution of key factors may be divided into 5 zones. The key factors withinside the first zone have the maximum impact and the least dependence, that is, they are the variables that influence the rest of the system (concentration of management and planning (Var02)).

Zone two includes two-dimensional variables. These variables have the highest influence and dependency, which are unstable. Any movement on these variables has an impact on other variables. This triggers feedback on two-dimensional variables that increase or decrease the influence on other variables. A small number of two-dimensional variables makes the system stable. In an unstable system each variable is both influential and dependent, and any action on one variable has consequences for all other variables. Key factors in this study include political and spatial concentration of power (Var01), polarization of regions (Var07), top-down planning (Var04), sectorial planning (Var05), revenue concentration and monopoly resources of the country (Var13), being a single product (Var14), radial budgeting (Var11), capital flow toward the center (Var19), employment concentration in poles and unemployment in deprived areas (Var20), and transparency of government structure (Var08), infrastructure centralism (Var17) are in the second zone. Due to the importance of two-dimensional variables in unstable systems in this study, most of the key factors are placed in the second

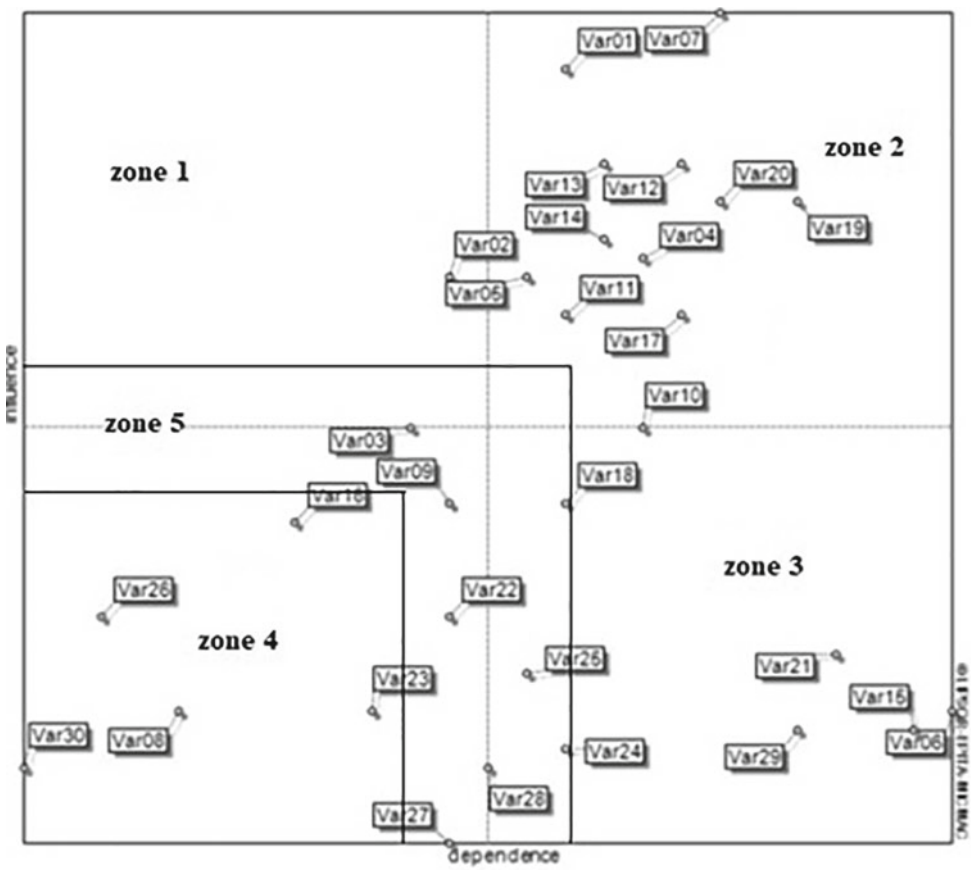

Fig. 4 Distribution status of key factors

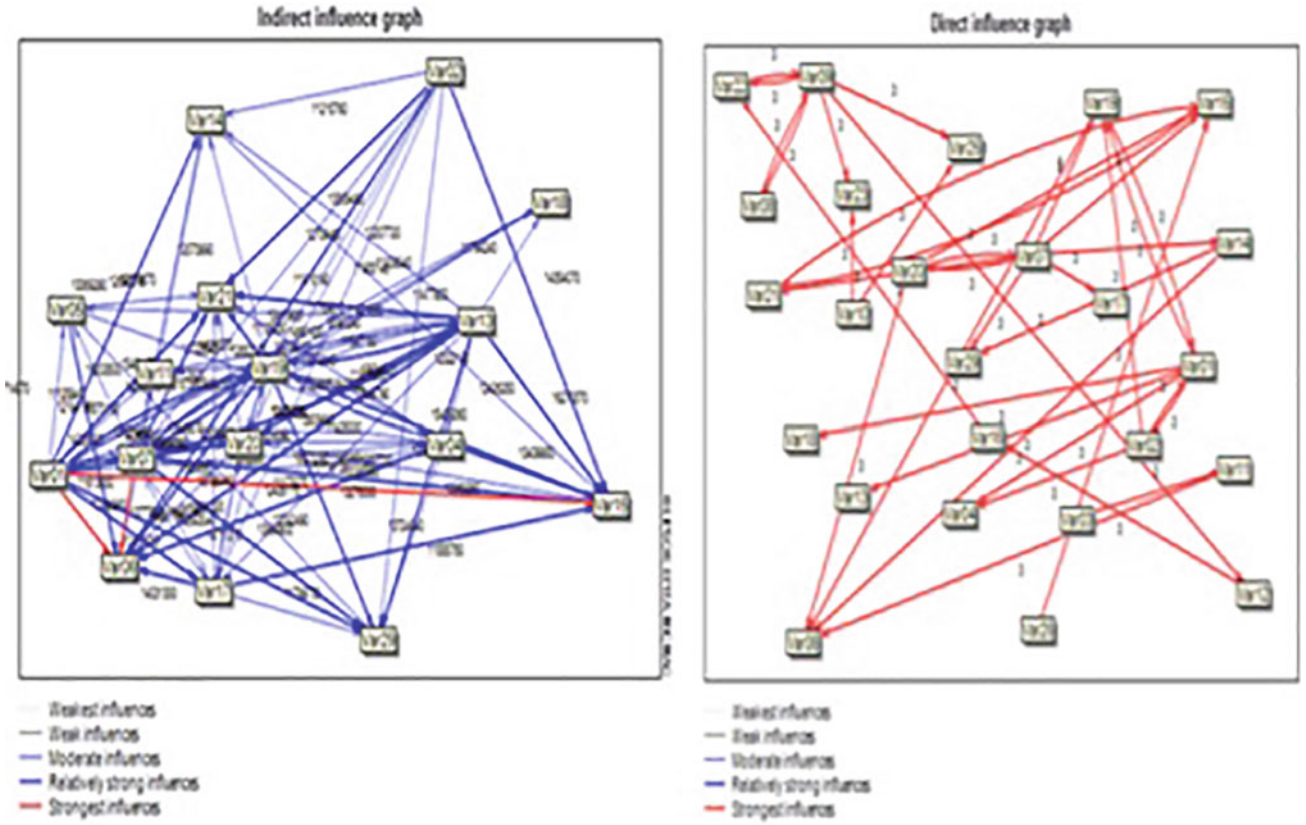

Fig. 5 Intensity of relationships between key factors (right: direct relationships and left: indirect relationships)

zone. The higher and more upright the variables are unstable (Fig. 4).

Zone three identifies the key dependences factors. These variables have the least influence and highest dependence. These variables are influenced by the variables in zone one and zone two (The spatial and political dispersion (Var06), the decline of the agricultural sector (Var15), the migration of the active and young population from villages and small towns (Var15), Water transfer and dam construction (Var29)) (Fig. 4).

Also, zone four shows the variables with the least dependence and influence (close to zero). These variables are specific trends or factors that are not directly related to the system. These variables are not critical to the future of the system because of their relatively independent trends, so they can be excluded from the analysis. In this study, they are transparency in government structure (Var08), private sector and foreign investment (Var22), balance in the distribution of the urban system in terms of size and population (Var23), and access to natural resources (Var30).

Zone five shows key factors that no comment can be made on them (multiple decision centers (Var03), good governance (Var09), private and civil sector participation (Var22), regional participation in decision-making and planning (Var25), security and military factors in border areas (Var24) and Groundwater level reduction (var 28)). Also, the power of relationships between key factors is illustrated in Fig. 5.

4.4 Factors Ranking

Influential variables have the greatest influence on the evolution of a system. In contrast, dependence variables are those that are very sensitive to the evolution of the system. Although the direct influence matrix plays an important role in identifying variables, it is also important to consider indirect relationships to identify hidden variables. According to Fig. 6, the left and right columns show the direct and indirect influence respectively. The ranking of direct influence of key factors shows that political and spatial power concentration (Var01), concentration of management and planning (Var02), top-down planning (Var04), sectorial planning (Var05), polarization of regions (Var07), concentration of government revenues and monopolies (Var13), monoculture (Var14) and reduction of the agricultural sector (Var15), capital flow to the center (Var19), and concentration of employment in poles and unemployment in deprived

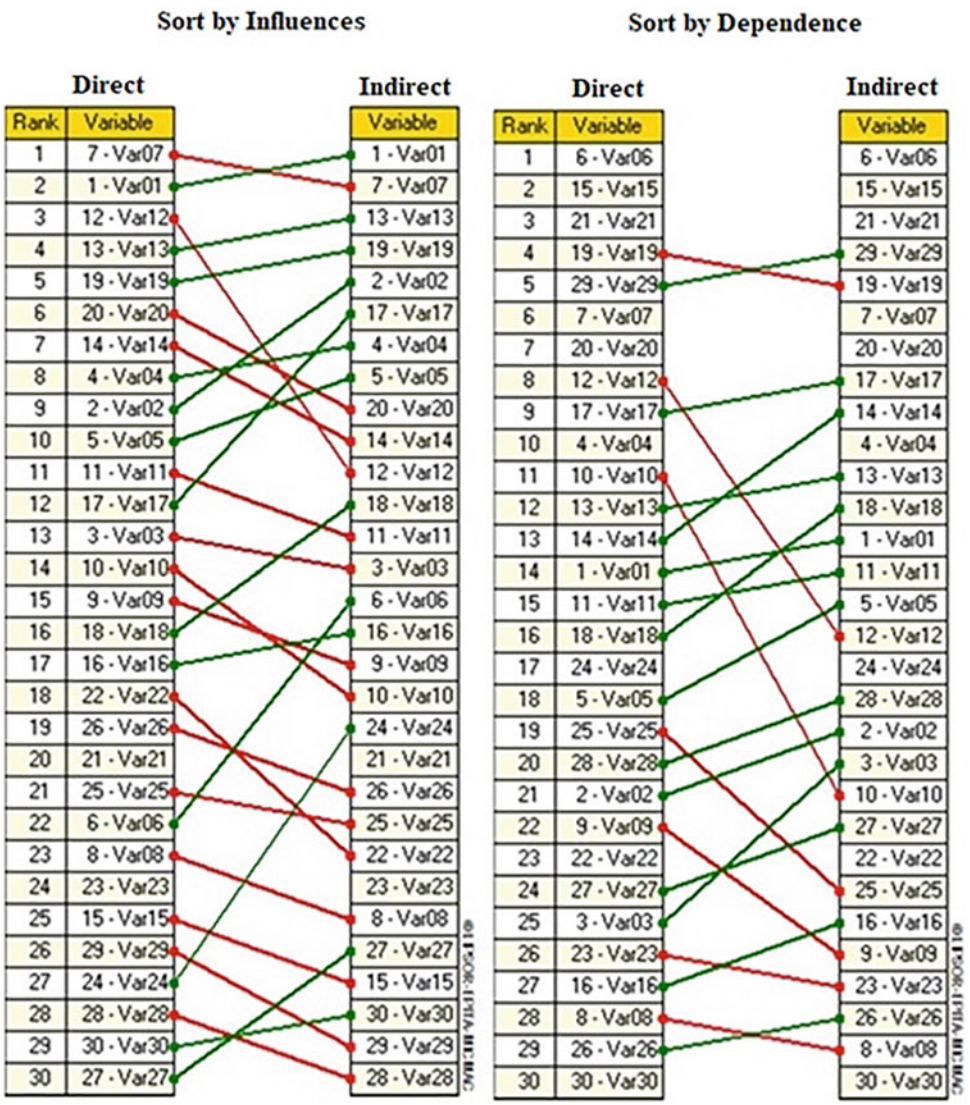

Fig. 6 Variables classify according their influences and dependence

areas (Var20) were selected as the first ten key factors. For direct impacts, the key factors are spatial and political dispersion (Var6), polarization of regions (Var7), regional competitiveness (Var12), decline of agricultural sector (Var15), private sector and foreign investment (Var16), Banking, business, investment monopoly (Var18), capital flows to the center (Var19), concentration of employment in poles and unemployment in disadvantaged areas (Var20), migration of active and young population from villages and small towns (Var21), and drought (Var26) are the variables that should be considered in order to reshape the system of Iran regional spatial structure based on their importance.

4.5 Future Scenarios

Based on the selected key factors (Zone one), four main scenarios can be proposed for the regional spatial structure of Iran. In this scenario, the development of the areas located at the highest levels of the spatial system is limited. Population and migration are strictly controlled. There is extensive decentralization in various dimensions and a strong decentralization policy. The communication pattern between the center and the surrounding areas is greatly adjusted, and the gap between the rich and the poor regions is greatly reduced. According to this scenario, the role and performance of the regions at the lower levels of Iran's regional spatial structure will increase compared to the regions at the upper levels, and the dominance of the polar regions over the regional spatial system to serve the entire country will decrease. The axes of development in these polar regions will be only scientific and technical and the development of administrative, industrial, and commercial sectors at their level will be prevented.

In the second scenario, the acceleration of development indicators of low-income areas will increase with an

intermediate rate. The gap between urban areas will also decrease. And thus, the role and performance of cities at the lower levels of the hierarchy of Iran's regional spatial structure compared to cities at the upper levels will increase and the dominance of polar cities over the country's urban system will decrease. In this scenario, similar to the first scenario, the role and function of the central regions will be weakened, but the population of these centers will increase.

The third scenario is the scenario of average development of the surrounding areas. According to this scenario, if the current trend in the regional spatial structure of Iran continues, the communication network between the regions will increase only among central regions. Considering the characteristics of this scenario, the large ratio of domination of the polar and central regions over Iran's regional spatial structure will be maintained if the current situation continues. Despite the increase in the population of central regions, the continuity of their spatial system will increase only with the poles and centers associated with the main axis of polar development. If something is done in the field of decentralization, it is only a relief, and in the true sense of the word, decentralization is not in the interest of the other peripheral areas.

The fourth scenario is the scenario of large-scale development of polarized territories and their decentralization. The axes of their development are comprehensive and include administrative, commercial, scientific, transport, and industrial axes. In the fourth scenario, the pattern of the existing communication network in the regional spatial structure is maintained. According to the characteristics of this scenario, the dominance of the poles and centers over the spatial system will increase, without increasing the role and function of other regions in Iran's regional spatial structure. Despite all the unfavorable situations in this scenario, the only key desirable factor is: the role and function of high-level areas will improve compared to the current situation, and they will benefit from more resources and facilities. But they will face more problems in the future.

5 Conclusion

The concentration of political, administrative, economic, and social activities in some of the most important Iran's regions, especially in Tehran, is an undeniable fact that the issues and problems arising from this concentration will not be hidden from anyone. It will lead to significant disruptions. A clear consequence is the unequal distribution of opportunities, facilities, and resources throughout the Iran, and the exacerbation of regional and local inequalities, exacerbated by past investments and infrastructure creation. With all these descriptions, a fundamental step must now be taken to reduce and prevent the increase of such inequalities in the spatial and regional structure of the country by recognizing the current regional spatial structure in order to present viable strategies with capable management as well as effective monitoring. Step by step and based on the plan and policy, which are based on a complete knowledge of all spatial-esthetic dimensions of Iran, it is hoped that the regions will enjoy the desired and equal prosperity in the future, and in this situation, they will direct their energy toward further development and better global standards. In this context, scenario development is considered as an effective and efficient method of futurology. Developing scenarios for future development makes it possible to cope with the complexities. The future of regional spatial structure in Iran based on the situation of key factors of the presented scenarios can be explained in four situations: ideal, good, the continuation of the current trend, and bad. This means that the future of Iran's regional spatial structure can be predicted. This process is related to the type of attitude toward planning to draw it. Achieving the best and most balanced regional spatial structure requires consideration and awareness of uncertainties and more effective use of key factors. The result of such a process is the balanced spatial structure of regions in the territory of Iran. The key factors of this research are considered as tools for mapping the future, and the way each factor is approached will affect the future of regional spatial structure in Iran. Concentration of management and planning is the only key factor with more influence and less dependence shows the importance of this factor. Eleven key factors are in a state of instability that is very sensitive to the regional spatial structure behavior. A notable point among the key factors in Iran is in the fourth zone or key factors that can be eliminated. This indicates that the planning of the regional spatial structure in Iran has nothing to do with the presence of resources, which has prevented even experts from considering this factor as an influential factor. In other words, the planning system of regional spatial structure in Iran must be considered by other factors. The presented scenarios for the future of the regional spatial system in Iran show how to deal with the key factors. To achieve the most favorable scenario, none of the effective key factors should be in a medium or static position. If the key factors are superior to the static and critical situations, we can see a favorable scenario. If the key factors are in an intermediate position, the current trend of imbalance in the regional spatial structure will continue. If there is no proper response to the effective key factors, the unfavorable situations will outweigh the medium and desirable situations of the key factors.

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References

Angel, S., & Blei, A. M. (2016). The spatial structure of American cities: The great majority of workplaces are no longer in CBDs, employment sub-centers, or live-work communities. *Cities, 51*, 21–35.

Christaller, W. (1966). *Central places in southern Germany* (Vol. 10). Prentice-Hall.

Coates, J. F. P., & Godet, M. (1994). *From anticipation to action: A handbook of strategic prospective*. Unesco publishing.

Dadashpoor, H., & Alidadi, M. (2017). Towards decentralization: Spatial changes of employment and population in Tehran metropolitan region Iran. *Applied Geography, 85*, 51–61.

Fearon, D. (2006). Alfred weber: Theory of the location of industries, 1909. *Ŕ Center for Spatially Integrated Social Science*.

Friedmann, J. (1967). *A general theory of polarized development*.

Ghaderi Hajat, M., & Hfeznia, M. R. (2020). Codification strategies for achieving spatial justice in Iran. *Spatial Information Research, 28* (3), 357–367.

Glenn, J. C., & Gordon, T. J. (Eds.). (2009). Futures research methodology-version 3-0. Editorial desconocida.

Godet, M. (2000). The art of scenarios and strategic planning: tools and pitfalls. *Technological forecasting and social change*, 65(1), 3–22.

Habermas, J. (1998). *On the pragmatics of communication*. MIT press.

Harvey, D. (2010). *Social justice and the city* (Vol. 1). University of Georgia Press.

Iran Program and Budget Organization. (2000). *Document of the Third Economic, Social and Cultural Development Plan of the Islamic Republic of Iran*.

Madani Kashani, Q., & Kabiri, M. (2008). Necessity of preparing and implementing regional development programs in the process of compiling national development plans. *Proceedings of the First Conference for Compiling the Third Plan of the Country, 5*(6), 1–1600.

Nordquist, M. (2013). Seeking spatial justice by Edward W Soja. *Contemporary Political Theory, 12*(1), e16–e18. https://doi.org/10.1057/cpt.2011.40

Philippopoulos-Mihalopoulos, A. (2014). The movement of spatial justice. *Mondi Migranti*.

Rawls, J. (2020). *A theory of justice*. Harvard University Press.

Soja, E. W. (2013). *Seeking spatial justice* (Vol. 16). U of Minnesota Press.

Taylor, P. J., Hoyler, M., & Verbruggen, R. (2010). External urban relational process: Introducing central flow theory to complement central place theory. *Urban Studies, 47*(13), 2803–2818.

Williams, J. (2018). *Spatial justice as analytic framework*.

Istanbul: The Ecology, Nature and Disasters Designing Future Cities with Innovative Housing Projects

Hülya Coskun

Abstract

This research presents an examination of the problems of Istanbul which has always been known as a problematic city since the beginning of the twentieth-century, such as migrations, earthquakes, environmental and sea disasters interwoven with housing issues in the context of the effects of the new urban planning dynamics. Istanbul has witnessed migration for many years as a major factor in the uncontrolled development of the city since the mid-twentieth century. Istanbul is a historical city paradoxically has evolved into a different planning path recently by changing its priorities in housing planning considering earthquake, natural, ecological and other recent environmental disasters as well as the recent Covid-19 pandemic.

Constituted a discourse primarily on new climate-based or disaster-based planning theories of the historical city Istanbul the research established on new and innovative design theories of city's recent problematics that supposed had very few research on as well as the previous planning to maintain continuity on planning theories. This research presented an updated study of the nature and climate-based problems of Istanbul; the earthquakes, sea-disasters, and deforestation due to uncontrolled urban-sprawl has experienced in recent years and the projection and measures taken by both the government and the private sector that would mitigate the effects and new housing projects and models developed by architects.

By the 2000s, the disasters became more significant for the city's future planning and three major planning issues came to the fore; first was regeneration applications initiated just after the earthquake, in 1999, the second was Climate-change-based plannings, which was launched after the 2010s and finally with the recent pandemic the people has started to search new living styles and housing models which were gained momentum in the world and İstanbul. A research taxonomy was prepared with diachronic analysis according to the city's recent problems as well as the previous problems as the recommended new planning theories and housing models transferred from internationally or developed uniquely for Istanbul after the recent disasters and the Climate-change issue. Although previous research on this subject included the problems of Istanbul so far, this study aimed to present an updated work dealing with very recent problems or disasters also Covid-19 with the new and innovative projects developed in the emergency disaster response plan, especially over the last 20 years.

Keywords

Istanbul • Disasters • Ecology • Future planning • Green planning • Housing

1 Introduction

This study presents an updated examination of the problems of Istanbul which has always been known as a problematic city since the beginning of the twentieth-century interwoven with migrations, disasters and housing problems. Furthermore, this research centered on recent new, and innovative climate-based urban and housing planning discours as well as the existing theories in Istanbul city that has transformed recently paradoxically being a historical city.

Although the Istanbul city's planning dynamics have undergone rapid changes with the many problematics in the last 20 years the earthquake in the 2000s, and recent the marine pollution in the Marmara Sea and latest Covid-19, very few research addressed the its recent problems. So, this research was prepared aimed to this gap in this area and presented an updated study. In this research, the Climate-change problem and disasters such as earthquakes, which

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have been on the agenda of the city for the years as well as the housing models and typologies changed after the recent impacts of Covid-19, the lifestyle and houses were examined. The deficiency in this research area was tried to add, by recent research, and policies of Government and (IMM), Istanbul Metropolitan Municipality as well as the other publications, to create a resource that will be useful for the next research.

Additionally, this study presented a new section of the city's the new planning projections and housing design and policies carried out by both the public and private sectors in the rapidly changed disasters experienced in the last 20 years. Although in the study the disasters considered to be the primary proposition in the research, the subject of housing and newly developed housing models and typologies has obtained a similar place in its importance.

Indeed, Istanbul, has became a problematic city experienced recurring multiple disasters throughout its history known as one of the leading mega-cities in the world, with a significant population of 15 million according to the United Nations (United Nations Populations Fund, 2007). Until the 2000s, while migration was considered as the major problem, the planning of the historical city became much more complicated after the newly unforeseen multiple disasters.

In Istanbul city planning policies of the early Republican period of the early twentieth century did not address the migration which would be significant after the 1950s–60 s. In the 2000s, the city's planning policies and regulations have changed with the 1999, earthquake, as a turning point, later in the 2010s, the new and innovative planning has become significant as a new goal the city's planning considered to improve eco-system and sustainable design, and especially after the 2020s, the recent sea disaster, climate responds planning and the Covid-19 pandemic caused to establish quite new dynamics induced the development of the city in the last 20 years.

As the main indicator of the importance of the issue of Climate-change by the state in recent years a step of the Turkish Government in 2021, was the name of the *Çevre ve Şehircilik Bakanlığı* (Ministry of Environment and Urbanism) altered to the *Çevre, Şehircilik ve Iklim-Değişikliği Bakanlığı* (Ministry of Environment, Urbanism and Climate-change) (Son Dakika, 2021). Indeed, on the theoretical basis of the Government's Housing Policy Reports (Turkish Housing Policy Commission Reports, 2018) the issue of Climate-change and sustainability was specified as a substantial matter in a comprehensive report. Soon after, the Turkish Contractors' Association announced a declaration about to produce "Climate-based constructions" the first time that the construction industry explained their interest in the Climate-change issues. After the recent Climate-change meeting, Cop-20, the recent Istanbul Mayor made important statements about the immediate measures that will be taken regarding Climate-change in Istanbul drawing attention to certain issues of uncontrolled urban-sprawl to the green and forest areas, hence deforestation and water scarcity, but the housing problem was not considered (CNN, 2021).

Although the interest of both Turkish government and private housing construction companies in disaster and sustainable planning has increased in recent years, practically the effects of Covid-19 were beyond predicted even the Climate-change summits. The Covid-19 revealed that the importance of the issue of livable housing for everyone, which has been aimed to be a goal of Habitat for many years. After Covid-19, some steps have been taken by the Turkish private contractors to produce the new, innovative housing planning. The demand of people who were clustered in their apartments during the pandemic shut-down has emerged in the recent idea of living in houses with gardens will be planned in cities outer zones, airy and green areas.

The pandemic led to the search for new climate responsive designs, as well as nature-friendly lifestyles and housing models would be planned in green areas. Even though Climate-change have came to the fore as a neglected issue over the years, another phenomenon in Istanbul the recent marine disaster proved that it was a witnessed reality and people changed their perception of Climate-change issues that they heard about years.

The latest developments were truly a crucial turning point for Istanbul, the Turkish planners found themselves at a certain threshold of change. They needed to review and specify their strategies according to economical and implementation problems, also updating Istanbul's agenda on the major developments were needed new planning strategies in the world as well as the without losing sight of the earthquake issue and its timeliness.

2 The Research Methodology

This research was constituted on a theoretical base that referred to the problems and disasters in Istanbul and housing problematic that has been experienced since the beginning of the twentieth century. Although Istanbul has changed and transformed over the years, its fictitious connection with the Prost Development plan designed at the beginning of the twentieth century has continued.

This research focused on mainly natural and climatic disasters in Istanbul and the housing models that emerged afterwards. Nevertheless, without excluding the historical background of the city, the housing areas whose primary designs were determined by the Prost Development plan and its effects on the housing areas emerged as new housing models and typologies were examined. The disasters such as lived in the 2000s the earthquake and afterwards initiated

of the regeneration plannings also the new and innovative housing projects in the context of sustainability with the Climate-change issue were examined.

A research taxonomy was prepared with diachronic analysis according to the city's previous problems as well as the new planning theories and housing models developed after the recent disasters and the Climate-change issue. With a formation of inductive design coming from a deductive technique of urbanism. Thus, a deductive method was applied to examine the new housing models from the historical background of the city to the present.

In the context of this whole research concept, the study was established on a triple research axis.

1. The subject of the first part was focused about on the examination of the housing and housing problematic in the context of its historical past.
2. The subject of the second part was concentrated mostly established on the earthquake problems, which was the most important phenomenon of the 2000s and regeneration projects initiated just after the earthquake as a solution to this problem.
3. The latest subject of the part of the research was focused on the Climate-change issues and some climate-friendly projects: green architecture, sustainable, new and innovative housing, and eco-cities.

Finally, with the recent change of plannings paradigm in the cities after the Covid-19 pandemic the new planning ideas likewise planning "garden-city" houses, "healthy-houses" in green areas were examined.

3 Istanbul: The Early Twentieth Century-1990s, Housing Plannings Towards Modern City

The city primarily was planned after the significant planning periods at the beginning of the twentieth century, from the 1940s to the 1960–70s by prominent planning actors such as French architect-planner Henri Prost and later by the Italian architect-planner Luigi Piccinato.

Istanbul's first city planning realized by Henri Prost, a French urban planner who was invited by Atatürk founder of the Turkish Republic, in 1935. Thus, a planning process was started with Henri Prost who had previously planned the Paris modernization projects. Using old French traditional planning methods his plannings were known as "*l'embellissement*" (beautifying), and "*l'hygiène*" (hygiene) plans (Prost, 2007). Henri Prost was affiliated with the French urbanism school, and he used this school's old *l'aménagement* (regulatory) and *l'embellissement* (beautifying) planning tools (Doğrusöz, 1981) as well as the twentieth century's vehicle oriented modern planning principles known as modernization (Coskun, 2017a, p. 100) (Fig. 1). Indeed, Henri Prost and his colleagues were founders of the new discipline known as "*l'urbanisme*" (urbanism) at the beginning of the twentieth century (Bruant, 2011). However, his Master Plans for Istanbul was known as a modernization project focusing on the city's transportation problems as a part of the Republic Modernization (Bilsel, 2011, p. 101). H. Prost's plans were monumental and static emphasizing the physical form of the city rather than concentrated on the urban function and the city's developed planning dynamics (Tekeli, 1994, p. 75).

In the 1960s, in post-Prost period, an Italian architect and urban planner Luigi Piccinato was invited to Istanbul who had realized a "zoning" planning on prior worked with Abercrombie, London, prepared *nuclei satellite* (nucleis of satellites) (Malusardi, 1993, p. 49) (Table 1). Previously using Henri Prost's French applications in his plans (Barattucci, 2006, p. 85), Luigi Piccinato wanted to solve the problems of the city's malpractices of Henri Prost's plans during the Democrat Party's reign.

In the 1960s, the planning dynamics in the country were completely changed, and the city entered a more chaotic period with the uncontrolled planning implementations of the Democrat Party. Soon after Henri Prost's planning tool was turned into an urban application tool for the Democrat Party's mainly concentrated on city planning based policies. Henri Prost's plans were not considered to address the future planning of the city population increase of inner mass migration from rural areas to the city (Iller Bank, 1972). Later, his plans were continued to be used in the post-Prost period both legally and illegally after the Henri Prost, these uncontrolled implementations were considered destroyed the city's civil architecture.

In the post-Prost period, after the 1950s, Henri Prost 1938 Istanbul Development plan was the main application plan that remained valid for long years. It was effective in the city's main planning decisions even to the present day (Pinon, 2012; Borie & Pinon, 2010, p. 45). Even though it was used and revised multiple times until the 1970s–1980s, the physical Master plan of Henri Prost which was reflecting a characteristic of European planning practice especially in the interwar years in Turkey (Taylor, 1998, p. 105) (Table 1).

Although it had long-lasting effects in the city, the Henri Prost Development plans created a chaotic situation rather than solving the problems on the city, with the applications of the Mayor of the period, Lütfi Kırdar, in the post-Prost era (Akpınar, 2010, p.170). Prost Development plans, as modernization planning explicitly included roads and streets and implicitly housing planning, were implemented in the city for many years (Coskun, 2017b) (Figs. 1, 2 and 3).

After the 1960s, the construction practices totally handed out to the private-sector increasing uncontrolled and

Fig. 1 Istanbul city, 1938, French Planner Henri Prost's Istanbul Development plan. IFA Archives, *(Académie de l'Architecture /Cité de l'Architecture et du Patrimoine/Archives d'Architecture du XXe Siècle)*, Paris

Table 1 The planning process of the Istanbul city through the years

Dates	Istanbul city planners	Plans	Region
1935–1950	Henri Prost Plan	Modernization Plan	European and Asian side mainly
1950–1960	Luigi Piccinato	Metropolitan Plan	Out of the historical city area
1970–1999, Inner Migration Problem	Increasing of Illegal Housing	Building Blocks and Apartments, Legal and Illegal Houses,	All City; Bosphorus Hights, Suburbans

unplanned housing construction. In the 1960s, with the rapid mass internal migrations, the housing issue was emerged as a problem for the first time and has continued for many years in the city. As a solution to the future housing problematic some housing models developed by the Henri Prost in the nearly entire Historical Peninsula. The "archetype of a block-building" individual property-based housing planned for newly emerged Turkish *bourgeoise* within (*Le Musée Sociale*, Social Museum thinking system) by Prost with was implemented by uncontrollably, unauthorized contractors and land speculators after the construction works left to the private sector (Dogrusöz, 2016).

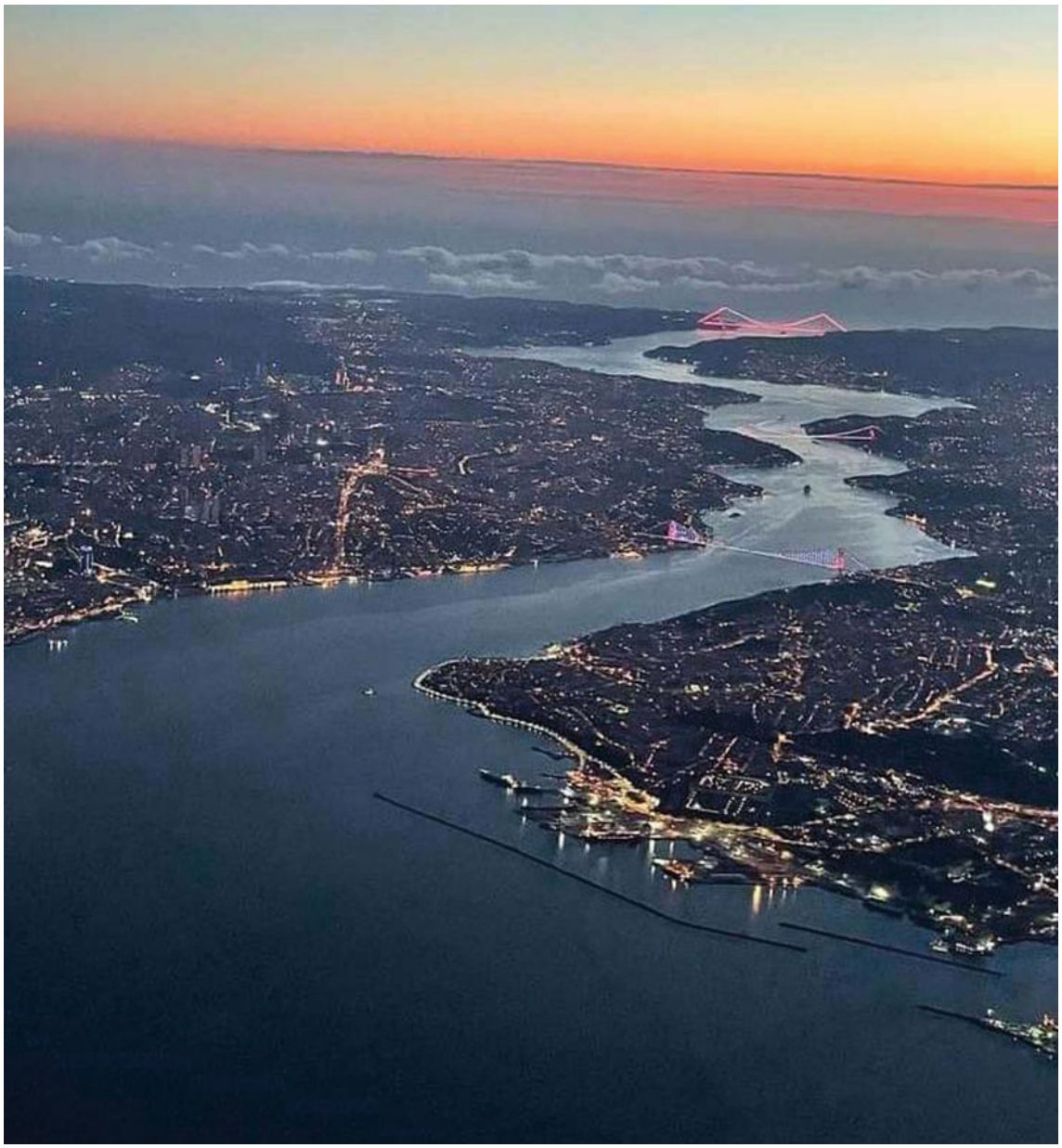


Fig. 2 Istanbul City, Bosphorus, the view of the three Bridges: Bosphorus, (first, on the front), the mid Fatih SM and Yavuz SS Connecting Urban Network of two Continents European-Side (left) and Asian-Side (right) and Housing Density. Photo, Anatolian Photography Society

However, the regions in the Historical Peninsula were rapidly developed uncontrolled and constructed by the private-contractors with the H. Prost's "building-blocks" in the 1960s. After him, the increase of unplanned and uncontrolled housing was led to the critical destruction of the vernacular areas and civil architecture especially in the Historical Peninsula in which the protection of the historical areas of the city was significant in the Prost plans.

In the 1970s, the rapid urbanization and city sprawl was increased which was induced by the migration gaining momentum after this date. Thus, in this period, the expansion of the city was emerged with the newly developed suburban areas known as *banlieues* (suburban) which were identified in the similar French term, as well as the illegal houses, gradually expanded toward the city's vacant and green areas especially in the east-west axis.

In the 1970s, by the Süleyman Demirel Government put into effect the new applications for housing issue thus, this process was initiated a third planning cycle and approved the new Bosphorus Bridge in Istanbul (Fig. 2). The opening of the new Bosphorus Bridge in 1973 changed the city's time-distance matrix and adopted new conditions of urban metropolization (Tekeli, 2013, p. 358) (Figs. 2, 3 and 4). The Bosphorus Bridge and newly opened housing

Fig. 3 Istanbul City, 1938, French Planner Henri Prost's Istanbul Development plan. IFA Archives, *(Académie de l'Architecture/Cité de l'Architecture et du Patrimoine/Archives d'Architecture du XXe Siècle)* Paris, France

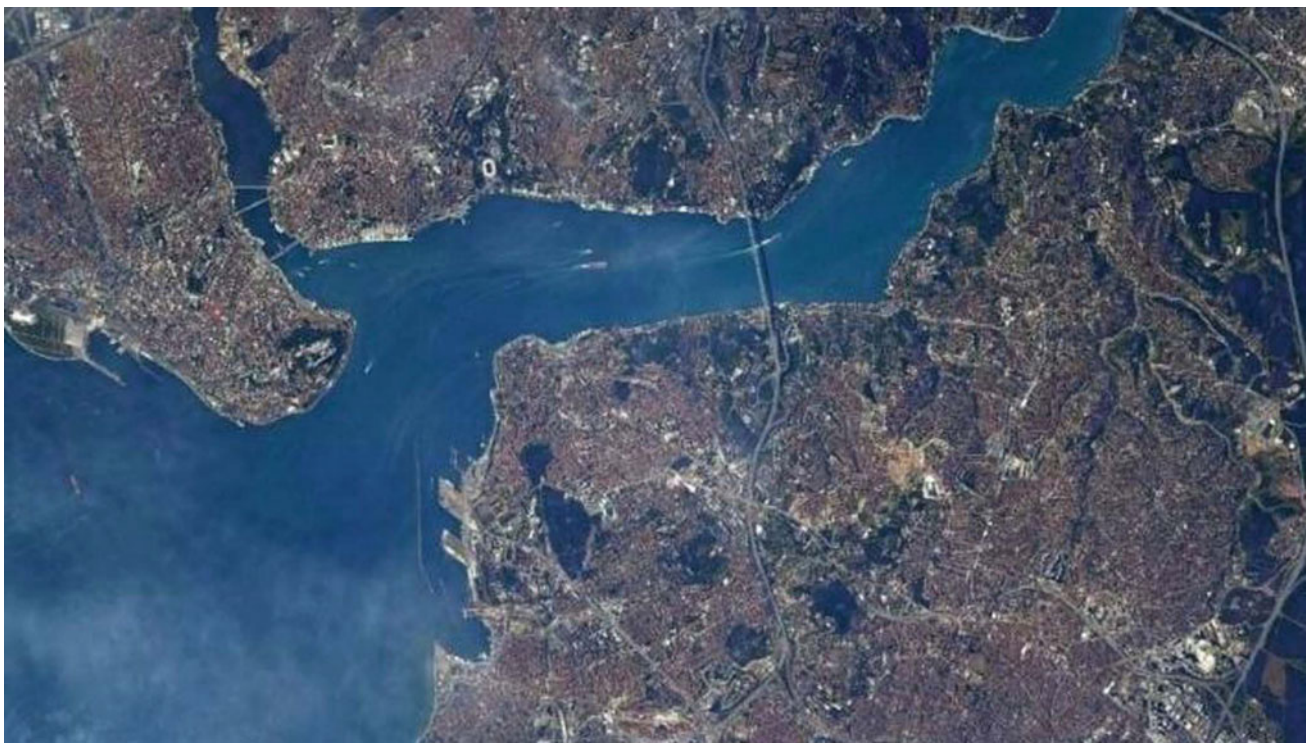


Fig. 4 Istanbul, Houses, and the recent Urban Sprawl, Housing Density Around Bosphorus, European-Side (left bank) and Anatolian-Side (right bank) Bosphorus-Bridges, Satellite view. Photo, NASA

areas previously foreseen by Henri Prost Master plan provided the connection between the two sides of the city and led to increasing construction of houses with gardens known as "garden-cities" first launched on the Anatolian side (Coskun, 2020). Also, accelarated the urban-sprawl in the city and subsequently brought the rapid increase in illegal housing, which would have been the city's biggest problem in the 1970s. In these years the lands were designed for the project and constructed the dwelling commercialized and which led their users no control over its influence (Keles, 1990, p. 162).

In the 1980s, the liberal policies carried out by Prime Minister Turgut Özal Government was indicated as another problematic era in housing issues. With his rules, uncontrolled immigration and privatization increased the creating problem of illegal housing (Fig. 6). The government attempted to legalize the laws to interrupt illegal housing to protect the green-areas along the Bosphorus. Contrarily, these laws were not implemented effectively, led the legalization of illegal constructions. Thus, the slum buildings, (*gece-kondu*) known as low-rise poor quality residences, were replaced by high-rise apartments very short period. The rate of slums on cooperative parcelling was quite high and these were low-standard "*yap-satcı*" (build-seller) apartments forced the "zoning" decisions (Tekeli, 2012, p. 205). The uncontrolled urbanization became more complicated with the amnesty laws entitled to unplanned slum houses (*gece-kondu*). In 1980s, liberal policies, the city planning system turned into a profit-focused system with the demands of landowners.

4 Istanbul: 1990–2000s, Plannings After the Disasters, Earthquakes and Regeneration Projects

Although Istanbul's agenda focused on the problems created by the unpreventable migration and with the deficiency of housing stock until the 2000s, however the 1999 earthquake became the new paradigm shift for the city and urged to autorities to implement some new planning priorities concentrated predominantly on the earthquake issues. After the 1999 earthquake, the city's planning policies were changed almost completely an intensive emergency regeneration process was initiated for the planning and construction of earthquake resistant-buildings, especially in the city centers.

Furthermore the late earthquake was revealed that the inadequacy of housing stock and the urgent necessity of renewing of existing housing-stocks quality in the city which was specified in Government Reports as very risky: combined with the natural hazards depending on the land structure an unsafe situation would be triggered in terms of natural disasters, earthquakes and landslides took out (Turkish Housing Policy Commission Reports, 2018).

After the earthquake, an emergency plan was put into use immediately as a priority to made accordance to new laws against to future earthquakes. In 1999 World Bank and the Turkish Government launched the Marmara Earthquake Emergency Recovery Project (MEER), (World Bank, 1999) a reconstruction programme with comprehensive reform of the legislative frame collaboration between the construction industry and local communities on high development standards in Master plans and infrastructure (Gibson & Kocabaş, 2007, p. 166). Also it was stated that the plan emphasized by the Master Plans must be included new "housing typologies" for earthquake resistance. Furthermore, the earthquake revealed that before many people were lived under-served, or unserved by urban infrastructure and services (Baharoğlu & Leitmann, 1998, p. 132) (Figs. 5 and 6).

The impacts of the earthquake in the Istanbul city were vast than the predicted: due to the poor housing quality not specificly to slum areas the destruction was seen in the houses owned not only by poor people, but also owned by the middle-upper class, and even in the luxury houses (Erder, 2007, p.281). With the planning urgency of the earthquake resistance housing in the Istanbul has become a significant driver and urban regeneration as rapid emergence against the major urban problematic. Specified as a major challenge in the Government the first Master plans were prepared for earthquakes institutes and universities and pilot projects launched in the some regions of Istanbul implemented regeneration projects.

After the 2000s, these applications spread to the whole city and regeneration projects, carried out primarily by TOKI, a state institution, and contributed to the private sector became more common. After the earthquake, an obligation was conducted on ground surveys of regions so, the weak soils that were not resistant to the earthquake were declared priority area for the regeneration process. The regions declared on priority both in the European-side and in the Anatolian-side districts; Avcılar, Küçükçekmece, Yenikapı, Pendik, Kartal, etc. An intense regeneration process was initiated as an immediate necessity of the city's agenda and the renewal of non-earthquake-resistant houses. With the Akparti administration a Governmental Housing Institution, TOKI, was established to solve the housing problem, mainly to construct Mass-housing, low-income houses, and houses for earthquake impacted regions across the country, also high-income houses (TOKI, 2021). TOKI has also come forward as the important institution in the implementation of the regeneration process. In the regenerations, TOKI became the only authority to change the zoning status of the region, creating new plans, building new houses, and expropriating properties (Kuyucu, 2014, p. 79).

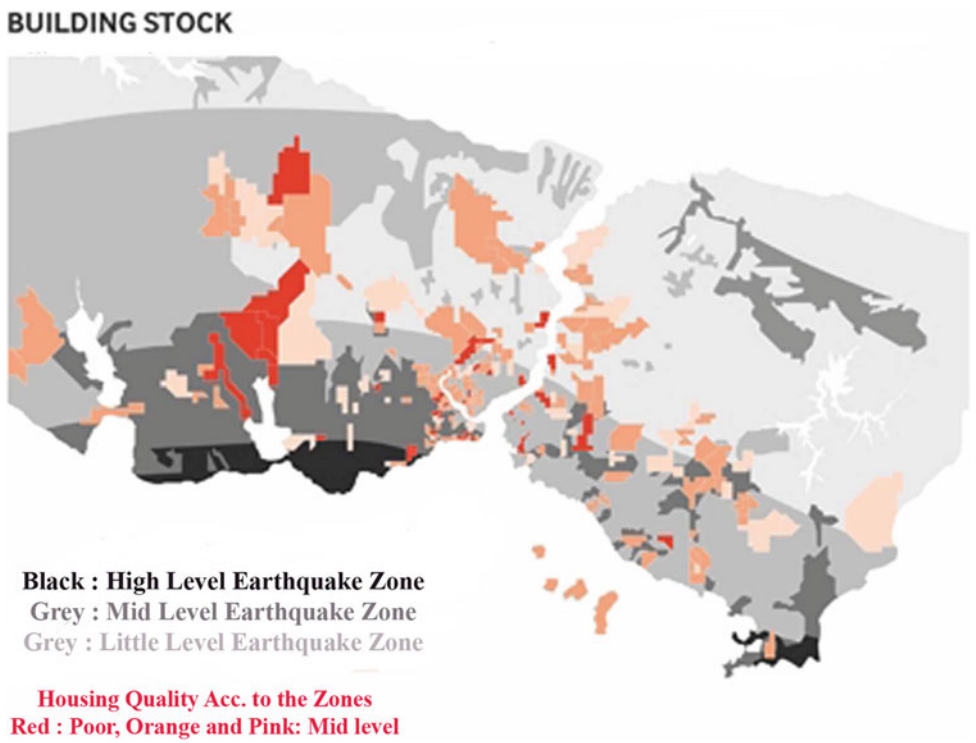


Fig. 5 Istanbul, the Map showing the Earthquake-zones and the Housing-density and recent quality of Building-Stock of Istanbul. Map, mapping Istanbul

Fig. 6 Istanbul, late 2000s, looking from European-Side to the Anatolian-Side, houses with gardens in the Anatolian-Side on the front, and on the background the European-Side mixed with Business and slum buildings (*Gecekondu*) developed uncontrolled after the Bosphorus-Bridge construction, in1970s. Photo, Meriç Sümer

Fig. 7 Istanbul, large-scale regeneration project in Fikirtepe, Kadıköy District, in the scope of the earthquake plan will be applicate in the area of poor quality, slum houses, (*gece-kondu*), mid of the Photo, carried-out by mostly private construction companies. Photo, Fikirtepe.com

As a Government institution, TOKI has been acting more like a private sector company in recent years equipped with various powers and laws (Geray, 2007, p. 333). Also, TOKİ has collaborated with private or state institutions, Emlak bank similar to the French bank-Municipality system only applicated in Istanbul city since the early twentieth century by French planner Henri Prost, but other cities were planned according to the German cooperative model. While individual and small-scale projects were carried out by private contractors, TOKİ undertook the construction of large-scale and mass-housing projects including urban regenerations (Fig. 7). This situation was also the fictionalized version of the system that had been intended to be constructed since the 1980s. In TOKI's projects, besides the conveniences in implementations brought by the government such as tax cuts, and rent assistance until the houses were built, there were also some difficulties and contractors demanded additional payments to expropriated houses to cover their costs or wanted to relocate to cheaper TOKI projects. Very recently, accordance with the new scope of the state's recommendation on earthquakes; it was suggested that the newly planned houses should be built more horizontally and low-rise instead of the high-rise buildings.

As a model project and in the context of the regeneration process on a large scale, Kartal Region Master Plan was prepared by Zaha Hadid Architects (Arkitera, 2006) (Fig. 8). Despite some physical, propery and land incompatibilities, the regeneration project of Zaha Hadid was a very innovative and modern project. Unfortunately, this project had to be stalled as a result of the some problems and disagreement between the landowners and the Kartal Regional Municipality.

5 The 1990–2000s, World and Istanbul: New and Innovative Housing Plannings; Green Urbanism, Green Architecture, Sustainable Design, and Eco Design

Recently, new design paradigms have developed in urban planning and the cities have begun to evolve quite in innovative ways which have not been known until now. At the beginning of the twenty-first century, the world of urban planning excluded the old explanatory models and today when we considered the urban ecology completely rethinking ecology and its actors (Paquot, 2013, p. 122). Indeed, in

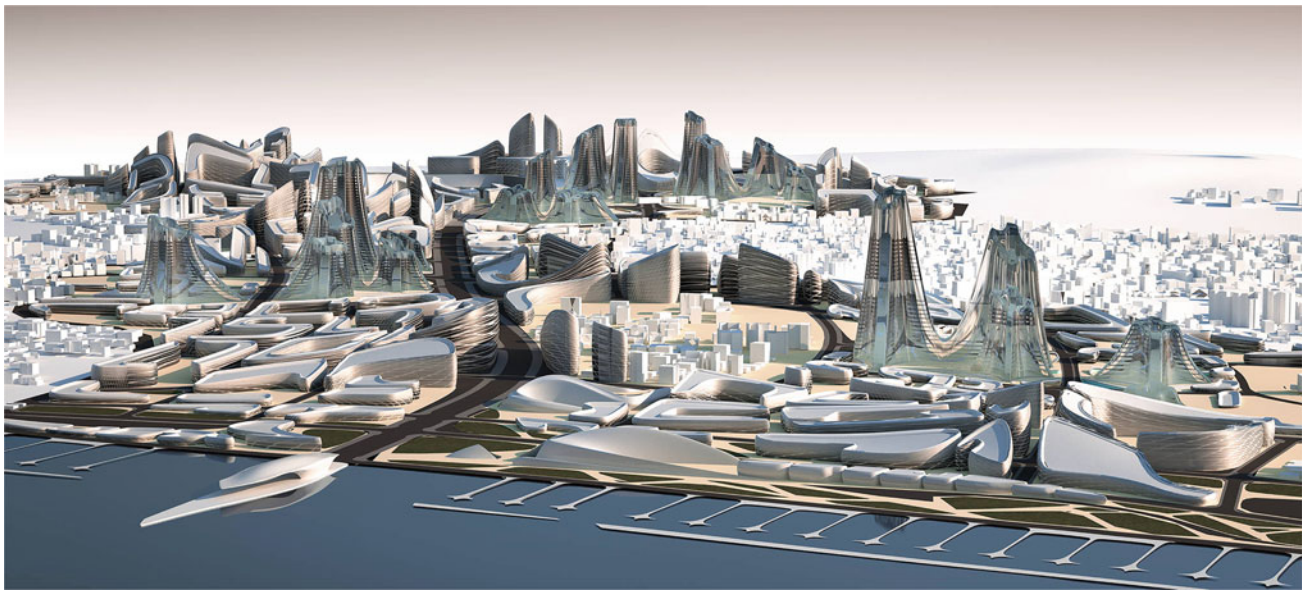


Fig. 8 Istanbul, a large-scale regeneration project in Kartal district, Kartal Master Plan by ZHA, Zaha Hadid Architects planned within the earthquake plan in the area of poor-quality, slum houses (*gece-kondu*). Project Photo, ZHA website

the twenty-first century, we have to concentrate and work new context of lifestyles, for which we needed to develop new city and housing models (Lehmann, 2011, p. 244). In 1992, the debates were started with the first "Climate-Summit" held in Rio de Janeiro, Brazil, by the United Nations focused on "sustainable planning" formulated as part of Agenda 21. After the rising awareness about Climate-change, the UN-Habitat was established in 2002, "United Nations Human Settlements" and at least 100 million achieved the Millennium Development Goal of "significantly improving slum dweller life" provided the opportunity to receive effective assistance from the government.

On sustainable development of cities UN developed an Agenda; "Accessible and connected urban transport, infrastructure that was resistant to disasters and Climate-change, sustainable production and consumption, and long-term management with integrated urban planning, design, disaster management and finance with the participation of all stakeholders, including civil society" (United Nations, Habitat, 2016). The third UN-Habitat Conference was held in 2016, in Ecuador, Kito, and the "New Urban Agenda" was declared on Sustainable Development with the decisive role of Paris Climate-change, 21st Conference Parties (COP-21). After that, the Turkish housing policies have been rearranged and adopted some new principles. In these principles; the "sustainable and inclusive urban economies," "environmental sustainability" and "housing as a human right" were emphasized.

According to the latest Turkish Government Reports Climate-change considered one of the major problems of the country as well as the earthquake issue. In the reports underlined that the country's lands were reduced due to uncontrolled development, global warming, and increasing intensity of Climate-change also the issue of sustainability was underlined as one of the main problematic as well as the disasters the three main compromises were addressed in the study: to access to enough and equal and social housing, financing and sustainability in the world (Turkish Housing Policy Commission Reports, 2018). Finally, debates on the issue of sustainability and the possibilities of achieving sustainable urban growth in Turkey are still underway, however not very far advanced (Türker, 1999, p. 123).

After the 2000s besides the earthquake issue also the Turkish planning world found itself in the new phase of the fifth period of major developments after the paradigm change in 1999, earthquake including the planning and adapting processes experienced by EU countries and move toward sustainable planning. Although as a crucial turning point for the city, by updating Istanbul's agenda, the earthquake issue would always remind of us its timeliness, without losing sight of the new planning strategies in the world. The idea of living in houses with gardens and concepts such as "healthy-houses" newly emerged housing models in the city as a reaction to extreme urbanization especially by the people who had to confine their houses long months during to the Covid-19. Also, the urbanization with the high-rise buildings in Istanbul has reached such a terrible level that even two storeys slum dwellings (*gecekondu)* in the city's outer districts and green-areas became significant and today they considered as more liveable places in the city (Ortaylı, 2022). Indeed, a

new demand revaled due to determination of the will of the people and represented the recent trend towards the requested for houses with gardens in the green-areas Istanbul radically changed after Covid-19.

Recently, the Istanbul mayor has announced a new statement after 2021, Cop-26 important steps will be taken against to Climate-change problem of the city especially for deforestation and water scarcity due to uncontrolled urban-sprawl toward to green areas and Northern-forests (CNN, 2021). The mayor has explained that they will develop a Climate-based Activation plan (SECAP), Sustainable Energy Activation plan (SUMP), Sustainable City Movement plan, waste management plan and zero-carbon city plan for Istanbul, also explained that they determined a concrete roadmap for the city being a carbon–neutral and climate crisis resistant (Dünya, 2021) (Figs. 9 and 10). Furthermore, Istanbul is the only Municipality member of C40 in Turkey that was specified 14 targets for a Visional plan for 2050 in the context of the Climate-change Activation Plan (Iklimhaber, 2021). However, despite these significant steps recently, the forest areas are still in danger with the enactment of the recent law allowing settlements when it was necessary. On the other hand, while the number of the migration has increased, the city has continued to rapidly urbanize toward green-areas and even Northern forests. Although an innovative plan is aimed at Istanbul, migrations and rapid urbanization have made it impossible effective implement this planning. Furthermore, new problems have been added to current ones as well as the in 2000, the threat of earthquakes; the latest environmental disasters, and Covid-19 pandemic experienced in recent years.

5.1 After the 2000s, Istanbul: The Recent Projects and Towards Innovative Housing Projects; Recent Models Eco-Cities, Sustainable Cities, Healthy Projects, Etc.

In the 2010s, even though Istanbul Climate-summit, 1996, did not create enough awareness after the Rio, 1992 that was resonated in the world, there was seen an interest relevance in new projects in the city 15 years after the summit. Thus, an Architectural competition was started in various regions in Istanbul with the planning of new and innovative projects. First time the Climate-change issue came to the fore as a new problematic in the city and even an beyond the new idea developing an "Eco-city". The Istanbul Municipality opened in the city's east–west axis, in the west K. Çekmece district,

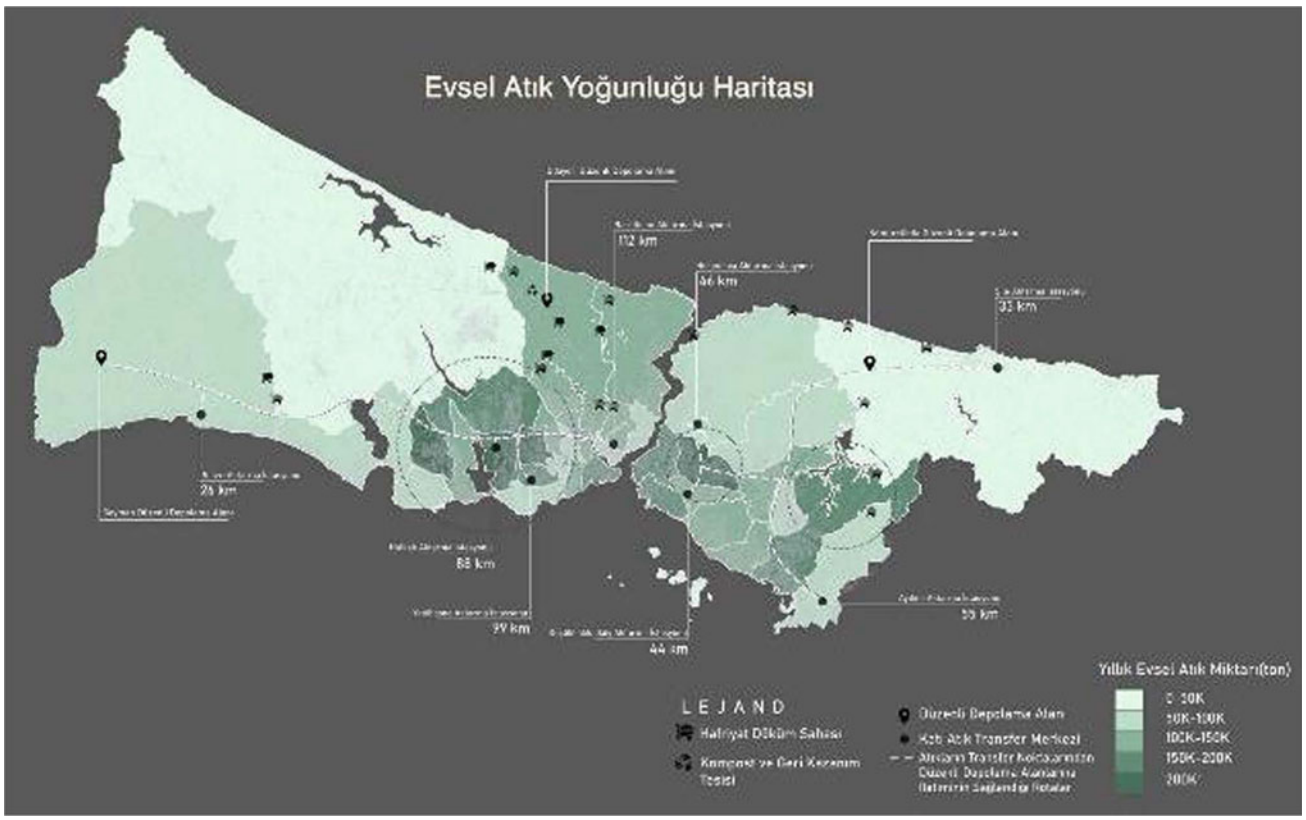


Fig. 9 Istanbul, Urbanization and Urban-Sprawl to the City's Northern-forest and green-areas in Suburban Districts. The Map showed that the Population Density and Urban-waste Density. Map, Auraistanbul

Fig. 10 Istanbul, Marmara sea, recent environmental Marine pollution, Sea-mucilage spread whole Marmara Sea along the Istanbul shores and deforestation towards Northern-forest with the Urban Sprawl, and recent Mega-projects. Map, Northern Woods.org

and in the east Kartal districts to the new large-scale projects participation of prominent architects; an "Eco-city" project by Ken Yeang, the others Rem Koolhaas, and MRVD, in the K. Çekmece Region also a "macro-city" regeneration project by ZHA, Zaha Hadid Architects in Kartal Region (Bozdoğan & Akcan, 2012, p. 293). Explained by Ken Yeang the concept of the "Eco-cities" plan as matched with selected flora species in a composite biodiversity matrix (Yeang, 2009, p. 30). Even though it might be a good model for the city's future innovative and ecological planning also a regeneration project for the lake area, due to previous water pollution led by excessive urbanization, however his project could not be implemented (Figs. 11, 12 and 13). Indeed, as a model project as new human settlements, self-sustaining resilient structures that function of natural "eco-systems" were seen important in the world started as a non-profit organization primarily by Richard Register (Register, 2018, p.3). These innovative projects became significant due to a new era in the cities where energy, water and food supply are critical in the technological world (Beck, 2000). In this context planned with new and innovative housing models and typologies promoted specifically under the name; green-city, eco-city, smart-city or digital-city (Caprotti et al., 2015, p. 497). Indeed, with the changing architectural and urban planning dynamics so, undermining the effects, of the Climate-change and the another phenomenon the recent pandemic of Covid-19 became much more influential than the Climate-change summits. Furthermore, the idea of everyone having a right to have a livable home that drew attention to Habitat was once again remembered with the Covid-19 (Türkün, 2021, p. 8). Although its effects in the world were mostly considered on the basis of transportation, even Covid-19 effective and reflected in housing models in all the world and also in Istanbul. Thus, the public transportation systems altered and started to acted as disease addictive zones (UK Department of Transport, 2020), (Gosc´e & Johansson, 2018, p. 4) also housing models and typologies were changed radically. Eventually, in Istanbul especially after the Covid-19, pandemic the private contractors have agreed to launch to construct new, innovative houses. These houses designed with gardens or terraces would be plan to a new concept in architectural terminology for the first time created new term as "healthy-houses" or "terraced-houses" have designed uniquely according to Istanbul people's demand who were clustered in their high-rise apartments during the pandemic.

With the recent Covid-19 pandemic E. Howard's "garden-cities" became popular again in England. Reyner Banham pioneered the idea the needs of humans on an environmental basis should be integrated into architecture (Banham, 1969). First transferred to Istanbul, via French architect H. Prost "garden-cities" were planned with a pragmatical view to solve the Istanbul housing problem (Dogrusöz, 2016) with French *Le Musée-Sociale* (Social-Museum) (Rabinow, 1991,

Fig. 11 Istanbul, Küçükçekmece district, environmental disaster in the Küçükçekmece Lake, 2010 and fishes death before recent marine pollution Sea-mucilage, 2021. Photo, Küçükçekmece

Fig. 12 Ken Yeang's Küçükçekmece, Istanbul "Eco-city" proposal, a regeneration project for the existing "eco-system" of Küçükçekmece Lake and Region. Photo, K. Yeang, *eco master planning*

Fig. 13 Ken Yeang's Küçükçekmece, Istanbul "Eco-city" proposal, a regeneration project for the existing "eco-system" of Küçükçekmece lake and Region. Photo, K. Yeang, *eco master planning*

p. 172) The original idea of Henri Prost's French model *cité-jardins* (garden-cities) were planned on the Anatolian side; Kadıköy, Acıbadem, Koşuyolu, etc. and some *cité-parcs* (park-cities) in Bosphorus woods (Bilsel, 2010b, p.369). In the 1990s–2000s, Istanbul city began to develop towards the outside of the center, especially to the north, the new residential projects in green areas, were evoked the English country style"garden-cities" were planned in the far northern axis; Kemerburgaz, Zekeriyaköy, Sarıyer, Kemer Country, İstanbul&Istanbul, etc. in the Anatolian side Ömerli Town, Beykoz project (Table 2). Inspired by E. Howard's early English "garden-cities," these were very modern and innovative projects. Although these projects could not appeal to the majority population previously described as far from the city, became popular recently after the pandemic.

Table 2 The Recent years housing models and planning in Istanbul city

Dates	Istanbul city	Projects	Districts
After 1999 earthquake	Starting Gentrification Process	Regeneration plannings by government TOKI and other private constructors, Zaha Hadid's Kartal Master plan	City Centers; European and Asian Side; Nişantaşı, Kadıköy, Göztepe, Suadiye, Bostancı, etc
After 2010s	Future planning of the city, etc	Future Projects; Ken Yeang's Eco-cities, green plannings, sustainable plannings, etc	City's out-skirsts, green areas; K. Çekmece, Kartal, Sarıyer, Zekeriyaköy, Kemerburgaz, Kurtköy, etc
After 2021	Green and healthy plannings for pandemic	Projects after the Pandemic; "healthy-houses" in Green areas	Nişantaşı, healthy-houses by TOKI, and private sector, terrace houses, etc

6 Conclusion: Istanbul, Recent Housing Policies, Disaster Response and Sustainable Design

Although Istanbul has changed and transformed over the years, its fictitious connection with the Prost Development plan designed at the beginning of the twentieth century has continued. In this research, the subject of housing, which has changed with the planning theories, policies over the years in the city, was discussed in the context of the disasters faced in its past. The housing problem was examined in the context of earthquakes, natural and climatic disasters occurred in the city over the years. While making this review, detailed research on historically the housing issue in the city was presented with its previous considerations related to the past plannings, projects and events.

According to the taxonomy prepared for including Istanbul city's change and transformations periodically, in years concluded the houses and housing models planned for disasters such as the earthquakes or Climate-change issues and the recent pandemic Covid-19 as well as the early housing models were examined and various new and innovative housing models were reached. The disaster responsive projects planned such as after the Covid-19 needed the green and healthy-houses, modern "garden-cities" and "green-architecture" planned in the out of the city in the green areas also due to the recent sea disaster the new, innovative "Eco-city" plannings and after the earthquakes the "regeneration projects" were reached in this context (Table 3).

Some housing models were examined which had to change metaphorically and spontaneously from time to time to today, due to some disasters such as earthquakes, or Climate-change issues as well as the Covid-19. Thus, these housing models had to develop under the influence of Climate-change or with new and innovative trends in the world specified and designed specifically and uniquely for Istanbul. In this research it was achieved some findings on new, and innovative housing models and projects were initiated to produce for Istanbul city uniquely (Table 3).

Since many housing models in Istanbul were previously transferred from French and German housing models in the interwar years, these similar models have been used for many years. Furthermore, some housing models from the past, such as the "garden-city" model came-back into the design agenda of the cities again in the world. With this old, existing "garden-city" models, which was planned in the past as green-based housing settlements, today indicated that an rapid increase in the demand for living in green-areas outside the city and in houses with gardens, especially after Covid-19.

In recent years, in Istanbul highly qualified projects had been planned by international architectural competitions in the outer zones and the vacant areas of the city. Among these projects, considering the Climate-change issue, regeneration projects, as well as quite innovative projects such as "eco-cities," achieved. With the these newly opened competitions, it was emphasized once again how important such new, and innovative projects were. Like Küçükçekmece an "Eco-city" project was creating its own "eco-system" with green, healthy, airy, and clean water considered to benefit of human and other species. The very recent marine pollution mentioned as sea mucilage experienced in the Marmara Sea last year, "eco-cities" remembered us once again there would be many benefits for the future of the city the development of such exemplary model projects as necessesity.

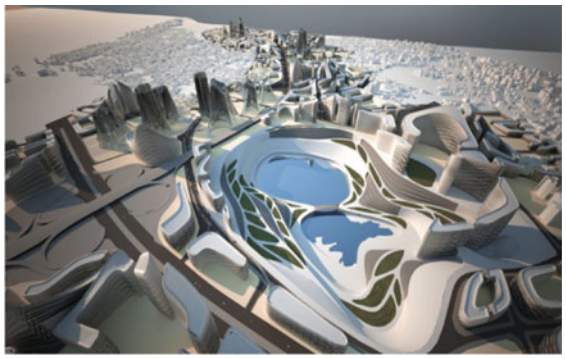
In public side, even though still undermined however the effects of Covid-19 were more than expected in the city led to more reflection than the Climate-change summits held by organizations. With Covid-19, the idea of everyone's right to have a livable home that once drew attention to Habitat principles once again came to the agenda and emphasized and found the opportunity to realize this idea with Covid-19 also with raising public awareness.

The effects of Covid-19 in the world cities were primarily influential on transportation issues, and in Istanbul, it led to increasing demand for innovative housing models. After the Covid-19, on the public side, the private contractors started to build new, innovative housing planning and houses with gardens or more spacious terraces or in green-areas and woods. These houses are developed within as a new concepts in architectural terminology first time such as "healthy-houses" due to the increasing demand of people who were confined in their apartments during the pandemic.

Hence, leading to the search for new nature-friendly lifestyles has emerged and a rapid transition in housing models, thus apartments with green-terraces or garden-terraces or houses designed with vertical gardens or houses with gardens in green areas. So, new and innovative housing models and typologies "garden-houses", "terraced-houses" or "healthy-houses" have started to be developed regarding sustainable design and Covid-19 accelerated. On the other hand, even though Climate-change has come to the fore as a neglected issue over the years, another phenomenon the recent marine disaster proved that it was real issue and a witnessed reality.

The Government side with some planning policy changes, the Government has taken new steps the name of the *Çevre ve Şehircilik Bakanlığı* (Ministry of Environment and Urbanism) changed to *Çevre, Şehircilik ve Iklim-Değşikliği Bakanlığı* (Ministry of Environment, Climate-change, and

Table 3 The Problems Of the Istanbul City and New and Innovative Housing Projects and Models Developed in Istanbul City Last Twenty Years

Years	Istanbul problems	Projects solutions	Developed projects and housing models
After 1999	*The earthquakes*	*Regeneration projects* A Large-Scale Regeneration Project Planned by Zaha Hadid in 2010	
2000s	*Climate-change issueS*	*Green based projects* Modern (Garden-Cities) Developed After the 2000s Istanbul, Kemer Country	
2020	*After the COVID-19*	*Searching new living styles and housing models out of the cities in green areas* Recent green-based large-scale projects	

(continued)

Table 3 (continued)

Years	Istanbul problems	Projects solutions	Developed projects and housing models
2021 More Problematic After 2021 Mucilage	*Marine pollution-mucilage*	*Eco-cities* Küçükçekmece Eco-City Project Planned by Ken Yeang	

Urbanism). After the Government also the private sector contractors explained that their interests in the Climate-change issue. Furthermore, in 2021, the Turkish Contractors Association issued a new declaration, announcing that they reached a consensus on producing "sustainable-housing." Afterwards, the Central Bank announced that it will establish a new department on "Green Economy" and "Climate Change Management." All these steps have indicated that the Government and as well as the private sector's recent interest in the climate-change issues.

Recent developments have not only affected housing models and typologies but also the housing construction models and methods have also changed. In this research, it was found that the production of houses, the early period French model, which is based on the French influences of the twentieth century, the Bank-Municipality joint-venture planning and construction model, after that it was developed and dominated by the state-owned institutions. Today, developed as a unique model for Istanbul previously later this housing construction system worked as a model like the State-Bank, TOKI-Emlak bank or the State-private sector model, similar to the French model in the past.

Recently, the production of both temporary and permanent residences planned as the earthquake response constructions (also regeneration projects in the context of the renewement of poor housing-stock) has placed among the important housing production targets highlighted by TOKI's official website. The earthquakes specified as a major hazard in the projection of the Government due to the country being located in one of the most active earthquake zone of the world. Another problem was specified in the Government reports the not good even poor quality of the housing-stock stemmed from application of dated construction regulations and applications which was emerged in 1999, earthquake and the appeared necessity of renewal of existing housing-stock as well as the housing shortage. On the other hand, some new regeneration projects which would be implemented not prepared specifically according to the urban fabric of paradoxically old Istanbul city's historical character could be another problematic, on the old, historical regions, vernacular areas, also the regions with the civil architecture in the context of the Architectural Heritage.

Additionally, on a theoretical basis, in Government reports on global-warming, Climate-change matters were seen as a major problematic as well as the earthquake and the issue of sustainability was underlined as one of the main problematic by the Government. Theoretically, although the government has taken remarkable steps, especially regarding Climate-based issues and disasters, it seems that it will take some more time to implement them in practice while earthquake-related regeneration studies still continued. However, even though the Government explained its interest theoretically, recently an innovative approach to TOKI's constructions in practice has come to the agenda the private sector initiated pioneering new, innovative housing projects due to cimate-change and sustainable issues.

References

Akpınar, İ. (2010) İstanbul'da Modern Bir Pay-i Taht, Prost Planı Çerçevesinde Menderes'in İcraatları. In *İmparatorluk Başkentinden, Cumhuriyet'in Modern Kentine, H. Prost İstanbul Planlaması(1936–1951).* İstanbul Anadolu Araştırmaları Enstitüsü, İstanbul.

Arkitera. (2006). Retrieved September 21, 2021, from https://v3.arkitera.com/news.php?action=displayNewsItem&ID=8148.

Baharoğlu, D., & Leitmann, J. (1998) Coping strategies for ınfrastructure, how Turkey's spontenaus settlements operate ın the absence of formal rules. *Habitat İnternational, 22*(2), 115-135.

Banham, R. (1969). *Architecture of the well-tempered environment*. University of Chicago Press.

Barattucci, C. (2006). Le Zoning Dans l'Urbanisme Italien et Francais du XX. Siecle, *Urbanisme,*Septembre-octobre, 2006, N.344.

Beck. (2000). Database on the structure of the development, academic. oup.com

Bilsel, C. (2010b). Serbest Sahalar : Parklar, Geziler, Meydanlar. *İmparatorluk Başkentinden, Cumhuriyet'in Modern Kentine, H. Prost İstanbul Planlaması (1936–1951)* İAE

Bilsel, C. (2011). Les Transformations d' İstanbul: Transformations of İstanbul by Henri Prost, AIZ. *Journal of Faculty of Architecture, 8* (1), 100–116.

Borie, A., & Pinon, P. (2010) *Istanbul, Portrait de Ville*, Cite del'Architecture et du Patrimoine, IFA, Paris.

Bozdoğan, S., & Akcan, E. (2012). *Turkey*. Reaktion Books.

Bruant, C. (2011). Eugene Henard, Paquot, Thierry. *Les Faiseur De Villes,* İnfolie Editions, Paris. (Deuxieme Édition, Premier Édition in 2010.)

Caprotti, F., Springer, C., & Harmer, N. (2015). 'Eco' for whom? Envisioning Eco-urbanism in the Sino- Singapore Tianjin Eco-city, China. *International Journal of Urban and Regional Research, 39* (3), 495–517. https://doi.org/10.1111/1468-2427.12233

CNN. (2021). *Tv News*, *Turkish Edition,* Retrieved September 10, 2021.

Turkish Housing Policy Commission Reports. (2018). Retriveted September 9, 2021, from https://www.sanayi.gov.tr/assets/pdf/plan - program/%C4%B0STANBUL.pdf.

Coskun, H. (2017a). In the beginning of the 20th century, analyzing methods of the housing problem and an example: Henri Prost's Istanbul plannings. *PhD Thesis*, 2017a, MSGSU, Mimar Sinan Fine Arts University, The Institute of Science, Faculty of Architecture, Building Design, Istanbul, Turkey.

Coskun, H. (2017b) ISTANBUL: 19th and 20th century transformations ın the historical peninsulaand after the 1950s Reflections of the globalization. In: *ISUF, 2017b Conference*, September, 2017b, Universitad Valencia, Valencia, SPAIN. E-Press.

Coskun, H. (2020). Henri Prost's paris and Istanbul plannings, zoning regulations urban planning tools : housing, green areas, parks, axis. *GU- Green Urbanism*, 24–26 November, 2020, Rome Tre Univesity, Rome, ITALY. On-line, 2020.

Doğrusöz, U. (1981). Henri Prost, (*Unpublished Master Thesis),* Paris, 1981.

Dogrusöz, U. (2016). *Interview*, Istanbul.

Dünya, (2021), dunya-com.cdn.ampproject.org., Retrieved September 02, 2021.

Erder, S. (2007) Kentsel Arsa ve Konut Üretim Sürecinde Kırsal Alışkanlıklar ve Kuralların Etkisi Üzerine, *KENT ve PLANLAMA*, İmge Kitabevi, Istanbul.

Geray, C. (2007). Toplumsal Konut Yönetisi ve TOKI'nin Tutum Ve Yöneltilerindeki Son Degişiklikler, *KENT ve PLANLAMA*, İmge Kitabevi, Istanbul.

Gibson, M., & Kocabas, A. (2007). Turkish planning at a crossroads: False dawn or vision of new era. *KENT ve PLANLAMA*, İmge Kitabevi, Istanbul.

Gosc´e, L., & Johansson, A. (2018). Analysing the link between public transport use and airborne transmission: Mobility and Contagion in the London underground. *Environmental Health, 17*(84). https://doi.org/10.1186/s12940-018-0427-5.

United Nations, Habitat (2016). Retrieved September 15, 2021, from https://unhabitat.org/world-cities-report.

Iklimhaber. (2021). Instagram photos and videos from İklim Haber Gazetesi (@iklimhabergazetesi), (Instagram Retrieved September 07, 2021)

Keles,. (1990). *Housing policy in Turkey*. Routledge.

Iller Bank. (1972). 1958–60 İller Bankası İstanbul Planlama Müdürlüğü ve Prof. *Piccinato'nun, Çalışmaları, Mimarlık, 7*, 1972.

Kuyucu, T. (2014). Hukuk, Mülkiyet ve Muğlaklık : İstanbul'un Kayıtdışı Yerleşimlerinin Yeniden Yapılandırılmasında, Hukuki Belirsizliğin Kullanımları ve İstismarları, *YENİ ISTANBUL ÇALIŞMALARI*, Metis, İstanbul.

Lehmann, S. (2011). What is green Urbanism? Holistic principles to transform cities for sustainable. In: *4thInternational Conference of Contemporary Affairs in Architecture and Urbanism.*

Malusardi, F. (1993). *L' Azione per Una Cultura Urbanistica Senza Frontiere*. Luigi Piccinato e L'Urbanistica Moderna, Edizioni Officina, Roma.

Ortaylı, İ. (2022). Turiszm Deken Çevreye Dikkat, *Hürriyet Gazetesi*, İstanbul.

Paquot, T. (2013). Introduction L'Urbanisme est a Penser, *Repenser l'Urbanisme*, Sous la Direction de Thierry Paquot, İnfolio, Paris.

Pinon, P. (2012). Prost Yıkımları, *Konferans,* Bilgi Univ., İstanbul, 6 Mayıs, 2012. In: *Conference in University of Bilgi*, Istanbul.

Prost, H. (2007). İstanbul Hakkında Notlar, Cumhuriyet Dönemi, İstanbul Planlama Raporları, *1934–1995*, Derleyen Ş. Özler, *TMMOB, Mimarlar Odası, İstanbul Şb*., İstanbul 2008.

Rabinow, P. (1989). *(1991), French modern norms and forms of the social environment*. Chicago Press Edition.

Register, R. (2018). *Ecocity Berkeley: Building cities for a healthy future.* North Atlantic Books.

Taylor, 1998 Taylor. (1998). Urban planning theory since 1945, London, Sage Publishing.

Tekeli, I. (1994). *The development of the Istanbul Metropolitan areas: Urban administration of planning Istanbul*. Kent Basımevi.

Tekeli, İ. (2012). *Türkiye'de, Yaşamda ve Yazında, Konutun Öyküsü, (1923–1980)*, TTVY., yay., İstanbul.

Tekeli, İ. (2013). *İstanbul'un Planlamasının ve Gelişiminin Öyküsü,* TTKV Yurt Yayınları, Birinci Basım, İstanbul.

TOKI. (2021). Retriveted September 5, 2021, from https://www.toki.gov.tr/en/.

Türker, P. A. (1999). Evaluation of Turkish planning system within the context of sustainable urban development. In: paper presented on *International Conference on 20th Century Urbanisation&Urbanism*, Bled, Slovakia, 9–11 December.

Türkün, A. (2021). *Mimarlık Degisi*, 2022, S.422., İst.

UK, Department of Transport. (2020). Coronavirus (COVID-19): Safer travel guidance for passengers. Retriveted September 03, 2021, from https://www.gov.uk/guidance/coronavirus-covid-19-safer-travel-guidance-for-passengers.

United Nations, Populations Fund. (2007). *State of world population, 2007*. Unleashing the potential of Urban growth.

World Bank. (1999). Project ınformation document, Turkey Marmara earthquake emergency reconstruction, MEER. Project World Bank Washington.

Yeang, K.. (2009). *Eco master planning*, 1st ed.

City-Effect: New Centralities in Post-pandemic Regional Metropolis Pescara-Chieti

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Abstract

Throughout the Covid-19 pandemic, the functioning of cities has been challenged, both spatially and a-spatially. This has therefore, exposed parts of urban areas to obvious disruption. Cities have expressed an evident spatial centralisation in places with high identity values and specific functions. The frequent disruptions from health limitations have underlined the important relationship between compact cities and conterminous fragments, thus, starting a process of a sustainable rebalancing of the urban system. The purpose of this work is to present the case study of the regional metropolis Pescara-Chieti and highlight how these fragments can become new complementary centralities with the continuous city. These additional centralities can form a multipolar system with different intensities and contribute to the quality of life in peri-urban areas.

Based on a literature review, a set of indicators and criteria is proposed to identify the city-effect, that is the capacity of the city to offer, attract and contain. The recent paradigms of the 15-min city, reinforce the thesis advocated and the consequent reconfigurations of urban space as a driver of regeneration and mitigation action at different planning levels. The methodology was applied to a conurbation of 14 municipalities in the Abruzzo Region (Italy), with polarity to the city of Pescara. This work reasons with city users, defined as dynamic on the territory by ISTAT (Italian National Institute of Statistics), on the spatial dislocation of amenities and accessibility. The results have underlined the relationship between spatial continuity and functional integration of urban fragments—interested by the movement of internal dynamics—with different degrees of city-effect. For the latter to be triggered, urban fragments must assume the role of new centrality through the urban project to counteract marginality phenomena.

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City-effect • Centralities • Spatial planning • Public space • Post-pandemic city

1 Introduction

The Pescara-Chieti conurbation is an area characterised by strong dynamism due to the presence of many administrative, educational, health and cultural services. This urban condition permits important flows of people for work and study to Abruzzo. This has established Pescara as the main pole of attraction of the Abruzzo conurbation, both at a regional and supra-regional level. However, recent transformations in socio-economic and ecological conditions have imposed a revision of the overall governance of the conurbation in order to eliminate (or at least reduce) the spatial inequality between the compact city and the "dust municipalities". The continuous evolution of the role of the Pescara-Chieti conurbation has modified the relations between different areas of the city and has generated new territorial dynamics.

Today, the urban condition that has emerged during the pandemic has exposed parts of the city, particularly in the hinterland and marginal areas, to obvious hardship. It is evident how covid-19 triggered spatial re-planning phenomena; creating a multipolar network between the current main pole (Pescara) and the contiguous fragments arranged around the "city in spatial continuity". In the future, this could give rise to the emergence of new centralities defined by socio-economic dynamics, the housing market and the decisions of the city's residents and users. The aim of the manuscript is to analyse the case of the regional metropolis Pescara-Chieti, highlighting the creation of a multipolar network between the city in spatial continuity and the conterminous fragments. This urban planning strategy should begin an incremental development of the conurbation in

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urban quality, social and economic issues. The results underline that conscious planning between the city in spatial continuity and neighbouring fragments can indicate urban areas where urban regeneration could take place. This article has attempted to define and describe the "city in spatial continuity and functionally integrated". This document is divided into:

- Literature review, intended as a reflection on the main research carried out on the theme of the medium-sized city and the debate on the Pescara-Chieti conurbation;
- Methodology, that is setting out the various stages of the research;
- Findings, i.e. the identification of areas without a functional mixitè and the city-effect;
- Conclusions, that is a reflection on the future development of the Pescara-Chieti conurbation. The conclusions highlight how urban space can be reinterpreted as an active element of territorial dynamics.

2 Literature Review

2.1 Interpretation of Urban Periphery and Functional Mixitè

«Social relations, intra-firm networks, labour markets, built-up territories, infrastructure corridors and socio-environmental traces […] overlapped and connected with each other, to create what Jean Gottman had […] described as "an irregular colloidal fabric of rural and suburban landscapes"» (Brenner, 2015). These last words highlight the difficulty of interpreting the city in a direct and immediate way. This operation requires reflections on the functioning, the perimeter of the city and the movements of the population. These issues have already been the subject of many studies. Among the main Italian studies is the "Demix" research[1] (MiBACT-DGAAP, 2017). This research investigated the degree of amenities (urban activities and services) in nine Italian metropolitan cities. The aim of the research was to identify the level of "functional mixitè" as the main factor in urban quality. This study was described as a valid methodology to support city-makers engaged in urban regeneration. In the Demix research, urban regeneration is not only viewed as redevelopment, but as socio-economic and cultural reactivation of settlement systems. In addition, the concept of the city-effect is particularly relevant. It is referred to as the sum of four urban categories: (i) territorial attractions; (ii) social, health and sports services; (iii) cultural activities and services; (iv) retail, crafts and tourism. This focuses attention on the local difference between urban services, but excludes the quality of public space, real and perceived urban safety and the distribution of property values. With the ecological transition and the urgent demand for sustainable cities, it is vital to include the quality of public space as a fundamental element of urban design. Therefore, the different urban spaces should not be "elements of chaos", but "active urban elements" in the system of urban layers.

2.2 Network of Multipolar Centralities in Medium-Size Cities

If cities are nothing more than a form of urbanisation (Gandy, 2014), that is products of broader socio-spatial processes and socio-ecological transformation (Brenner, 2015), they cannot be reduced to a trivial perimeter. The interpretation of the city must highlight the functional interdependencies present in the network of "multipolar centralities". In this regard, the research "Città medie e metropoli regionali" (Mascarucci, 2020),[2] using open data (OSM, Opendata Abruzzo) and statistical data (ISTAT), focused on studying the perimeter of the medium-sized city. The objective was to create an atlas whereby 30 medium-sized cities were analysed. These analyses were based on the use of four macro-categories: (i) area, (ii) city, (iii) centrality and (iv) urban amenities. The research has developed interpretative synthesis figures capable of restoring the spatial articulation of the intermediate urban system. Until now, intermediate systems were based on the role expressed by poles as the main providers of proximity services. The research "Città medie e metropoli regionali" has the merit of having opened up the debate on the level of organisation of urban services and territorial dynamics. This made it possible to identify the problems of the "metropolitan" dimension and the necessary design of new urban centralities.

In order to have an ideal geography, the research recognised the FUR (Functional Urban Areas-FUAs) (ESPON, 2006) and DMAs (Dynamic Metropolitan Areas) methodologies as useful tools to identify the perimeter of medium-sized cities. This approach has made it possible to restore the socio-economic structure and the links of functional interdependence between the different settlement

[1] "Demix" is a research commissioned by MiBACT (Ministero dei beni e delle attività culturali e del turismo) and DGAAP (Direzione Generale Arte e Architettura Contemporanea e Periferie Urbane) and coordinated by KCity.

[2] The research "Città Medie e Metropoli Regionali" was developed in the INU Research Community "Area Vasta e Dimensione macro-regionale" (Scientific coordination: Prof. Arch. R. Mascarucci).

systems. However, in order to highlight the concept of centrality, the research has integrated the classic statistical indicators with complementary categories for interpreting spatial phenomena (property values, accessibility, settlement continuity and modal interconnection). One of the main macro-categories adopted is centrality. This is the system of attractive places with a city-effect, defined by the assessment of the value of the heritage management, the level of urban density and the spatial spread of local tertiary activities. Therefore, centralities can be identified as architectural elements that generate a strong power of attraction or areas with a high identity value.

2.3 Pescara-Chieti: Post-pandemic Issues and the Metropolitan Dimension

Since 2014, the administrations of Pescara, Montesilvano and Spoltore wanted to merge municipalities. This strategy was named "Grande Pescara". However, the territorial issues that arose during the pandemic discouraged this plan. Due to the pandemic, the institution of "Grande Pescara" was ineffective, as it didn't consider the creation of a small metropolis. Today, the idea that emerges is the valorisation of the fusion of municipalities capable of fostering the development of activities and the territory. Therefore, the integration strategy cannot be based on the exclusive administrative merger between Pescara, Montesilvano and Spoltore. This would limit the development of the small regional metropolis.

Today, two main approaches to strategic planning are plausible. The first approach is based on the idea of the "city in spatial continuity", that is the union of contiguous territorial systems with certain affinities. The second approach considers the idea of the "functionally integrated city" and interprets the territory through the use of the new ISTAT category of "day-time population" (Bocca, 2021). This makes it possible to consider not only the system of the "city in spatial continuity", but also the urban systems (contiguous fragments) gravitating on the main pole (Pescara). Moreover, the ongoing process of metropolisation supports the goals of the UN Agenda 2030 for Sustainable Development and the post-pandemic economic revival.

To achieve these objectives, functional mergers can be made between municipalities' common goals, rather than mere programmatic mergers. Reference is made to the possibility of accessing funds from European programmes and the National Recovery and Resilience Plan (PNRR). The resulting idea is the characterisation of new land use based on the regeneration of the city's infrastructure and urban spaces. It highlights the need to favour the development of a renewed and sustainable habitat, starting from the design of roads for a real urban and territorial regeneration.

3 Methodology

The proposed work adopts the "Demix" research methodology, focusing not only on statistical issues and concentration of services, but also on the quality of urban space. This allows us to think about how urban quality can encourage a better urban experience. The first operation was a critical reading of the Labour market areas (LMAs) (ISTAT).[3] This reading reveals the density of economic relations in the area. These analyses show a socio-economic dimension that, looking exclusively at the perimeter of institutional geographies, is often not evident (or not at all) when considering multi-level governance. The analyses made on the Local Employment System check whether the municipalities included in the PUMAV[4] are able to reach their research goal. The evaluations show that an ideal geography could be built by the 9 municipalities of the PUMAV (Pescara, Montesilvano, Città Sant'Angelo, Spoltore, Manoppello, Chieti, San Giovanni Teatino, Ortona, Francavilla al Mare), with the integration of other administrations (Cappelle sul Tavo, Cepagatti, Silvi, Ripa Teatina, Torrevecchia Teatina). On this ideal perimeter, the gravitation of each municipality on the two poles of the conurbation Pescara-Chieti was calculated. Considering a gravitation of greater than 10%, this makes a ring of 20 municipalities, 5 of which have double gravitation (Cepagatti, Nocciano, San Giovanni Teatino, Torrevecchia Teatina, Francavilla al Mare) (Table 1).

In the identified perimeter there are different settlement realities, classified by ISTAT as inhabited centres, living centres, industrial localities and scattered houses. These categories have helped to define the spatial continuity, which extends into Abruzzo conurbation. Consequently, "spatial continuity" was defined as the built-up urban space characterised by morphological-spatial density, high accessibility and efficiency of public mobility services. In this regard, the category of built-up areas was selected as the most functional category for the identification of spatial continuity. This level of continuity showed the aggregates of contiguous or neighbouring houses with interposed streets, squares and the like, or in any case short continuity solutions with a variable value of around 70 m. This continuity is characterised by the presence of services or public facilities

[3] Labour market areas (LMAs, "local labour systems-SLL" in Italy) are sub-regional geographical areas where the bulk of the labour force lives and works. They are defined by commuting flows for work/study purposes recorded in the Census of Population and Housing.

[4] The PUMAV (Large Area Urban Mobility Plan/Piano Urbano della Mobilità di Area Vasta, 2007) was conceived as a reflection and inter-municipal consultation between settlement policies and infrastructure. Its strategic lines concerned: (i) regional metropolitan rail service (SFMR); (ii) the reorganisation of automotive services; (iii) the airport system; (iv) the interporto and logistics; (v) the port system.

Table 1 Commuting rate on Chieti and Pescara

Commuting rate on CHIETI					Commuting rate on PESCARA				
Municipality	Total population	Working population	Commuters	Commuting rate (%)	Municipality	Total population	Working population	Commuters	Commuting rate (%)
Bucchianico	5221	3420	1059	31	Cappelle sul Tavo	3959	2737	425	16
Casalincontrada	3153	2108	792	38	Cepagatti	10,449	6915	887	13
Cepagatti	10,449	6915	1236	18	Città Sant'Angelo	14,379	9442	1260	13
Francavilla al Mare	23,816	16,144	1586	10	Collecorvino	5908	3886	497	13
Manoppello	7008	4608	911	20	Francavilla al Mare	23,816	16,144	3002	19
Nocciano	1800	1202	115	10	Montesilvano	50,413	33,901	7986	24
Ripa Teatina	4188	2778	644	23	Moscufo	3264	2216	437	20
Roccamontepiano	1792	1136	202	18	Nocciano	1800	1202	181	15
Rosciano	3663	2478	497	20	Pianella	8437	5497	872	16
San Giovanni Teatino	12,733	8721	870	10	San Giovanni Teatino	12,733	8721	1985	23
Torrevecchia Teatina	4092	2709	528	19	Silvi	15,401	10,102	980	10
Villamagna	2437	1508	228	15	Spoltore	18,566	12,569	4099	33
					Torrevecchia Teatina	4092	2503	243	10

(school, public office, pharmacy, shop, etc.) that give an urban condition of autonomous social life. This condition creates attractions for the inhabitants of nearby urban areas for various reasons (worship, education, business, food supply). This determines the existence of a social life coordinated by urban centres (ISTAT)[5] in the compact city. Therefore, the city in spatial continuity is characterised by a high connection between the individual urban components (places of community life and economic development) in the urban grid that ensures the connection towards the "dust municipalities" of the hinterland of the Pescara-Chieti conurbation. The city in spatial continuity is made up of five municipalities (Pescara, San Giovanni Teatino, Montesilvano, Francavilla al Mare, Città Sant'Angelo), with three discontinuities (or linear gaps) near San Giovanni Teatino, Silvi and Ortona. This interpretation has implications for the spatial and territorial functioning of the conurbation: on the one hand, thanks to the indifference of amenities location, it determines favourable "urban conditions"; on the other hand, it determines effects on the shape of urban settlements. Thus, fragments are not only single entities on the territory, but an active part of spatial development. They can play an important role in the revitalisation of the area, provided that they consider not only governance issues, but also local vocation and identity. According to the methodology adopted, three discontinuities or linear gaps (>150 m) are evident: (i) to the north at the border between Silvi and Montesilvano, (ii) to the south in the municipality of Ortona and (iii) to the south-west in the municipality of San Giovani Teatino. It is important to note that Chieti's urban system remains outside the city in spatial continuity. This determines Pescara as the main pole of attraction of the compact city-system in spatial continuity. At the same time, around the compact city there are many urban fragments, defined as "conterminous fragments". These "conterminous fragments" could be potential centralities if effectively networked through an adequate design of the infrastructure network (Fig. 1).

These fragments behave differently according to the presence or absence of services and infrastructures. The presence of urban services determines the centrality and attractiveness of the urban fragment in comparison to the city in spatial continuity. In order to identify which neighbouring fragments are attractive, a census was made which shows the main urban services in the area (Fig. 2). This latter survey was based on the presence of: shopping centres (department stores, shopping centres, supermarkets); schools (nursery schools, primary and secondary schools, high schools and universities); public buildings and services (public buildings, courthouses, town halls and post offices);

[5] Glossary. Available online: http://dawinci.istat.it/daWinci/jsp/MD/misc.jsp?p=7.

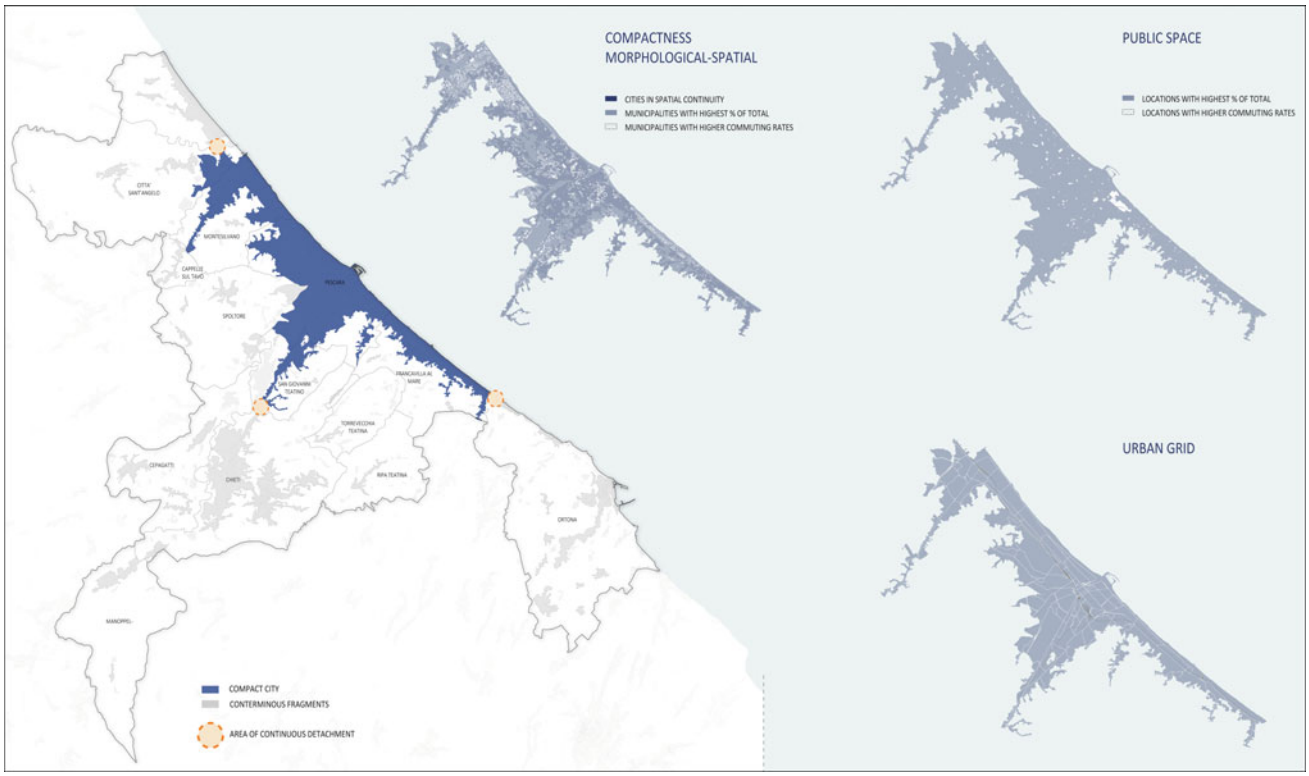

Fig. 1 Compact city and conterminous fragments

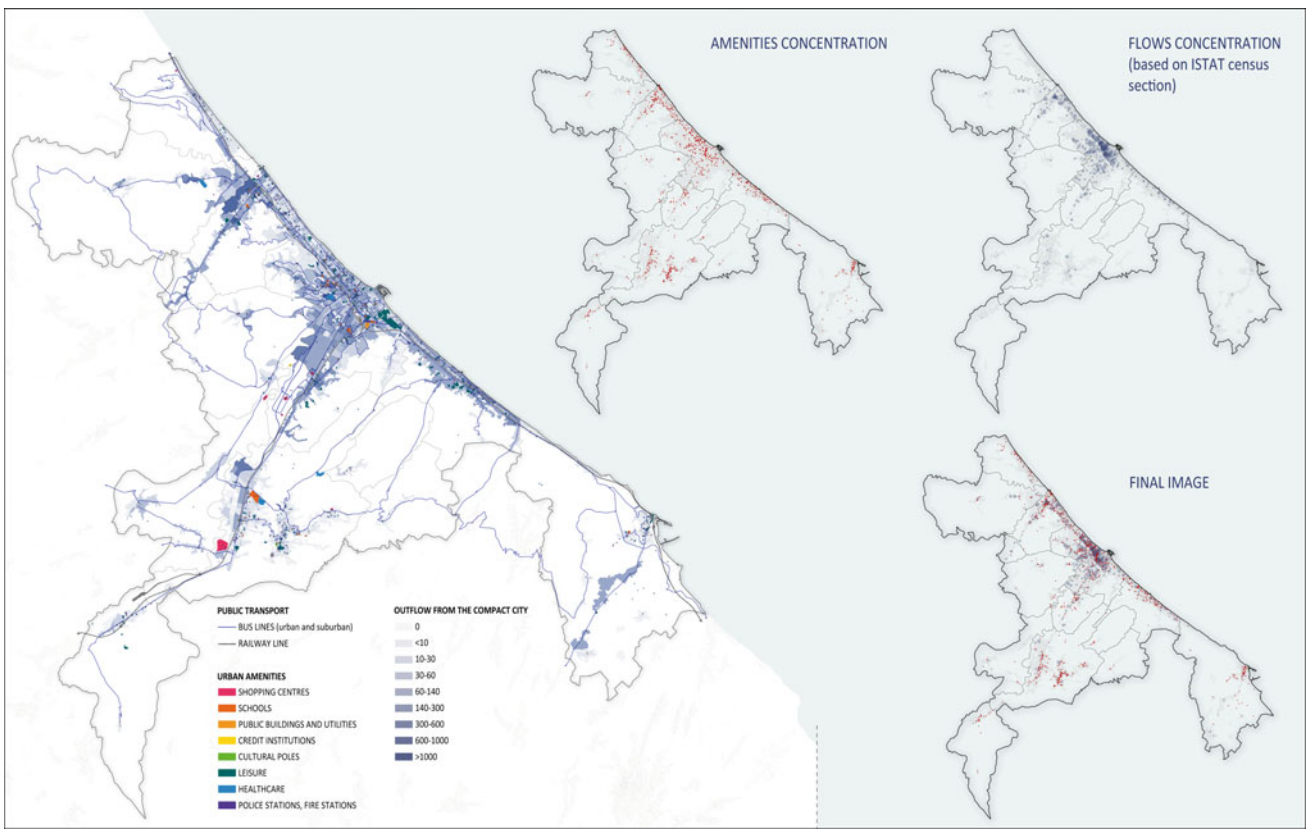

Fig. 2 Compact city and conterminous fragments: flow and urban amenities

credit institutions (banks and ATMs); cultural centres (cultural centres, works of art, castles, museums, monuments, libraries, memorials and theatres); leisure (stadiums, attractions, cinemas, parks, sports centres and swimming pools); health (hospices, doctors, hospitals, pharmacy); barracks (police stations, fire stations). Once the amenities were identified, the journeys between the different census sections were analysed. This analysis was made through the interpretation of the functional connections between the compact city and the "conterminous fragments". This analysis, based on the presence of public transport services, tried to define the "functionally integrated city". The evaluations made confirmed the tendency of the compact city to attract and self-contain most of the people flows in the study area.

Therefore, it is evident how the territory is characterised by multiple "spatial morphologies" that determine both social processes and the use of the metropolitan conurbation. In some cases, this has generated polarisation phenomena with an increase in geographical and socio-economic gaps. In addition, the health crisis and economic instability have revived the proximity dimension, as well as the promotion of local realities. The difference between centrality and polarity is obvious. It is shown in the creation of a polycentric network that is attractive to city users and promotes the area. A successful balance between attraction and self-containment generates urban well-being.

The next step was the definition of the "centrality index" (ISTAT), defined as the ratio between the incoming and outgoing flows from the single fragments, net of the employed people residing in the area considered. According to the calculations made, the higher the percentage value of the resulting flow, the greater the centrality in the territory. Moreover, the territory is crossed by different types of people on the move (city users, dynamic, static). Therefore, «the morphological and functional transformations of modern cities require not only the verification of daily flows related to workers, but also of the more sporadic flows created by the occasional consumers of the city» (Nuvolati, 2007). This urban condition is reflected in the emergence of new social relations in public and private spaces for different uses. In order to interpret the heterogeneous flow of dynamics on the territory, ISTAT (2020) has coined new definitions, including that of "day-time population". Based on the new definitions the index of attraction was calculated (1), self-containment (2) and coexistence (3).[6] These indices are useful to interpret the imbalance between the population using the territory and the resident population.

$$I_{attr} = \frac{A}{A+B+C} \quad (1)$$

$$I_{autocont} = \frac{A}{A+C} \quad (2)$$

$$I_{coe} = \frac{D}{E} \text{with} D = E + C - B \quad (3)$$

A = Incoming dynamics; B = Incoming dynamics; C = Outgoing dynamics; D = Day-time population; E = Resident population.

4 Findings

A comparison between the flows of the Pescara-Chieti conurbation and neighbouring fragments shows that some of the latter have a high level of centrality. Examples are Chieti and Città Sant'Angelo, both historical settlement systems as well as centres of higher-level services. Based on a morphological and typological analysis of the urban environment, the different taxonomies were identified in relation to the city-effect levels and the linear distance to the nearest higher-level census section. Using the definitions proposed by the "Demix" research, the following were defined (Fig. 3):

- *Sezioni contermini* or *Neighbouring sections*: These cannot be considered peripheral, despite low equipment. Moreover, the proximity to better equipped census sections results in regular and continuous configurations;
- *Sezioni soglia* or *Threshold sections*: These have clear elements of discontinuity, even though they are part of the surrounding urban system;
- *Agglomerati discontinui e conclusi* or *Concluded and discontinuous agglomerations*: These are complete urban fabrics, connected to the city in spatial continuity, but in discontinuity with it;
- *Costellazioni* or *Constellations*: These are independent urban sections that form a poorly endowed and diffuse urban system. These work over medium and long distances;
- *Insediamenti orbitanti* or *Orbiting settlements*: These are small fragments that live a relationship of attraction and dependence on the poles;

This has made it possible to explore the metropolitan territory and the condition of isolation that characterises the

[6] The statistics considered are part of the "Experimental Statistics" programme. To follow the path taken by Eurostat and other statistical institutes, ISTAT is experimenting with the use of new sources and the application of innovative methods in data production. The work is not yet finished. A first report of the Experimental Statistics was published in 2020, considering only some Italian settlement systems. Furthermore, due to lack of a full release of the new statistical dataset. The new ISTAT definitions were adapted to the 2011 commuting data, with some changes to the mathematical formulae. The conclusions elaborated are the responsibility of the author.

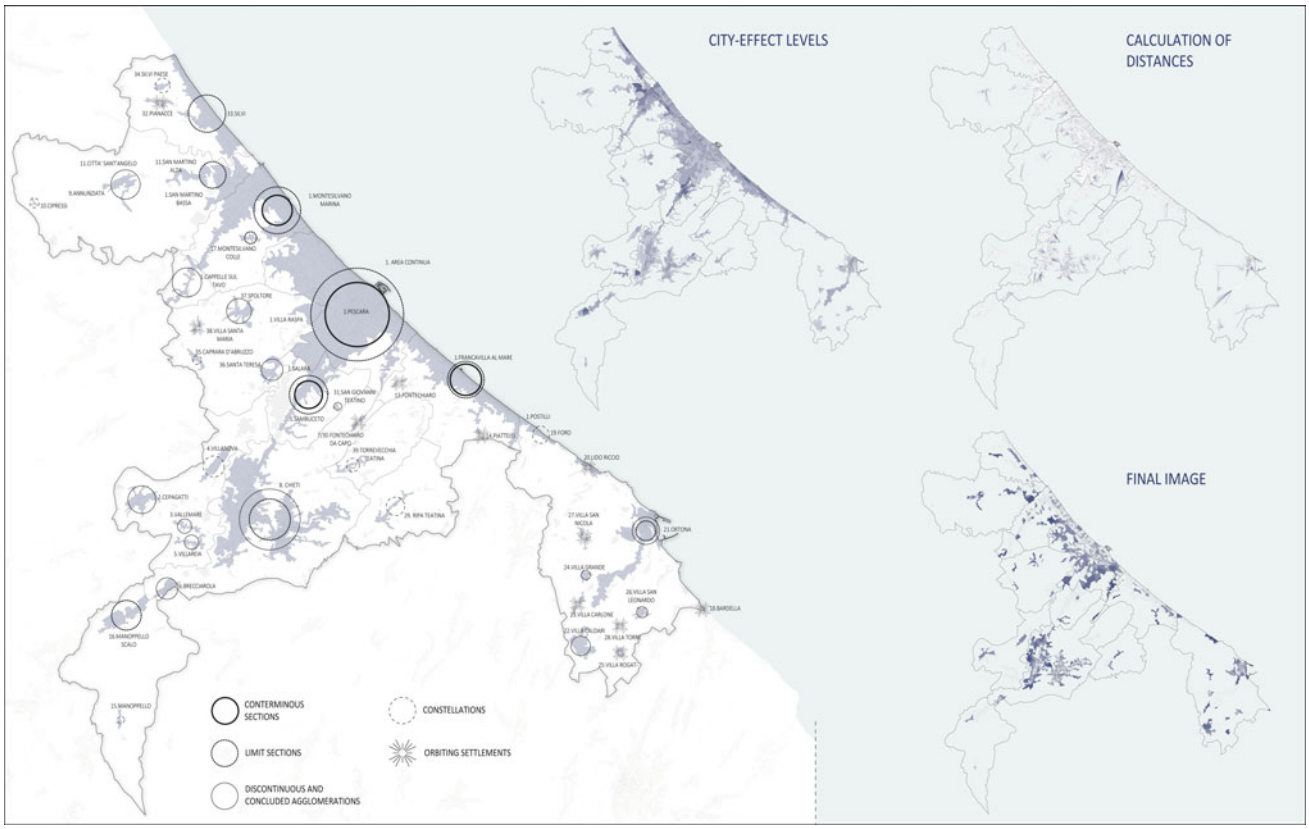

Fig. 3 City-effect

various fragments. The analyses highlight the functional rarefaction of some fragments, making it possible to identify those which can trigger the city-effect through spatial design. This condition would allow the fragments to go from being a territorial "ballast" to an active element of the Pescara-Chieti conurbation. However, these fragments could become hinges (or "pivots") of wide area systems. This urban planning strategy would decline space not only at a local level, but also at a territorial level (Mascarucci, 2021a; 2021b). The new "small metropolitan region" approach would include a "territorial triangle" between Ortona, Silvi and Manoppello. Such a functioning would counteract the loss of the role of centralities by encouraging the urban system to function with an «isotropic character» (Viganò, 2010). Considering the population movement in the area, this leads to a focus on the quality of spatial design and the level of accessibility of the "spatially continuous and functionally integrated city". This approach implies an «urban planning strategy that concerns […] mainly the physical part of the city […] of social inclusion and economic development» (Oliva & Ricci, 2017). It determines a configuration of a "city in spatial continuity and functionally integrated" that goes beyond the municipal boundaries of the main pole. These spatial analyses have shown the relationship between the compact city and services located beyond the geographical limits. The latter are waiting to be connected by a multipolar network through the design of new sustainable infrastructures.

These analyses, in addition to exposing a different approach to the planning of centrality networks, have highlighted the gap in the control of the design and image of public space. This underlines the lack of effective disciplinary management between the urban plan and the architectural definition of public space. In recent years, planning has focused on large-scale planning. However, urban quality cannot be guaranteed by this level of planning alone. It is the synthesis of personal satisfaction and social justification, creative processes and spatial performance. The revitalisation of the territory is hypothesised through a combination of different inputs: (i) motivational force and attractiveness of the place, (ii) universal accessibility, (iii) functional variety and mixed use of urban space, (iii) environmental well-being, and (iv) real and perceived safety. Thus, it is assumed that there is a direct link between the open and built space and the social practices that take place there. Based on the conceptual inputs presented, planning can initiate strategies within the centralities and urban sections identified

above. Beyond sectoral and technical approaches, urban design can move towards a new holistic and comprehensive approach to achieving urban quality.

5 Conclusion

Until now, the city has been identified as the hyper-centre where everything is concentrated in a single urban pole. Today, the quest for psycho-physical well-being and the creation of a city on a human scale has made it possible to discover the value of proximity and of smaller historic centres. It is clear that in order to revitalise an urban area it is not enough to restyle the square or emulate the historic urban palimpsest. Moreover, the 15-min city concept can be read as an idea extracted from the morphological and spatial setting of the network of religious and civil structures of the historical system. If we translate this design approach into the current urban planning season, it is clear that there is a need for essential services within a short distance, first of all in peripheral and marginal contexts. Unfortunately, talking about essential services, equipment and facilities means considering how these are interpreted exclusively in monetary terms. In fact, until now the minimum endowment (services and equipment) has been made to a "monetisation", often without this really regenerating the territory. Standards, services and equipment must evolve from an exclusively economic concept to a socio-ecological and performance-based one. However, the 15-min city approach is a partial answer to today's urban problems. The different types of sections and agglomerations studied can help to identify urban areas where strategies to ensure urban quality can be implemented. However, it would be necessary to rethink services in relation to each other, as well as to the "places of urbanity". It is an urban regeneration project capable of using skills and innovating public action and infrastructure. These considerations prompted institutions and researchers to focus mainly on the regeneration of the peripheral, which often suffer from social fragility, urban decay and lack of services.

Therefore, the continuous and progressive change in the role of urban places and territory must be supported by the construction of valid strategic visions. Urban space design must be able to activate dynamics in response to the need for recovery and resilience programmes (PNRR). Such a strategy would be able to answer positively to the environmental issues of the New Green Deal and the socio-economic recovery assets of the Recovery Plan. The planning requires the cooperation of cross-disciplinary expertise: (i) land and urban planning, (ii) economics, (iii) sociology, (iv) geography, (v) administrative law, (vi) management, and (vii) meteorology. We cannot continue to talk about social infrastructure if sociologists and geographers are not involved. It is impossible to talk about the fight against climate change without collaborating with meteorologists. The time of urban planners and architectures as actors-protagonists is over. The challenge is to understand to what extent they are able to ensure functional, adaptive and high-performance urban environments: it's time for synergy.

It is not a question of abandoning or radically rethinking the space-city, but of understanding what value they exert in the morphological, urban and socio-economic system both in the immaterial dimension and in the local and territorial one. The anthropic systems were stressed by urban concentrations, the wild consumption of land, economic crises and health emergencies, subordinating urban space to a residual element of the city. The space and multifunctional buildings can be the trigger of the newfound urbanity, especially if they are interconnected. These premises require urban environments to become once again "pivotal elements" of the "city-system" thanks to the presence of mixitè (social, environmental and cultural functions). The new configuration of medium-sized metropolitan conurbations requires the definition of a new concept of "multipolar centrality", investigating the new "rhythms of use" of the diffuse reticular city. It is evident that the intermediate urban system can be a strategic asset, if properly planned, for the revitalization and development of the territory. We need to start talking about systems of networked areas with the implementation of multi-level governance processes. These actions would characterise the urban planning project in order to strengthen the identity of local communities. Therefore, "centrality" can no longer be trivially identified as "polarity". Today, centrality takes the form of something new and flexible, integrated with the policies to increase urban quality. The centralities can represent the ability to ensure an adequate level of liveability through the reconfiguration of public space and the spread of the city-effect triggered by the policies and development strategies adopted. The centrality can represent the ability to be a "place" of interchange and relationship. This work aimed to reinterpret the contemporary city with new terms and design guidelines to abandon the planning of "undifferentiated urban space". The objective is the pursuit of an urbanity characterised by a multipolar network of centralities, understood as a complementary and synergistic structure of territorial and local development.

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References

Bocca, A. (2021). Effetto città: relazioni tra città medie e centralità. In N. Caruso, G. Pasqui, C. Tedesco, & I. Vassallo (Eds.), *Rigenerazione dello spazio urbano e trasformazione sociale. Downscaling, Rightsizing. Contrazione demografica e riorganizzazione spaziale, Proceedings of SIU National Conference* (Vol. 5, pp. 93–98). Planum Publisher, SIU-Società Italiana degli Urbanisti. https://doi.org/10.53143/PLM.C.521.

Brenner, N. (2015). Pensare lo spazio urbano senza più esterno. *I&C-Imprese & Città, 6*, 23–34. Retrieved April 10, 2021, from http://urbantheorylab.net/uploads/Brenner_2014_urban_theory_without_outside_Italian.pdf.

ESPON, European Spatial Planning Observation Network (2006). *The Role of Small and Medium Sized Town* (SMESTO). Retrieved May 10, 2021, from https://www.espon.eu/programme/projects/espon-2006/role-small-and-medium-sized-towns.

Gandy, M. (2014). Where does the city end? In N. Brenner (Ed.), *Implosions/explosions: Towards a study of planetary urbanization* (pp. 82–89). JOVIS Verlag GmbH. https://doi.org/10.1515/9783868598933-006.

ISTAT, Istituto Nazionale di Statistica. *Labour market areas (LMAs, "local labour systems-SLL" in Italy).* Retrieved May 10, 2021, from https://www.istat.it/it/informazioni-territoriali-e-cartografiche/sistemi-locali-del-lavoro.

ISTAT, Istituto Nazionale di Statistica. (2020). *Experimental statistic. Day-time population for study and work.* Retrieved May 10, 2021, from https://www.istat.it/en/archive/249905.

Mascarucci, R. (2020). *Città medie e metropoli regionali*. INU Edizioni.

Mascarucci, R. (2021a). Sistema urbano intermedio e aree montane. In F. Corrado (Ed.), *Urbano montano verso nuove configurazioni e progetti di territorio* (pp. 66–82). Franco Angeli.

Mascarucci, R. (2021b). Il progetto dello spazio urbano intercomunale. *Urbanistica Informazione, 292*, 75–76.

MiBACT-DGAAP (2017). *Demix. Atlante delle periferie funzionali metropolitane*. Pisa: Pacini Editore.

Nuvolati, G. (2007). *Mobilità quotidiana e complessità urbana*. Firenze University Press.

Oliva, F., & Ricci, L. (2017). Promuovere la rigenerazione urbana e la riqualificazione del patrimonio esistente. In E. Antonini, & F. Tucci (Eds.), *Architettura, città, territorio verso la green economy*. Edizioni Ambiente.

Viganò, P. (2010). *I territori dell'urbanistica: il progetto come produttore di conoscenza.* Officina.

Compactness as a Condition, Compaction as an Ambition—Potentials and Pitfalls of an Interdisciplinary Global Debate on the Compact City

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Abstract

The Compact City is discussed intensively in academia, with ambiguous and inconclusive outcomes regarding its contribution to sustainability. In the practice of urban design and planning, however, compaction is used globally—and largely uncritically—as a tool for sustainable development. Hence, there are large gaps in the communication between different academic disciplines, between academia and practice, and between different geographies. This paper aims to address these gaps by proposing a new way of structuring the Compact City debate and testing it through an extensive literature review as well as take-aways from an international symposium. The hypothetical premise is that the Compact City can be either a measurable *condition* of degrees and effects of compactness, or an *ambition* for compaction that is articulated by various actors. For compactness as a condition, it is found that a missing consensus on indicators makes it difficult to address existing research gaps through comprehensive studies. For compaction as an ambition, it is found that while policy analysts are mainly concerned with aligning compaction ambitions for more efficient practical application, urban theorists express fundamental concerns about the desirability of compactness. Drawing on discussions of the symposium, the paper shows that the hypothetical premise is suitable to reveal numerous deficiencies. Central issues include the introduction of multi-scalar approaches and the establishment of indicators beyond urban form. It is concluded that while the Compact City debate has an urgent need for reformation, it has the potential to make pragmatic, holistic, and interdisciplinary contributions to sustainable development.

Keywords

Compact city • Compactness • Compaction • Urbanization • Sustainable urban development • Literature review

1 Introduction

The Compact City is one of the leading paradigms in urban development (Bibri, 2020). The term was originally introduced by the US-American mathematicians Dantzig and Saaty (1973). While their actual proposal is merely discussed, their principles of high population density, high accessibility of public transport, and high degrees of mixed-use are commonly associated with the Compact City until today. More recent definitions try to simplify the concept into a combination of density and intensity (e.g., Garcia & Vale, 2017), but a common and specific definition of the Compact City is yet to be established (Burton et al., 1996; Lee et al., 2015; Neuman, 2005; Westerink et al., 2013).

In addition to the conceptual difficulties of the Compact City, its actual benefits are also constantly questioned: while the economic effects of urban compactness have shown to be mostly positive, its social and environmental effects are more ambiguous (Ahlfeldt et al., 2018). Furthermore, scholars have been criticizing the Compact City to be a simplistic antidote to urban sprawl (cf. Rode, 2018), and a tool to pursue neoliberal agendas (cf. Kjaeras, 2020). These concerns have led to significant skepticism towards compaction among researchers (cf. Neuman, 2005). However, this has not stopped practitioners from heavily promoting the Compact City: a majority of national governments worldwide have introduced policies for compact urban development (OECD, 2012). Despite continuous criticism in research, practitioners keep pushing the Compact City as "the most preferred model of sustainable urbanism for responding to the challenges of sustainable development" (Bibri, 2020,

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p. 1). This enthusiasm of practitioners is not supported by researchers.

The paradoxical nature of the Compact City makes it a controversial part of sustainable urban development. While much effort is put into empirical studies and the in-depth investigation of small aspects of the Compact City, little attention seems to be paid to the overall structure of the debate, methodological approaches, and the formulation of research agendas. This paper addresses these shortcomings. After shortly reiterating the motivations for a reformed way of discussing the Compact City, a possible structure for the debate is proposed: compactness as a condition, compaction as an ambition. This structure is tested through a qualitative literature review that gives a comprehensive impression of the deficiencies and potentials of Compact City research. Lastly, the suitability of the hypothetical structure is assessed by reflecting on its application in panel discussions during an international symposium organized by the authors. This leads to some remarks on how this majorly academic discussion can influence the practice of urban development. Hence, the paper tries to identify different strains of disciplinary discourses, structure them into sub-themes, and eventually contribute to a streamlined global debate for sustainable compaction.

2 Research Outline

Controversies in the debate on the Compact City are not new. Following the rapid increase of proponents of compaction in the 1990s, numerous unsolved issues regarding the sustainability and desirability of the Compact City remained. Authors emphasized issues such as the multi-scalarity of impacts and the fuzziness of policy recommendations (Burgess, 2000), as well as the threats of generalizing Compact City benefits across different geographies (De Roo & Miller, 2000). Today, it seems like little progress has been made: the majority of research on the Compact City is conducted in developed countries (Ahlfeldt et al., 2018), and most studies seem to take districts and neighborhoods as their main unit of observation. Furthermore, while scientific outputs on the Compact City have been steadily increasing in the last two decades (cf. Schraven et al., 2021), it seems like the share of *theoretical* research decreases: fundamental critical reviews of the 1990s and 2000s (e.g., Breheny, 1996; De Roo, 2000; Neuman, 2005) make the short list of such literature from the last decade (e.g., Kjaeras, 2020) look dismal.

It is for these reasons that the debate on the Compact City needs to be revived and restructured, particularly with regard to its ontology and epistemology. Therefore, this paper aims to form the starting point for establishing a structural outline of Compact City research that enables critical assessments of existing studies in order to identify gaps and misleading emphasis. The main research question is: *which conceptual structure can be used to observe advances in Compact City research, and how can this structure reveal deficiencies and potentials of the current debate on the Compact City?*

2.1 Premise: Compactness as a Condition, Compaction as an Ambition

In order to find an entry point into the contemporary debate, this paper starts with the hypothetical premise that research on the Compact City can mainly be categorized into two lines of thinking. The first line of thinking investigates the Compact City as a condition whose degrees and effects can be measured—*compactness as a condition*. The second line of thinking investigates the Compact City as being part of an agenda that different actors are thriving for—*compaction as an ambition*. Accordingly, Compact City research either focuses on compactness as a socio-economic condition of space that can be higher or lower, or it focuses on compaction as a strategic ambition of stakeholders that want to increase this condition. The investigation of compactness is more descriptive and empirical because it takes the condition of the built environment as it is. The investigation of compaction is more interpretive and exploratory because it is concerned with the values and intentions that drive the transformation of the built environment.

Compaction seems hard to understand without a sound definition of compactness. The paper will be structured accordingly. Going through the review allows for first assessments on whether or not the premise can be of use for structuring the Compact City debate, as mentioned in the first part of the research question.

2.2 Structure and Methods

This paper dives deep into research on the Compact City and thereby tries to identify crucial gaps within academic efforts. By investigating structures, topics, and methods, a concise overview of what is there and what is missing should be generated. While some short notes on the theoretical genesis of the Compact City were made above, the remainder of this paper focuses on the recent and current debate.

According to the structural premise presented above, the main body of this paper is divided into two sections: compactness as a condition and compaction as an ambition. For both sections, the selected literature is presented and discussed. The limitations of this paper do not allow for an in-depth review of each study. What is more interesting here is the synthesis of both the thematic focus points and the conclusions drawn from the conducted research. There is an

enormous amount of studies that use the terms Compact City, compactness, or compaction. But, as it will be shown, behind these terms there are very different understandings, beliefs, and intentions.

In order to explore the nuances of Compact City research, this paper is structured as a qualitative literature review—an *exploratory* approach that helps to "integrate what others have done and said", and to "identify the central issues in a field" (Creswell, 2014, p. 61). It is thereby also a form of content and discourse analysis that aims to build grounded theory through an *inductive* process of engaging with the literature (Berg & Lune, 2017). Such *meta-analytical* applied research is commonly used to reflect the openness and the broad range of inputs that influence research on the built environment (cf. Du Toit & Mouton). Finally, this approach is preferred here over a quantitative review because literature is not only used to form a theoretical basis, but also to constitute the research process itself. Nonetheless, some remarks on the selection of the literature need to be made.

Table 1 lists the literature that will be discussed in the subsequent chapters. The selection follows several criteria, but also occasionally diverts from them in order to present extensive and yet concise insights into the debate as well as to preserve the exploratory character of this review (cf. Creswell, 2014). To ensure the scholarly soundness of the literature, the focus lies on peer-reviewed journal articles. Additionally, some books and research reports were used (i.e., Ahlfeldt et al., 2018; Brenner, 2014; Ewing et al., 2002; Garcia & Vale, 2017; OECD, 2012; Rode, 2018). To keep the focus on recent advances in the debate, the focus lies on literature from 2010 or later. Six older sources were included to illustrate original arguments that were made earlier but are still deemed relevant. Within these criteria, sources were selected because they are either popular or original contributions to the debate. *Popular* articles were selected based on their appearance in either Google Scholar or Web of Science (see Table 1 caption for further explanation). *Original* articles were selected because they make significant and unique contributions to the debate that, to the best of the authors' knowledge, are not covered elsewhere. Based on these considerations, a total of 31 sources were chosen.

The discussion part of the paper will test the suitability of the two structural lines by confronting them with the discussions of a symposium on the Compact City. The symposium was hosted by the Hong Kong Polytechnic University's School of Design as a half-day online event in May 2021. It brought together several international scholars with relevant research expertise on this topic—much of which is discussed later in this paper. Adding insights from the symposium to this paper helps to strengthen the meta-analytical purpose of this review by adding another layer of discussion. The open character of a verbal debate also leads to statements that may be more straightforward than what is expressed in scientific articles, which is beneficial to conduct applied research (cf. Du Toit & Mouton, 2013). Eventually, this helps to guide towards the practical implications of this paper.

3 Compactness as a Condition

According to the structural premise presented above, this section provides an overview of academic research that conceptualizes the Compact City as a spatial condition of urban landscapes—compactness. This includes studies that take conventional features of the Compact City and explore their correlations with economic, social, and environmental characteristics of a given area. Titles such as "Effects of a Compact City on Urban Resources and Environment" (Shi et al., 2016) or "Is compact city livable? The impact of compact versus sprawled neighborhoods on neighborhood satisfaction" (Mouratidis, 2018) are typical examples of this approach.

Explicitly excluded from this review are studies that conceptualize the Compact City as a given, static context without specifying empirical characteristics or degrees of compactness. As much as such studies might contribute to similar debates that relate to sustainable urban development, they tend to confuse the Compact City debate by displaying compactness as a fixed category. Hong Kong, for instance, is often presented as a categorically Compact City (cf. Mathab-ub-Zaman et al., 2000; Tian et al., 2012). However, while it seems safe to agree that parts of Hong Kong show tremendously high degrees of building density, population density, and functional diversity, such general statements ignore the nuances within the city's territory, where spread-out monofunctional developments are commonly seen as well. This way of using the term Compact City thereby supports an oversimplified understanding of a highly complex and fluid condition. Tan and Rinaldi (2019) present a valuable example of how the complexity of compact urban development can be acknowledged without making it the main topic of discussion.[1]

[1] There is a risk of making false accusations here. Many scientific papers mention the paradoxical nature of the Compact City at some point, even though their titles and abstracts seem to suggest that the Compact City is a categorical condition. More in-depth investigations of this phenomenon could be valuable, but for the purpose of this paper it is sufficient to say that the Compact City should always be acknowledged with respect to its theoretical background and with an indication of specific definitions and indicators.

Table 1 Features of the literature discussed in this paper. "Popularity" means that the research appears in the top ten search results for "Compact City", "Urban Compactness", or "Urban Compaction" on Google Scholar or Web of Science—either in the list for "all-time" or since 2010 (accessed on December 3, 2020). "Originality" means that the research was manually chosen by the authors because it covers a unique aspect of Compact City research that is not covered elsewhere. "Exemplary" means that the research was only chosen to illustrate a specific phenomenon and therefore has limited relevance for the discussion of the Compact City debate.

References	Chosen based on popularity/originality/other?	Relevance for compactness as a condition?	Relevance for compaction as an ambition?
Ahlfeldt et al. (2018)	Popularity	Yes	No
Brenner (2014)	Broader theoretical context	No	Yes
Brenner and Schmid (2015)	Broader theoretical context	No	Yes
Burton (2002)	Popularity	Yes	No
De Roo (2000)	Popularity	No	Yes
Ewing and Hamidi (2017)	Originality	Yes	No
Ewing et al. (2002)	Popularity	Yes	No
Garcia and Vale (2017)	Originality	Yes	Limited
Kjaeras (2020)	Originality	No	Yes
Koziatek and Dragićević (2019)	Originality	Yes	No
Lee et al. (2015)	Popularity	Yes	No
Liu et al. (2014)	Originality	Yes	No
Martins (2012)	Originality	Yes	No
Mathab-ub-Zaman et al. (2000)	Exemplary	Limited	No
Merrifield (2013)	Broader theoretical context	No	Yes
Mouratidis (2018)	Popularity	Yes	No
Mouratidis (2019)	Popularity	Yes	No
Mubareka et al. (2011)	Popularity	Yes	No
Neuman (2005)	Popularity	Yes	Yes
OECD (2012)	Popularity	No	Yes
Raman (2010)	Popularity	Yes	No
Rode (2018)	Popularity	No	Yes
Rogatka and Ribeiro (2015)	Originality	Yes	No
Shi et al. (2016)	Originality	Yes	No
Stigt et al. (2013)	Originality	No	Yes
Swensen (2020)	Popularity	No	Yes
Swyngedouw (2006)	Broader theoretical context	No	Yes
Tan and Rinaldi (2019)	Originality	Yes	No
Tian et al. (2012)	Exemplary	Limited	No
Tsai (2015)	Originality	Yes	No
Westerink et al. (2013)	Originality	Yes	No

Source Authors

3.1 The (Empirical) Knowledge Gap

Probably the most comprehensive study to date on the effects of compactness was commissioned by the OECD (i.e., Ahlfeldt et al., 2018). In a review of more than 300 scientific papers, the authors synthesize relations between three main characteristics of the Compact City—economic density, morphological density, and mixed land use—and a total of 15 outcome dimensions that are categorized as either economic, social, or environmental. This comprehensive review leads to some crucial statements both on the effects of compactness as well as on the state of compactness-related research itself. Firstly, positive effects of compact urban form are most clearly found in economic dimensions such as productivity, innovation, and value of space. For social and environmental dimensions, the effects are more ambiguous: while compactness positively influences social equity, safety, and sustainable mode choice, it has negative effects on factors such as health, well-being, and biodiversity (Ahlfeldt et al., 2018). This imbalance is exacerbated by the focus of existing research: almost eighty percent of the examined studies (256 out of 321) measure compactness through economic density, "typically measured as population or employment density" (Ahlfeldt et al., 2018, p. 12). Less than four percent measure the effects of mixed land use. Lastly, the majority of research on compactness "has been conducted in cities in high-income countries" (Ahlfeldt et al., 2018, p. 5). Hence, simply speaking, research on compactness seems to be heavily skewed towards confirming the positive economic effects of economic density in rich countries. There is a clear gap regarding comprehensive assessments of compactness as a condition by considering more than just high concentrations of people. To find potential remedies for the deficiencies revealed by Ahlfeldt et al. (2018), several approaches to Compact City research are discussed hereafter. The focus lies on finding ways of supporting a holistic understanding of both the constituents and the effects of compactness as a condition. Furthermore, the studies presented hereafter develop their analysis with specific considerations of Compact City theory, which makes them more *active* contributions to the debate than the often fragmented individual studies that formed the basis for the OECD report.

3.2 Indices

The first approach to discuss here is the development of Compact City indices. Many attempts to develop a Compact City index have been made, and the outcomes are as diverse as the definitions of compactness itself. Distinctions can be made between the choice of indicators for compactness, the choice of related datasets, the synthesis of indicators into a single index, and the applicability to different contexts. While most existing indices take the conventional measures of density, accessibility, and mixed-use as the basis, their translations of broad categories into specific indicators vary significantly (Lee et al., 2015). Early examples are Burton's (2002) list of indicators to measure compactness in the UK, Ewing et al.'s (2002) sprawl index for the US, or the confrontation of indicators for sprawl and compactness developed by Neuman (2005). More recent examples tend to be more spatially specific (e.g., Koziatek & Dragićević, 2019; Mubareka et al., 2011; Shi et al., 2016) and attempt to introduce multiple scales of analysis (e.g., Ewing & Hamidi, 2017; Koziatek & Dragićević, 2019; Lee et al., 2015). Assessing these indices individually is beyond the scope of this paper, but it can be argued that holistic indicator sets, multi-scalar and specific measures, and applications in multiple geographies are beneficial to advance the Compact City debate. Eventually, a critical synthesis of existing indices is of course needed to move towards an academic consensus.

While the development of an index represents important groundwork to explore compactness as a condition, it does not specify how to measure *the effects* of compactness. As mentioned above, Ahlfeldt et al.'s (2018) literature review uses a lot of studies with very specific thematic focus points and places them within the conceptual framework of the Compact City. Empirical studies that explicitly position themselves within the Compact City debate seem to be rather scarce. Some exceptions are discussed hereafter.

3.3 Social and Environmental Effects of Compactness

There are several more or less recent studies that present empirical investigations of the *social* effects of urban compactness. Livability and well-being are typical concepts here. Compactness is often measured through simple but consistent data related to density and mixed-use, and statistical measures are used to draw links between causes and effects (cf. Mouratidis, 2018, 2019; Raman, 2010; Rogatka & Ribeiro, 2015). The spatial scales of investigation are rather small, analyzing several neighborhoods in a country or region (Mouratidis, 2019; Raman, 2010) or across a single city (Rogatka & Ribeiro, 2015).

Some studies investigate both social and environmental effects of urban compactness. One of them was published by Westerink et al. (2013), who investigate peri-urban areas in European city-regions and present an extensive literature review on the Compact City that is synthesized into a list of "sustainability claims" (p. 478) related to compactness,

including the categories social, environment, economic, and resilience. The results of their analyses underline the problem of "trade-offs" related to compactness. Another such study by Liu et al. (2014) investigates "the relationship between urban compactness and CO2 efficiency in China" (p. 92). This topic is obviously mostly related to environmental issues, but the authors also include some considerations of "urban CO2 social efficiency", measured through the relationship between emissions and welfare indicators. Similar to Westerink et al. (2013), they conclude by pointing out trade-offs in the effects of compactness. In both studies, data on the city-regional scale are compared.

When it comes to studies that focus purely on environmental effects of compactness, an issue arises: while Liu et al. (2014) still mention some references to Compact City theory, other environmental studies rarely mention such a theoretical framework. For instance, Martins (2012) and Schindler and Caruso (2014), who both focus on correlations between urban compactness and air pollution, use common references from Compact City theory (e.g., Burton et al., 1996; Neuman, 2005), but exclusively refer to their empirical findings. Therefore, it is questionable if these studies should be considered to be comprehensive contributions that can advance the Compact City debate as a whole, or if they are specialized studies that rather use the Compact City as a vague label to frame their investigations. Either way, an important observation to be made here is that studies with an environmental focus (cf. Liu et al., 2014; Martins, 2012; Westerink et al., 2013) tend to conduct comparative studies on city-regional scales, while studies with a social focus (cf. Mouratidis, 2018, 2019; Raman, 2010; Rogatka & Ribeiro, 2015) investigate smaller spatial scales, especially neighborhoods.

3.4 Compactness as a Condition—Conclusion

The review of studies that investigate compactness as a condition shows that even though the knowledge gaps of empirical research on the Compact City are obvious, studies that holistically address the effects of compactness within a solid framework of Compact City theory remain sparse. Missing consensus on the plethora of indices makes it difficult to address multiple issues at once: if each paper tries to outline a "new" indicator system before it proceeds to its application, it is only logical that the considered effects are limited. However, since "measuring the effect of compaction […] is a very complex task" (Garcia & Vale, 2017, p. 135), such comprehensive approaches are needed to advance the Compact City debate and form a strong link between theoretical concepts and their empirical application.

4 Compaction as an Ambition

The previous section laid out the broad range of approaches to measure the degrees and effects of urban compactness. This descriptive approach is mostly explored through empirical research, and occasionally leads to concrete policy suggestions to be used in practice. Such suggestions typically include cautionary notes on trade-offs, ambiguities, and context specificities related to compaction (e.g., Ahlfeldt et al., 2018; Liu et al., 2014; Neuman, 2005; Westerink et al., 2013). However, as mentioned earlier, there is a dominating assumption among policy-makers—and maybe among urban practitioners in general—that compact urban form is a desirable condition. This might also explain the tremendous support for urban compaction articulated by leading voices on urban development around the world (e.g., European Commission—Directorate General for the Environment, 2017; UN-Habitat, 2017, 2020; World Bank, 2021). Not much of the caution expressed by academics seems to make it into the practical discourse on sustainable urbanization. Hence, a specific look into research on ambitions for compaction is needed.

The selection of literature for this section is twofold. Firstly, and similar to the review of compactness as a condition, empirical research with a focus on policy analysis is discussed. This includes studies that analyze existing policies that claim to be based on Compact City principles or are likely to affect compactness features. Secondly, more theoretical studies are discussed, representing attempts from urban geography and urban studies to critique the conceptual foundation of the Compact City. This review does not include non-scientific primary sources like governmental policy documents or strategic outlines by public institutions, because the synthesis of such sources would exceed the scope of this paper. As for the previous section, the focus lies on studies published in 2010 or later, in order to get an impression of the recent debate on compaction.

4.1 Policies

Just like compactness as a condition, compaction as an ambition can be best introduced by a study published by the OECD. The report "Compact City Policies: A Comparative Assessment" (OECD, 2012) analyses and compares policies for compact urban growth around the world. It also makes suggestions for improved compaction policies, based on the assumption that such policies "can help achieve the economic and environmental benefits of green growth." (OECD, 2012, p. 21). It is argued that compaction has been mostly promoted in relation to its environmental benefits through urban containment, but more attention should be

paid to the potential contributions of compaction to economic growth. This shows how this policy analysis (i.e., OECD, 2012) was approached in a much more normative way than the literature review published six years later (i.e., Ahlfeldt et al., 2018).

The report's basic definition of compactness fits well into the general consensus: "dense and proximate development patterns", "urban areas linked by public transport systems", and "accessibility to local services and jobs" (OECD, 2012). It is concluded that such features can support economic growth, for instance, because they "make public service delivery more efficient and promote agglomeration economies" (OECD, 2012, p. 74). Even though some remarks on the need for robust quantitative underpinnings are made, and the difficulty of applying the same principles to different geographies is mentioned, the general message of the report is that Compact City policies *should* be enforced. The issue rather lies in the coordination and harmonization of policies (OECD, 2012).

Rode (2018) takes a similar approach in his book "Governing Compact Cities: How to Connect Planning, Design and Transport". He presents an extensive review of research on the Compact City, and also explicitly discusses critiques of urban compaction. He does, however, take the position "that compact urban growth is a central component of a more sustainable global development pathway." (Rode, 2018, p. 2). He later specifies this by stating his acceptance "that certain cities have bought into this agenda and here I focus on related institutional implications." (Rode, 2018, p. 24). Just like the OECD (2012), he therefore aims to support the optimization of existing policies because it can be considered to be the most efficient way towards sustainable development. Both Rode (2018) and the OECD (2012) analyze policies on the city scale.

Besides these two in-depth studies, some papers focus on more specific parts of compaction policies. Here, a typical field of interest seems to be pointing out tensions between compaction and other concerns, such as environmental policy integration (Stigt et al., 2013), heritage conservation (Swensen, 2020), or meeting housing demands (Tsai, 2015). As for compactness, some of these studies make rather shallow links to the Compact City in their theoretical frameworks and use rather conventional indicators of compact urban form. Tsai (2015) points out that "definitions of compactness/ sprawl are static" (p. 2443), and proposes a more dynamic approach for measuring compaction over time.

4.2 Critical Urban Studies

To conclude the overview of literature on compactness and compaction, some theoretical studies with critical views on urban compaction as an ambition are presented. Much of the critique on urban compaction builds upon the conflict that is commonly called the Compact City "dilemma" (De Roo, 2000) or the Compact City "paradox" (Neuman, 2005): while compact urban development can be beneficial for open landscapes, it can also create and increase issues for urban areas themselves. Neuman (2005) argues that compactness contradicts the dominant desire for suburban lifestyles—at least in Western societies. There is an "inverse relation of the sustainability of cities and their livability" (p. 15). These qualitative observations underline the ambiguous outcomes of the empirical studies presented above, and they emphasize the risk that is posed by the widespread enthusiasm for compaction in practice. Thereby, the Compact City paradox links to critical urban theory.

There is little *recent* research known to the authors that draws links between the Compact City from the perspective of urban morphology and the broader field of urban studies. As this paper shows, most studies on the Compact City are quantitative (spatial) data analyses, qualitative policy analyses, or syntheses of evidence found in the two former types. A recent exception is represented by Kjaeras (2020), who develops a critique on the application of the Compact City with regard to its exclusive focus on urban form as well as its operation within fixed urban units. The former is supported by Neuman (2005), who argues for the importance of understanding that urban flows constitute urban form. For the latter, Kjaeras (2020) refers to Swyngedouw (2006) and Brenner and Schmid (2015) to argue that urban development in one place is likely to have effects on other—occasionally far-away—places. These "multiple elsewheres" (Kjaeras, 2020, p. 12), that are merely considered in Compact City research, are an essential part of the theory on planetary urbanization.

Planetary urbanization is a complex concept that is founded in a long history of urban studies. As the name suggests, it mainly proposes that processes of urbanization are of an increasingly global and all-encompassing extent, and that various transformational dynamics constitute the contemporary landscapes of a capitalist society (cf. Brenner, 2014; Brenner & Schmid, 2015; Merrifield, 2013). Discussing the concept as a whole is beyond the scope of this paper, but what is of particular importance for the Compact City is the idea of "concentrated urbanization" and its relation to "extended urbanization" (Brenner & Schmid, 2015). Concentrated urbanization describes processes of clustering, agglomeration, and intensification of human activities into cities and regions that make them "central arenas and engines of massive urban transformation" (Brenner & Schmid, 2015, p. 167). These processes have been extensively discussed in urban disciplines, and much has been said about both the potential that urban concentrations offer as well as the inequalities that they create. Such theoretical arguments reveal numerous ways of critique towards urban compaction,

many of which have been discussed earlier in this paper. A critique that is less often articulated stems from the relation to extended urbanization, which Brenner and Schmid (2015) describe as the processes that require expansions of urban territories and flows, and create what they call "operational landscapes" that are both created and required by the urban concentrations described beforehand. Against this background, Kjaeras (2020) notes that "the way in which a city urbanises matters to far-off places with no obvious connection to this specific city" (p. 9). This understanding reinforces and expands concerns about the negative socio-environmental effects of urban compaction that were presented beforehand. Furthermore, it raises the issue that ambitions for compaction are increasingly driven by economic considerations, and that the positive environmental connotation of the Compact City is used as a vehicle for the exploitation of urban landscapes.

4.3 Compaction as an Ambition—Conclusion

While policy analysis shows little criticism towards compaction and focuses mostly on internal alignments, theoretical studies present a highly critical perception of the Compact City. Judgments of this discrepancy should be made with caution, because it is of course the purpose of policy analysis to contribute to better practical frameworks, and it is the purpose of urban theory to take a critical and more external perspective on urbanization processes. Nonetheless, this section shows that it is highly beneficial to approach the Compact City from both these perspectives, as it helps to draw a more complete and sophisticated image of a paradigm that is often used and discussed superficially. While the more practice-oriented side of research seems deeply invested in the idea of sustainable compaction, scholars with a theoretical focus have fundamental concerns regarding the desirability of compactness.

5 Discussion: Take-Aways from an International Symposium

The main body of this paper shows the wide range of existing research on the Compact City and proposes a potential way of structuring it into two lines of thinking. Based on the comprehensive review by Ahlfeldt et al. (2018), compactness as a condition is discussed through studies that propose indices as well as studies that investigate the social and environmental effects of compactness. Compaction as an ambition is discussed through research that focuses on the analysis of Compact City policies as well as theoretical literature that takes a more critical position towards the conceptual basis of compaction. In order to address the research question of this paper, the final issue to discuss here is whether the structural premise is suitable to advance the Compact City debate. A quick look into the take-aways from the symposium mentioned above can help with this.

The two panels of the symposium were roughly divided in accordance with the two lines of thinking presented in this paper.[2] While one panel focused on measuring and assessing compactness and its effects in both quantitative and qualitative ways, the other panel focused more on the theoretical and conceptual backgrounds that make up the desire for compaction. The panelists were economists, architects, urban designers, urban planners, policy analysts, and geographers, which created some of the interesting interdisciplinary confrontations that one might desire based on the literature. Thereby, the expertise in the symposium was well aligned with the range of studies presented above.

The panel that discussed compactness as a condition brought up two main points that support the observations of this paper. Firstly, a sound definition of indicators, or the synthesis of existing indicators respectively, is needed. The panelists thereby agreed with the observations made above that there are multiple indicator systems and indices, but little effort is being made to synthesize them into a consistent and comprehensive set of measures. Particularly *morphological density* (Ahlfeldt et al., 2018) requires more specific definitions. Secondly, the panelists agreed that indicators beyond the measurement of urban form are needed, which is in line with theoretical literature (e.g., Kjaeras, 2020; Neuman, 2005). Specific indicators discussed in the panel were diversity and the intensity of interactions. An issue that remained unresolved during the panel discussion was the relation between context-specific studies and more global syntheses of the effects of compactness. While the panelists agreed that both are needed, little insights were gained with regard to how one can feed into the other while neither losing the specificity of a locality nor the desire for generalized bench-marking.

Figure 1 presents a simplified overview of how different bodies of literature as well as the panel discussions led to a series of statements on the shortcomings of the Compact City debate. While the panels mostly confirmed the above-mentioned deficiencies of the Compact City debate, they spark thoughts about the refinement of the structural premise proposed here. Issues of an exclusive focus on urban

[2] The discussion on compactness included Gabriel Ahlfeldt, Shibu Raman, and Kostas Mouratidis. The discussion on compaction included Brenda Vale, Martin de Jong, Kristin Kjaeras, and Gerhard Bruyns. The symposium was moderated by Henry Endemann. For more information on the schedule and topic of the event, see www.sd.polyu.edu.hk/en/event/compact-city-international-symposium (last accessed on December 9, 2021).

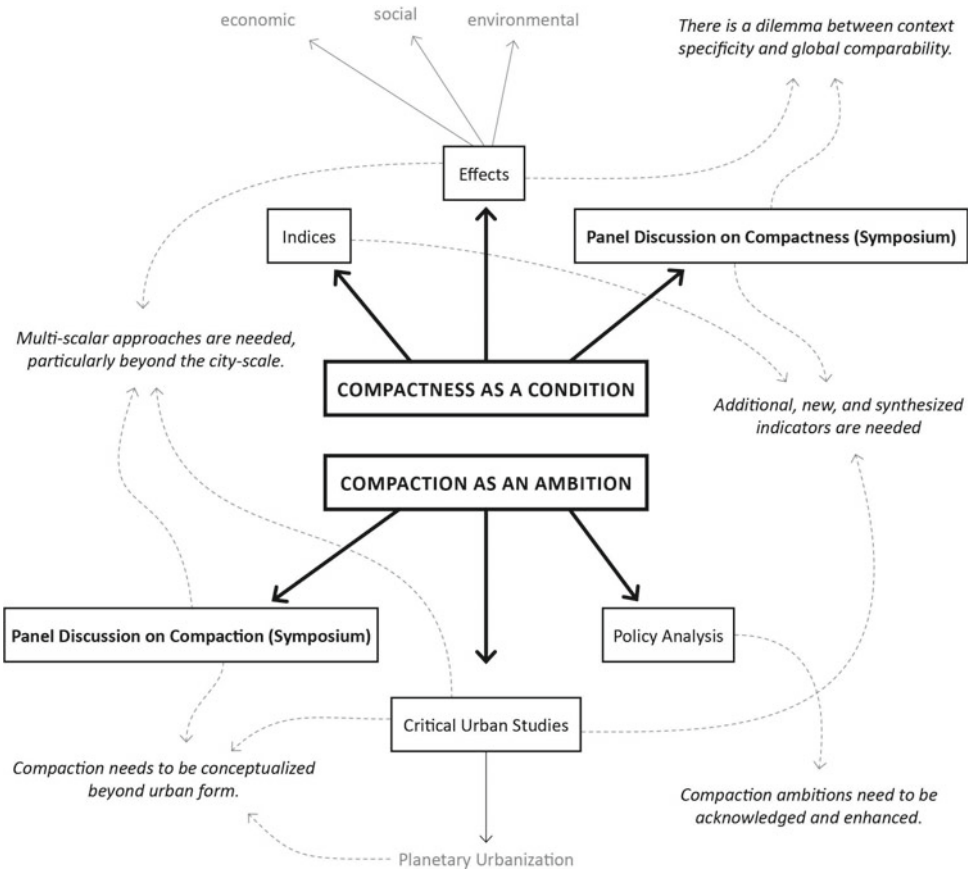

Fig. 1 Mind map of the different elements of the review on compactness and compaction, including the sub-themes that constitute the two lines of thinking (black boxes and black arrows), and the simplified statements that can be drawn from the different bodies of research and discussion (text in italics and dashed grey arrows). *Source* Authors

form, economic density, and city districts are mentioned in the literature, and they are reinforced by the panelists. The same applies to the need for consistent indices. But there are certain overlaps in the focal points of the two lines of thinking. Both the panel on compactness and the panel on compaction led to discussions on indicators. However, while the panel on compactness talked very specifically about indicators for morphological density, diversity, and intensity, the panel on compaction spoke more broadly about the scales and types of indicators to be chosen in the first place. Opposed to the structure in this paper, this can be interpreted as a suggestion that the discussion on compaction should *precede* the discussion on compactness. It can also be interpreted in the sense that the discussion on compaction is less well defined and requires more "work". Either way, while the discussion on compactness seems to have a more consistent scholarly foundation, both compactness and compaction have various unresolved issues.

6 Conclusions

The structural premise of compactness as a condition and compaction as an ambition has proven to reveal a multitude of deficiencies in recent research on the Compact City. The overlay with the panel discussions suggests that the premise is an effective way of giving an order to the debate. Nonetheless, the degree of consensus in the compactness-discussion seems higher than in the compaction-discussion. One reason for this might be the disciplinary discrepancy between practice and theory that was identified in the literature review: the desire of practitioners to pursue compact urban development does not only lack support from empirical research, but it also lacks a robust structure that scholars could use to approach urban compaction more systematically. This underlines the importance of establishing a discourse between critical theory and its efficient practical application. Continuing and advancing this discourse is thereby a crucial task for future research that requires more than just quantification and empirical synthesis—as identified in the compactness-discussion. Eventually, a productive form of theory-building through concrete applications (cf. Storberg-Walker, 2003) is most likely to be achieved through a more frequent academia-practice discourse that uses synthesized empirical research to lead to constructive strategic guidance.

The deficiencies in the academic debates that this review reveals also have several implications for practice. Most importantly, the Compact City cannot be used as a blueprint strategy. It does have benefits, but they are highly dependent

on the degree, scale, and type of compaction. This also means that, to some extent, the widespread desire for urban compaction needs to be acknowledged. The research on Compact City policies reviewed in this paper shows some direction on how to work with—not against—compaction ambitions. However, these studies do not provide strategic directives and design guidelines that not only *react* to existing policies but also actively try to *affect* stakeholder agendas. A major shortcoming in the existing research is, therefore, a systematic investigation of alternative modes of compaction—neither accepting nor rejecting the Compact City, but critically challenging and testing it.

Despite numerous deficiencies and challenges, this paper also presents some promising potentials of the academic debate on the Compact City. Most importantly, the multiple disciplines concerned with the Compact City enable a comprehensive scholarly debate with holistic implications for various fields. An interdisciplinary debate makes it possible to communicate issues and suggestions to a variety of actors. Cross-disciplinary collaborations and the strong link to sustainability can lead to research that is highly sought-after in the current academic environment. Such a broad range of involved disciplines may also help to match scholarly work with the daily operations of practitioners.

Lastly, the Compact City debate could have the potential to contribute to sustainable development without the pressure of comparable paradigms: as research by Schraven et al. (2021) shows, the Compact City receives constant attention in academia since several decades, but did not experience a rapid jump in research activity like it was the case for the Eco City, the Sponge City, or—above all—the Smart City. This might spare the Compact City debate from activities that try to buy into a trendy topic, and instead enable a reasonable and rational development towards a useful, operational principle for sustainable urbanization. This positive possibility should, however, not hide the fact that the Compact City debate is already being harmed by inflated expectations from urban practitioners.

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References

Ahlfeldt, G., Pietrostefani, E., Schumann, A., & Matsumoto, T. (2018). *Demystifying compact urban growth: Evidence from 300 studies from across the world*. OECD. https://www.oecd-ilibrary.org/development/demystifying-compact-urban-growth_bbea8b78-en

Berg, B. L., & Lune, H. (2017). *Qualitative research methods for the social sciences* (9th ed.). Pearson.

Bibri, S. E. (2020). Compact urbanism and the synergic potential of its integration with data-driven smart urbanism: An extensive interdisciplinary literature review. *Land Use Policy, 97*, 104703. https://doi.org/10.1016/j.landusepol.2020.104703

Breheny, M. (1996). Centrists, decentrists and compromisers: Views on the future of urban form. In E. Burton, M. Jenks, & K. Williams (Eds.), *The Compact City: A Sustainable Urban Form?* (pp. 44–55). Taylor & Francis Group. http://catdir.loc.gov/catdir/enhancements/fy0651/96083466-d.html.

Brenner, N. (2014). *Implosions / explosions: Towards a study of planetary urbanization*. Jovis Verlag.

Brenner, N., & Schmid, C. (2015). Towards a new epistemology of the urban? *City, 19*(2–3), 151–182. https://doi.org/10.1080/13604813.2015.1014712

Burgess, R. (2000). The compact city debate: A global perspective. In M. Jenks, & R. Burgess (Eds.), *Compact cities: Sustainable urban forms for developing countries* (pp. 9–25). Spon Press.

Burton, E. (2002). measuring urban compactness in UK towns and cities. *Environment and Planning b: Planning and Design, 29*(2), 219–250. https://doi.org/10.1068/b2713

Burton, E., Jenks, M., & Williams, K. (1996). *the compact city: A sustainable urban form?* Taylor & Francis Group. http://catdir.loc.gov/catdir/enhancements/fy0651/96083466-d.html.

Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). SAGE Publications.

Dantzig, G., & Saaty, T. (1973). *Compact city: A plan for a liveable urban environment*. Freeman.

De Roo, G. (2000). Environmental conflicts in compact cities: Complexity, decisionmaking, and policy approaches. *Environment and Planning b: Planning and Design, 27*(1), 151–162. https://doi.org/10.1068/b2614

De Roo, G., & Miller, D. (2000). *Compact cities and sustainable urban development: A critical assessment of policies and plans from an international perspective*. Ashgate.

Du Toit, J., & Mouton, J. (2013). A typology of designs for social research in the built environment. *International Journal of Social Research Methodology, 16*(2), 125–139. https://doi.org/10.1080/13645579.2012.657013

European Commission - Directorate General for the Environment. (2017). *Indicators for sustainable cities*. Publications Office. https://data.europa.eu/doi/https://doi.org/10.2779/121865.

Ewing, R., & Hamidi, S. (2017). *Costs of sprawl*. Taylor & Francis.

Ewing, R., Pendall, R., & Chen, D. (2002). *Measuring sprawl and its impact*. Smart growth America. https://trid.trb.org/view/724911.

Garcia, E., & Vale, B. (2017). *Unravelling sustainability and resilience in the built environment* (1st ed.). Routledge. https://doi.org/10.4324/9781315629087.

Kjaeras, K. (2020). Towards a relational conception of the compact city. *Urban Studies*, 0042098020907281. https://doi.org/10.1177/0042098020907281.

Koziatek, O., & Dragićević, S. (2019). A local and regional spatial index for measuring three-dimensional urban compactness growth. *Environment and Planning B: Urban Analytics and City Science, 46*(1), 143–164. https://doi.org/10.1177/2399808317703983

Lee, J., Kurisu, K., An, K., & Hanaki, K. (2015). Development of the compact city index and its application to Japanese cities. *Urban Studies, 52*(6), 1054–1070. https://doi.org/10.1177/0042098014536786

Liu, Y., Song, Y., & Song, X. (2014). An empirical study on the relationship between urban compactness and CO2 efficiency in China. *Habitat International, 41*, 92–98. https://doi.org/10.1016/j.habitatint.2013.07.005

Martins, H. (2012). Urban compaction or dispersion? An air quality study. *Atmospheric Environment, 54*, 60–72. https://doi.org/10.1016/j.atmosenv.2012.02.075

Mathab-ub-Zaman, Q., Lau, S. Y., & Mei, S. H. (2000). The compact city of Hong Kong: A sustainable model for Asia? In M. Jenks, & R. Burgess (Eds.), *Compact cities: Sustainable urban forms for developing countries* (pp. 255–268). Spon Press.

Merrifield, A. (2013). The urban question under planetary urbanization. *International Journal of Urban and Regional Research, 37*(3), 909–922. https://doi.org/10.1111/j.1468-2427.2012.01189.x

Mouratidis, K. (2018). Is compact city livable? The impact of compact versus sprawled neighbourhoods on neighbourhood satisfaction. *Urban Studies, 55*(11), 2408–2430. https://doi.org/10.1177/0042098017729109

Mouratidis, K. (2019). Compact city, urban sprawl, and subjective well-being. *Cities, 92*, 261–272. https://doi.org/10.1016/j.cities.2019.04.013

Mubareka, S., Koomen, E., Estreguil, C., & Lavalle, C. (2011). Development of a composite index of urban compactness for land use modelling applications. *Landscape and Urban Planning, 103*(3), 303–317. https://doi.org/10.1016/j.landurbplan.2011.08.012

Neuman, M. (2005). The compact city fallacy. *Journal of Planning Education and Research, 25*(1), 11–26. https://doi.org/10.1177/0739456X04270466

OECD. (2012). Compact city policies: A comparative assessment. *OECD*. https://doi.org/10.1787/9789264167865-en

Raman, S. (2010). Designing a liveable compact city: Physical forms of city and social life in urban neighbourhoods. *Built Environment, 36*(1), 63–80. https://doi.org/10.2148/benv.36.1.63

Rode, P. (2018). *Governing compact cities: How to connect planning, design and transport*. Edward Elgar Publishing Limited. http://ebookcentral.proquest.com/lib/polyu-ebooks/detail.action?docID=5233942.

Rogatka, K., & Ribeiro, R. R. R. (2015). A compact city and its social perception: A case study. *Urbani Izziv*, *26*(1), 121–131. JSTOR.

Schindler, M., & Caruso, G. (2014). Urban compactness and the trade-off between air pollution emission and exposure: Lessons from a spatially explicit theoretical model. *Computers, Environment and Urban Systems, 45*, 13–23. https://doi.org/10.1016/j.compenvurbsys.2014.01.004

Schraven, D., Joss, S., & de Jong, M. (2021). Past, present, future: Engagement with sustainable urban development through 35 city labels in the scientific literature 1990–2019. *Journal of Cleaner Production, 292*, 125924. https://doi.org/10.1016/j.jclepro.2021.125924

Shi, L., Yang, S., & Gao, L. (2016). Effects of a compact city on urban resources and environment. *Journal of Urban Planning and Development, 142*(4), 05016002. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000324

Stigt, R., Driessen, P. P. J., & Spit, T. J. M. (2013). Compact city development and the challenge of environmental policy integration: A multi-level governance perspective. *Environmental Policy & Governance, 23*(4), 221–233. https://doi.org/10.1002/eet.1615

Storberg-Walker, J. (2003). Comparison of the Dubin, Lynham, and Van de Ven theory-building research methods and implications for HRD. *Human Resource Development Review, 2*(2), 211–222. https://doi.org/10.1177/1534484303002002007

Swensen, G. (2020). Tensions between urban heritage policy and compact city planning – A practice review. *Planning Practice & Research, 35*(5), 555–574. https://doi.org/10.1080/02697459.2020.1804182

Swyngedouw, E. (2006). Circulations and metabolisms: (Hybrid) Natures and (Cyborg) cities. *Science as Culture, 15*(2), 105–121. https://doi.org/10.1080/09505430600707970

Tan, P. Y., & Rinaldi, B. M. (2019). Landscapes for compact cities. *Journal of Landscape Architecture, 14*(1), 4–7. https://doi.org/10.1080/18626033.2019.1623540

Tian, Y., Jim, C. Y., & Tao, Y. (2012). Challenges and strategies for greening the compact city of Hong Kong. *Journal of Urban Planning and Development, 138*(2), 101–109. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000076

Tsai, Y.-H. (2015). Housing demand forces and land use towards urban compactness: A push-accessibility-pull analysis framework. *Urban Studies, 52*(13), 2441–2457. https://doi.org/10.1177/0042098014538681

UN-Habitat. (2017). *New urban agenda*. United Nations. https://habitat3.org/the-new-urban-agenda/.

UN-Habitat. (2020). *World Cities Report 2020: The Value of Sustainable Urbanization*. United Nations. https://unhabitat.org/World%20Cities%20Report%202020

Westerink, J., Haase, D., Bauer, A., Ravetz, J., Jarrige, F., & Aalbers, C. (2013). Dealing with sustainability trade-offs of the compact city in peri-urban planning across European city regions. *European Planning Studies, 21*(4), 473–497. https://doi.org/10.1080/09654313.2012.722927

World Bank. (2021). Pancakes to PYRAMIDS: City form to promote sustainable growth. *World Bank*. https://doi.org/10.1596/35684

Liveable Urban Open Spaces for Health and Wellbeing. Towards the Careggi Campus Landscape Masterplan for Florence University-Hospital

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Abstract

Spatial fragmentation and congestion have become increasingly apparent in cities, also due to the functional specialization of open spaces. Such phenomena also affect the accessibility of the public realm and therefore urban liveability. With this in mind, it seems necessary to turn public open spaces into dynamic and flexible places that can induce wellbeing and develop a shared identity. Urban open spaces that relate to hospitals and universities play a double role in terms of the specific functions of care, research, learning, innovation, and the overall liveability of the city in which they provide collective services. The ongoing "Careggi Campus" research deals with the case study of Florence University-Hospital as an important part of the broader urban network of public open spaces. In this complex, over twenty thousand people per day use the fragmented and cluttered open spaces, which clearly fall short when it comes to accessibility and liveability. The research aims to produce a landscape masterplan focused on transitioning from a street-based model of mobility and accessibility towards a people-based network of liveable places. In this context, accessibility is a complex driving criterion for landscape design to investigate how the hospital's open spaces could perform as a high quality network and sustain health by providing wellbeing and fostering lifestyles changes. A main topic of research is how this collective system can host the existing wide variety of permanent functions and spontaneous uses without creating conflict and dysfunction. As the new Urban Sustainable Mobility Plan promotes an innovative vision for public transport, active mobility and intermodal parking lots, rethinking hierarchies between the active mobility of vehicles and people within the University-Hospital could lead to a sustainable transformation of its landscape.

Keywords

University-hospital • Urban open spaces • Liveability • Accessibility • Health campus

1 Context

Spatial fragmentation and congestion have become increasingly apparent in cities, also due to the functional specialization of open spaces. Fragmentation is not just a key concept in ecological landscape studies, but also in sociological urban ones (Piroddi & Colarossi, 1991; Madanipour, 1999, 2005; Parker et al., 2012; Mela, 2014; Dayo-Babatunde et al., 2019; Kärrholm & Wirdelöv, 2019). Fragmentation is also considered with regard to the relationships between single open spaces and the urban landscape (Romaniak et al., 2014; Kilić et al., 2019) and the concept of tissue (Piroddi & Colarossi, 1991), but it also matters at the scale of single open spaces (Carmona, 2010), especially in the urban landscape and with regard to the public realm. The splitting of open spaces into sections with a functional specialization makes each part less than the whole, not just when it comes to the unitarity and expressiveness of its image but also in terms of its 'breath' and the related capacities to meet and support different needs and use loads. Such phenomena have affected the accessibility of the public realm and as a result urban liveability. Open spaces are often cluttered, also because spatial congestion caused by objects, signs and signals is added to factors such as the size of vehicles and people flows. With this in mind, it seems necessary to turn open spaces into dynamic and flexible places capable of inducing wellbeing and developing a shared identity. The most visionary, meaningful and effective contemporary experiences include critical proposals by Jan Gehl

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(2010) and initiatives carried out by his agency (Tsay & Gold, 2017). Furthermore, according to Gustafson, Porter and Bowman (2021), research by designing uncluttered and barrier-free places emerges as a key for more healthy and liveable cities: it 'clears' spaces, but also fosters non-motorised mobility (Forsyth et al., 2009). Since Buchanan's main work "Traffic in Towns" (MoT, 1963) highlighted the need to tackle the problem of cars in cities many contributions to this issue have been made in scientific discourse and professional practice. Design for sustainable mobility has become relevant and attempts to understand which quality features are needed to encourage walking and cycling and enhance the identity of places in cities while reducing the danger produced by vehicles. Different approaches have emerged to accommodate through design all the functions that streets require from this perspective. "Woonerf", a term first coined by Niek de Boer in 1965, refers to residential areas where vehicles conform to pedestrian and cyclist rules, and "complete streets" emphasize the need for a comprehensive design for users of all abilities and with all kinds of transportation. Besides, "democratic streets", in Mark Francis' theory (2016), deal much more with the concept of collective use and social equity, and "shared streets", as promoted by Hans Monderman, involve the removal of signage for the self-regulated sharing of space among all users and vehicles. This research also provides an insight into this last approach to better explore its implications in landscape design.

2 Health and Wellbeing in Urban Open Spaces and in Hospital Spaces

As cities change due to interdependent economic, social and environmental phenomena, their public spaces are both objects and subjects of transition for local, national and international authorities.

The WHO Regional Office for Europe states the importance of public open spaces for citizens' health and wellbeing (WHO, 1997), considering them as resources that can develop and preserve good qualities. In the urban landscape, everybody and everything is connected through open spaces. The accessibility of the whole public realm depends on its outdoor components and their relationships. Life flows through the free open spaces of streets, squares, gardens and parks, reaching other open spaces for specific uses and all public and private buildings. So if the urban network of public open spaces has good properties it can protect health and provide wellbeing, but on the contrary, it may be unhealthy and unable to induce perceptions of comfort. For two decades, the health paradigm has been renewed with rightful concern for the social and environmental features of urban habitats and implications for urban planning processes to create a city more hospitable for the weakest people and therefore capable of fostering wellbeing among us all (Duhl & Sanchez, 1999). The WHO Shanghai conference (2016) linked health promotion to the sustainable development goals adopted by the UN in 2015 (Kickbusch & Nutbeam, 2021). So the Division of Policy and Governance for Health and Wellbeing of the WHO Regional Office for Europe relates to "five interdependent strategy directions" to implement the 2030 agenda for sustainable development; among them we have considered the statement of intent "establishing healthy places, settings and resilient communities" (Menne, 2018; WHO, 2021b). This requires integrated multifunctional visions and actions capable of dealing with the complexity of such contemporary urban issues and challenges. For instance, if we agree on the importance of dealing with climate change and the related heat-health risks (WHO, 2021a) we must consider the improvement of urban habitat performances as the main topic, that is making landscape transitions that not only create more sustainable buildings but that also have more efficient open spaces to provide essential ecosystem services for hygro-thermal comfort. Such a goal, however, cannot be pursued through a sectoral strategy because it could specialize in open spaces while projects and works should aim to "encourage the multi-use of public spaces and co-existence among citizens" (WHO, 1997). In fact, if on the one hand reducing congestion and providing freedom of action foster liveability in urban environments (Rahman et al., 2015), on the other many studies consider the benefits for people's health brought about by habitats with good quality open spaces. These depend on a set of active factors involving both the presence of trees (Salmond et al., 2016) and biodiversity in general (Brown & Grant, 2005), as well as the use of nature-based solutions (Kabisch et al., 2017), the availability of green spaces (Nutsford et al., 2013; Pietilä et al., 2015; Sugiyama et al., 2018) and more generally sustainable urban environments (Bentley, 2013) and outdoor recreational activities (Mackintosh et al., 2016; Poulain et al., 2020). Other studies identify and assess the benefits of green spaces from a clinical point of view (Schweitzer et al., 2004; Lee & Maheswaran, 2010; van den Berg et al., 2015), a context in which the "Erice 50 Charter" sets out some main topics concerning healthy cities (D'Alessandro et al., 2017). Other scholars focus on design as a tool for health promotion (Jackson, 2002; Springer et al., 2017) and highlight the social benefits of green spaces as levers in terms of their effects on health (Jennings & Bamkole, 2019).

On a related note, wellbeing also emerges as a compass for urban strategies involving open spaces as a resultant of several psychological and physical factors such as thermal comfort (Taleghani, 2018; Dunjić, 2019; Lai et al., 2019; Abdi et al. 2020; Antonini et al., 2020; Gatto et al., 2020),

morphological (Peng et al., 2021) and biological (Wood et al., 2018) spatial diversity, mental perception (Wang et al., 2019), life-course changes (Douglas et al., 2017), accessibility (Francis, 1998; Evcil, 2012; Game Tobias & Batista Ferreira, 2014), walkability effects and options (Abraham et al., 2010, Duwall, 2011, Marcus Johansson et al., 2011), relationships with plants (Ulrich & Parsons, 1992) and the effects of their visibility from indoor spaces (Elsadek et al., 2020).

All the issues mentioned also matter with regard to hospitals and universities with both common and specific meanings, needs, and opportunities. Furthermore, the influence of green spaces on people's health and wellbeing are fully evident in literature from more scientific fields, as can also be argued according to the above cited papers and has been highlighted with specific regard to university campuses (Lau et al., 2014) and hospitals too. In the Campus Forest vision created for the Queen Elizabeth II Medical Centre in Perth, health is core in clinical research and education. The masterplan is based on a powerful set of design goals: "amplifying health and wellbeing; a strong campus identity; cooling campus (reducing the carbon footprint); extending green infrastructure; refuge, respite and active and passive places to meet; and a highly legible public realm linking key places and facilities" (Sharley, 2019).

In such a context, our research focuses on the Florence case study and seeks a framework, items, and first and foremost a cultural approach to a landscape-based masterplan to develop a university-hospital campus on a site that has undergone a century's worth of building densification and fragmentation and shrinkage of open spaces. To tackle this situation, we considered the hypothesis that a network of liveable and attractive places could play a double role in both the specific activities of healthcare, research, learning, innovation, and the overall liveability conditions of the city in which both the hospital and the university provide collective services. With this comprehensive goal in mind, we see accessibility as a driving criterion underlying landscape projects for hospital open spaces capable of sustaining health by providing wellbeing and fostering lifestyle changes. A literature review on designing open spaces for healthcare facilities (Shukor et al., 2012) considers seven key categories: "location and view", "accessibility", "layout and space", "seating arrangement", "planting", "design details", "practical services". They describe the cross-cutting qualities of open spaces, which have meaning everywhere and for everything in the urban landscape, and also of all hospitals, but in the review accessibility to green spaces is considered more for acute care hospitals. Another review indicates accessibility to green spaces as a key quality, but in this case with regard to the features of the spaces (Weerasuriya et al., 2019).

In brief, the main topic of the research is how a public campus can host a wide variety of permanent functions and spontaneous uses of a university-hospital avoiding functional conflicts and dysfunction, providing healthcare and promoting wellbeing also through safe, inclusive and resilient open spaces for a sustainable habitat (UN, 2015).

3 'Careggi Campus': The Research Position and Its Ongoing Investigation

The Careggi Campus research deals with the case study of Florence University-Hospital as a specific and meaningful part of the wider and interconnected urban network of public open spaces. More than twenty thousand people per day - patients, visitors, workers, students – use the fragmented and cluttered open spaces, which are barely accessible and fairly unliveable. The research therefore aims to produce a landscape masterplan focused on the transition from a road-based model of mobility and accessibility towards a people-based network of shared places for widespread outdoor liveability. Changing the inner mobility is the main condition to free up space for people and for the hospital to function optimally. At present, several private vehicles access and park in the hospital's open spaces with no real need to do so and occupy space used by people moving about and spending time outdoors, creating many dysfunctional interferences of different flows, also for the mobility of service vehicles.

However, matching the word campus with university-hospital is not a simple issue and it seems useful to pinpoint its meaning. The word implies both spatial features and functional structures as its earliest meaning referred to university settlements in the US. But nowadays it is also commonly used to talk about digital universities and research centres. So the functional dimension of the word 'campus' seems to be the most taken into account, even if the spatial features matter too. Despite this, we previewed the research hypothesis on Florence University-Hospital focused on the network of open spaces (Cristiani & Paolinelli, 2020) with the awareness that they really matter. Some of the following topics identify the concept we are investigating to facilitate an effective master-planning process. Different operators use vehicles to provide services to many buildings in the hospital area, so the campus cannot be considered an urban park due to the presence of several buildings and the related need for services provided by vehicles. The urban canon of the road will not be necessary for service vehicle flows. People will enjoy plant formations everywhere, also from the hospital's interior spaces. So the campus tissue has to be different from that of a common urban district. Furthermore, we have considered some spatial complementary keys for designing: closed/open; barrier/

threshold; homogeneous/heterogeneous; indoor/outdoor; abiotic/biotic; pervious/impervious; shady/sunny; dedicated/shared; able/disable; uncluttered/cluttered; temporary/permanent. Finally, because accessibility also depends on the identity and communication of places, the hospital management should develop and implement an integrated way-finding strategy. Last but not least, sustainability represents a major challenge when it comes to the energy transition of the whole future campus and requires the architectural integration of technologies to preserve open spaces from further soil mineralization and spatial occupation. We shared with the General Management of Careggi University-Hospital a framework covering the implementation of a masterplan over two decades through a step-by-step process of change. This timeframe is meaningful for many environmental and social reasons, one of which seems interesting to mention. Because there has been a hospital on the site for a century, it has mature and senescent trees. Consequently, the campus masterplan could be seen as an urban forestry strategy with a wide planting plan/program: by conserving some existing trees and planting new ones over two decades, the species' different speeds of growth will result in the vegetal heterogeneity of the landscape.

4 Open Space Features at Careggi University-Hospital

Some different needs have to be met in an integrated functional vision that reclaims the fragmented and congested open spaces network of the hospital. At the same time, the common need for wellbeing and ethical health issues requires effective answers.

The settlement covers around 75 hectares and several buildings were developed on it over time with progressive additions and juxtapositions instead of a real overall project. Both patches of countryside and historic architectures interface the urban spaces of the hospital. Many streets cross the length and breadth of the area, affecting the life within it: the spatial canon of the urban road and its uses is everywhere, even if it is not necessary, so much so that congested places are found next to others that are almost completely isolated.

Because the research process challenges the potential of the open spaces, it considers most buildings as unavoidable constraints with regard to their position, surface, height, entrances, safety exits and use. So both the morphometric relationships between buildings and open spaces and the sizes of the latter matter when it comes to investigating the hypothesis of a transition towards a barrier-free, uncluttered, accessible and attractive network of outdoor places on a sustainable campus. At present, the open spaces are inappropriately taken up by private vehicles both moving around and parked, and by the chaotic distribution of street furniture. A widespread lack of accessibility compromises the availability of spaces for people with motor and/or sensory disabilities. In general, the lack of architectural identity creates discomfort and disorientation. In short, there is a problem with landscape architecture: the open spaces are more the result of many building transformations than places designed for people where expressiveness and properties could fit for promoting wellbeing and health.

Some photos (Figs. 1, 2, 3, 4, 5 and 6) show the current situation of congestion in open spaces and of fragmentation sometimes in really narrow places and a map shows the distribution of users within them (Fig. 7). But in the sections of three street corridors (Figs. 8, 9 and 10) we can also see their potential for spatial transition. Imagining them as empty spaces, the design possibilities reveal free spaces of different sizes, allowing us to understand their real 'breath' and seize opportunities for change to meet a wide range of general and specific needs.

Fig. 1 Open spaces along Viale San Luca: pedestrians are forced into narrow spaces due to the dominance of the spatial canon of the urban road

Fig. 2 Viale San Luca: the spatial canon of the urban road is dominant without a real need for it inside the hospital's open spaces

Fig. 3 Parking areas have been designed as merely useful spaces with no architectural care for the surrounding environmental and social properties

Fig. 6 The street-scape is a de facto shared place, dysfunctional and uncomfortable because the inner mobility is again more focused on cars than on people

Fig. 4 Outdoor life everywhere is affected by vehicles and people moving around and spending time in narrow and/or cluttered spaces

Fig. 5 Pedestrian spaces are often empty as they are barely accessible and decidedly incongruous

5 Early Research Outcomes

A qualitative investigation of users and their daily overlaps provides a design framework for some basic questions. Which users move around and stand about in the University-Hospital collective spaces? What needs do they have regarding open spaces? How are they distributed throughout the spaces of the whole complex and at different times of the day? Users have been gathered into six categories: healthcare professionals, other workers, students, patients, ambulatory or day hospital patients and visitors. These categories have in common the way people use the open spaces, which does not necessarily require vehicles. So the analysis considered pedestrian users to focus on the public realm as a place where relationships can develop. The needs were grouped into six categories: parking, having lunch or other breaks, observing nature, moving around or spending time outdoors, waiting in line for medical services, and celebrating events such as graduation. The study of the distribution of the users' types within the open spaces began with cataloguing and localizing the different services within the hospital buildings. By identifying the distribution of the activities hosted indoors, it was possible to detect how many categories of users overlap in the pavilions. With this knowledge, we studied the indoor concentration of the six categories. The buildings currently abandoned or temporarily inaccessible due to works and the decommissioned or refurbished pavilions have been highlighted.

Based on the distribution of users within the buildings, a graphic diagram (Fig. 7) shows the typological density of people's interaction in open spaces: a colour gradient from black to light grey shows where all the categories overlap and those where just one category makes meaningful use of

Fig. 7 Coexistence of users in the open spaces: dark to light dots indicate the typological density of users (healthcare professionals, other workers, students, patients, ambulatory or day hospital patients and visitors)

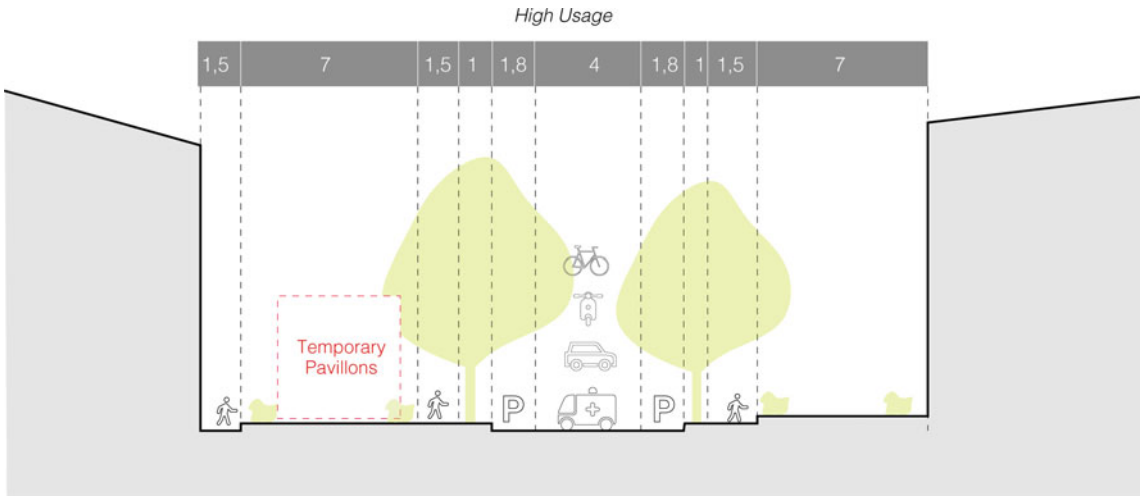

Fig. 8 A cross-section of Viale San Luca, the main axis of the University-Hospital settlement

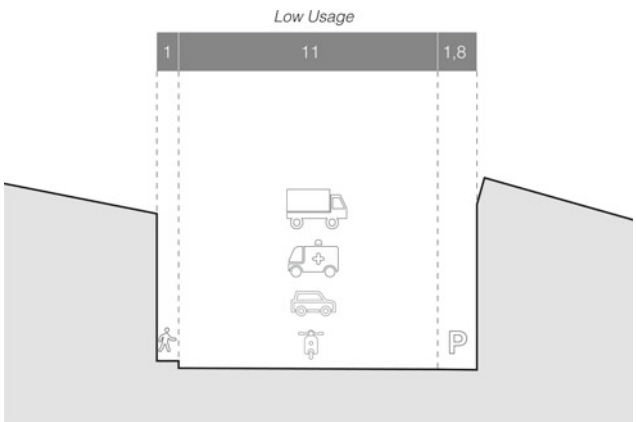

Fig. 9 Cross-section on Viale della Maternità

the outdoor spaces; areas that are currently inaccessible are in yellow. The graphic use of dots aims to communicate the non-infrastructural nature of the open spaces and to portray them as sequences of related places. The map highlights the different presence of users in the southern area compared to the northern one, which is almost completely occupied by a single category of users or at most two.

Seeing how user categories interact led to the articulation of needs within the open spaces with regard to the concentration of people in space and time. The polyclinic currently encourages more use of the open spaces in the southern area than those in the north as they have fewer functions and there are more logistic, technological, technical, and administrative activities. The exception in the northern area

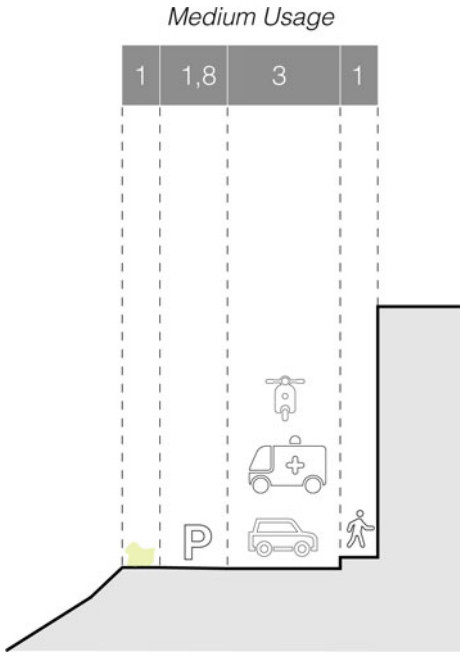

Fig. 10 Cross-section on Via Lungo il Rio Freddo

is where there is a significant presence of health and university training facilities and research departments.

Moreover, the research studied the streets for a short series of the main features in the spatial corridors: width between the buildings or buildings and open spaces, and also between open spaces; height of the buildings and/or trees; horizontal shapes, regular and homogeneous or irregular and heterogeneous; type of use, pedestrian, cyclist and similar, vehicular; use load, classified into high, medium, low. This study of streets and flows, currently unsupported by numerical data, was conducted through direct observation of the dynamics. It aims to identify the potential degree of space transformation with the main goal of removing fragmentation and functional separation and providing comfortable and efficient spaces to be shared by people and vehicles as a founding principle of the campus vision. It could improve accessibility, functional flexibility and the capability of spaces, also in the future transformations of the hospital often brought about by departments moving from one pavilion to another.

As the new Metropolitan Sustainable Mobility Plan of Florence promotes an innovative vision for public transport, active mobility and intermodal parking lots, rethinking the hierarchies between vehicles and people within the University-Hospital could lead to a sustainable transformation of its landscape. In short, a new framework is needed for mobility to improve accessibility and liveability. So, if a car-free environment effectively promotes health (Nieuwenhuijsen & Khreis, 2016), a similar choice is both possible and called for on a university-hospital campus. On the one hand, the only people that really need to park private cars on the campus themselves are disabled persons. Furthermore, for the latter, it is more important to have little car parks for two-four vehicles well spread and integrated into the spatial tissue, than few wide specialized parking areas too far for good accessibility. On the other hand, the hospital's operational framework requires some vehicle flows both inside the area and outside it. The inner distribution of goods and services could also improve by adopting more silent and smaller electric means, but the flows and how they interfere with the pedestrian and cycle routes requires great improvement, which could be achieved through private mobility management change in a car-free model. The open spaces have become more and more fragmented and congested, and are now dysfunctional; this is a fact, but despite it, analysis and critical thinking about their features and uses reveal good potential for change.

In order to meet the basic needs of people and provide widespread conditions of wellbeing in a liveable urban habitat, the existing open spaces could be converted into a network of uncluttered and barrier-free places with shared paved surfaces and green strips capable of promoting mental and physical health and lifestyles evolutions too.

6 Critical Issues

Nowadays there is growing interest in the contribution to healing provided by outdoor spaces in healthcare facilities and a deeper understanding of the need for more integrated functioning between hospitals and cities. At the same time, the notion of an university campus superimposed on the city is being surpassed by a more widespread and interconnected exchange pattern among different cultural, economic and educational services within the urban areas.

These studies result in an overall understanding of the present chaotic and congested mixed-use of open spaces where various needs merge without enough space to be well separated, and streets are heavily occupied by vehicles. So it seems necessary to overcome the typological canon of urban roads moving towards a more inclusive and integrated design of shared spaces for slow flows of people and vehicles and widespread opportunities for staying and parking. As a place of technique, innovation and culture, a university-hospital should be the appropriate context in which to experiment and foster progress in terms of sustainability for health and wellbeing, promoting and driving a cultural transition that could evolve lifestyles and consequently social and individual behaviours in the whole city towards changes to the habitat to better meet human needs.

The ongoing research by design represents a step towards a landscape masterplan for the Careggi University-Hospital Campus. Here a focus is placed on accessibility as a primary and cross-cutting issue through which a series of landscape features can be evaluated and re-imagined to create integration between buildings and open spaces through the sustainable transformation of the latter, also with an urban forestry vision to improve the microclimate, hydrological resilience, sense of place and a wide set of environmental and social ecosystem services. Furthermore, reclamation of the Terzolle Stream could provide a major urban connection for active mobility in a landscape project based on hydraulic features and the dynamics of the water-course and its basin.

Nevertheless, some critical issues emerge with regard to integration between the university-hospital and the city. In fact, it is worth being aware that the primary healthcare functions should not be affected by disturbing phenomena such as overcrowding or noise. While a relationship with the surroundings is desirable in terms of liveability, cultural exchange and the attractiveness of the setting, and social interaction provides significant salutary effects in both patients and visitors, the landscape must convey a need for quietness and psycho-physical wellbeing. Moreover, because of the widespread presence of expensive and fragile facilities within the hospital, the project also has to take into account spatial management and security issues.

The complex functioning of logistics mostly depends on vehicular transportation and so its spatial interpretation is a diriment issue. In order to provide well-structured operational flows, the network of continuous and non-specialized surfaces for mixed-uses must be carefully designed to avoid conflicts and disfunction.

According to a hypothesis of comprehensive design to fulfill all the needs, it is necessary to be both innovative with the new inner mobility and careful with regard to its focus on inclusion. For instance, some disabled patients should always be directly accompanied to the hospital buildings in a vehicle. So a management choice must be made between the options of selected private accesses or shuttle services connecting external parking areas with the departments. This is an example of alternative choices which are both compatible with the structural and functional features of an university-hospital campus if its mobility model enhances accessibility and inclusion by avoiding flows and the parking of generic private vehicles, which is a main critical issue of the present situation. Therefore, some green areas should be left for the exclusive use of severely ill patients who need rest, silence and privacy but could benefit from healing gardens from a physical, psychological and social perspective. This is an example of the need for open green spaces: the lack of them is a major hazard as over the century the number and size of the buildings have increased. On the one hand within the hospital area, there are disused buildings with large surfaces: meeting the new needs of the hospital or academic facilities by reclaiming them must be an absolute priority to protect the open spaces. On the other hand, they can be more effectively protected by developing their environmental and social functions and making them perceptible through sensitive design and culturally perceived through adequate communication.

In summary, taking into account that the existing settlement is not appropriate for providing healthcare and well-being, mostly due to its congestion and fragmentation, a comprehensive and systemic landscape design could improve the quality of the open spaces. Careful critical thinking can drive the design process for the landscape and its development inside the hospital area aiming to change it into a sustainable contemporary campus. At the same time, better integration between the campus and the city is possible and could generate powerful synergies and mutual benefits for quality of life and opportunities inside and outside the campus.

Credits

The Careggi Campus research is an initiative of the Department of Architecture of the University of Florence and of the General Direction of the Careggi University-Hospital Public Company. The process has been promoted by Gabriele Paolinelli and Saverio Mecca for the University, and by Rocco Damone and Valentino Patussi for the Company. It is coordinated by Gabriele Paolinelli and is being carried out by Francesco Alberti, Nicoletta Cristiani, Giacomo Dallatorre, Lorenza Fortuna, Luca Marzi, Claudia Mezzapesa, Emanuela Morelli, Lorenzo Nofroni, Nicoletta Setola, Antonella Valentini. Several students are providing their collaborations in the Master's Degree programmes in Landscape Architecture and Architecture.

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Fig. 11 A sample of the ongoing Careggi Campus vision for a network of uncluttered and barrier-free shared open spaces

Fig. 12 Design sample of the Careggi Campus network of shared places with free paved surfaces suitable for services and vehicles for disabled people with slow flows between people moving around and spending time outdoors: 'breath' and simplicity provide spatial expressiveness, flexibility and accessibility with a comprehensive output of wellbeing

References

Abdi, B., Hami, A., Zarehaghi, D. (2020). Impact of small-scale tree planting patterns on outdoor cooling and thermal comfort. *Sustainable Cities and Society, 56*

Abraham, A., Sommerhalder, Æ. K., Abel, Æ. T. (2010). *Landscape and well-being: A scoping study on the health-promoting impact of outdoor environments*. *International Journal of Public Health, 55*

Antonini, E., Vodola, V., Gaspari, J., De Giglio, M. (2020). *Outdoor wellbeing and quality of life: A scientific literature review on thermal comfort*. *Energies, 13*

Bentley, M. (2013). An ecological public health approach to understanding the relationships between sustainable urban environments, public health and social equity. *Health Promotion International, 29*, 3.

Brown, C., & Grant, M. (2005). Biodiversity and human health: What role for nature in healthy urban planning? *Built Environment, 31*, 4.

Carmona, M. (2010). Contemporary public space, part two: Classification. *Journal of Urban Design, 15*, 2.

Cristiani, N., & Paolinelli, G. (eds.) (2020). *Careggi Campus. Un'ipotesi di cambiamento degli spazi aperti dell'Azienda Ospedaliera Universitaria di Careggi*. DIDApress, Department of Architecture, Florence

Dayo-Babatunde, B., Martinez, J., Kuffer, M., Kyessi, A. G. (2019). *The street as a binding factor. Measuring the quality of streets as public space within a fragmented city: The case of Msani Bonde la Mpunga, Dar es Salaam, Tanzania*. In: M. van Maarseveen, J. Martinez, & J. Flacke (Eds.), *GIS in sustainable urban planning and management*. Taylor & Francis, Boca Raton, FL, US.

Douglas, O., Lennon, M., Scott Green, M. (2017). *Space benefits for health and well-being: A life-course approach for urban planning, design and management* , 2017 Cities, 66.

Duhl, L. J., Sanchez, A. K. (1999). *Healthy cities and the city planning process. A background document on links between health and urban planning*. WHO Regional Office for Europe, Copenhagen

Dunjić, J. (2019). Outdoor thermal comfort research in urban areas of Central and Southeast Europe. *Geographica Pannonica, 23*

Duwall, J. (2011). *Enhancing the benefits of outdoor walking with cognitive engagement strategies*. *Journal of Environmental Psychology, 31*.

D'Alessandro, D., Arletti. S., Azara, A., Buffoli, M., Capasso, L., Cappuccitti, A. et al. (2017). Strategies for disease prevention and health promotion in urban areas: The Erice 50 Charter. *Ann Ig - Annals of Hygiene, 29*

Evcil, A. N. (2012). Raising awareness about accessibility. *Procedia - Social and Behavioral Sciences, 47*

Elsadek, M., Liu, B., & Xie, J. (2020). *Window view and relaxation: Viewing green space from a high-rise estate improves urban dwellers' wellbeing*. *Urban Forestry & Urban Greening, 55*

Forsyth, A., Krizek, K. J., Rodriguez, D. A., et al. (2009). Hot, congested, crowded and diverse: Emerging research agendas in planning. *Progress in Planning, 71*, 153–205.

Francis, M. (1998). Changing values for public space. Landscape Architecture, January 1998

Gatto, E., Buccolieri, R., Aarrevaara, E., Ippolito, F., Emmanuel, R., Perronace, L., & Santiago, J. L. (2020). Impact of urban vegetation on outdoor thermal comfort: Comparison between a Mediterranean city (Lecce, Italy) and a Northern European city (Lathi, Finland). *Forests, 11*, 228.

Gehl, J. E. (2010) *Cities for people*. Island Press, Washington D.C.

Gustafson, K., Porter, N., Bowman, M. (2021). Engagement - Inclusive design. Retrieved June 24, 2021, from www.gp-b.com/engagement.

Kabisch, N., van den Bosch, M., Lafortezza, R. (2017). *The health benefits of nature-based solutions to urbanisations challenges for children and elderly - A systematic review*. *Environmental Research, 159*

Kickbusch, I., & Nutbeam, D. (2017). A watershed for health promotion. In: *The Shanghai Conference 2016*, *Health Promotion International* (Vol. 32, pp. 2-6)

Kilić, J., Jaiac, N., Rogulj, K., & Mastelić-Ivić, S. (2019). Assessing land fragmentation in planning sustainable urban renewal. *Sustainability, 11*, 2576.

Jackson, L. E. (2002). The relationship of urban design to human health and condition. *Landscape and Urban Planning, 64*

Jennings, V., Bamkole, O. (2019). The relationship between social cohesion and urban green space: An avenue for health promotion. *International Journal of Environmental Research and Public Health, 16*

Lai, D., Liu, W., Gan, T., Liu, K., Chen, Q. (2019). *A review of mitigating strategies to improve the thermal environment and thermal comfort in urban outdoor spaces*. *Science of the Total Environment, 661*

Lau, S. S. Y., Gou, Z., Liu, Y. (2014). Healthy campus by open space design: Approaches and guidelines. *Frontiers of Architectural Research, 3*

Lee, A. C. K., & Maheswaran, R. (2010). The health benefits of urban green spaces: A review of the evidence. *Journal of Public Health, 33*, 2.

Marcus Johansson, M., Hartig, T., & Staats, H. (2011). Psychological benefits of walking: Moderation by company and outdoor environment. *Applied Psychology: Health and Well-Being, 3*(3)

Mackintosh, C., Zehndorfer, E., & Darko, N. (2016). *Outdoor recreation as a potential lever for health improvement: A review of the health benefits, barriers and opportunities for the sector*. Metropolitan University Business School.

Madanipour, A. (1999). *Why are the design and development of public spaces significant for cities? Environment and Planning B: Planning and Design, 26*

Madanipour, A. (2005). *Public spaces of European cities*, Nordisk Arkitekturforskning, 1

Mela, A. (2014). Urban public space between fragmentation, control and conflict. *City Territory and Architecture, 1*, 15.

Menne, B. (2018). Implementing the 2030 agenda for sustainable development. *Eurohealth, 24*, 3.

Nieuwenhuijsen, M. J., & Khreis, H. (2016). Car free cities: Pathway to healthy urban living. *Environment International, 94*

Nutsford, D., Pearson, A, L., & Kingham, S. (2013). *An ecological study investigating the association between access to urban green space and mental health*. *Public Health, 127*

Parker, P., Delshammar, T., & Magnus, J. (2012) *Planning for appropriation: Public space led development to integrate a fragmented city*. ISA Forum, Buenos Aires

Peng, Y., Feng, T., & Timmermans, H. J. P. (2021). Heterogeneity in outdoor comfort assessment in urban public spaces. *Science of the Total Environment, 790*

Pietilä, M., Neuvonen, M., Borodulin, K., Korpela, K., Sievänen, T., & Tyrväinen, L. (2015). Relationships between exposure to urban green spaces, physical activity and self-rated health. *Journal of Outdoor Recreation and Tourism, 10*

Piroddi, E., & Colarossi, P. (1991). The urban project: From fragmentation to recomposition. *Architecture & Behaviour, 7*, 4.

Poulain, T., Sobeck, C., Ludwig, J., Igel, U., Grande, G., Ott, V., et al. (2020). Associations of green spaces and streets in the living environment with outdoor activity, media use, overweight/obesity and emotional wellbeing in children and adolescents. *Environmental Research and Public Health, 17*

Rahman, N. A., Shamsuddin, S., & Ghana, I. (2015). What makes people use the street? Towards a liveable urban environment in Kuala Lumpur city centre. *Procedia - Social and Behavioral Sciences, 170*, 624–632.

Romaniak, A., Skaliczki, J., & Szabó, Á. (2014). Strategies resolving spatial fragmentation: Case study in the Brownfield Zone of Budapest. *Periodica Polytechnica - Architecture, 45*, 2.

Salmond, J. A., Tadaki, M., Vardoulakis, S., Arbuthnott, K., Coutts, A., Demuzere, M., Dirks, K. N., Heaviside, C., Shanon, L., Macintyre, H., McInnes, R. N., & Wheeler, B. W. (2016). Health and climate related ecosystem services provided by street trees in the urban environment. *Environmental Health, 15*(suppl. 1), 36.

Sharley, H. (2019). *QEII Futures. Masterplanning project for the QEII medical centre*. WA Pty Ltd, QEIIMC Trust

Shukor, S. F. A., Stigsdotter, U. K., & Source, K. N. (2012). A review of design recommendations for outdoor areas at healthcare facilities. *Journal of Therapeutic Horticulture, 22*, 2.

Schweitzer, M., Gilpin, L., & Frampton, S. (2004) Healing spaces: Elements of environmental design that make an impact on health. *The Journal of Alternative and Complementary Medicine, 10*

Springer, A. E., Evans, A. E., Ortuño Salvo, D., Varela Arévalo, M. T. (2017). Health by design: Interweaving health promotion into environments and settings. *Frontiers in Public Health, 5*

Sugiyama, T., Carver, A., Kooshari, M. J., & Veitch, J. (2018). Advantages of public green spaces in enhancing population health. *Landscape and Urban Planning, 178*

Taleghani, M. (2018). Outdoor thermal comfort by different heat mitigation strategies - A review. *Renewable and Sustainable Energy Reviews, 81*

Tsay, S., & Gold, R. (Eds.). (2017). *A Mayor's Guide to Public Life*. Gehl Institute.

Ulrich, R. S., & Parsons, R. (1992). *Influences of passive experiences with plants on individual well-being and health*. In: D. Relf (Ed.), *The role of horticulture in human well-being and social development*. Timber Press, Portland

UN. (2015). *Transforming our World: The 2030 Agenda for Sustainable Development*. United Nations, Department of Economic and Social Affairs, Sustainable Development

Van den Berg, M., Wendel-Vos, W., van Poppel, M., Kemper, H., van Mechelen, W., & Maas, J. (2015). *Health benefits of green spaces in the living environment: A systematic review of epidemiological studies*. *Urban Forestry & Urban Greening, 14*

Wang, R., Helbich, M., Yao, Y., Zhang, J., Liu, P., Yuan, Y., et al. (2019). Urban greenery and mental wellbeing in adults: Cross-sectional mediation analyses on multiple pathways across different greenery measures. *Environmental Research, 176*

Weerasuriya, R., Henderson-Wilson, C., & Townsend, M. (2019). Accessing green spaces within a healthcare setting: A mixed studies review of barriers and facilitators. *Health Environments Research & Design Journal, 12*, 3.

WHO - Regional Office for Europe. (1997). Green cities, blue cities. *Local authorities, health and environment briefing pamphlet series, 18*

WHO - Regional Office for Europe. (2021a). *Heat and health in the WHO European Region: Updated evidence for effective prevention*. WHO Regional Office for Europe, Copenhagenx

WHO - Regional Office for Europe. (2021b). *Health and well-being and the 2030 Agenda for Sustainable Development in the WHO European Region: An analysis of policy development and implementation*. WHO Regional Office for Europe, Copenhagen

Wood, E., Harsant, A., Dallimer, M., Cronin de Chavez, A., McEachan, R. R. C., & Hassall, C. (2018). Not all green space is created equal: biodiversity predicts psychological restorative benefits from urban green space. *Frontiers in Psychology, 9*

New Paradigms for City Management and Planning. From Open Data Knowledge Sharing Platforms to e-Participation in Italy

Elisa Cacciaguerra and Barbara Chiarelli

Abstract

For several years, society has been transforming itself into a virtual society, at different intensities and speeds. The health emergency we are experiencing has accelerated this change also in the Public Administration, one of the contexts that has always presented major challenges in the field of digitalization, but which can benefit more from it in terms of simplification and transparency of processes. The intrinsic capacity of the virtual society, to be detached from spatial constraints in the construction of knowledge and the capacity for renewal, assumes a central role in solving problems due to the coexistence of interests and positions of even extremely different nature (different stakeholders). One of the areas that could benefit from a digital transition is planning, specifically concerning participatory processes. Recalling one of the principles of the Charter of Public Space, according to which the design of public space should involve, through participatory processes, every single citizen, it is useful to consider that the wider the perimeter of participation, the wider the possibility of obtaining indications that are genuinely shared within civil society. The adoption of ICT (Information and Communication Technologies) in urban planning and transformation processes refers to the so-called e-planning, a new discipline that consists of different information systems to facilitate planning activities by improving accessibility and information, guidance and services related to planning (Chen et al. in Handbook of research on e-planning: ICTs for urban development and monitoring. IGI Global, 2010). This innovative way of planning can also allow the achievement of a greater number of city-users, building an in-depth knowledge of the territory both from an objective technical point of view, through the mapping of spaces and their technical characteristics (through BIM and GIS technologies) and through participatory processes, which can define a pattern of the needs of all subjects which insist on the territory, optimizing the definition of hypothetical scenarios. The research is proposed as a moment of advancement in disciplinary practices aimed at experiencing new frontiers of participatory planning. The use of ICT tools, whose operational impacts integrate and improve current and future scenarios, allows verifying an operational model that, through the interaction and interoperability between the different actors, can manage the uses and transformations of the territory in the process of urban regeneration.

Keywords

ICT • GIS • BIM • eParticipation • ePlanning

Nomenclature

PA	Public Administration
ICT	Information and Communication Technologies
BIM	Building Information Modelling
GIS	Geographic Information System

1 Introduction

In Italy, since the early 1990s, there has been a push towards innovation policies by public bodies through the digitalization and standardization of procedures. The modernization of the country is necessarily linked to the digitalization of the Public Administration, which must become the vector of change, towards the elimination of the digital divide and the introduction of e-government practices. However, these objectives are met with widespread resistance to change, making the digitalization process a real "cultural revolution" in the Public Administration.

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1.1 Urban Spaces as Common Good

The Charter of Public Space, drawn up on the occasion of the Biennale of Public Space in 2013, defines the concept of public space as "any place of public ownership or public use accessible and accessible to all, free of charge or for non-profit purposes." According to the document, these spaces are key elements of individual and social well-being, in which the community recognizes itself and strives to improve its quality, making it necessary for all decisions concerning these spaces to be subject to understandable and transparent participatory processes involving all stakeholders (INU, 2013).

Since 2001, the Italian Constitution (art. 118, paragraph 4 Italian Constitution) assigns to public administrations at different levels (based on the principle of subsidiarity) the task of encouraging the autonomous initiative of citizens, individuals and associations, to carry out activities of general interest.

Public Administration, in fact, has the task of promoting and protecting the common good, governing the development of the territory, organizing appropriate services and creating new forms of governance and social responsibility.

Greater sharing of city-related information can lead to greater development in the regeneration of spaces, attracting potential investments in areas, thereby increasing the level of well-being of cities.

Thus, the objective of digitising processes and information has been the basis of policy in recent years, both in relations between public entities and between public and private as an essential element in achieving a new administrative efficiency. However, the provision of spatial data provides a more complex approach, requiring greater administrative and structural efforts to manage and adopt IT-based techniques and tools (Scanu et al., 2013).

1.2 Digitalisation in Public Administration in Italy

Italy's economy has shown great difficulty in keeping up with other European countries in terms of its productivity, with GDP growth from 1999 to 2019 of only 4.2%, compared with an increase of more than 21% in France and Germany. This is due to the failure to seize the many opportunities associated with the digital revolution: inadequate infrastructure and a lack of digitally mature production and social fabric (Agenzia per l'Italia Digitale & Dipartimento per la Trasformazione Digitale, 2020; Consiglio dei ministri della Repubblica Italiana, 2021; European Commission, 2016).

From the public sector point of view, there is a lack of familiarity with digital technologies, despite the many plans and strategies implemented since the early 2000s to promote innovation in this context. The Digital Economy and Society Index (DESI, 2020), reported in June 2019, show Italy's general backwardness on digital issues, placing it in 25th place compared to 28 European countries. In particular, the biggest gap in this area is identified concerning e-skills, which is reflected in a low take-up of online services, including digital public services, which, although offering a high supply, show a low take-up.

Following the Covid-19 pandemic crisis, the European Union has set up the Next Generation EU (NGEU) programme, which foresees investments and reforms aimed in particular at accelerating innovation, digitisation and ecological transition. In Italy, this programme is translated into a plan (Piano Nazionale di Ripresa e Resilienza) which aims to implement important reforms of the context, including the Public Administration, to improve administrative capacity at the central and local level, encouraging the simplification and digitisation of administrative procedures, as well as the strengthening of "digital citizenship" through initiatives, to improve basic digital skills, to enable active participation in democratic life and the uptake of digital services.

2 eGovernment, Open Government and eParticipation

Technological advances have revolutionized the way citizens interact with governments. eGovernment is seen as key in the Digital Agenda to improve the quality of public services, foster participation and promote open and transparent administration. The term e-government refers to the process of computerization of the Public Administration implemented through the adoption of new communication and information technologies, aimed at improving its performance. The need to facilitate citizens' access to online services is, therefore, part of "digital citizenship" intending to guarantee citizens and businesses the right to access all data, documents and services of interest to them digitally, as well as simplifying access to personal services by reducing the need for physical access to public offices. Unlike traditional methods of communication and management of operations, e-government allows for greater involvement of citizens, who can be actively involved in the decision-making process (Fioravanti, 2019).

Open Government refers to how power is exercised, at both central and local levels, whereby all activities of governments and public administrations of the state must be open and available, to promote effective action and ensure public control over their actions. The Open Government is based on three main pillars (Fig. 1) ("Open Government Partnership Italia," n.d.):

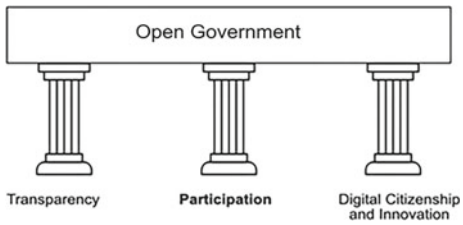

Fig. 1 Pillars of Open Government (author elaboration)

- Transparency: citizens must have access to all the information they need to know how public administrations work and operate. Data should also be made available in an open format to ensure re-use and re-processing.
- Participation: citizens, civil society organizations and businesses must be involved in national and local decision-making and policy-making by contributing ideas, knowledge and skills to the common good and efficient administrations.
- Digital Citizenship and Innovation: new technologies make administration more efficient and facilitate transparency and civic participation by promoting the development of public platforms for the provision of services, the expansion of e-citizenship and the sharing of ideas and information.

eParticipation refers to the use of information and communication technologies to enhance political participation and citizen engagement (Mukherjee, 2019). In recent years, a great deal of analytical research has been focused on the subject.

The issue of participation is usually confined to the most critical areas, which attract social criticalities. The ability to interpret positive or negative trends in urban dynamics can be of great help in the proper management of resources, as well as in making citizens aware of the state of affairs. In cities, changes move fast and are determined by several factors that are not always easy to estimate a priori. Since the 1980s, Italy has promoted a series of urban regeneration and regeneration initiatives that have promoted a participatory approach in different ways, with different results (Ciaffi & Mela, n.d.; European Commission, 2016; It et al., 2008; United Nations, 2020).

2.1 Elements Needed for Successful Operations

For this kind of operation to be successful, it is necessary to ensure that certain elements are present, including the presence of professional skills who can coordinate activities, channel the work and ensure that the results achieved are highlighted in close contact with the public. The correct management of time and resources, keeping alive the

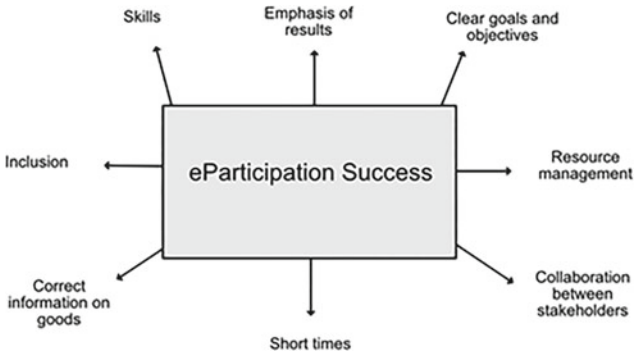

Fig. 2 eParticipation success elements (author elaboration)

collaboration between public and private actors, with the aim of each one achieving its own success, without trampling on the rights of other actors (Fig. 2) (Panopoulou et al., 2014).

The evaluation of a participatory process is very complex, as anticipated in fact the factors to be evaluated change very quickly and are articulated at different levels. According to a document edited by the members of the "Autoscuola della Partecipazione", a training course on participation issues, valuating is an action-research activity that accompanies the whole implementation of the project, not just the end of the process itself. Therefore, for a process to be successful it is necessary to implement a monitoring plan (i.e. the process of continuously collecting data and on the progress of the project), and to foresee a series of evaluation steps (to assess the long-term effects, positive and negative, primary or secondary, intended or unintended) (Franceschini & Monacelli, 2016).

It can be seen that the main factor to be taken into account in the success of a participatory process operation is the impact it generates. For this to be properly assessed, however, data and information need to be collected from the early stages of the operation, so that the operation is properly designed and the indicators to be assessed are clearly defined, as well as the expected results.

2.2 Approaches, Roles and Objectives

The progressive inclusion of private subjects within public interest operations means that the interests to be protected during the operation are different, and it is necessary to achieve a correct balance through the correct setting of the operation and the identification and maintenance of roles.

Participatory processes can be divided into two macro types of approach: a top-down approach, of an exclusive type and which is lowered from above on the issues chosen by those who have the power to implement the choices, and a bottom-up approach, which starts with the less strong subjects, who come together to make their needs felt by

those who have the authority to implement the choices (Homsy et al., 2019).

Considering the complexity linked to the evaluation of participatory processes, a reflection (without pretending to simplify marginalization) is proposed to try to identify a series of elements that can facilitate, slow down or frustrate the actions that are added, analysing a selection of experiences shared by the aim of promoting, first, the common sense of belonging to the spaces object of intervention by the inhabitants. Two SWOT process matrices follow, bottom-up on one side and top-down on the other, to isolate the strengths and weaknesses of these experiences (Tables 1 and 2).

From the cross-reading of two SWOT matrices, the fundamental role of the public subject capable of obtaining the recorded shots emerges. In fact, if among the requests of the top-down processes there is "Poor participation in the parts of citizens due to a priori lack of trust in institutions", the point on which an administration knows it will have to work emerges: investing in actions aimed at increasing trust on the part of citizens, it is very likely that it will be able to obtain more participation and consequently better results. On the other hand, among the requests of the bottom-up processes, it is noted how the opposition of a disinterested administration can impose itself on the community, frustrating every effort and further alienating citizens. It follows the great responsibility of the public entity in the success of any intervention project on public space and common goods, which as already mentioned, depends to a large extent on its ability to respond to the real needs of those who live in a specific space, who recognize themselves in the place object of intervention he appropriates it by crossing it, frequenting it, living it, taking care of it.

We can therefore define the roles, interests and rights of the different actors involved in the process (Table 3).

As anticipated, the Public Administration has the role of controller and verifier that the public good is safeguarded, and that the rights of each actor involved in the process are protected. The action that must be carried out for the process to go well is having a clear vision about the city planning, a correct analysis of the spaces and buildings object of interest for the operation through a correct and exhaustive provision of the information in its possession so that private subjects can exploit it for submitting proposals that result in operations from which an economic profit can be made. The Public Administration, therefore, has the task of achieving the best possible result by safeguarding the public good and using the best tools at its disposal.

The role of the citizen in such an operation is to be able to benefit from the result of the operation, having the right to make their own contribution within a debate that is able to grasp the needs and requirements of those who will later be the users of good.

Reference is made to the work of Nunes Silva (Nunes Silva, 2010) who states that new technologies applied to planning lead to a potential twofold improvement: on the one hand, if used for in-depth analysis (economic, demographic, social, physical), they can process and analyse enormous quantities of data and easily simulate new spatial scenarios. On the other hand, because they can facilitate interaction between stakeholders, a more open and

Table 1 Top-down—the project was created by the will of the institutions

S Knowledge of the state of the art of the place (indirect thanks to data, information and statistics) Certain resources (professionals, budgets) Organizational ability to manage the process with suitable methods and tools, including evaluation	W Distance between institutions and communities of disheartened citizens The slowness of processes, difficulty in seeing results in a short time Knowledge may not always be up to date Methods, tools, and resource management may not always be the best
O Good feedback in terms of participation and involvement of citizens, with positive results	T Poor participation in initiatives by citizens due to a priori lack of trust in institutions, with negative results

Table 2 Bottom up—Il progetto nasce per volontà di soggetti non istituzionali

S Compactness of the community of citizens Knowledge of the state of the art of the place (direct from experience: habits, perceptions, …)	W Lack of certain resources (professionals, budget) but only voluntary Lack of organizational skills (methods and tools) to manage the process
O By properly disclosing the process, the community can network, bringing together volunteer experts and similar cases to deal with	T The opposition of a disinterested administration can impose itself on the wishes of the community, nullifying any effort

Table 3 Role, interests rights of actors

	Role	Action	Right
Public Administration	Verify that the public interest is always safeguarded	Vision of the operation analysis and provision of information regarding the asset	Keep control over the asset
Citizens	Owner of the asset	Exploitation of the well-being deriving from the action on the good	Be listened to and participate in the debate on public space
Private subjects	Investor	Proposal and message in the practice of operations	Profit from the operation

transparent dialogue, deliberation by participants in the planning process and the choice of actions to be implemented.

3 Use of ICT

The use of ICT can undoubtedly increase the success of operations, in the face of a greater commitment by the Public Administration, which must take charge of the digitalization of information and its provision (through Open Data), putting all actors on the same level.

It is clear that, depending on the stage of the process and the person involved, the ICTs used can be different. The synergy and interoperability of these tools can increase the audience of stakeholders, enabling more valid transactions (van Buiten, 2021).

The following is an overview of what ICT is made available to the Public Administration and what can be the relative uses it can make about each of the actors involved in the operations.

3.1 Geographic Information System: GIS and Web-GIS

Within the Public administration for years and in an increasingly widespread way, the use of geographic-based computer systems (GIS) has been used, i.e. tools for the storage and management of geospatial data that allow the integration and processing of information useful for the analysis and planning of the territory (Worboys & Matt, 2004).

GIS technologies, first introduced in 1966 with the Canada Geographic Information System (CGIS), have progressively evolved into many other disciplines, such as disaster management (Ertug Gunes & Kovel, 2000). The versatility of this kind of tool is well known, which, through the application of information levels, allows to map and analyse the territory defining a rich and questionable information database, now necessary for proper planning and management at the territorial level.

Web-GIS technologies are information systems published on the web. What distinguishes them from the GIS is therefore the purpose of communication and information sharing. Clearly, this can be how cartographic information can be made available to the public.

3.2 Building Information Modelling (BIM)

The BIM methodology is a building process management system in which digitally accurate virtual models of a building are constructed to support all phases of a building's lifecycle, from design to management and decommissioning, allowing more efficient analysis and monitoring than traditional methods. Once completed, these models contain the parametrically constructed geometry and all the information needed for the design, selection of the contractor, construction and then management of the building (Di Giuda et al., 2017).

To respond to new economic, environmental and social needs and challenges such as climate change, resource efficiency and infrastructure obsolescence, like other sectors, the construction sector has also started its "digital revolution." In the construction sector, the public sector has recently developed and progressively adopted several innovative strategies to reduce costs and increase performance.

In Italy, BIM has recently entered the horizon of public administration. In fact, following the European Directives 2004/18/EC and 2014/24/EC which concerning public procurement refer first to the increase of competition and efficiency of public procurement and to the saving of time and money compared to their use and then expressly invite the member states to "encourage, specify or impose" the use of the BIM, the Code of Public Contracts (Legislative Decree 50/16), through its implementing decree (DM 560/17, the so-called BIM decree) makes the BIM compulsory using a timetable that will be progressively used for all public processes by 2025.

3.3 Virtual Reality and Augmented Reality

Virtual Reality (VR) is a digital environment created by one or more computers that simulate actual reality and recreates it intangibly. This allows complete and generally multisensory immersion in a virtual simulation. In this case, you completely lose the perception of the real world.

Augmented Reality is the superimposition of one or more information layers (virtual and multimedia elements, geolocated data, etc.) in the real world. In this case, the perception of the real is always maintained, to which information is added.

There are many applications of both types of simulation, from education to medicine to the world of construction.

This kind of technology is highly attractive in realisation to the remarkable ability to represent the projects (in the face of a substantial work of modelling and restitution) exhaustively, making the intentions of the designer and the public administration easy to understand even for those who do not speak the same technical language.

4 Hypothetical Workflow

From what has been reported so far, it is clear that to define a successful operation it is necessary to define a process with clear objectives at the planning stage of the operation so that all essential information is made available through the most suitable means to communicate in a way consistent with the language of each person so that everyone can understand and express themselves. The following is a hypothetical workflow (Table 4), which a public authority could implement in order to progressively involve all actors in the operation (Lourenco et al., 2017).

- Phase 1: Study and analysis by the Public Administration through the systemization of information on urban planning held by the Public Administration with the support of GIS tools (such as urban plans, constraints, etc.) at the territorial level to define a vision regarding the actions to be taken for the regeneration of cities.
- Phase 2: Definition of a Web-GIS participatory platform for the involvement of citizens in the mapping of spaces to collect geo-referenced reports concerning problems, suggestions and reflections on public space for public property sites to be redeveloped.
- Phase 3: Through the evaluation of the results obtained from the two previous phases, Public Administration focuses on the precise study of the areas identified, to concentrate resources and energies on operations that are of interest to the largest number of actors.
  At this stage, Public Administration has to evaluate which are information to made available about buildings to be requalified, to attract potential investors is assessed.
- Phase 4: BIM analysis and modelling of buildings to be redeveloped concerning the objectives and characteristics of the object of interest. The result of this work can allow analyses consistent with the real state of the building, leading to a correct and concrete assessment of the possible actions to be implemented to redevelop it, making clearer to the investor the amount of expenditure that could sustain.
- Phase 5: Attraction of potential stakeholders within the operation. In fact, the generation of BIM models allows a consistent and real count of the elements present, allowing a correct assessment of the size of the transaction and the consequent advantage to participate.
- Phase 6: Once the project hypotheses have been established, it is appropriate to involve the public once again in

Table 4 Description of the workflow

	Action	Subjects involved	ICT tools
Phase 1	Definition of a vision for the actions to be taken Territorial study and analysis	Public Administration	GIS
Phase 2	Mapping of suggestions on the public space	Public Administration Citizens	Web-GIS
Phase 3	System of the information obtained. Choice of areas of interest and detailed analysis	Public Administration	GIS Web-GIS
Phase 4	Analysis and modelling of the selected buildings	Public Administration	BIM
Phase 5	Attracting potential investors through the models made available through Open Data Evaluations	Public Administration Private subjects	BIM GIS
Phase 6	Representation of design hypotheses using the medium most comprehensible to the non-technical citizen	Public Administration Citizen Private subjects	BIM WEB-GIS VR/HR

the choice. It is now necessary to consider how the project can be communicated more easily to non-technicians. We highlight the possibility of using Virtual Reality or Augmented Reality tools that can transfer project information in a very realistic way to the citizens so that they can express their choice.

5 Conclusions

The work aimed at ordering and evaluating the possibilities of the actors involved in e-planning, considering their different roles and objectives. The workflow identified aims to define what steps a Public Administration can take to make the best use of the ICT available to it, putting in the foreground the safeguarding of the public good, through the search for the result that can satisfy the greatest number of users. Finally, there is a fundamental element to consider in order to increase the effectiveness of actions, namely a constant effort to educate both technicians and citizens in the correct use of technologies. As we have seen, Italy, more than other countries, is lagging behind in terms of digitalisation, which means a high rate of digital divide. Dissemination of knowledge through the use of ICT in all its forms can only improve the chances of success of operations, which will have to tend to be increasingly optimised and directed towards safeguarding the common good.

References

Agenzia per l'Italia Digitale, & Dipartimento per la Trasformazione Digitale. (2020). Piano Triennale per l' Informatica nella Pubblica Amministrazione.

van Buiten, M. D. (2021). *How to evaluate digital tools in public participation?*

Nunes Silva, C. (2010). The e-planning paradigm—Theory, methods and tools: An overview. In *Handbook of research on e-planning: ICTs for urban development and monitoring*. IGI Global.

Chen, Y., Hamilton, A., & Borning, A. (2010). Modelling & matching and value sensitive design: Two methodologies for e-planning systems development. In *Handbook of research on e-planning: ICTs for urban development and monitoring*. IGI Global.

Ciaffi, D., & Mela, A. (n.d.). Città partecipate: un possibile decalogo.

Consiglio dei ministri della Repubblica Italiana. (2021). Italian National Recovery and Resilience Plan.

DESI. (2020). Indice di digitalizzazione dell'economia e della società (DESI) 2020. Italia, 1–15.

Di Giuda, G. M., Maltese, S., Re Cecconi, F., & Villa, V. (2017). *Il BIM per la gestione dei patrimoni immobiliari*. Hoepli.

Ertug Gunes, A., & Kovel, J. P. (2000). Using GIS in emergency management operations. *Journal of Urban Planning and Development, 126*(3), 136–149. https://doi.org/10.1061/(ASCE)0733-9488(2000)126:3(136).

European Commission. (2016). Piano d'azione dell'UE per l'eGovernment 2016–2020.

Fioravanti, C. (2019). ICT e integrazione: strumenti di e-government a supporto dell'accesso all'informazione e del processo di inclusione nelle società interculturali. https://doi.org/10.32091/RIID0013.

Franceschini, S., & Monacelli, M. (2016). PartecipAzioni: sostantivo, plurale. Guida metodlogica per la gestione dei processi di partecipazione integrati. *Regione Emilia-Romagna*, 276.

Homsy, G. C., Liu, Z., & Warner, M. E. (2019). Multilevel governance: Framing the integration of top-down and bottom-up policymaking. *International Journal of Public Administration, 42*(7).

INU. (2013). Carta dello Spazio Pubblico.

It, D., Albrecht, S., Kohlrausch, N., Kubicek, P. H., & Lippa, B. (2008). eParticipation—Electronic participation of citizens and the business community in eGovernment. Study on behalf of the Federal Ministry of the electronic participation of citizens and the business community in eGovernment. January 2016.

Lourenco, R. P., Piotrowsky, S., & Ingrams, A. (2017). Open data driven public accountability. *Transforming Government: People, Process and Policy, 11*(1).

Mukherjee, S. (2019). How IT allows e-participation in policy-making processes. *Computer Science* (Computers and Society).

Open Government Partnership Italia. (n.d.). Retrieved from http://open.gov.it/.

Panopoulou, E., Tambouris, E., & Tarabanis, K. (2014). Information and organization success factors in designing eParticipation initiatives. *INFORG, 24*(4), 195–213. https://doi.org/10.1016/j.infoandorg.2014.08.001.

Scanu, G., Podda, C., & Spanu, B. (2013). Innovazione digitale nella gestione del territorio. Gis e webgis tra semplificazione e sburocratizzazione (Digital innovation in land management. Gis and webgis: Simplifying and undoing red tape. (149), 151–165.

United Nations. (2020). *E-government survey 2020—Digital government in the decade of action for sustainable development: With addendum on COVID-19 response*. *United Nations e-government surveys* (Vol. 1).

Worboys, M., & Matt, D. (2004). *GIS, a computing perspective* (2nd ed.). CRC Press.

Evolution of Users Behavior Towards Designing Public Buildings in the Era of Covid-19. Alexandria New Restaurants Design Case Study

Nourhane M. El-Haridi

Abstract

A series of specific buildings, open spaces and more have a new design thinking and framework, that require to be reconsidered regarding the structure of constructions and open areas, especially after the pandemic of Covid-19. During this era of the pandemic, the design for public venues could be a challenge; for example, the design of commercial places such as restaurants, because the need to provide contemporary open public spaces has been modified, to provide a better quality of life and ensure a safe interaction for the various population in the cities. In this paper, a new behavior towards architectural design was studied to achieve social distancing guidelines, that promote separation to avoid the spread of the virus and encourage the design of open public spaces. In addition, the pandemic crisis has proved that the interaction between people and the built environment are the main engines, that innovate architectural design theories. This paper reviews the evolution of architecture in the context of a survey about the opinion of users on the new design of the public buildings, such as the new restaurants in Alexandria as a case study. As a result of the questionnaire is the development of the architectural adaptability to achieve the needs of the users, and improve the design of public spaces to achieve the transformation of the behavior of people. Finally, the results of the analysis of the survey demonstrate the transformation of the architectural concepts and ideas about the behavior of the users after Covid-19, and their interaction with the built environment and the outdoor design.

Keywords

Built environment • Evolution • Rethinking • Quality of life • Pandemic • Social distancing

1 Introduction

The decisions of restaurant visitors, related to whether to visit the restaurant once more or not, are not based solely on food satisfaction, but rather on psychological satisfaction with the interior elements and functions (Lee et al., 2015); especially after the world pandemic of covid-19 where some behaviors and thoughts about closed and indoors public buildings designs, have become a threat for some people. In this paper, an evaluation of the users' behavior, towards designing restaurants and cafés from different categories of visitors and different ages, was elaborated in a survey. The results of this survey indicated that there are some main requirements and precautions for visitors to the public buildings after the pandemic of the Coronavirus, especially the restaurants and cafés. The design of restaurants depends recently on the indoor and outdoor environment quality and visitors' satisfaction, which should provide a good quality of life and health, since the environment is being attacked daily by human life, and restaurants are considered a part of the problem (Choi & Parsa, 2007). Generally, research is also needed to better understand the suggestions of users' satisfaction in environmentally friendly restaurants designed in the era of covid-19.

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2 Literature Review

While it is acknowledged that design is not always rational (Parnas & Clements, 1986) restaurants and café designs become better with the users' opinions and experiences. The existence of restaurants is now a spatial representation of social formation, where people, friends, relatives or lovers meet (Diane, 2005). Before the pandemic of Covid-19, most architects cared about the design factors (such as exterior features, furnishers and materials as well as restaurant's layout), along with social and ambient factors (such as color, sound, lighting and scent), but recently some factors were explored and used the foundation of the designs' solutions, such as the environmental treatments, the indoor environmental quality and the social distances. For example, environmental stress such as severe temperature, humidity, ventilation, vibration, noise and glare may all become irritating (Wheldall, 1975) especially after the city's isolation during the pandemic of Covid-19, since most of the cities had to close all public indoor areas due to the safety and precautions.

The design of restaurants and the attitude and behavior of users towards restaurants during the pandemic have changed, hence, different researches results suggest that customers have been paying fewer visits to restaurants since the outbreak, assigning lower ratings, and showing limited evidence of spending more as per a study entitled: Analyzing Restaurant Customers' Evolution of Dining Patterns and Satisfaction during COVID-19 for Sustainable Business Insights by Susan (Sixue) Jia from School of Finance and Business, Shanghai Normal University at 2021. Before the pandemic, restaurants' designs were more interested in the interior designs and the indoor spaces, rather than the outdoor areas, especially in Alexandria city.

From the above reviews, it is clear that the perception, emotion and behavior of users are important socio-psychological factors that determine the type and the design of restaurants and cafés, either indoor or outdoor designs especially in the era of Covid-19. Accordingly, a study on the transformation of restaurants in Alexandria city in Egypt and a survey on users' evolution was discussed in this paper.

3 General Guidelines for New Restaurants and Cafés in Alexandria City

The design of restaurants before the pandemic was more comfortable because people were caring about the food and the interior design of the restaurant more than being concerned about the social distance and precautionary measures, thus, sometimes users do not mind going to crowded places. Before Covid-19, people used to go to restaurants to see and to be seen and to become part of the idea of the place (Farrelly, 2003), but after the pandemic, people should take distance and safety precautions.

Over the last two years, most people in the entire world have suffered from the spread of Covid-19 and isolation, but after the appearance of the different vaccines, some cities had opened their public areas under some precautions; Egypt for example. Most of the young people were encouraged to visit open restaurants and cafés. In Alexandria city, many new restaurants opened and renovated their designs to achieve the needs of users' behaviors towards outside seating areas and exterior designs, also designers have minimized the indoor seating areas to comply with the different needs (see Fig. 1). The expansion of these designs' concepts is a remarkable and apparent design direction that warrants

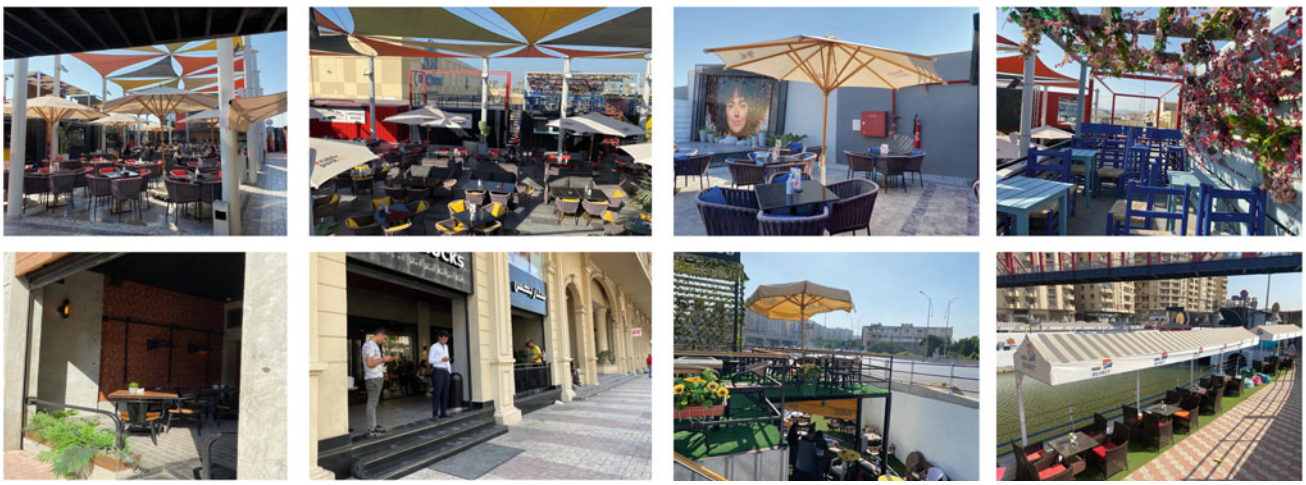

Fig. 1 New restaurants and cafés ideas in Alexandria city in Egypt. (The photos were taken by the author)

investigation and understanding (Simpson, 2003). As shown in the following Fig. 1; taken by the author during the observation of the outdoor areas and by a field survey of the new cafés and restaurants in Alexandria city that different new cafés and restaurants in Alexandria have succeeded to attract some visitors by changing their styles, and create outside seating areas with integration into the nature.

The study aims to highlight and approve the changes and the development of the design of the restaurants and cafés especially the outdoor designs, considering the needs and the requirements of the users' behavior during the pandemic.

The intent of the architectural guidelines is adopted to encourage creative architecture that is responsive to the local and regional context and contributes to the aesthetic identity of the community (Councilman, 2000), also protect and enhance the character and quality of restaurants in Alexandria city. In order to enhance the users' experiences and encourage new visitors to restaurants and cafés, a survey was suggested and analyzed to find the new needs and requirements of users in the era of Covid-19.

These restaurants and cafés are all new public places that did not exist in Alexandria city earlier, consequently, they were designed and built in the last two years only. It was remarked that they were all designed with outdoor areas and open spaces to achieve the needs of the users and their requirements, as per the following survey that will verify their opinions and needs especially after the pandemic.

4 Enhancing Design of Restaurants and Cafés by Customer Behavioral Intentions

The following study explores the evolution in the opinion of restaurants users regarding visiting or staying in them for a long time after the pandemic of Covid-19 and discusses their fears and preferences that should be taken in the future architectural design of public buildings generally and restaurants, especially in this period.

4.1 Methodology

A survey was developed for the purpose of collecting data about the evolution of users' behavior and opinion towards restaurants and cafés in order to enhance their design preferences, especially after the pandemic Covid-19. The data for this research were collected from different ranges in ages of 110 users from 15 years old up to over 65 years old. The questionnaire consisted of eight diverse questions that summarizes the behavior and preferences of the users and visitors of restaurants and cafés after the pandemic of Covid-19. This study examined the stages of sustainable development and the ages that prefer to visit restaurants in addition to the design rethinking about innovative ideas that could meet the needs of users in the future to get a better-built environment.

4.2 Data and Results Analysis

The results of the survey illustrate clearly the needs of the users since 61.82% of restaurants' visitors' ages range were from 26 to 45 years old and only 1.83% were over 65 years old as in Fig. 2a, on the other hand when the users had to choose between visiting the indoor public areas and the outdoor public areas they agreed more with visiting the outdoor public buildings especially after the pandemic of Covid-19 with 78.18% as appears in Fig. 2b, and only 8.18% still like the indoor public areas, but also 19.09% visitors of public buildings did not care whether it is indoor or outdoor places. As shown from the analysis of the questionnaire that this research is based on visitors that are in

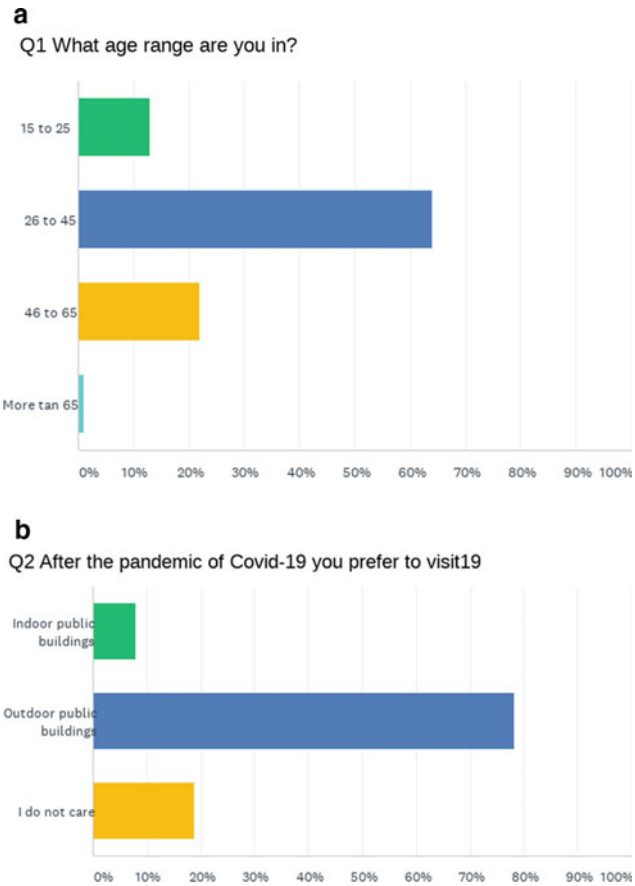

Fig. 2 **a** Range of ages participating in this survey and **b** the percentage of users preferences in outings

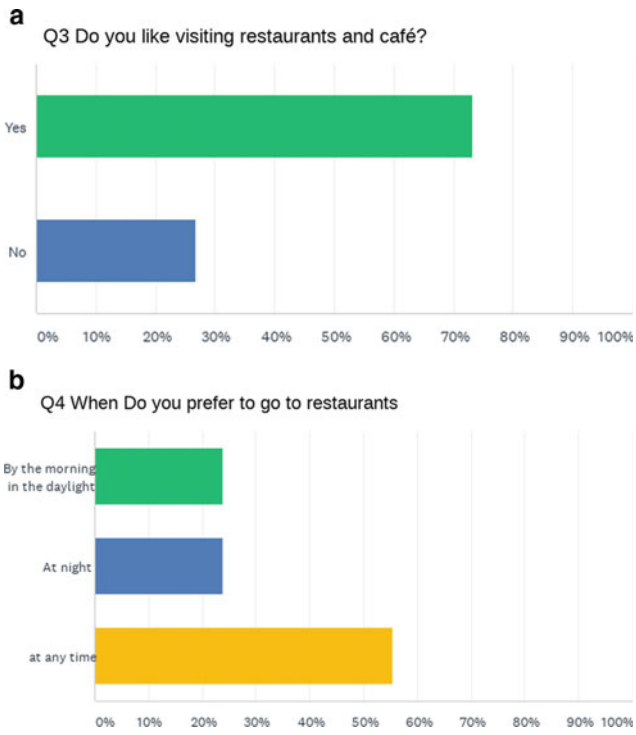

Fig. 3 **a** Respondents on visiting restaurants and **b** when the users visit the restaurants

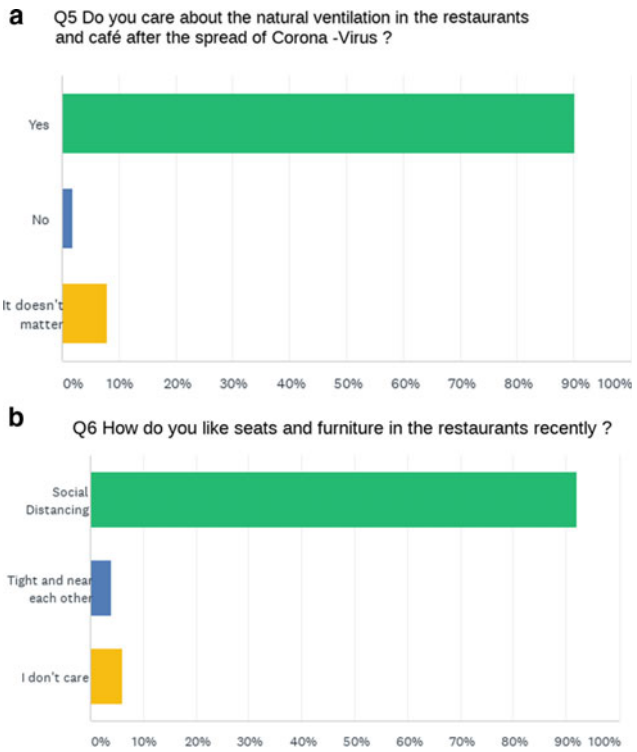

Fig. 4 **a** Respondents on the natural ventilation in restaurants and **b** respondents on social distancing in covid-19

the middle of their ages and youth and that they are more interested in outings and outdoor activities even after the pandemic of Coronavirus.

According to the respondents to the questionnaire, the majority of people like to visit restaurants and cafés with a percentage of 74.55% and only 25.45% do not like their visits as in Fig. 3a. In addition, 53.64% of visitors prefer to visit restaurants and cafés at any time during the day. The other surveyors were equally divided in this answer between their preferences to visit the restaurants in the morning and at night with a percentage of 24.55% as in Fig. 3b.

The results are in agreement with the expected behavior of people towards the environmental treatment and the natural ventilation of restaurants and cafés since 89.09% of visitors agree that they prefer good environmental quality, but 2.73% do not like the natural ventilation while 9.09% do not give great attention to this matter. Therefore, the results clearly show the important role of the architect to provide good environmental aspects in the design process to achieve the needs of the users and their comfort as in Fig. 4a. In addition, 92.66% of users like social distancing and large spacing in restaurants' furniture and seats to provide more safety and comfort especially after the spread of the virus of Covid-19 in the last two years; this was the most surprising result that elaborated the importance of respecting the awareness of people during this era of Covid-19 as in Fig. 4b.

Finally, the results revealed that the design of the restaurants and cafés has changed according to the needs and behavior of users since there was a variety in the results between the agreements in behavior of the users with 31.82% as total and between some of the users that strongly disagree with a percentage of 6.36% while others neither agree nor disagree with a percentage of 25.45%. But as a consequence of these results, architects and designers should create more innovative ideas to achieve better results to comply with the behavior of users towards public buildings in the era of Covid-19 as in Fig. 5a.

In the end, the results of the last question have illustrated the importance of this survey since 86.36% have agreed that actually, their behavior had changed towards public spaces in the era of Covid-19 as shown in Fig. 5b.

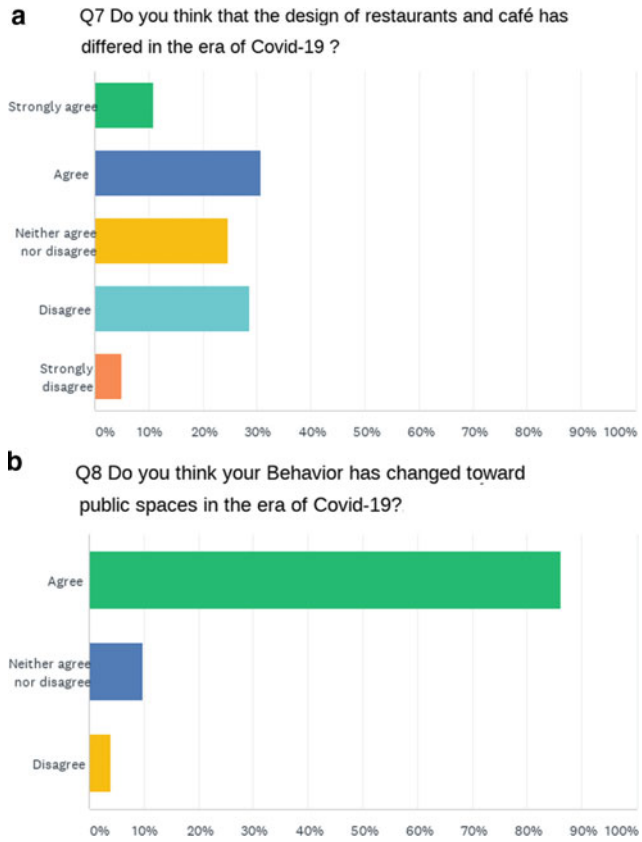

Fig. 5 **a** Respondents design changing during covid-19 and **b** respondents on the users behavior toward public spaces during covid-19

5 Conclusion

The findings of this research and survey offer valuable data showing that it is important for architects and designers to respect the changes in needs, and rethink the preferences of the users towards the locations' environment and especially towards the public buildings since the survey has interpreted the evolution in the behavior of visitors towards the restaurants and cafés after the pandemic of covid-19. In addition, the importance of creating new innovative ideas to achieve better indoor and outdoor environmental solutions and better quality of life as in the case study of the restaurants and cafés in Alexandria city in Egypt. There are other types of public buildings that could be studied and explained as a case study in the future like the restaurants studied in this paper, so it is recommended to make a future study on the evolution in the behaviors of users to other different types of public buildings during the era of Covid-19.

References

Choi, G., & Parsa, H. G. (2007). Green practices II: Measuring restaurant managers' psychological attributes and their willingness to charge for the "green practices". *Journal of Foodservice Business Research, 9*(4), 41–63.

Councilman, D. R. (2000). *Restaurant design guidelines-Adopted by the City of Scottsdale.* Dennis Robbins Councilman, Mark Hammons, Andrea Lee Forman, Margaret Dunn, Mark Soden, Fred Davidson, J. T. Elbracht.

Diane, S. (2005). Environmental distinctions: The discriminating dining environment. *LesCahiers Du CICLas, 6*, 55–57.

Farrelly, L. (2003). *Bar and restaurant interior structures* (p. 12). Wiley-Academy.

Lee, C. J., Wang, Y. C., & Cai, D. C. (2015). Physical factors to evaluate the servicescape of theme restaurants. *Journal of Asian Architecture and Building Engineering, 14*(1), 97–104.

Parnas, L., & Clements, P. C. (1986). A rational design process: How and why to fake it. *IEEE Transactions on Software Engineering, 12* (2), 251–257.

Simpson, R. (2003). *Theme and experience in restaurant design: A theory.* Corpus ID: 108908511.

Wheldall, K. (1975). *Social behavior: Key problems and social relevance*. Methuen.

From the Neighbourhood Unit to the 15-Minute City. Past and Recent Urban Models for Post-COVID Cities

Francesco Alberti and Antonella Radicchi

Abstract

This article critically discusses the 15-Minute City model through a review of proximity-based concepts and theories developed in the twentieth century, proposed here under the umbrella term of the Proximity City, thus tracing its historical trajectory from Perry's Neighbourhood Unit to Calthorpe's Transit-Oriented Development up to more recent time-based models such as the 1-Minute City. Furthermore, it scrutinizes the limits and potential of this model against four main challenges highlighted by the COVID-19 pandemic, namely self-sufficiency, social cohesion and inclusiveness, environmental sustainability and climate responsiveness and resilience to future health crises. In conclusion, it provides recommendations to inform future research and practice aimed at creating eco-social urban systems for post-COVID future cities.

Keywords

15-Minute City • Planning • Urban design • Proximity • Sustainability

1 Introduction

With the outbreak of the COVID-19 pandemic, the implementation of restrictive measures limited free circulation, forcing people to stay at home and walk around their neighbourhoods. These massive changes in lifestyle and habits led to a rethinking of living and working conditions and fuelled discussions about sustainable urban models for the post-COVID City, which often refer to urban proximity as a requirement to make cities more socially, environmentally and economically resilient when it comes to tackling epidemiological threats, while improving urban sustainability and liveability (see inter alia Forsyth, 2020; O'Sullivan & Bliss, 2020; Sennet, 2020). Similarly, time-based definitions have been coined or revived to label post-pandemic urban visions, such as the well-known 15-Minute City, the 30-Minute City, the 20-Minute Neighbourhood and the 1-Minute City.

According to the Cambridge Dictionary (2021),[1] the 15-Minute City can be defined as 'a city that is designed so that everyone who lives there can reach everything they need within 15 min on foot or by bike'. The 15-Minute City model was first theorized as *la Ville du quart'heure* by Carlos Moreno, the smart city advisor for the City of Paris, who proposed it as the guiding principle to make Paris a more sustainable and inclusive city (Moreno et al., 2021). This model fosters a more balanced distribution of public spaces and facilities throughout the city, support for local economic fabrics and the strengthening of social networks within urban communities while promoting an overall reduction of private transport dependency in favour of public mobility systems.

Although often presented as a new model, the 15-Minute City is rooted in concepts and theories developed in the twentieth century that, within the context of this article, we propose to be grouped under the umbrella term of the Proximity City, thus including Perry's Neighbourhood Unit (1929), Christaller's Central Place Theory (1933), Hall's Proxemics Theory (1966), Calthorpe's Transit-Oriented Development (1993) and Gehl's Human Scale City (1971, 2010) to name but a few.

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[1] In May 2021, the Cambridge Dictionary launched a poll to ask whether the 15-minute city should be added as a new word to the dictionary.

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In past decades, the application of these concepts and theories in urban planning and design projects led to outcomes that did not always meet the expectations or tackle the sustainability, resilience and inclusiveness objectives that support the idea of urban proximity as a feature of the post-COVID City.

Against this backdrop, this work critically discusses the Proximity City concept by retracing its historical trajectory, from early prototypes to recent developments in theory and practice (Paragraph 2), thus unpacking the limits and potential that could inform the eco-social transition of urban systems in a way that may also be responsive to sudden crises like the one caused by the COVID-19 pandemic (Paragraphs 3–4).

2 Evolution of the Urban Proximity Concept and the Role of the Neighbourhood in Modern Urban Planning Theories and Practices

2.1 Perry's Neighbourhood Unit and Its Further Applications

In the nineteenth century, massive industrialization processes led to increasing urban growth, widespread pollution and environmental degradation, which created inhumane working and living conditions, especially for the working class, as documented by Engels and Marx (see inter alia Cuthbert, 2007). Consequently, on the threshold of the twentieth century, criticism of the ills of the industrial city brought a new generation of thinkers to develop novel urban theories to foster the re-creation of human-scaled living conditions, based on socio-spatial models such as Ebenezer Howard's Garden City and Clarence Perry's Neighbourhood Unit (NU). The Garden City model originated in the UK and was exported to the US, where it was deployed for the preparatory analysis of the New York Regional Plan commissioned by the Russell Sage Foundation to Thomas Adams (Hall, 2002). As part of this plan, the NU was proposed by Clarence Perry (1929a) as a suitable development model for solving traffic issues and addressing social problems such as alienation, youth delinquency and lack of civic participation through the enhancement of the physical design of communities (Sharifi, 2016). The NU model implies a spatial unit with a 400-m radius, providing housing for a population of approximately 5,000–9,000 people (Fig. 1). At the core of the NU are the elementary school and public facilities, while the shops are located at the edges. To provide a safe pedestrian environment, the major arterial roads are placed on the surroundings of the NU which is equipped with an internal network of curvilinear roads allowing residents to reach civic facilities

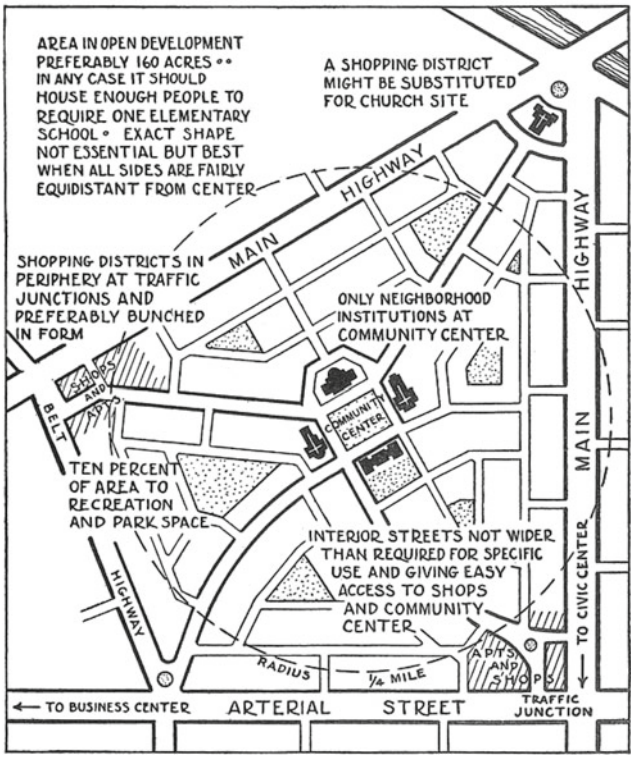

Fig. 1 Perry's Neighbourhood Unit model (Perry, 1929a)

and commercial areas within walking distance from home (Perry, 1929a; Sharifi, 2016).

Although conceived as the key mechanism for developing a more comprehensive urban reform operating at city scale, the NU was mainly applied to create residential developments, e.g. middle-class garden suburbs and social housing districts. An exemplary prototype of the NU is Radburn, a new town of approximately 5,000 inhabitants[2] planned by Clarence Stein in New Jersey in 1929 as a satellite district of New York equipped with basic facilities and administrative autonomy. Advertised as 'the Town for Motor Age' (Fig. 2), Radburn is in fact a representation of Perry's intent to balance the 'ever-growing stream of cars' providing a safe and liveable environment made up of 'residential islands' (Perry, 1929b, p. 99), with the expectation that this would generate a sense of belonging and community among the inhabitants.

Both the NU and Radburn have greatly influenced urban planning theory and practice throughout the twentieth century, anticipating planning tools and principles such as the superblocks, traffic specialization and functional segregation that informed CIAM urbanism (Panerai et al., 2004; Mehaffy et al., 2014). On the other hand, the NU was criticized by

[2] The original plan for 25,000 inhabitants was never implemented due to the 1929 financial crisis.

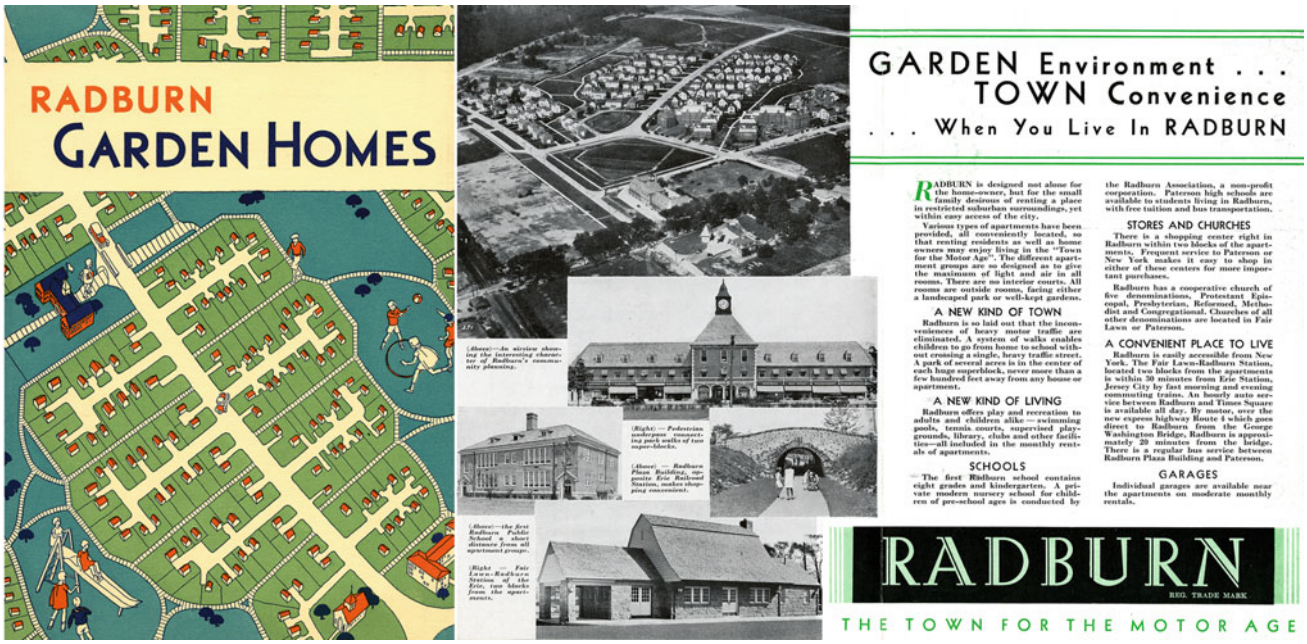

Fig. 2 Pages from the advertising booklet of Radburn, 'the Town for the Motor Age', 1929. *Source* Rockefeller Archive Center (CC by 4.0)

scholars who argued that this inward-looking model would undermine the integrity, identity and vitality of the city and foster social segregation (Jacobs, 1961; Mehaffy et al., 2014).

After WW2, the NU was adopted for the design of the English New Towns, whereas Radburn was taken as a model for several residential developments in the US, Canada, the UK and Australia. The NU also inspired Colin Buchanan's Environmental Area scheme (Fig. 3)—a pedestrian-friendly zone included in the major city road network (Buchanan, 1963)—largely applied in the second generation of English New Towns (e.g. Milton Keynes) and in several planned urban additions in North European countries. Examples of the adaptation of the NU to social housing programmes can be found in Italy, both in post-war large-scale estates developed by the national agency INA-Casa—e.g. the Quartiere Tiburtino and Quartiere Tuscolano in Rome (Caniglia Rispoli & Signorelli, 2001)—and in small-scale projects from the 1970s and 1980s. Among the latter, two neighbourhoods designed by Giancarlo De Carlo are worth mentioning for their experimental character: the Villaggio Matteotti in Terni (Fig. 4), an early example of participatory design involving the housing recipients, and the Quartiere Mazzorbo in Venice, an attempt to recreate the human scale of traditional communities in contemporary settings.

Scrutiny of the above-mentioned projects highlights several limitations deriving from Perry's NU model such as dependency on the mother city for most of their needs except for housing. Moreover, these projects often produce social enclaves, either for privileged or disadvantaged populations, and this, contrary to Perry's predictions, frequently goes hand in hand with the deterioration of the built environment and the spread of micro-crimes (The Academy of Urbanism, 2015).

2.2 Extra-Disciplinary Contributions on the Concept of Proximity and Implications for Urban Planning and Design

The concept of proximity is central to theories developed in the cognate fields of geography and anthropology, such as the Central Place Theory (CPT) and the Proxemics Theory, which have influenced urban design and planning.

CPT was formulated by German geographer Walter Christaller in 1933 (Hall, 2002). This theory is grounded on the assumption that space is isotropic, population density and purchasing power are constant and people behave as consumers. Accordingly, it theorizes that people would act rationally to minimize transportation costs by visiting the nearest location offering the desired goods or services (Terfrüchte & Flex, 2018). Translated into physical terms, it suggests a hierarchical structure (Fig. 5) from neighbourhood to district to city in terms of catchment areas for services and facilities of different calibre, although this structure should not prevent 'people from having free choice as to which of these areas they frequent and which of their services and facilities they use—provided they are mobile; hence the importance of mobility in the city or city region'

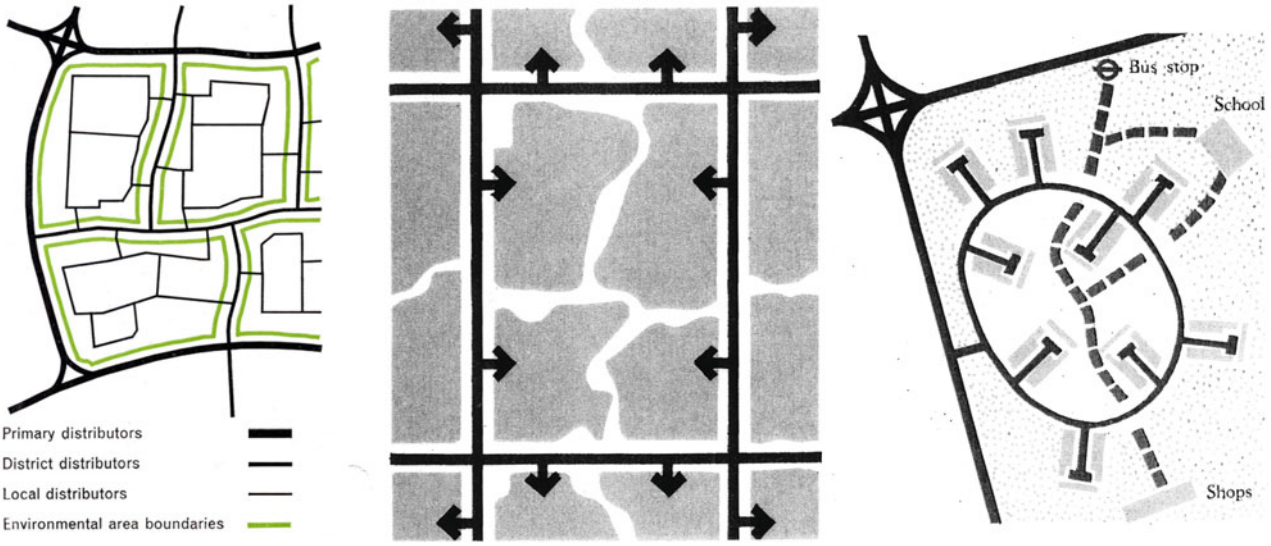

Fig. 3 Buchanan's schemes for the Environmental Area, inspired by Radburn's layout (Buchanan, 1963)

Fig. 4 The Villaggio Matteotti at Terni (Italy), designed by Giancarlo De Carlo (1975). *Photo* Giorgio Casali (https://www.facebook.com/centrostudigiancarlodecarlo/)

(Frey, 1999). CPT has had a significant impact on territorial and spatial planning throughout the twentieth century in Europe and beyond. For example, Terfrüchte and Flex (2018) highlight spatial-related influences in the fields of regional settlement development, commercial economy, mobility planning and large-scale retail, while Barton and colleagues (2006) focus on CPT's impact on the field of neighborhood planning and design.

Proximity is also inherently related to the Proxemics Theory developed by the American anthropologist Edward T. Hall in the 1960s. With the term proxemics—made up of the terms 'proximity' and 'phonemics'—Hall refers to the meanings that humans attribute to the concepts of distance and space and thus identifies four main types of space that surround individuals: intimate, personal, social and public space (Hall, 1966). Intimate space can only be entered by the closest friends and intimates; personal space is for interaction between friends; social space is where exchange with acquaintances takes place; and public space is where public relations and public speaking happen. Proxemics Theory has greatly influenced urban design and placemaking: for instance, in his work, Jan Gehl refers to

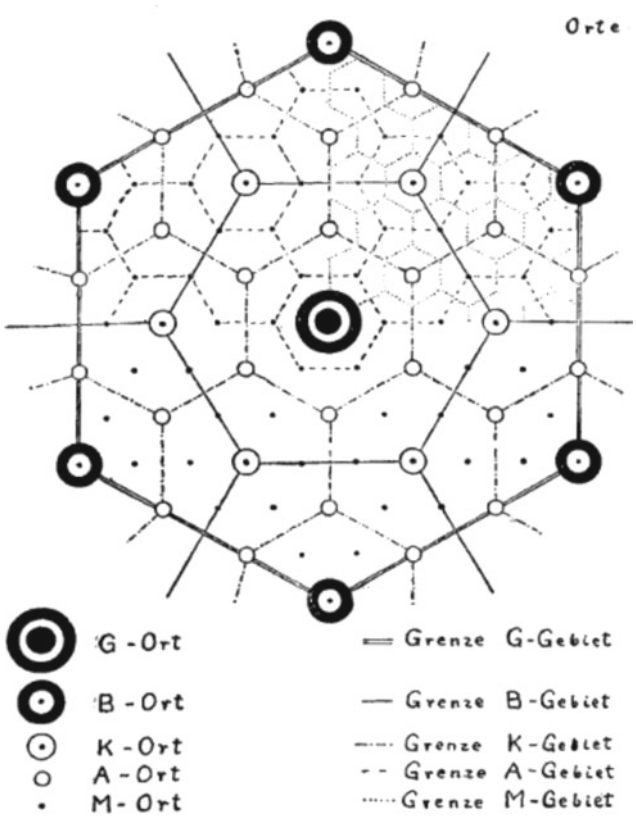

Fig. 5 Christaller's hierarchical city structure, according to the Central Place Theory (Christaller, 1933)

Hall's Proxemics Theory about space, distance and human senses to provide design guidelines for working with the human scale and applying it to urban design and regeneration projects (Gehl, 1971, 2010).

2.3 The New Urbanism and the Revision of the 'Traditional Neighbourhood'

In the early 1990s, urban proximity and the neighbourhood-scale became central themes in the international debate on sustainable development and cities due to the publication of the Brundtland Report (WCED, 1987) and the organization of the Earth Summit in Rio de Janeiro in 1992.

In the United States, sustainable urban development has been addressed through the lens of 'Smart Growth', a low-impact urban development model proposed as a solution to mitigate sprawl by supporters of New Urbanism, a movement inspired by neo-traditionalist architectural and urban theories advocated in Europe by Leon and Rob Krier (Duany et al., 2000). According to the New Urbanism principles,[3] urban planners should strive to create mixed-use neighbourhoods where different functions and facilities—such as housing, shops, workplaces, schools, parks and essential civic facilities—are integrated and located within walking distance from public transport hubs. Specifically, this idea of creating mixed-use neighbourhoods, where urban proximity and accessibility to public transportation are development drivers, is central to the Transit-Oriented Development model (TOD), promoted by Calthorpe (1993) as a neighbourhood or district within an average walking distance of 2,000 ft (about 10 min) from a transit stop and a core commercial area (Fig. 6).

The TOD model has widely influenced urban design and planning and has been put into practice internationally as part of urban renewal processes and neighbourhood developments. For instance, in Portland (USA) the TOD model has been taken as a reference for metropolitan planning since 1995 and has been key to the city's Climate Action Plan (2015) which aims to create a network of '20-min neighbourhoods' where 90% of residents can easily walk or bicycle to reach all basic daily needs (City of Portland, n.d.). A similar approach to the TOD model can be found in Melbourne, Australia, where it has been adopted by the Melbourne Minister for Planning as part of the Melbourne Plan 2017–2050 to develop the 20-Minute Neighbourhood Pilot programme, which promotes access within a 20-min return walking trip from home to 17 facilities (Fig. 7) including local schools, shopping centres, green areas, health services and the like (State of Victoria, 2019). Further examples of New Urbanism influence on North American urban planning can be found in the publication of the *Smart Growth Manual* (Duany et al., 2010) and in the involvement of the Congress of New Urbanism in the definition of the LEED certification criteria for Sustainable Neighbourhood Development (LEED-ND) (USGBC, n.d.).

Beyond its legacy, New Urbanism has been critically discussed in literature by scholars who questioned its deployment for creating market-driven new developments and redevelopments across the US that often led to gentrification and the expulsion of local residents thus producing socially segregated enclaves built within privileged areas or in low-income neighbourhoods (e.g. Hetzler et al., 2006; Smith, 2002; Talen, 1999, 2019; Wyly & Hammel, 2003).

[3] These principles are outlined in notable New Urbanism manifestoes such as the *Ahwhanee Principles for Resource-Efficient Communities* released by the non-profit organization Local Government Commission (LGC) in 1991; the *Charter of New Urbanism*, written during the first Congress for the New Urbanism (CNU, 1993); the decalogue of Smart Growth, set out by the Smart Growth Network (1998) and the *Canons of Sustainable Architecture and Urbanism*, published by the CNU in 2009 as an addendum to the Charter of New Urbanism.

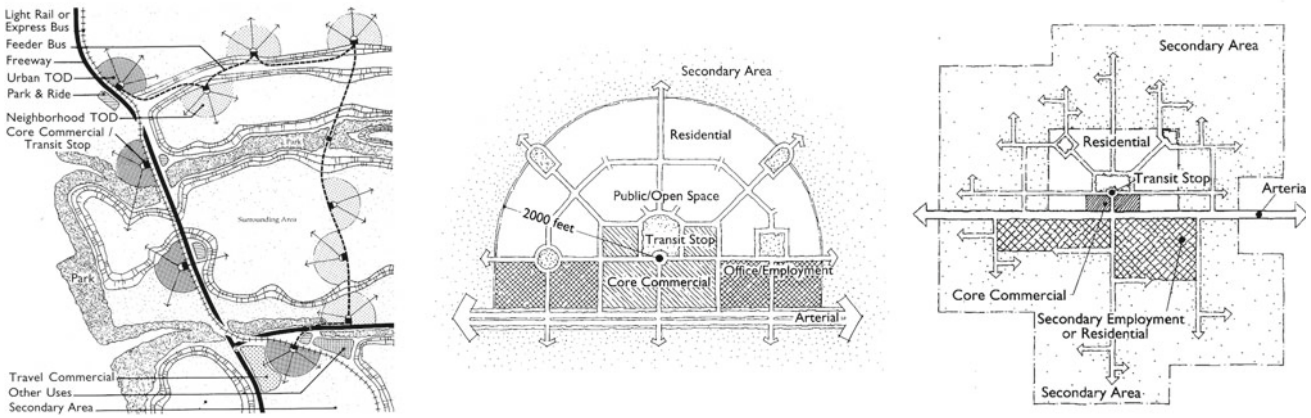

Fig. 6 Calthorpe's schemes for the Transit-Oriented Development (Calthorpe, 1993)

Fig. 7 Melbourne's 20-Minute Neighbourhood features. *Source* State of Victoria

2.4 Further Approaches to Urban Proximity as a Dimension of Sustainable Urban Models

Urban fabric density, mixed-use neighbourhoods and districts networked by a hierarchy of public transport lines are also key ingredients of the Compact City, a reference model for the sustainable city in the European tradition of urban planning studies (Burton et al., 1996). This approach was inspired by the British government's strategy for a 'new urban renaissance' developed at the turn of the century (The Urban Taskforce, 1999) and is still a key reference for EU urban policies. Another seminal example is represented by the *Ecocity. Urban Development towards Appropriate Structures for Sustainable Transport*[4] research project which identified the concept of the 'City of short distances' as a pivotal feature of a polycentric urban model, structured around a network of mixed-use city quarters with access to green areas, affordable housing and jobs, low environmental impact from transport and efficient use of local resources (Gaffron et al., 2005). Furthermore, a similar approach can

[4] This research was conducted by the Hamburg University of Technology with the financial support of the European Commission.

be found in the so-called 'eco-neighbourhoods' and 'eco-districts' implemented in several European countries, such as the Hammarby Sjostad (Stockholm) and the Bo01 (Malmö) in Sweden, the Vauban and Rieselfeld (Freiburg) in Germany, the GWL Terrain (Amsterdam) in Holland and the ZAC Le Bonne (Grenoble) in France.

3 The Proximity City in the Wake of the COVID-19 Pandemic

The 15-Minute City (or the 'complete neighbourhood') model along with concepts of urban proximity, the increase of green areas and the creation of city-wide walking and cycling networks have been reported in the *Mayors' Agenda for a Green and Just Recovery* (C40, 2020) as key measures to socio-economic policies to be adopted in response to the COVID-19 pandemic.[5] In this Agenda, Portland's strategy for 20-Minute Neighbourhoods and Mayor of Paris Anne Hidalgo's programme for the *Ville du quart'heure* are mentioned as best practices adaptable to different urban contexts in response to global challenges. As for the latter, *la Ville du quart'heure* or *Ville de la proximité* is one of the pillars of Hidalgo's second-term political programme *Paris en Commun*, aimed at ensuring full access to the main urban functions, including housing, work, healthcare, education, shopping and recreation, within neighbourhoods that can be covered in 15 min on foot and 5 min by bicycle (Fig. 8). To achieve this goal, the city has set up participatory processes to redesign existing spaces and facilities in all Paris districts, where schools should play the role of pivots in the community, similarly to Perry's NU, and become the catalysts of urban regeneration (Ville de Paris, 2021).

Within the C40 group, the 15-Minute City model has inspired Mayor Claudia López to turn Bogota into a 30-Minute City by enforcing a polycentric plan, 'where the inhabitants can live and work within a 30-min radius, in environmentally sustainable districts linked by green corridors, with priority for pedestrians and cyclists' (Alcadía de Bogotà, 2020). This plan aims to implement a still very ambitious but more realistic model than the 15-Minute City one, as people in Bogota currently spend a daily average of two hours commuting from the residential *barrios* to work.

Other cities, such as Barcelona and Milan, that subscribed to the *Mayors' Agenda*, have given new impetus during the COVID-19 crisis to projects already underway aimed at strengthening the role of neighbourhoods in providing services for citizens, inclusive public space and green areas, and in promoting active mobility. For example, Barcelona has developed a new interpretation of the 'superblock' (*Superilla*) model, which was introduced in 2016 as part of the city's sustainable mobility strategy. This implies the aggregation of several urban blocks whose streets are turned into public spaces, redesigned by means of tactical urbanism techniques and closed to the main traffic flows which are channelled to the outer superblock's perimeter—like the traffic management model first implemented in Radburn on the existing city pattern. After the successful testing of the *Superilla* in three pilot neighbourhoods (Poblenou, Horta and Sant Antoni), in 2021, the programme was extended to the whole central city with the aim of reallocating 40 ha of road space to create new pedestrian and green areas at a short walking distance from citizens' homes (Fig. 9) (Ajuntament de Barcelona, n.d.).

In Milan, a place-based approach has been applied to the *Piazze Aperte* (Open Squares) programme. From 2018, this programme has been developed by the City in cooperation with Bloomberg Associates, the National Association of City Transportation Officials and the Global Designing Cities Initiative to convert street intersections and parking lots into public spaces, involving residents' associations in the design and management process (Fig. 10). Following a public call launched in 2019, the city has collected 65 proposals for the redevelopment of community spaces within the framework of the so-called Piano Quartieri (Neighbourhoods Plan) (Comune di Milano, 2020a). In 2020, the *Piazze Aperte* program was paired with *Strade Aperte* (Open Streets), a new initiative which aims to increase sidewalkmes and bicycle lanes along the main urban routes (Comune di Milano, 2020b).

A 'hyperlocal variation, on a national scale' (O'Sullivan, 2021) of the 15-Minute City underlies the 1-Minute City, a programme launched in 2020 by Sweden's innovation agency Vinnova in cooperation with the design think tank ArkDes and tested in Stockholm (Fig. 11), Gothenburg, and Helsingborg. Here, a different approach to urban proximity has been implemented focusing on the space outside citizens' front door, with which 'you have the most regular and direct participation, responsibility, and interaction, merely propped up on propinquity' (Hill, 2020). In the 1-Minute City, the street is treated as the elementary unit of the city, to be regained as a community space through a combination of traffic-calming measures, re-greening and newly designed modular street furniture, which can be quickly assembled by residents to build basic facilities such as playgrounds, urban gardens, spaces for sitting, bicycle racks and the like (Hill, 2020). In so doing, in the long term, it aims to transform a 40,000 km national street network into living streets for the people and by the people.

[5] C40 is a network of world cities committed to achieving the climate targets of the Paris Agreement.

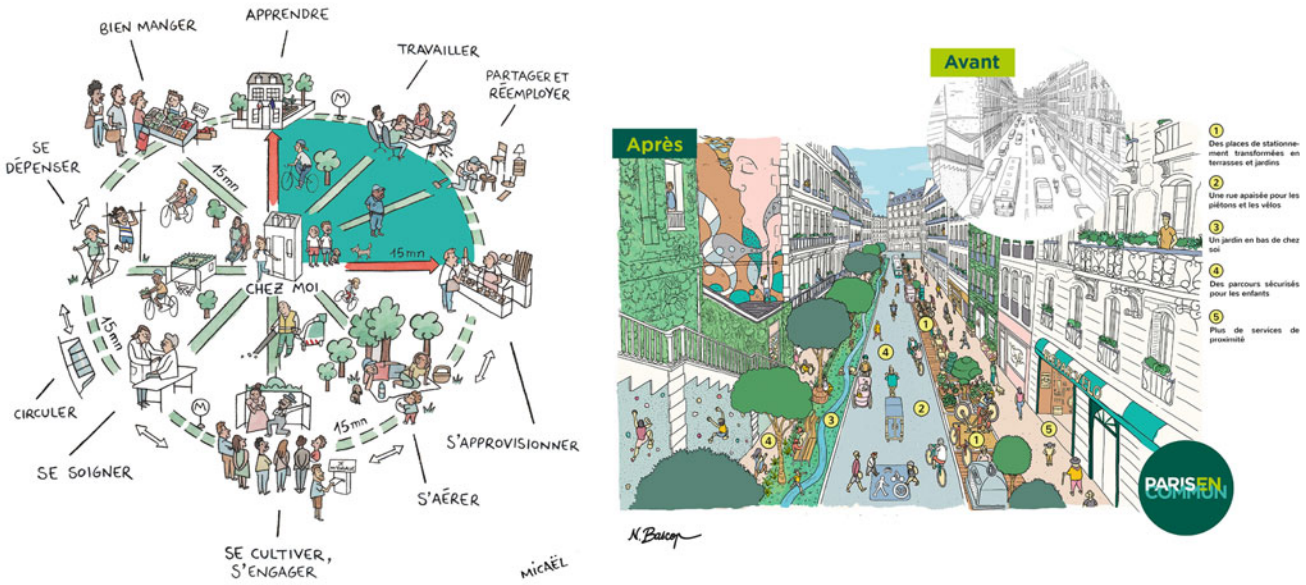

Fig. 8 The vision of Paris as *Ville du quart d'heure*. *Source* Ville de Paris

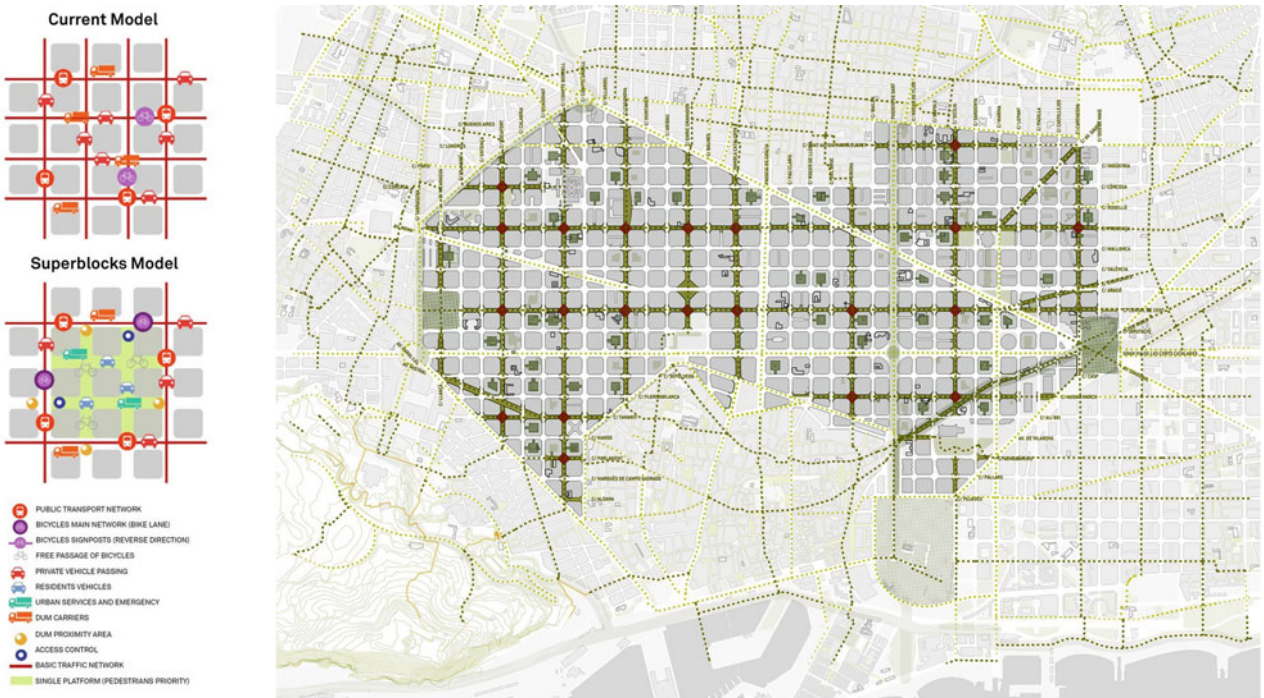

Fig. 9 Barcelona's Superblocks model and regreening plan. *Source* Ajuntament de Barcelona

Fig. 10 Piazza Bacone, an example of public space regeneration in the framework of Milan's *Piazze Aperte* programme. *Source* Comune di Milano

Fig. 11 Street furniture in Stockholm to implement the 1-Minute City. *Photo* Elsa-Soläng (https://www.facebook.com/ArkDes/photos/4012305508785954)

4 Discussion

A comparison between the characteristics of the 15-Minute City required to respond to the challenges of the eco-social transition of cities—amplified and made more urgent by the pandemic—and the objectives pursued and the results obtained by the aforementioned past experiences suggest that considering 'planning by neighbourhoods' (Mumford, 1954, p. 256) is not sufficient by itself to accomplish the desired social and spatial objectives, as per the examples discussed hereafter.

Self-sufficiency for most people's needs

This is a goal that planned neighbourhoods conceived as 'residential islands' (Perry, 1929b) failed or didn't even attempt to achieve. Mixed uses are in fact only viable in well-integrated urban systems where local, small urban 'cells' are clustered within 'larger spatial units' (Frey, 1999) and have a sufficient critical mass to ensure, at different scales, a balance between the supply and demand of public and private services: this condition reflects the Christallerian hierarchical principle to some extent. It leads to an idea of neighbourhoods with blurred boundaries within a continuous

urban fabric, albeit with variable density, that is more akin to the traditional *quartier* of historic European cities, such as Paris and Milan, than suburbs modelled like Radburn; alternatively, or additionally, this implies a polycentric system of networked districts, as driven by the TOD approach. As for the possibility of bringing work and home closer together, envisaged by *la Ville du quart d'heure* (which differs in this respect from the 20-Minute Neighbourhood), this would imply 'an economic revolution' (Sennet, 2020) eventually induced by the COVID-19 pandemic or other external factors and supported by public administrations willing to adopt new approaches to urban welfare.

Social cohesion and inclusiveness

Social and economic homogeneity is a recurring feature of planned neighbourhoods, whether it be new developments for the free market or housing estates, which usually facilitates spontaneous interaction and solidarity among neighbours, but can also bring about social segregation and increased urban inequality. As Talen (1999, 2019) pointed out, there is no evidence that the urban form of a neighbourhood could by itself engender a sense of community (as claimed, in particular, by the New Urbanism theory). Class division also affects traditional neighbourhoods due to different real estate values. There is therefore a real risk that, given the lack of incisive social policies and corrective measures for the market, more neighbourhood services could trigger gentrification processes in contradiction to the vision of a post-COVID city 'with jobs and an inclusive economy for all, resilient and equitable communities', as outlined by the C40 *Mayor's Agenda* (C40, 2020, p. 9).

Environmental sustainability and climate responsiveness

Sustainability and climate-related objectives, uncovered in the earlier models, can be fruitfully addressed through the design of new developments (as an increasing number of eco-neighbourhoods show), as well as in urban regeneration projects inspired by proximity models. Nonetheless, they refer to global challenges that cannot be reduced to the scale of the neighbourhood but push for systematic action at the scale of the city and the region. Even the shift to sustainable travel modes, a hallmark of the TODs and the 15-Minute City, is not implicit in 'planning by neighbourhoods'. On the contrary, in Perry's NU and its direct or indirect derivations (via Radburn or Buchanan's Environmental Area), the creation of safe pedestrian precincts in the middle of a superblock facilitates mass motorization in cities and has often resulted in the building of new urban developments, where car dependency is at its highest.

Resilience to future health crises

This requirement 'flags up a big issue: how to reconcile and integrate the healthy city with the green city' (Sennet, 2020), as it challenges both the idea of density/compactness usually associated with urban sustainability and the role of public transport (where social distancing is impossible to accomplish without a significant impact on service costs or prices) as the main alternative to car mobility. Its achievement by means of the 15-Minute City or similar models is therefore strictly related to the self-sufficiency rate neighbourhoods can actually provide in the fulfilment of people's everyday needs, including different forms of work. An essential item is also to ensure that citizens have access to large green areas that allow freedom of movement while maintaining interpersonal distancing. This is relatively easier to find in suburban developments, but in urban central areas, it may require a radical approach, like that implemented in Barcelona with the extended *Superilla* project.

5 Conclusion and Future Research Directions

The 15-Minute City model is currently being implemented in several Western cities. The scrutiny of the selected policies, plans and pilots presented in this article showed that they share common characteristics consisting of human-scale design, access to public transport, a mix of services and activities, environmental quality of public spaces and pedestrian-friendly streetscapes. On the other hand, it emerged that further research is needed to investigate the spatial, social and environmental outcomes of these programmes and projects in order to validate this model(s). Along this line, a comparative analysis between the case studies of Paris, Barcelona and Milan highlighted how the concept of urban proximity has been operationalized in different ways according to (i) administrative management and governance models, (ii) planning and implementation procedures and (iii) the social, economic and environmental impacts expected from the planned measures (Alberti & Radicchi, 2022). As per this comparative study, the 15-Minute City label proved to be reductive, especially in light of its implications for urban welfare and economy, once taken as the blueprint of urban transition and 'just recovery' policies, as pointed out in the discussion section.

In addition, this review points to replicability and inclusiveness issues that may affect the 15-Minute City model thus suggesting, on the one hand, the need for further studies and applications of the model in practice that account for sensorial and cognitive disabilities across different populations (e.g. the elderly), by mobilizing a diversity, equity and

inclusion approach (see inter alia Agyeman & Evans, 2003). On the other hand, the replicability of the model should be further tested, for example, by applying it (or even Bogota's 30-min variant) in cities located in the Global South and Asia. In fact, the trust placed in the suitability of this model for solving living and working issues, which originated from the pandemic outbreak in European and US cities, does not necessarily assure that it will properly work when applied to other geographical contexts.

References

Agyeman, J., & Evans, T. (2003). Towards just sustainability in urban communities: Building equity rights with sustainable solutions. *Annals of American Academy of Political and Social Science, 590*, 35–53.

Ajuntament de Barcelona. (n.d.). *Superilles*. https://ajuntament.barcelona.cat/superilles/en.

Alberti, F., & Radicchi, A. (2022). The Proximity City: A comparative analysis between Paris, Barcelona and Milan. *Techne. Journal of Technology for Architecture and Environment, 23*, 69–77.

Alcadía de Bogotà. (2020, September 23). *Mayor Claudia López spoke about her plan to build a 30 minute city*. https://bogota.gov.co/en/international/mayor-claudia-lopez-spoke-about-her-plan-build-30-minute-city.

Barton, H., Grant, M., & Guise, R. (2006). *Shaping neighbourhoods: For local health and global sustainability*. Routledge.

Buchanan, C. (Ed.). (1963). *Traffic in towns. A study of the long term problems of traffic in urban areas*. Her Majesty's Stationery Office.

Burton, E., Jenks, M., & Williams, K. (Eds.). (2021). *The compact city: A sustainable urban form?*. Third Edition. Routledge.

C40 Cities. (2020). *Mayors' agenda for a green and just recovery*. https://www.c40knowledgehub.org/s/article/C40-Mayors-Agenda-for-a-Green-and-Just-Recovery?language=en_US.

Calthorpe, P. (1993). *The next American metropolis: Ecology, community, and the American dream*. Princeton Architectural Press.

Cambridge Dictionary. (2021, May 31). *New words*. About Words. https://dictionaryblog.cambridge.org/2021/05/31/new-words-31-may-2021/.

Caniglia Rispoli, C., & Signorelli, A. (2001). L'esperienza del piano Ina-Casa: tra antropologia e urbanistica. In P. Di Biagi (Ed.), *La grande ricostruzione. Il piano Ina-Casa e l'Italia degli anni '50* (pp. 187–204). Donzelli Editore.

Christaller, W. (1933). *Die zentralen Orte in Süddeutschland*. Gustav Fischer.

City of Portland. (n.d.). *Portland Plan. 20-Minute Neighborhoods*. https://www.portlandonline.com/portlandplan/index.cfm?c=52256&a=288098.

Comune di Milano. (2020a, February 11). *Piano Quartieri. Piazze Aperte*. https://www.comune.milano.it/aree-tematiche/quartieri/piano-quartieri/piazze-aperte.

Comune di Milano. (2020b, April 30). *Quartieri. Con "Strade aperte" nuove aree pedonali, ciclabili, zone 30 e spazi pubblici*. https://www.comune.milano.it/-/quartieri.-con-strade-aperte-nuove-aree-pedonali-ciclabili-zone-30-e-spazi-pubblici.

CNU, Congress for New Urbanism. (1993). *The charter of new urbanism*. https://www.cnu.org/who-we-are/charter-new-urbanism.

CNU, Congress for New Urbanism. (2009). *Canons of sustainable architecture and urbanism*. https://www.cnu.org/charter-new-urbanism/canons-sustainable-architecture-and-urbanism.

Cuthbert, A. (2007). *The form of cities*. Wiley.

Duany, A., Plater-Zyberk, E., & Speck, J. (2000). *Suburban nation: The rise of sprawl and the decline of the American dream*. North Point Press.

Duany, A., Speck, J., & Lydon, M. (2010). *The smart growth manual*. McGraw Hill.

Forsyth, A. (2020, March 19). What role do planning and design play in a pandemic? *Harvard University Graduate School of Design. News*. https://www.gsd.harvard.edu/2020/03/what-role-do-planning-and-design-play-in-a-pandemic-ann-forsyth-reflects-on-covid-19s-impact-on-the-future-of-urban-life/.

Frey, H. (1999). *Designing the city. Towards a more sustainable urban form*. Taylor & Francis.

Gaffron, Ph., Huismans, G., & Skala, F. (Eds.). (2005). *Ecocity, Book I. A better place to live*. Facultas Verlags- und Buchhandels AG. https://www.oekostadt.at/root/img/pool/files/book_1.pdf.

Gehl, J. (1971). *Life between buildings. Using public space*. Arkitektens Forlag/The Danish Architectural Press.

Gehl, J. (2010). *Cities for people*. Island Press.

Hall, T. E. (1966). *The hidden dimension*. Peter Smith Pub.

Hall, P. (2002). *Cities of tomorrow*. Wiley-Blackwel.

Hetzler, O., Medina, V. E., & Overfelt, D. (2006). Gentrification, displacement and new urbanism: The next racial project. *Sociation Today, 4*(2). http://www.ncsociology.org/sociationtoday/v42/gent.htm.

Hill, D. (2020). 36. Slowdown landscapes: One-Minute City—Fifteen-Minute. *Slowdown papers. Beyond the curve of the coronavirus*. https://medium.com/slowdown-papers/35-slowdown-patterns-one-minute-city-fifteen-minute-city-5bfeeaaff01e.

Jacobs, J. (1961). *The death and life of great American cities*. Random House.

LGC, Local Government Commission. (1991). *Ahwhanee principles for resource-efficient communities*. https://www.lgc.org/who-we-are/ahwahnee/principles/.

Mehaffy, M. W., Porta, S., & Romice, O. (2014). The "neighborhood unit" on trial: A case study in the impacts of urban morphology. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*. https://doi.org/10.1080/17549175.2014.908786.

Moreno, C., Allam, Z., Chabaud, D., Gall, C., & Pratlong, F. (2021). Introducing the "15-Minute City": Sustainability, resilience and place identity in future post-pandemic cities. *Smart Cities, 4*(1), 93–111.

Mumford, L. (1954). The neighborhood and the neighborhood unit. *Town Planning Review, 24*(4), 256–270.

O'Sullivan, F. (2021). Make way for the 'One-Minute City'. *Bloomberg CityLab*. https://www.bloomberg.com/news/features/2021-01-05/a-tiny-twist-on-street-design-the-one-minute-city.

O'Sullivan, F., & Bliss, L. (2020). The 15-Minute City—No cars required—Is urban planning's new utopia. *Bloomberg New Economy*. https://www.bloomberg.com/news/features/2020-11-12/paris-s-15-minute-city-could-be-coming-to-an-urban-area-near-you.

Panerai, P., Castex, J., DePaule, C., & Samuels, I. (2004). *Urban forms: The death and life of the urban block*. Architectural Press/Elsevier.

Perry, C. A. (1929a). The neighborhood unit, a scheme of arrangement for the family-life community. *Neighborhood and Community Planning, Regional Plan of New York and Its Environs*. Committee on Regional Plan of New York and Its Environs, *8*, 30.

Perry, C. A. (1929b). City planning for neighborhood life. *Social Forces, 8*(1), 98–100.

Sharifi, A. (2016). From garden city to eco-urbanism: The quest for sustainable neighborhood development. *Sustainable Cities and Society, 20*, 1–16. https://doi.org/10.1016/j.scs.2015.09.002

Sennet, R. (2020). How should we live? Density in post-pandemic cities. *Domus,* 1046. https://www.domusweb.it/en/architecture/

2020/05/09/how-should-we-live-density-in-post-pandemic-cities.html.

Smart Growth Network. (1998). *The principles of smart growth.* https://smartgrowth.org/smart-growth-principles/.

Smith, N. (2002). New globalism, new urbanism: Gentrification as global urban strategy. *Antipode, 34*(3), 427–450. https://doi.org/10.1111/1467-8330.00249.

State of Victoria. (2019). *20-Minute Neighbourhoods. Creating a more liveable Melbourne*. https://www.planning.vic.gov.au/__data/assets/pdf_file/0031/428908/Creating-a-more-liveable-Melbourne.pdf.

Talen, E. (1999). Sense of community and neighbourhood form: An assessment of the social doctrine of new urbanism. *Urban Studies, 36*(8), 1361–1379.

Talen, E. (2019). *Neighborhood*. Oxford University Press.

Terfrüchte, T., & Flex, T. (2018). Zentraler Ort. In ARL—Akademie für Raumforschung und Landesplanung (Eds.), *Handwörterbuch der Stadt- und Raumentwicklung*. https://shop.arl-net.de/media/direct/pdf/HWB%202018/Zentraler%20Ort.pdf.

The Academy of Urbanism. (2015, January 12). Urban idiocy: Brilliant ideas that ruined our cities. *AoU Journal Here & Now*. https://www.academyofurbanism.org.uk/urban-idiocy-brilliant-ideas-that-ruined-our-cities/.

The Urban Taskforce. (1999). *Towards an urban renaissance*. Routledge.

USGBC, US Green Building Council. (n.d). *LEED certification for neighborhood development*. Retrieved March 31, 2022, from https://www.usgbc.org/leed/rating-systems/neighborhood-development.

Ville de Paris. (2021, November 23). *Paris ville du quart d'heure, ou le pari de la proximité*. https://www.paris.fr/dossiers/paris-ville-du-quart-d-heure-ou-le-pari-de-la-proximite-37.

WCED, World Commission on Environment and Development. (1987). *Our common future*. Oxford University Press.

Wyly, E. K., & Hammel, D. J. (2003). Mapping neoliberal American urbanism. In R. Atkinson & G. Bridge (Eds.), *Gentrification in a global context: The new urban colonialism* (pp. 18–38). Routledge.

The Nature Smart City—Defining the Next Urban Vision

Anne Stenros

Abstract

Architect Cedric Price raised a critical voice already in 1966, stating that "Technology is the answer, but what was the question?"—Today, we need to reframe the question of human society, cities, and nature to understand their interdependencies in order to create a more humane and sustainable both man-made and natural environment in the future. Narratives represent collective wisdom in a nutshell, they encapsulate complex information into a compact and memorable form. Climate change is one collective narrative and thread that should be written into a legend. What kind of narrative could be powerful enough to save the planet and us in the future? I have proposed a new urban narrative, the Nature Smart City, based on the theory of multiple intelligences by Howard Gardner. Nature Smart is one of the seven human intelligences, and it is an essential element of our nature connection. By applying nature wisdom, we can create more sustainable, livable, and lovable cities. However, single cities are not enough when reframing the future planetary problems; instead, we need an all-encompassing perspective, a new meta-narrative for a more sustainable future, doing and living well. By combining local ecological, environmental, individual, and social information, data, and wisdom through systems thinking, we can start to build a powerful future meta-narrative, that of the nature smart society, which is based on nature wisdom and the quest for human-nature wellbeing. It confronts the prevailing meta-narrative of techno progress and replaces it with a narrative of harmony, health, humanity, and hope.

Keywords

Architecture • Urban planning • Nature smart city • Eco smart city • Biophilic city • Biophilic architecture • Biophilic design • Blue and green spaces

1 Introduction: Fifty Years Later

"I believe that I do not really teach architecture, but that I teach myself."—Louis I. Kahn

My father is an emeritus professor of architecture, currently 90+ years old. Recently, I found some papers that he gave me a long time ago, before I was about to begin my studies in another Finnish school of architecture. The bottom-most paper in the box happened to be his teaching curriculum for first-year architecture studies. Top of the list in the fall semester there were the topics: Spiritual Needs, Work, Exercising the Body, Living Well, Nature, Neighborhood, and Milieu. The program was planned for the fall of 1972. Those were early days of Environmental Psychology, a topic that my father brought into the curriculum of architecture, a first in Finland. Already 50 years ago, he talked about the architectural quintessence of human life and wellbeing related to creating, designing, building, and planning the built environment.

And there I was, almost 50 years later, sitting and writing about the very same topics without knowing or remembering my father's list. My themes were: Personal Wellbeing, Human Health, Human–Nature Connection, Community Spirit, and Planetary Boundaries. Was it a coincidence?—Or could the approach result from decades of interaction with my kin? I was wondering who would be next to write about these themes 50 years from now, in the 2070s? Perhaps someone who had listened to me and become inspired by the topics that I have tried to explain, and then developed them further through their experiences. Or perhaps it will be a person sitting under the very same mother tree and getting

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the wisdom and knowledge from there, like an ancient storyteller sharing an everlasting epic.

I remember reading in my early years in architecture about Louis I. Kahn's idea of the origin of the school. There was a drawing of a big tree with people sitting under it in the shadow. The text stated: "Schools began with a man under a tree, who did not know he was a teacher, discussing his realization with a few, who did not know they were students."

In my mind, this story told by Kahn is the origin of the human version of a Mother Tree or a Hub Tree. Professor Suzanne Simard, who created the ground-breaking and radical theory of the complex interdependent relationships in forests among the trees, has recently published a book about the essence and importance of mother trees for forest well-being. Her research centers on the relationships between plants, microbes, soil, carbon, nutrients, and water that underlie the adaptability of ecosystems, especially the below-ground fungal networks that connect trees and facilitate interplant communication and support (Featuring Suzanne Simard, 2021).

> Mother trees can recognize her kin and intentionally transfer carbon to her kin seedlings to favor them. That's a behavior that has got intention and consequences, and there's decision-making going on there…There's a choice. And we could deconstruct that to physics or something like that, but when we were starting to discover that she recognized her kin and could send more resources, I thought that's wisdom, because there's intention there. There's a sentience. (Featuring Suzanne Simard, 2021)

In our cultural ecosystem, a Mother Tree is someone who has extensive knowledge and original wisdom, and who is willing to share that insight and understanding with others. To be a Hub Tree is a passion, not a role. It is to encourage each and everyone by coexisting and co-envisioning with others through helping them to flourish and thrive in what they are doing. A Mother Tree is supportive of others through her encouraging, doing, networking, speaking, writing, and reading. The best Mother Trees don't consider themselves teachers, rather they are lifetime students. They pass the knowledge that they have acquired during their lifetime in doing, learning, and experiencing. Their appetite and openness for new things and topics are endless. They explore and experiment, since they are excited about a vast number of things. Yet at the same time, they know where they are heading.

They have a lifelong mission and vision to follow. You are lucky if you have met some of these Mother Trees during your lifetime.

However, not every tall tree is a Mother Tree. According to the story, the young Constantin Brancusi left the atelier of great Auguste Rodin after serving only a few months as an assistant by saying: "Nothing grows well in the shade of a big tree." A true Hub Tree can be recognized based on the person's integrity, humility, compassion, and kindness. A Mother Tree has strong roots and a tall trunk, sharing facts with a vision. The origin of a Mother Tree or a Hub Tree is a genuine understanding and respect for being a human in the service of others. The best forest is a diverse one, including both tall trees and seedlings and everything in between.

> If you have a structured forest where you've got small ones, and big ones helping out the small ones, and mid-canopy trees, and different species, they're occupying all the niches in that forest, that diverse forest, and so that's actually a much healthier forest, is to have that kind of diversity. (Featuring Suzanne Simard, 2021)

It took me a long time to understand that it is not enough to try my best, both at work and in life. We all need Mother Trees, people who support us and give us a second chance by believing in us more than we do ourselves. These people carry on living, generation after generation, as a living legacy of their wisdom and generosity for others. That is why they are the tallest trees in the forest. A Hub Tree is a teacher of teachers. Growing among and under Mother Trees and filtering their wisdom from generations of doing and living well with nature is the flow of life telling us that life itself is a constantly evolving force, it is:

A Living Idea

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> Life is an endless unfolding, and if we wish it to be, an endless process of self-discovery, an endless and unpredictable dialogue between our own potentialities and the life situations in which we find ourselves. By potentialities I mean not just intellectual gifts but the full range of one's capacities for learning, sensing, wondering, understanding, loving and aspiring.—John W. Gardner (Gardner, 2021)

2 Under a Mother Tree: A City is a Hub Tree

"The old trees nurture the young ones and provide them food and water just as we do with our own children. It is enough to make one pause, take a deep breath, and contemplate the social nature of the forest and how this is critical for evolution."—Suzanne Simard

In his widely cited essay, *A City is not a Tree* (1965), Architect Christopher Alexander defines cities as Natural Cities and Artificial Cities by saying that natural cities have grown mostly spontaneously over the years, whereas artificial cities have been deliberately created by designers and planners. Both have complex structures, but they differ system-wise by nature. According to Alexander, these two systems, a tree and a semilattice, are names for structures of sets. Says Alexander: "Both the tree and the semilattice are ways of thinking about how a large collection of many small systems goes to make up a large and complex system" (Alexander, 1965).

Fig. 1 A smart city as a tree. *Photo* © Kimmo Rönkä

Alexander emphasizes that the artificial city is always organized to form a tree. This means, according to him, that "whenever we have a tree structure, within this structure no piece of any unit is ever connected to other units, except through the medium of that unit as a whole. It is a little as though the members of a family were not free to make friends outside the family, except when the family as a whole made a friendship" (Alexander, 1965), (Fig. 1).

On the other hand, the semilattice, by comparison, is the structure of a complex fabric; it is the structure of living things, of great paintings and symphonies, says Alexander. In reality, semilattices represent a thicker, tougher, more subtle, and more complex view of structure. In the semilattice structure, the different units do not coincide, neither are they disjoint, but overlap. Says Alexander: "In a natural city, for example play takes place in a thousand places it fills the interstices of adult life. As they play, children become full of their surroundings" (Alexander, 1965, 14).

The key question that Alexander proposes in his essay is: why is it that so many designers have conceived cities as trees when the natural structure is in every case a semilattice? And his answer is:

> I shall try to convince you that it is for this second reason that trees are being proposed and built as cities - that is, because designers, limited as they must be by the capacity of the mind to form intuitively accessible structures, cannot achieve the complexity of the semilattice in a single mental act… The tree is accessible mentally and easy to deal with. The semilattice is hard to keep before the mind's eye and therefore hard to deal with. (Alexander, 1965, 16–17)

As a conclusion, a tree as a concept is a single complex system unlike the semilattice, which is a system of overlapping ecosystems. Alexander wrote his thesis of the natural city structure already almost 60 years ago and later published a book about it in 2015. But if we consider the latest development in the tree ecology, we can see a huge leap of development in understanding how trees function as microecosystems in the overall forest ecosystem. A tree as a metaphor is no more a stand-alone structure, rather a "socially connected" ecosystem with its overlapping connections. The current structural idea of a tree is therefore approaching the semilattice as a structure (Fig. 2).

We have generally thought of trees as disconnected loners, competing for water, nutrients, and sunlight, with the winners shading out the losers and sucking them dry. However, according to Peter Wohlleben, a pioneering German forester, trees are far more alert, social, sophisticated, and even intelligent than we thought—some are calling them the "wood-wide web". All the trees in every forest are connected to each other through underground fungal networks. Trees share water and nutrients through the networks, also using them to communicate. They send distress signals about drought and disease, for example, or insect attacks, and other trees alter their behavior when they receive these messages. They communicate and take care of each other as a complex system (Grant, 2018).

If we consider the new model of a mother tree or a hub tree with its endless underground networks by Professor Suzanne Simard, we see the tree concept of a city in a

Fig. 2 The nature smart city model. *Photo* © Anne Stenros

different light: it is getting closer to the semilattice structure. Therefore, it is fair to say that the model for the structure of a nature smart city is a Hub Tree. Following this idea, one can say that the old (current) structure of the smart city is like a tree planned as a simplified system that does not respond well to nature-like structures, as Alexander explains in his famous essay. On the other hand, nature smart cities are evolving naturally based on the timeless way of the human–nature connection in our evolution, just like the tallest trees in the forest: the hub trees of urban life. It is like seeing the city as the forest and trees at the same time. It is the new way to create a smart city based on naturalistic intelligence or nature smart, following Howard Gardner's idea of multiple intelligences. Years after publishing his famous book *Frames of Mind: The Theory of Multiple Intelligences* (Gardner, 1983), in which he defined seven types of intelligence, Gardner added an eighth one to his model: naturalistic intelligence. This type of intelligence allows us to relate to the environment and other species, to see both the forest and trees.

A beautiful example of this is Edward O. Wilson's idea of the *Savannah Gestalt* in his book *Biophilia* (Wilson, 1984). Wilson describes the right place or a natural habitation of humans by saying that the savannah gestalt is a manifestation of triple criteria: (1) an abundance of animal and plant food, (2) some topographic relief—cliffs, hillocks, and ridges, and (3) access to lakes or rivers that offer fish and protection. Wilson says that when these elements are put together, it seems that whenever people are given a free choice, they move to open tree-studded land on prominences overlooking water. This worldwide tendency is no longer dictated by the hard necessities of hunter-gatherer life. It has become largely aesthetic, a spur to art and landscaping. The savannah gestalt is responding to a deep genetic memory of mankind's optimal living environment. It is the place of places and the shelter of shelters, the original site of an urban hub tree (Wilson, 1984, 110–111).

We can see a single neighborhood as a hub tree, supporting the microlocalism within the forest of a city—or we can see an entire city as a hub tree connected in a complex way with other cities surrounding and nearby. A city as a hub tree is a simple model which is at the same time complex enough to explain the Next City. Biophilic architecture and the biophilic cities movement are attempts to grasp this new, layered model of the next city in practice.

In this forest of hub trees, culture is the invisible "mycelium" that is connecting all elements together. Art, ideas, inventions, knowledge, science, and stories all create a network of human wisdom to share and celebrate. It is a network that is nurturing, renewing, revitalizing, and restoring the human spirit that we all share. It is the essence of human life. It is the meaning—telos—of life.

An urban hub tree includes the ancient wisdom of human habitat interpreted through the ages as flourishing syntheses of living well in harmony with nature. The roots of the urban hub tree are the identity and the layers of wisdom in designing, planning, and building a community. It is the treasure box of ideas of great masters and builders. The trunk of the hub tree is the core of the craft: designing, planning, and building a human shelter. It is also the ethics of the craft: what, how, whom, where, when, and why. The foliage of the hub tree is the context, the culture, and the connections to

other actors and disciplines. And finally, the treetop is the aspirations and the ultimate purpose—the *telos*—of the built environment at large.

As a young, freshly graduated architect from Finland, I went to study in UC Berkeley as I admired Christopher Alexander's work, especially his books *The Timeless Way of Building* (1979) and *The Pattern Language* (1977). I took all the courses he taught in the semester of 1983–84. He planted a seed that is still flourishing: a passion for understanding the laws of nature in thinking, doing, acting, and writing. He has been one of my hub trees. In the end, I am happy to continue the path he showed me a long time ago. His structural thinking resonated with my mind, and he opened doors to a world that I never could have imagined on my own. At this point in life, returning back to my architectural roots after a long time, I feel like coming home to rediscover something I had lost for a while. In the footsteps of Chris Alexander, I have come a long way from spatial structures to the meaning of place and life, to find the truth or the telos of *genius loci*—the spirit of place and the answer to the existential question of just what a human habitat and a city are.

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What started as a legacy, and then a place of childhood home, solace, and adventure in western Canada, has grown into a fuller understanding of the intelligence of the forest and, further, an exploration of how we can regain our respect for this wisdom and heal our relationship with nature.—Suzanne Simard

3 In Search for Happiness: Towards a Post-anthropogenic World

"Happiness is the meaning and the purpose of life, the whole aim and end of human existence."—Aristotele

In the time of a grand transformation, there are several phases to be understood: (1) The Now, (2) The Transformation, (3) The After, and, finally, (4) The Next (starting from zero again). When navigating through the transformation, one must have a clear picture of what is happening Now, but also at the same time understand the nature of the Transformation itself and its drivers. Then comes the emerging After, the outcome of the transformation, the balancing post-transformation time. And finally, the seedlings of the Next are sprouting, pointing the way towards a new era. We are living in the tipping point of the Anthropocene era, resulting from the influence of human action on nature. This human-centered and technology-driven era has created all the major crises that we face today. It is time to move on to the Next.

The Nature Smart City is a concept of the post-Anthropocene era, reflecting the Next that comes after the pandemic transformation and after the idea of the post-pandemic city. The Nature Smart City is a manifestation of the renaissance of four Hs: Harmony, Health, Humanity, and Hope in our search for Happiness. The goal of the new world is the classic idea of *Eudaimonia*—the happiness of doing and living well, in harmony with humans and nature. This new world addresses the global current crises in wellbeing, health, society, and climate. A key element of this development is rebuilding the human–nature connection (HNC) in all its formats: emotional, experiential, ethical, and existential.

Eudaimonia—the Greek word is translated as wellbeing, happiness, or "human flourishing" (Eudaimonia, 2021). This Aristotelian theory of happiness is based on the holistic idea of happiness as an ultimate end, not means. To pursue happiness is an action-based human endeavor for doing and living well. Aristotle's ethics are built around the premise that people should achieve an excellent character as a pre-condition for attaining happiness or wellbeing (Eudaimonia). Thus, Eudaimonia is based on human activity: living according to the human virtues. Eudaimonia can be seen as the ultimate goal and telos—the purpose of human life.

The basis for a good life and happiness is *holistic wellness* that comes from a natural state of balance and being through five pillars: our mental, emotional, physical, spiritual, and social wellbeing. *Mental wellbeing* is what maintains positive mental health; it is our mental resilience against life's stress and challenges. *Emotional wellbeing* contributes to healthy self-esteem, self-worth, self-confidence, and good emotional intelligence. Positive emotional wellbeing helps us cope and thrive in our relationships. It often coincides very much with our mental wellbeing (Holistic Wellness, 2021).

Physical Wellbeing relates to a healthy, balanced, and optimally functioning body. It is not only about being disease-free but also relates to our bodies' energy levels, endurance, and flexibility. Physical wellness is our physical lifestyle, the ability to sleep, eat, perform, and be resilient against stress. *Social wellbeing* is social inclusion and social belonging; feeling connected, supported by, and in equilibrium with the society or world you live in. Social wellbeing can be linked to values, traditions, and lifestyle. And finally, *Spiritual wellbeing* is the ability to experience hope, meaning, and purpose in life through a connection to oneself. It is known to be one of the most powerful sources of strength, inspiration, and motivation on the journey to recovery and healing (Holistic Wellness, 2021).

To support these four categories of wellbeing: mental-emotional, physical, social, and spiritual, we must understand what these mean in terms of the man-made environment. What are the spatial wellbeing elements and how are they manifested in the built environment?

In our search for happiness and holistic wellbeing, the Four Hs—Harmony, Health, Humanity, and Hope—can be

seen represented by four associated spaces: *Blue Space*, *Green Space*, *Red Space*, and *White Space*. These four spaces represent the four elements in life: water, earth, fire, and spirit. Often, they overlap and manifest themselves as pairs such as water-spirit and earth-fire. These spatial elements are interconnected and together create a complex system of places enabling life in its varied forms. The richer the ecosystem they create, the higher the level of overall human wellbeing. By understanding the importance, meaning, and impact of these elements, we can design, build, and create habitats that naturally support human life in harmony with nature and other species. In the core of these elements is the human–nature connection in its varied forms.

The Modes of the Human–Nature Connection and their spatial expressions:

- HNC as Mind -> Emotion: *Nature as an emotional state of mind*—Blue Space
- HNC as Experience -> Senses: *Nature experienced through senses*—Green Space
- HNC as Place -> Meaning: *Meaningful natural place*—Red Space
- HNC as Spirit -> Beauty: *The idea of natural beauty*—White Space

4 Mapping Happiness: Right Plant, Right Place

"A city is the place of availabilities. It is the place where a small boy, as he walks through it, may see something that will tell him what he wants to do his whole life."—Louis Kahn

The overall idea of a city as a hub tree is supported by the *Vitruvian Man*, the natural model of the essential virtues of any physical entity. The Roman architect Vitruvius is famous for asserting in his book *De Architectura* that a structure must exhibit the three qualities of *firmitatis*, *utilitatis*, and *venustatis*—that is, stability, utility, and beauty. These are sometimes termed the Vitruvian virtues or the Vitruvian Triad. According to Vitruvius, architecture is an imitation of nature. As birds and bees build their nests, humans construct housing from natural materials that give them shelter against the elements.

Vitruvius believed that "*venustas*" in architecture, just like in the human body, was a matter of "truth of nature". He perceived nature as the ideal designer and attempted to create a global idea of beauty through it. He later found that the body would fit into a perfect square and circle, which in his belief symbolized its perfection. With this finding, he emphasized that there was a link between geometric forms and the perfect body. Through these findings, Vitruvius arrived at the conclusion that the human body was to be treated as a rule book established by nature, and if done so, we could possibly achieve our sought-after image of the ideal city.

The Vitruvian Man (originally known as "The proportions of the human body according to Vitruvius") is a drawing made by Leonardo da Vinci circa 1490. It is accompanied by notes based on the work of Vitruvius. The drawing, which is in ink on paper, depicts a man in two superimposed positions with his arms and legs apart and inscribed in a circle and square. This can be interpreted as two spheres: the natural and the man-made one. The Vitruvian Man is the epicenter of our understanding of the nature and the universe. We are looking at life through the human lens. Ultimate happiness is a radius within our reach if we understand how to live in harmony with other humans and nature.

The four different types of spaces—blue, green, red, and white—create the elements around the nature-centered and human-like overall vision. These spaces overlap and create complex combinations of everyday stages for human interaction and activities. The cohesive force is the human–nature connection in its varied formats. The elements create a spatial entity that is *peaceful*, *practical*, *purposeful*, and *poetic* by nature: as a mindset, a habitat, a place, and a planet (Fig. 3).

According to Christopher Alexander, in the semilattice structure, the overlapping is not just random, but rather it must be the right overlap, because overlap alone does not give structure. It can also bring chaos. Says Alexander: "To have structure, you must have the right overlap, and this is for us almost certainly different from the old overlap which we observe in historic cities. As the relationships between functions change, so the systems which need to overlap in order to receive these relationships must also change. The recreation of old kinds of overlap will be inappropriate, and chaotic instead of structured" (Alexander, 1965, 19). The spatial–structural overlapping of elements should be a dynamic, self-corrective constellation—a living being.

5 Blue Space—Water

Mindset: Harmony of Mind

"The energy of the mind is the essence of life."—Aristotle

Blue Spaces are about the wellbeing experience, they regenerate emotional and mental wellbeing. They support a sense of peace, and they are all about water wellness and blue care. The best blue spaces resonate with our mind, giving a sense of harmony. These spaces stand for exercise, relaxation, and regeneration, and they are designed for the wellbeing experience in mind. The human–nature

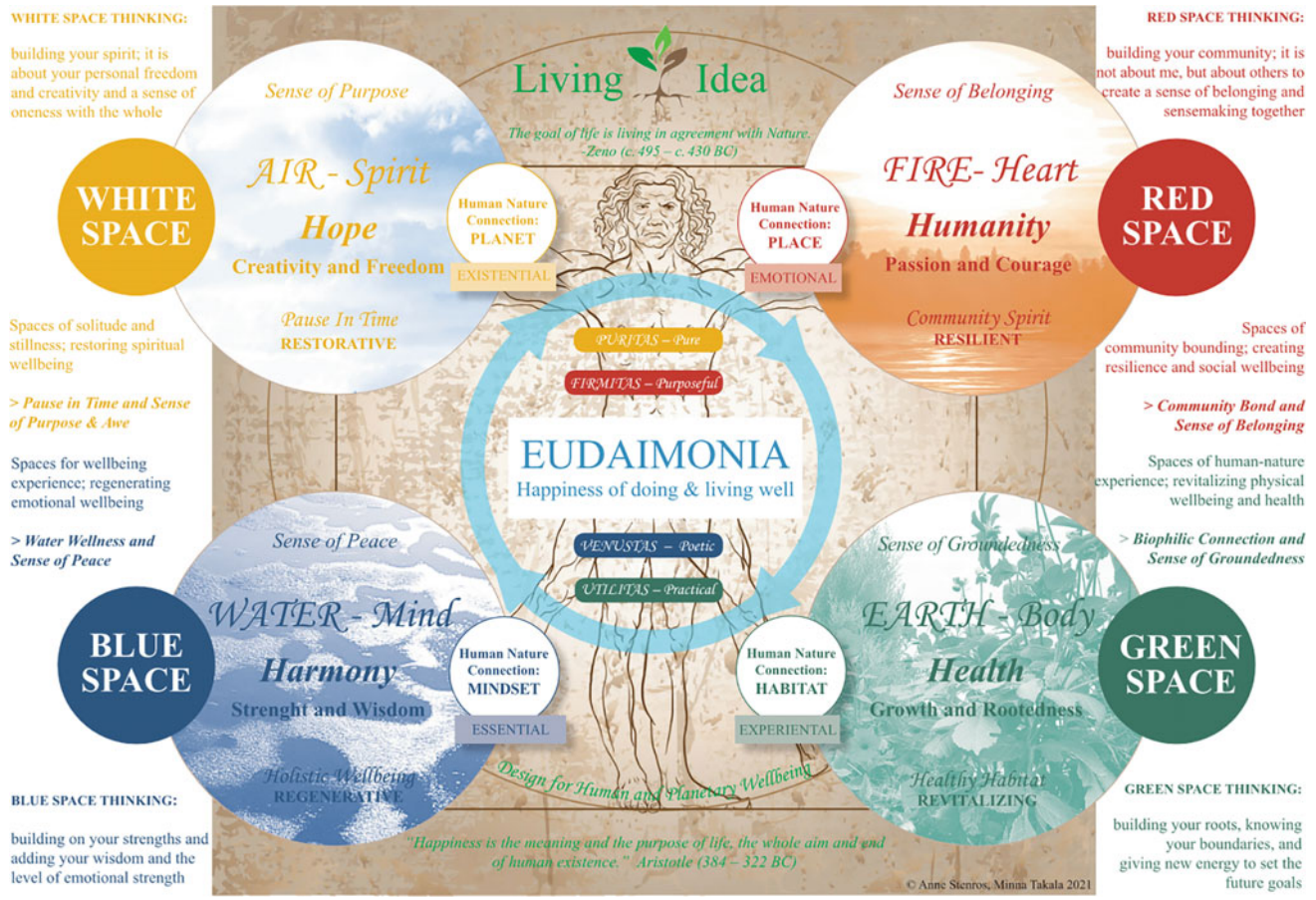

Fig. 3 Mapping human happiness and living well. © Anne Stenros and Minna Takala 2021

connection is based on a mindset, and it is essential by nature. Blue spaces are the manifestation of strength and wisdom. Blue spaces support inner harmony.

In recent studies, it is found that people who live in so-called Blue Zones—near the waterfront—have a longer lifespan expectancy, and their wellbeing and happiness rates are on a higher level than on average. The overall wellbeing in these places is based on the location, local diets, and community care. There is nothing radical in their lifestyle, rather it is very moderate and, in a sense, exemplifies the idea of a "good-enough" life. According to a Blue Zone report:

> Residents of Sardinia, California, Costa Rica, Greece, and Japan have the highest lifespans globally. Residents in these locations live to be at least 90, if not 100, and have significantly reduced rates of heart disease and dementia… The Blue Zone emphasis on community and a greater purpose is an important driving factor that slows aging and maintains collective happiness amongst locals. Participating in group-focused exercises such as walking, dancing, or even gardening doubles as social interaction and regular, moderate physical movement in these communities. (Blue Zone Living, 2021)

Recently, there has been discussion about the benefits of Blue Care, meaning all the activities on the waterfront that enhance overall human wellbeing: swimming, walking, kayaking, fishing, and sailing. Water as an element creates harmony and a sense of peace, and its regenerative impact is shown in many studies. It is the cornerstone of Holistic Wellbeing. Blue spaces represent the mind and thinking, and they support health-boosting lifestyles. They are also places for relaxing and even healing—blue spaces are energizing and therefore life essentials.

The Nordic Wellbeing Experience

"The greatest wealth is to live content with little."—Plato

The Nordic countries are considered the happiest in the world. Rankings show that Finland, Denmark, Sweden, and Norway are among the Top 10 Happiest Countries in the World 2021. For the fourth year in a row, Finland has been named the happiest country in the world. Richard Layard, co-director of the Wellbeing Programme at LSE's Centre for Economic Performance, points out that living long is as

important as living well, and that in terms of wellbeing years per person born, the world has made great progress in recent decades (Happiest Countries 2021, 2021).

The elements of Nordic happiness and wellbeing are simple: space, clean air, plenty of nature with lots of blue spaces, functional infrastructure, high level of education, good healthcare, job opportunities, and democracy with freedom. These countries are not without problems, but their aims are moderate enough to be reachable and their structure is transparent and open enough to be resilient when needed. The quality of life in the Nordics is good enough in every basic part of living: childcare, family life, education, working, culture, health and wellbeing, built and natural environment, and retirement. And the price of a welfare society is not considered excessive. There is a special concept in each Nordic country to describe an overall sense of wellbeing, happiness, and good-enough life:

- The Danish concept of *hygge* cannot be translated to one single word but encompasses a feeling of cozy contentment and wellbeing through enjoying the simple things in life.
- The Swedish concept of *lagom* translates to "enough, sufficient, adequate, just right." Unlike hygge, which aims to capture a feeling, lagom is an ethos of moderation.
- The Norwegian concept of *koselig* is translated "cozy" and it is the Norwegian equivalent of hygge. For those in Norway, it evokes much more than simple coziness—a sense of intimacy, togetherness, and inner warmth.

Finally, there is the Finnish spirit of *sisu*, which is all about our magical hidden strength. As Emilia Lahti, the award-winning researcher in the field, says: "Sisu is more about taking action against the odds and stretching beyond one's observed capacities, than about pursuing long term goals. It relates to what we do when we face formidable obstacles while striving for a goal." Sisu overlaps with certain endurance aspects of perseverance and grit but differs in its emphasis on short-term intensity rather than long-term stamina. Lahti states: "Stories of sisu are stories about transcending limitations across all domains of human life, from the physical to the emotional. It lends a word to the universal capacity of humans everywhere to endure in the face of adversity and take action against nearly impossible odds when needed" (Lahti, 2019).

Through the overall wellbeing experience of hygge, lagom, and koselig, plus the hidden strength of sisu, the Nordic countries have sustained their human-centric society and happy lifestyle even during hard times. This lifestyle is based on the basic human needs: freedom, openness, safety, self-expression, communality, and, above all, the opportunity for learning. The opportunity for life-wide learning is the single most important characteristic of wellbeing and happiness; everything else follows.

6 Green Space—Earth

Habitat: Health of Body

"A change in the shape of the body creates a change in the state of the soul."—Aristotle

Green Spaces are all about physical wellbeing, about a natural, healthy habitat for humans. They cover all aspects of green: green care, nearby green, forest bathing, gardening, natural materials, and circular light. Green spaces are the manifestation of growth and rootedness and a sense of groundedness. These spaces stand for revitalization and renewal. Green spaces have a direct impact on your bodily experience in the built environment. The human-nature connection is based on the natural habitat and is experiential by nature. Green spaces support overall health.

In his classic book titled *Biophilia* (1984), the ecologist Edward O. Wilson talks about his theory of a human bond with other species and our innate tendency to focus on life and lifelike processes. Seeing culture—arts and science—as part of human development next to the natural, he builds a mental map where everything is connected into a complex, sometimes even chaotic system of ecosystems. Says Wilson: "Ecologists speak of 'chaotic regimes' that rise from orderly processes and give rise to others in turn during the passage of life from lower to higher levels of organization" (Wilson, 1984, 7).

The word *biophilia*, with Greek origins, translates as a love for life and living things (Biophilia, 2021). *Biophilic Design* is an architectural framework inspired by the natural world, its organic patterns, and natural forms in the built environment, strengthening the human–nature connection. The biophilia hypothesis claims that humans have an innate affinity towards nature and that this connection is beneficial. Biophilic design is strongly rooted in the architectural tradition of Frank Lloyd Wright (The Fallingwater, Prairie House) and Alvar Aalto (Säynätsalo Town House, Vyborg Library) through their naturalistic idiom and use of natural materials.

In his book, Wilson presents the term *Savannah Gestalt* as the natural habitation of humans. Following his overall idea of this natural settlement, the emerging concepts of biophilic design, biophilic architecture, and biophilic cities are finding more and more followers in the aftermath of the pandemic. In the places where we live, work, learn and heal, creating a healthy, green environment has become a touchstone for quality of life. As part of life's expectations, it should not only be sustainable but also regenerative. We are moving from the era of user experience to the era of user

wellbeing. Biophilic design can reduce stress, enhance creativity and clarity of thought, improve our overall wellbeing and expedite healing; as the world population continues to urbanize, these qualities are ever more important. The movement of biophilic design is here to stay.

In its recent report, Terrapin Bright Green presents 14 patterns of biophilic design that articulate the relationships between nature, human biology, and the design of the built environment to help us experience biophilia's benefits for humans in the built environment. These patterns include everything from the visual connection with nature and the presence of water to dynamic light, biomorphic forms and patterns as well as complexity and order, plus the sense of mystery (Biophilic Design, 2021).

Bridging Humans with Nature

"The goal of life is living in agreement with Nature."—Zeno (c. 495–c. 430 BC)

The future biophilic office, "Welcome, feeling at work" in Milan, is designed by Kengo Kuma & Associates. It is a building project aiming to create a workspace centered on employee health and wellbeing, integrated into its local environment. The idea is to foster creative and forward-thinking work life. Natural elements in architecture (green, light, air, timber) that appeal to human senses make a difference in the workplace: living culture for better mental and physical states, creativity, and productivity. Imagined to be one of the most sustainable office developments to date, the project is scheduled for 2024. Says Yuki Ikeguchi, partner in Kengo Kuma and Associates: "Biophilic architecture: living with, and in nature. Welcome, feeling at work, is designed with organic, natural elements that appeals to our senses and tendency to find comfort and inspiration to the natural settings. Architecture space fully integrated living plants and greenery, composed with organic materials. […] Biophilic urban living; give life back to the city" (Biophilic Office, 2021).

In short, the biophilic city is a city that provides access to nature as a building block for the wellbeing of the individual and larger communities and fosters the qualities that will be essential to resilience, sustainability, and healthy social ecologies. These are cities that aspire to be richer in nature within their unique and diverse environments and where the planning and design abundantly incorporate the natural world into the daily lives of residents. The vision of biophilic cities is one of immersive nature—nature is not just something to be found in a park here or there, but rather to re-imagine the city AS a park, or AS a forest. Singapore is one of the best examples in showing that you can accommodate dense development and population growth, and actually protect and extend nature as well. Lush greenery is woven throughout the city, not only in numerous parks but also incorporated into the design of tall buildings. The Biophilic Cities Network acknowledges the importance of daily contact with nature as an element of a meaningful urban life, as well as the ethical responsibility that cities have to conserve global nature as shared habitat for non-human life and people (Biophilic Cities, 2021).

Biophilic design, architecture, and cities are living laboratories for applying the wisdom of a naturally built environment. They represent our living memory of the Savannah Gestalt from the past to the plausible, possible future ahead. They are bridging our connection to nature and, at the same time, they offer sustainable solutions to save the planet. A building based on biophilic architecture and design is like a hub tree of the natural man-made environment—it is based on the knowledge of designing for wellbeing by biophilic design principles as well as sustainable building principles and circular design. It is good for both human health and a healthy environment.

A biophilic city is a hub tree by structure: covering the full complexity or even chaos of the city, rich enough for a good life and good living in harmony with nature. This kind of city is regenerative, revitalizing, resilient, and restorative. A biophilic city is balancing the needs of human beings with those of other species. It is an open, dynamic balance making subtle corrections on the way. This kind of a natural, living city is never ready.

7 Red Space—Fire

Place: Humanity of Heart

"Educating the mind without educating the heart is no education at all."—Aristotle

Red Spaces are for the social interaction and social wellbeing in our life. They represent all the communal, collaborative activities. They support a sense of belonging and are built around community spirit. The human-nature connection is essential by nature, including the memorable natural places in one's life. These spaces support resilience and stand for passion and courage to express oneself among others. Placemaking, cocreating the place with its inhabitants, is a necessity. Red spaces support the social dimension of humanity.

The important part of holistic wellbeing is a healthy community, a sense of belonging, community care, and support through social networks—being with others and sharing moments and experiences. Community Spirit creates resilience and strengthens one's identity by nurturing courage and passion through community care. A neighborhood as a hub tree denotes multigenerational community building. Building upon diversity, bringing together the young and the old, solitary and social, thinkers and doers, creatives and critics. A place abiding by diversity, equality, inclusion, and

justice. It is like a diverse, healthy forest, where trees of all kinds and sizes have the best possible growth potential. A community that is co-growing with you.

I still remember my early school years and teens when living in old Tapiola, the garden city. At that time, it was the largest and most valuable example of the 1960s city planning and building ideologies in Finland, and it brought worldwide fame to Finnish urban planning. From its first stages, it gained both national and international fame for its high-class architecture and landscaping, and as an ideological experiment. Tapiola was built on the principles of Ebenezer Howard's garden city, a modern interpretation based on the following principles (Tuomi & Paatero, 2003):

- The starting point of planning is the individuality of man and closeness to nature, and the aesthetic value of nature and use of natural contours of the landscape are retained wherever possible.
- Nature dominates, architecture is secondary. All buildings must be harmonized with the natural setting.
- To be a working town, not a dormitory or nursery, you must provide as many jobs as possible to its inhabitants.
- The town should provide for a range of income levels —"a community of everyman, where the ordinary worker, successful businessman and university professor can live side-by-side."
- Consistent placing of multi-story buildings with alternatively low housing, resulting in a feeling of spaciousness and variety.

The pioneering spirit of the emerging city was evident in every respect; not only it was manifested in its modern architecture and landscaping but also in the schools, the library, the emerging city center, and the cultural activities for its young. In the 1960s there were world-class musical tutors and the Tapiola Choir, which today is a world-renowned and award-winning children's choir. There were art classes for children of any age, and sport clubs were available. Teachers were newly graduated, young, educated, and hungry for new knowledge. They taught us not only their respective subject but also the spirit of learning based on curiosity and a growth mindset. I must thank this incredible and diverse cultural forest where I spent my early learning years. It came naturally to become a pioneer, and a spirited lifetime learner—an explorer.

Third Place: The Second Home

"The development of an informal public life depends on people finding and enjoying one another outside the cash nexus."—Ray Oldenburg

The variety of not only different activities but also so-called Third Places, namely those local spaces where people gather when not working or staying at home, was also high in Tapiola. The characteristics of Third Places according to Ray Oldenburg are (Oldenburg, 1999):

- On Neutral Ground: It is a place where individuals may come and go as they please
- The Third Place as Leveler: A place that is a leveler is, by its nature, an inclusive place—people get together engaging their personalities beyond the contexts of purpose, duty, or role.
- Conversation is the Main Activity: The cardinal and sustaining activity of third places everywhere is conversation.
- Accessibility and Accommodation: Third places that render the best and fullest service are those to which one may go alone at almost any time of the day or evening with assurances that acquaintances will be there.
- The Regulars: Every regular was once a newcomer, and the acceptance of newcomers is essential to the sustained vitality of the third place.
- A Low Profile: As a physical structure, the third place is typically plain.
- The Mood is Playful: The playful spirit is of utmost importance; joy and acceptance.
- A Home Away from Home: The third place is remarkably similar to a good home in the psychological comfort and support that it extends.

A community culture where nobody is left behind, but everyone can find their second home—a place of social interaction and communication, feeling welcome and being accepted and finding company and friends, is a fireside place for humans, the ancient tradition of seeing each other at campfire and exchanging experiences, information and knowledge. These places, such as cafes, libraries, pubs, sport clubs, and youth centers are all places to educate not only the mind but the human heart, too.

When *Oodi*, Helsinki's new downtown library by ALA architects, was opened in 2018, the architect Pirkko Lucchesi wrote that it was "a community center for all with hang-out spaces, maker spaces, books, cafes, gaming areas. It is a building that reflects the Finnish's society's most important values of education, equality and openness."

8 White Space—Air

Planet: Spirit of Hope

"In all things of nature there is something marvellous."—Aristotle

White Spaces are for self-reflection, creativity and freedom. They serve a sense of purpose and are designed for solitude and stillness. They represent a pause in time and a pause in space in our lives. The human-nature connection is existential by nature, covering the entire idea of Mother Earth. White spaces are restorative, and they are used for not only acquiring knowledge, skills, arts, and science but also taking time for oneself. A sense of awe is the experience of oneness with nature. White spaces enhance happiness and hope.

The Soul of a Place

"Art is important. It is the most important thing now."—Tadao Ando

There are few architects today considered artists with respect to the buildings they have designed. The Japanese architect Tadao Ando is one of them. His uncompromising quest for the ultimate beautiful building leaves nobody cold thanks to his use of landscape, light, and material. Yet at the same time, there is an all-encompassing sensitivity in his spaces: they consider the place, time, landscape, people, and artwork they surround.

Some 30 years ago, Ando received a most exclusive and exiting commission; to create an art museum on an island in Japan where one could also lodge. Today, the Benesse House Museum in Naoshima, Japan, is world-renowned among art enthusiasts not only because of its unique collection of art, but also thanks to Ando's remarkable building compound on the island. Said by Ando: "I want to create a soul to the place and show the visitors the value of their life" (Benesse House Museum, Japan, 2021).

Ando says that the 30-year project has taught him a lot about the persistence of people. As a former boxer, he also says that fighting for the buildings and the spaces with artists has been a long journey, however rewarding. What he has tried to do is to create the best possible surroundings for an artwork at the time, and to understand how to have a dialogue with it through space and matter. He has also considered the local people living on the island and the old village, which has been revitalized. To experience Ando's buildings, one must come to the island as there is nothing similar anywhere else. There is a seamless continuity between the artwork, spaces, buildings, the landscape, the island, and the surrounding sea. They all respect each other in a complementary way. The soul of the place is its unity under sky: earth, wind, water, and mind.

The Ma Moment

"Every word has consequences. Every silence too."—Jean Paul Sartre

In Japan, there is a word called *ma*—emptiness that is a moment between two activities, stillness and a void—the Ma Moment. I learned it from Hayao Miyazaki, an award-winning Japanese animator, and director. Says Miyazaki: "It's called ma. Emptiness. It's there intentionally. [claps his hands] The time in between my clapping is ma. If you just have non-stop action with no breathing space at all, it's just busyness, but if you take a moment, then the tension building in the film can grow into a wider dimension. If you just have constant tension at 80 degrees all the time, you just get numb."

> Ma is the emptiness of a scene that gives both the characters in the film and the audience a chance to breathe. As time flees from us as we age, the beauty of taking time to reflect on what we have done so far is ever so important. What makes these films so magical can be taken and applied in our own lives as well. Life never stops for many of us, but we all have the ability to stop and reflect quietly; we can all learn ma and incorporate it in our own lives, too. (Ma Moment, 2021)

A *ma* moment can also be an extreme sense of oneness with nature, something that physicist and Nobel Prize winner Richard Feynman describes beautifully in his famous poem An Atom In The Universe (1955):

Stands at the sea,
wonders at wondering: I
a universe of atoms
an atom in the Universe.

This spiritual unity with the surrounding nature and life itself is a very human condition: our existential oneness with Mother Earth. It is the Mother Tree of Our Life; from her we have learned everything on earth, from the tiniest detail to the utmost distances and depths. This spiritual connection, sitting under the universal mother tree, is our endless source of wisdom from generations gone to generations to come.

9 Summary: Nature Smart Thinking

The four spaces represent also different thinking modes of naturalistic intelligence: *Blue Space Thinking*, *Green Space Thinking*, *Red Space Thinking and White Space Thinking*.

Water—Mind: *Blue space thinking* includes building on your strengths, facing your emotions, and finding harmony and peace of mind through different activities in water wellness or nearby the waterfront. Blue space thinking is regenerative: it opens your thoughts to new paths adding your wisdom and the level of emotional strength.

Earth—Body: *Green space thinking* is building your roots, it's your sense of groundedness. It is practical, naturalistic intelligence on how to survive and thrive. It is about healthy life and living, knowing your boundaries, and creating healthful habits. Green space thinking is revitalizing, allowing you more energy to set future goals.

Fire—Heart: *Red space thinking* is building your community. It is not about me, but all about you and others. It is open dialogue with others in order to expand your vision through sensemaking together, by encouraging and supporting others so they can thrive. Red space thinking creates resilience and a passionate sense of belonging.

Air-Spirit: *White space thinking* is about your personal freedom and creativity. It is all about solitude and stillness, about developing a sense of purpose. It is your ability to take a pause in space and time. It is a breathing space for self-reflection. White space thinking is restorative. Sometimes it can be a sense of oneness with the whole.

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This study journey started eight months ago—or perhaps 50 years and 8 months ago. It is still in its early stages and very much a work in progress since it is a living thing. I know I have not come very far, but I feel that I have a responsibility to keep the torch alive—for future generations. Acting as a mother tree for those adding to their knowledge and eventually overtaking me in the heights of wisdom. Since this is the origin of the hub tree: it never dies, it is the beginning and the end at the same time, over and over again.

> In three words, I can sum up everything I've learned about life.
> It goes on.—Robert Frost

10 Epilogue: Forty Years Ago

San Francisco, May 11, 1984

"… With that as a starting point, I widened my thesis to involve that particular quality in a place—whether inside or outside—that makes it a place where you can dream. Walking, standing or sitting, but most important of all: dreaming. It is the emotional content of a place that interests me—a form exists for me only if it evokes emotions: if you run the whole gamut of emotions there.

In that way, outdoor spaces are like a house: they should lend the opportunity to experience emotions and dream. A town like a house is a good place to live: you can have that very same emotional security as you have in your dollhouse or in your own house…

It is also vice-versa: a house like a town is a good place to live, because it gives you a sense of place and it widens your experience of the place and yourself: it allows you to dream and, in that way, to discover your opportunities. Thus, outdoors and indoors are not opposites, they support each other: a feeling of outdoors indoors gives the sense of place to indoors. A feeling of indoors outdoors lends the opportunity to dream and belong to a place.

… And it came to my mind that perhaps with my theme "*A Town as a House—A House as a Town*" I have unwittingly reached for the inclusive and deeply human design concept that is the legacy of the greatest Finnish architects, Alvar Aalto and Eliel Saarinen" (Stenros-Leinonen, 1984).

Appendix: The Alphabet of the Nature Smart City

A *Aesthetics* and Beauty, a sense of *Awe,* are all experiences of oneness with nature

B *Biophilia* is our bond with nature and *Biophilic Design* is rebuilding this connection

C *Curiosity*-Driven research and *Creativity* are the driving forces of nature innovation

D *Diversity* is the very essence of cities; biodiversity is elementary for life on Earth

E *Eudaimonia*—happiness of doing and living well with nature—is the meaning of life

F *Forests* are a source of wellbeing: they increase health and reduce stress and anxiety

G *Genius Loci*—the sense of place—is the authentic spirit and the origin of the city

H *Human-Nature* connections are an essential, vital part of life, health, and wellbeing

I *Inclusivity*, equity, and justice are the building blocks of a socially sustainable city

J *Jane Jacobs* is the visionary who pioneered the people-first approach in urbanity

K *Knowledge* on how a city works enable and empowers citizens to participate

L *Livable and Lovable* cities have a vibrant street life; they are walkable and less lonely

M *Mother Trees* creating ecosystems are the structural *Model* for Nature Smart Cities

N *Nature Smart City* is the next generation city, sensitive to nature and people

O *Oneness* with nature and rewilding are key to enabling and preserving biodiversity

P *Placemaking* is cocreating with People and Partners by harnessing their knowledge

Q *Quality* of the man-made and the natural environment is more important than quantity

R *Regenerate, Renew, Redesign, Recycle*, and *Reuse* are the future planning imperatives

S *System of Systems*: 'cities are ecosystems, and they should be treated like ecosystems'

T *Technology* is a good servant but a bad master; use smartness for the common good

U *Urban Ecology* is a path to a better city: greener, happier, healthier, less polluted

V *VUCCA*—Volatile, Ubique, Complex, Chaotic, Ambiguous is the true context of a city

W *Wood* architecture with compact, mid-rise timber building creates an eco-sensitive city

X *X-factor* for sustainability may turn out to be biophilic design and biophilic cities

Y *Yardstick* of a city is a 15-min neighborhood to reach most of the everyday needs

Z *Zero-Emission* or de-carbonized city is the biggest challenge of future humankind

References

Alexander, C. (1965). *A city is not a tree*. Pdf. http://en.bp.ntu.edu.tw/wp-content/uploads/2011/12/06-Alexander-A-city-is-not-a-tree.pdf.

Benesse House Museum, Japan. (2021, October). Benesse Art Site Naoshima. https://benesse-artsite.jp/en/art/benessehouse-museum.html.

Biophilia. (2021, October). Oxford Reference. https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095507389.

Biophilic Cities. (2021, October). Biophilic Cities. https://www.biophiliccities.org/singapore.

Biophilic Design. (2021, October). Terrapin Bright Green. https://www.terrapinbrightgreen.com/reports/14-patterns/.

Biophilic Office. (2021, October). ArchDaily. https://www.archdaily.com/958476/kengo-kuma-to-design-milans-biophilic-office-of-the-future.

Blue Zone Living. (2021, October). Wunderman Thompson. https://www.wundermanthompson.com/insight/blue-zone-living.

Eudaimonia. (2021, October). Britannica. https://www.britannica.com/topic/eudaimonia.

Featuring Suzanne Simard. (2021, October). Bioneers. https://bioneers.org/forest-wisdom/.

Gardner, H. (1983; 1993 Edition). *Frames of mind: The theory of multiple intelligences.* Basic Books.

Gardner, J. (2021, October). *Personal renewal*. JamesClear. https://jamesclear.com/great-speeches/personal-renewal-by-john-w-gardner.

Grant, R. (2018, March). Do trees talk to each other? *Smithsonian Magazine*. https://www.smithsonianmag.com/science-nature/the-whispering-trees-180968084/.

Happiest Countries 2021. (2021, October). Forbes. https://www.forbes.com/sites/laurabegleybloom/2021/03/19/the-20-happiest-countries-in-the-world-in-2021/?sh=4710455d70a0.

Holistic Wellness. (2021, October). The World of Health. https://theworldofhealth.co.uk/blog/holistic-wellness-5-pillars-of-holistic-wellbeing/.

Lahti, E. (2019). Embodied fortitude: An introduction to the Finnish construct of sisu. *International Journal of Wellbeing*, *9*(1), 61–82. https://doi.org/10.5502/ijw.v9i1.672.

Ma Moment. (2021, October). Medium. https://medium.com/nayeonpark/ma-the-best-moments-in-a-studio-ghibli-film-are-silent-27210e215b21.

Oldenburg, R. (1999). *The great good place*. Summary. Pdf. MNSU. https://www.mnsu.edu/voices/greatgoodplace.pdf.

Stenros-Leinonen, A. (1984). *A town as a house—A house as a town*. Thesis for the degree of Master of Architecture, University of California, Berkeley.

Tuomi, T., & Paatero, K. (2003). *Tapiola: Life and architecture*. Espoo Housing Foundation in cooperation with the City of Espoo.

Wilson, E. O. (1984). *Biophilia* (pp. 110–111). Harvard University Press.

Development of New Bio-based Materials Derived from Sicilian Agri-Food Industry Waste

Simona Colajannni, Tiziana Campisi, Alfonso Senatore, and Marco Bellomo

Abstract

The key factors that are transforming the market landscape are the European Green Public Procurement (GPP) policies, the rapid spread of voluntary green building rating programs, and the increasing focus on reducing our dependence on raw materials through the principle of the circular economy. As a result, the need for bio-based and sustainable building material solutions has increased dramatically. This research explores possible ways to reuse bio-based waste material (such as dried fruit shells), derived from the agri-food industry, for the production of healthy new building materials aligned with the principles of circular economy. Previous case studies and researches have demonstrated the reuse of dry-fruit shells for the making of new building components. However, current trends also show that synthetic resins are commonly used as binder to glue the valuable renewable agriculture by-product. This has a negatively impact on actual circularity of the resulting building materials as well as on people health and well-being due to VOC emissions. This study demonstrates, throughout laboratory-based investigations, the reuse of dried-fruit shells coupled with natural binders leading to a number of potential applications and the creation of bio-based new materials for the building industry. The encouraging initial results show how unused waste may become a valuable "nutrient" for the industry by keeping the material value flowing constantly in a circular loop and allowing material reuse and recyclability as long as possible. While testbed and reference of this study are the Sicilian context, the project outcome could be easily transferred to other countries with dried-fruit industries, encouraging the creation of new business models that replace or integrate the current ones, and also pushing skills and new roles in the supply chains capable of guaranteeing enhanced circularity of natural resources.

Keywords

Waste • Biomaterial • Circular flow • Dried fruit • Sicily • New economy • Hazelnut shell • Almond shell • Reuse • Recycle • Sustainability

1 Introduction

One of the problems to be addressed in the coming years is the reuse of raw materials, creating new products that use elements coming from waste. A very high percentage of waste in the world come from agri-food production, producing actually an unsustainable energy deficit. The potential reuse of waste is very high and equal to the quantity of waste present in the territory and in the agri-food production companies. The research aims to give new life to waste coming from agri-food production, with a particular attention to dried fruit, very diffuse in the Italian and Sicilian territory. The waste from the agri-food production of dried fruit entirely derives from fruit shells; these shells can be used and mixed as aggregates or inert into a new mixture, verifying the new properties. The experimentation will be based on the reuse of these materials, mixing them with only natural binders, such as natural wine vinegar and potato starch, creating some possible raw materials, applied for the design of new natural products. The context is that of a rapidly expanding market that requires more and more low-consumption materials, advantaging of natural recycled elements. In particular, the research aims to find a possible use of walnut waste as a fundamental element for the realization of a building component, easily recoverable and

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recyclable at the end of its construction life cycle. This premise implies the necessary and beneficial transition from a linear economy model to an increasingly sustainable and close circular economy model. We have studied the reference context of scientific literature related to hazelnut, almond, and pistachio shells use researches. We have focused our research basing on different areas of scientific literature, such as essays about the chemical characterization of waste walnut shells, the recycle of walnut shells as aggregates useful for the production of wooden particle boards or as aggregates for sustainable plasters, finally as a mixture for 3D printers. We also have examined some articles presenting studies of natural binders, creating mixtures for new cements or new insulating panels. What we finally highlighted is that, nowadays, there is a huge presence of use of unsustainable materials that make impossible the recycle of some products. Therefore, the aim of this study is to give an answer to the market demand for the creation of innovative and sustainable products, constituting a natural blend as well as an efficient reuse of waste material coming from the agro-food production of walnut shells. The ultimate goal is to re-enter into the market in a very competitive way, realizing a second material.

2 Circular Economy and the Reuse of Bio-based Waste

A well-established paradigm nowadays is the "circular economy", from the simple combination of the use of raw materials that identifies a production, a use, and a waste, we go from production to use, collecting the waste and recycling it in order to reuse it. The mechanism of the linear economy provides for the infinite use of raw materials, but the concept of circular is precisely in the fact that the material is not extracted but reused as the extraction of new materials is no longer sustainable in any field of innovation. The commitment to the mitigation of these risks and the search for new tools to ensure an efficient use of resources has led organizations to undertake innovative paths by approaching in a different way the issue of sustainable use of resources, through an ever-decreasing waste and waste disposal and an increasing reuse in new production processes. A technical and scientific opportunity for environmental sustainability in various sectors is now the implementation of the circular economy, identified as a centripetal driver of innovation (Fan et al., 2019). So an agricultural company, or a company of building materials, is able to participate in this sustainable project by enhancing the value of waste materials by giving new capacity for technological and innovative use. In this general context, the research of reusing food production waste into innovative and sustainable materials is focused, which can be revitalized into a new reconfigurable form and function as materials needed for development. The mechanism of circular economy should be usable in all categories of production of materials and also services, the study is conducted in the context of agro-food production of dried fruit in Sicily, where today all the waste product is eliminated, or reused as biomass (Angelidaki et al., 2018). This pool of waste becomes a flywheel for the production context, as it would give strength to a new economy and sustainable technology. In our economic system, a protagonist of sustainability must be the reuse of natural raw materials, in this area, the dried fruit becomes very important, as it can fill many needs of the demand for biobased materials. The study aims to identify possible natural and sustainable solutions to give a new life to agro-food waste produced by dried fruit companies in particular. Within the mechanism of the circular economy, there are countless solutions, of these, however, it is necessary to evaluate those that are energy sustainable and of course one of the objectives of this study is to establish a working table on the reuse of agro-food production waste by investigating sustainable and reusable solutions within the various branches of product use. Agricultural waste, also citing study (Gothard et al., 2018), is a huge pool of untapped biomass resources that can also represent economic and environmental burdens. They can be converted to bioenergy and bio-based products through cascading conversion processes within the circular economy and should be considered residual resources. Furthermore, the promotion of business based on agricultural residues is discussed through industrial ecology to promote synergy, on a local basis, between different agricultural and industrial value chains.

3 Research Objectives

One of the problems to be faced in the coming years is the reuse of raw materials in order to create products with the majority of elements coming from waste. A very high percentage of waste in the world is constituted by waste coming from the agro-food production, whose production creates an energy deficit and for this reason not very sustainable at present. The potential for reusing waste is very high and equal to the amount of waste present in the territory and in the agro-food production companies. These wastes are at the center of the study presented, when it was thought to convert them to make new materials and even new products, and the latter to produce them in a completely sustainable, reusable, and recyclable, so as to fit into the concept of circular economy now present in our lives. The research aims to give new life to the waste coming from the agro-food production and in this case from dried fruit, very present in the Italian and Sicilian territory. The waste from the agro-food production of dried fruits is almost entirely the waste of fruit

shells, these can be used and mixed as aggregates or inert within a new compound for a new reaction. The experimentation will be based on the possibility of reusing these materials by mixing them with only natural elements, such as wine vinegar and potato starch, present in nature, with which we can create new possible raw materials for the realization of new products of natural origin.

4 Materials and Methods

The research work on the possible reuses of waste materials from the agro-food production of dried fruit was organized in different programmatic phases of study. The research work was set up starting from the study of the state of the art, identifying various scientific researches and products in the same cultural context. The study of the state of the art on the reuse of products derived from food waste and in this case of dried fruit was followed by the study of quantities and presences in Italy and Sicily. It has been analyzed what are the most present elements within the Sicilian market, and what are the products that create the majority of waste within the production of dried fruit. Once the materials to work with have been chosen, a working process has been set up in the laboratory, where, using natural mixtures and natural binders, the response of the waste has been tested in various forms and with various compounds created. For the proposed study we followed a working methodology defined in the following steps:

- State of art evaluation and analysis of contextual literature;
- Analysis and characterization of waste material;
- Laboratory work;
- Analysis of results;
- Evaluations of possible prototypes.

Literature Review

Numerous past studies and case studies addressing the reuse of the by-product derived from the bio-based food industry, such as the reuse of dried fruit shells were identified and evaluated as part of this research project. The initial objective was to gather a solid foundation of knowledge on the studied subject, the state of the art on the reuse of agro-food waste in relation to the context of the green building materials and circular economy.

Many of the previous investigations and case studies discuss and evaluate the reuse of agricultural waste (i.e., hazelnut shell) as a pool of biomass for the production of bio-energy sources (Ahring et al., 2015) for generating both electricity and heat, or as potential renewable fertilizer (Bolzonella et al., 2017). Generating bio-fuel reusing agriculture waste seems to be the most logical way of valuing a residual resource like the dried fruit shells. It certainly represents a valid alternative to fossil fuels as well as a climate change mitigation measure. However, there are a number of constraints to be taken into account like the complexity and variability in the chemical composition of the waste feedstock, the presence of contaminants, and the degrading processes (Gontard et al., 2018), to just name a few. In addition, in all the energy processes considered above, the dried fruit shells are collected, treated, and then reused only once in order to be converted into usable bio-methane, bio-oil, bio-ethanol, or other forms of "sustainable" fuel. The material source is not constantly reused or recycled as required by the circular economy principles.

Another study suggests the reuse of hazelnut shells for the industrial production of particleboards and chipboards. In this case, a synthetic resin is used as binder to glue the valuable renewable agriculture by-product. According to the study, the resulting product may represent a valid wood substitute in panel production for the building industry (Cöpür et al., 2006; Senol, 2019). Similar studies explore the opportunity of using the structural strength of the shells to shape a novel material with an improved modulus of elasticity. The study shows that walnut shells can be used for the manufacturing lignocellulose and polyurethane-based panels while achieving enhanced strength performance (Cătălin Barbu et al., 2020). Dried fruit shells can also reused as a matrix for 3D printing (Singh et al., 2020). According to the study, the residual shells are powdered and reused to form a novel filament to be applied with 3D printers. The resulting polylactic acid (PLA)-reinforced almond husk powder is then used for the digital manufacturing of biomedical scaffolds.

The reuse of shell waste in the form of polymer–particle biocomposite is also explored by Muller. The study exploits the hazelnut (*Corylus avellana*) shells from a molecular point of view, demonstrating the possibility of using this waste in the area of polymer–particle composites with a low concentration of the filler based on hazelnut shell microparticles (5 wt%) and increased tensile strength. SEM analysis (Fig. 1) showed good wettability of the hazelnut shell microparticle-based filler. (Müller et al., 2018).

The use of synthetic resin and binders is a common characteristic of the identified past studies focused on the production of novel materials for the manufacturing of dried fruit shell base building products. However, the idea of reusing the agricultural waste in order to keep the reclaimed resource (the hazelnut shells) in use for as long as possible while extracting maximum value was one of the key drivers of our study. According to the principles of the circular economy, everything has to be designed to be constantly reused or recycled (Charlotte et al., 2019). On this basis, the investigation of published research and case studies was then stretched towards the reuse of dried fruit shells with natural

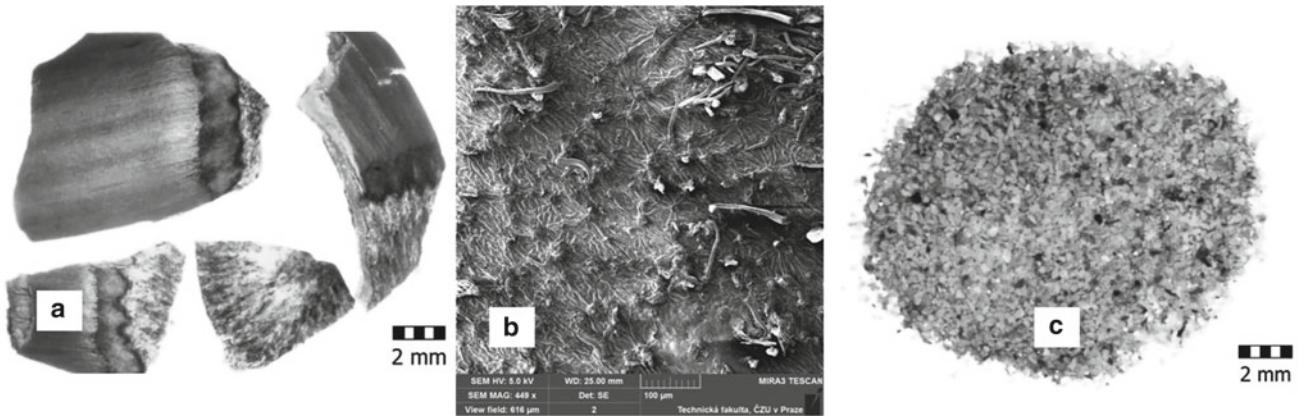

Fig. 1 SEM images of hazelnut shell © (Müller et al., 2018)

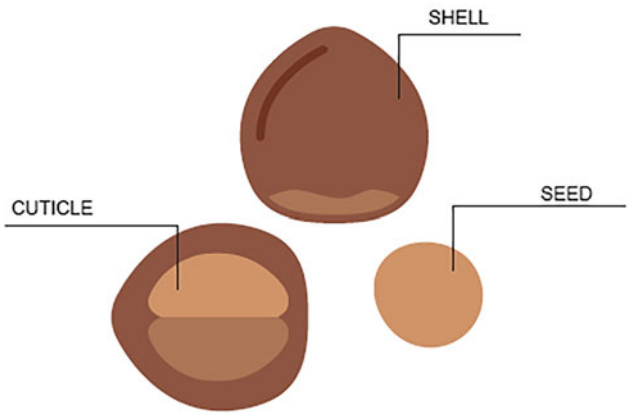

Fig. 2 Hazelnut scheme © (Manzella, 2020)

binders. An interesting contribution is represented by research on binders used for the production of glues for wood panels. (Müller et al., 2007). Due to the ecological and economic concerns, about harmful resins are replaced with natural binders for the production of wood binders. Pure bio-based binders or a combination of bio-based and conventional synthetic resins or chemical substitutes are also explored. Applications of natural binders depend on the properties of the binders and, most of all, by the "technique" used in the preparation of the glue adopted for the production of the boards. Chemical and physical properties of the resulting waste-based panels are directly affected by the strength of the binder. A further scientific research project, which served us as a basis for our exploration, is provided by the university's thesis called "Bùgia – Da scarto a risorsa" which was undertaken at the University of Turin (Ciancio et al., 2019–20). In this case, a novel bioplastic is produced by re-using hazelnuts and cocoa-based waste resources with natural binders. Researchers explore the use of glycerol, vinegar, potato starch, and water as natural binders together with hazelnut and cocoa cuticles.

On the basis of our literature review, it appears that very little has been done, to date, in evaluating the use of natural binders and fillers while exploiting the reuse the dried fruit shells. In fact, very few case studies were identified.

In response to the above knowledge gap, this research project has been building on previous studies and research projects to further explore the sustainable reuse of the dried fruit shell waste while keeping the material value flowing constantly in a circular loop, in order to allow reuse and recyclability as long as possible in order to extract maximum value (Salvador et al., 2019). In order to achieve the above, the exploration has been focused on the use of natural binders. The ultimate objective of the study was to advance the knowledge and qualitative data in relation to the reuse of the dried fruit shell waste coupled with natural binders aimed at the production of novel materials for the building industry.

Sicilian Dried-fruit Waste

Sicilian agriculture has always been described and narrated for the great variability of environments, climates, vegetation, and productions. From the North to the South of the island, from the Etna area to the one characterized by the salt pans of Trapani, each agricultural area has always had unmistakable always unmistakable elements of diversity that have made the region an environment of richness in the field of agricultural biodiversity widely recognized nationally and internationally, national and international levels. A substantial contribution has always been attributed to the sector of dried fruit, from which in Sicily are often derived elements of agricultural economy important that today important agricultural economy that today highlight timeless peculiarities with vivid contrasts in terms of development and perspective. Dried fruit is that sector which, in general, refers to the arboreal plant species producing fruits which, when ripe, are partially dried and which, after harvesting, undergo a process of complete drying before being marketed or

subjected to post-harvest processing. All tree species for dried fruit are present in Sicily and many of them have contributed to a consistent agricultural development. Many of them have contributed to a consistent agricultural development in the island, especially in the past; some species are even of exclusive Sicilian interest, determining a national leadership and an important position on the international level. A fairly common feature in this sector is the extremely defined localization of the various species of the different species. As far as, in fact, the presence of almond, pistachio, hazelnut, and carob tree, is quite widespread throughout the island, it goes without saying that in the regional territory, over the centuries, have been consolidated areas with greater tradition, culture, and specialization for each species. The carob tree, for example, is a species that is found in the agricultural landscape of all Sicily, but it is unequivocal that the province of Ragusa, the Hyblean plateau, and the agrarian landscape typical of this area is inextricably linked with the presence of the carob tree indissoluble with the presence of the carob tree that is not only an element of continuity and presence but also a source of income and local economy. Or at least, it was very much so in the past. The same is true, for example, for the pistachio, which is historically present in the area of Bronte, in the province of Catania, where 90% of Italian pistachio cultivation is concentrated Italian pistachio cultivation, even though it is possible to find interesting experiences of cultivation of the although limited in surface, in the provinces of Caltanissetta and Agrigento.

In recent years, many companies have undertaken research and development initiatives for the production of materials starting from food waste, which in many cases identifies the specificity and territoriality of the food, giving the material a high environmental and social value. One of the fundamental productions of the Sicilian economy is that of agro-food sector, and more specifically, the production of dried fruit in the island is produced, for example, 84.600 tons of almonds and 150.000 tons of hazelnuts, the production context covers a very large basin (INSTAT, 2020).

Thanks also to creativity and technology, many of these materials have spread internationally to be used also by big fashion and furniture brands for clothing with double-digit prices. A path that is only at the beginning and that promises to arrive at the valorization of different types of food waste. In the field of reutilization of food production waste, one of the protagonists is dried fruit and all types of seeds whose production involves the formation of a large amount of waste (Senol, 2019). The waste represents today almost half of the agri-food production, it is identified by the shells of almonds, hazelnuts, walnuts, and pistachios. These dried fruit scraps are characterized and united by the presence of different percentages of cellulose, hemicellulose, and lignin, which characterize their chemical and physical behavior (Table 1).

All these productions, only in Sicily, form a large amount of waste that today is not exploited within a mechanism of circular economy. Thanks to the mechanical and physical characteristics of nut shells (Table 2), they can be reused in a variety of ways, in this study, we have investigated the possibility of reusing nut shells, using a completely natural and sustainable working methodology.

Most of the hazelnut installations in Sicily are distributed in the province of Messina, especially in the areas of Nebrodi and Madonie. It is possible to find cultivation not only in plain but also in mountainous regions up to 1,400 m of altitude. The cultivated surface, according to ISTAT amounts to a little more than 15,000 and is mainly located in the province of Messina (81% of the production). Followed by the province of Catania (9.9%), Enna (7.5%), and Palermo (1.6%) (INSTAT, 2020). Here, the hazelnut groves

Table 1 Dried fruit vegetal chemical characteristics

Shell	Hemicellulose (%)	Cellulose (%)	Lignin (%)
Pistachios	25.0	43.0	16.3
Hazelnuts	30.0	26.7	42.9
Walnuts	22.5	25.3	52.3
Almonds	34.6	48.4	17.0

Table 2 Dried fruit vegetal physical–mechanical characteristics

Shell	Density (kg/m^3)	Thickness (mm)	Modulus deformability (N/mm^2)	Heating power (kWh/kg)
Pistachios	320	0.3–0.5	180	3.2
Hazelnuts	360	1–1.2	250	4.2
Walnuts	250	1.6–1.9	220	4.8
Almonds	340	1.5–1.8	280	5.2

grow in sloping areas and are poorly mechanized, with objective agronomic difficulties in the execution of the processing. Walnut kernel belongs to the Betulaceae family, genus *Corylus* L. and is native to the temperate zones of the northern hemisphere (Europe, Asia Minor, Asia, and North America). Within the genus, Corylus are distinguished by about 15 species.

Corylus comes from the Greek "koris" = helmet, for the shape of the involucre covering the fruits. Avellana derives from Latin and refers to the city of Avellino. The hazel is a very common plant, from the Mediterranean area to the mountains, where it reaches up to 1,400 m above sea level. It participates in the constitution of mixed deciduous forests, also lending itself well to the colonization of marginal soils. Its bark is smooth, gray-brown in color and, with time, it flakes, like that of the birch, and its leaves, round or oval, turn yellow in autumn before falling (Cătălin Barbu et al., 2020).

The fruits of this plant are hazelnuts, hazelnut is counted among dried fruits, it is initially greenish in color and then brownish, as the degree of ripeness continues. The seed, placed inside, is edible and has a crunchy consistency (Fig. 2). It is very rich in lipids (about 50–60% of fats), proteins (20%), and water (11%). This composition makes hazelnut a rather caloric food. Gastronomical uses of this fruit are really numerous, among the various ones, there is also the production of an alternative oil to the extra virgin olive oil (Queiròs et al., 2020). Besides being consumed alone, hazelnuts are used for the production of sweets, nougat, chocolate, ice cream, and sweets, as well as "healthy" foods such as muesli. Hazelnuts are also used in macrobiotic diets and in some diets. After almonds, they are the fruit richest in vitamin E and are a source of phytosterols, an important substance for the prevention of cardiovascular diseases. Hazelnut is a dry fruit; they are large achenes enclosed in a woody brownish pericarp. The fruits grow in groups of 2–4 and each is partially enclosed by a dome of overlapping bracts, modified fringed, and tomentose leaves. Research has shown that 20% of the shell is composed of a prebiotic fiber called Axos with antioxidant properties and beneficial effects on the immune system, cardiovascular system, and lipid metabolism. Hazelnut shells also have a high calorific value and are currently used as an alternative biofuel to pellets to fuel stoves, boilers, fireplaces, industrial boilers, and cogeneration plants. The cuticle of the fruit is rich in polyphenols, valuable substances in the fight against free radicals, metabolic diseases, and cognitive degeneration.

The first stage of the Corili cultural chain is represented by agricultural producers, who directly collect and introduce their production in the distribution circuit through wholesalers or other brokers, or indirectly through fruit and vegetable producers' organizations (OP) which distribute it through commercial companies or first processors. The latter carries out a phase of first treatment and manipulation of the raw material which, depending on the destination of the product obtained, involves the processes of cleaning, drying, sizing of the product in shell and shelled, polishing, shelling, roasting, shelling, plasticizing, and packaging. Subsequently, these realities also provide for the placement of the product on domestic or foreign markets: it can then be sold on the fresh market or to confectionery industries that transform it to obtain other finished products. Following the processing carried out on the harvested hazelnuts, it is possible to identify the main types of final products that can be obtained: hazelnuts in shell, offered on the fresh market in various weights and in packages of different weights; shelled hazelnuts, placed on the market without any processing, or subjected to roasting, processing into paste or grain. In particular, among shelled hazelnuts, it is possible to distinguish between good quality shelled hazelnuts, destined for the confectionery or fresh produce industry, and those processed only with an initial roasting, packaged in vacuum packs destined for industry, wholesalers, and the rest of the supply chain.

The chemical analyses (Cruz Lopes et al., 2012) revealed that hazelnut shells are composed of lignin (30.2%), cellulose (28.9%), hemicellulose (11.3%), tannins (18.2%), and protein (6.7%). The chemical composition of the ashes (27.7% K and 16.9% Ca) makes them a possible substitute for feldspar in the ceramic industry. XRD showed that hazelnut shell has cellulose fiber I with high-quality crystalline cellulose fibers (69.1%).

Hazelnut shells have a high calorific value and low humidity, so they are used as an alternative biofuel to pellets to fuel stoves, boilers, fireplaces, industrial boilers, and cogeneration plants. Hazelnut shells are natural eco-fuels that are not subjected to any type of chemical process, but only mechanical (without the addition of additives or other chemicals). They are ecological fuels, non-polluting, with a calorific value of around 4.2 KWh/kg. Their main characteristics are good performance under the thermal profile, local availability, and considerable economic and ecological savings.

5 Analysis

The first experimentation concerns the use of waste hazelnut shells. This started from the realization of a mixture defined according to the proportions of 15% of shells, 20% natural binder, 20% wine vinegar, 5% glycerol, and the rest water (Fig. 3).

Our mixture involves the use of hazelnut shells in three different grain sizes of 1, 2, and 5 mm, because research has shown that it is much more important to use the shells than the cuticles because the shells represent 50% of the fruit,

Fig. 3 Starting working materials © by the Authors

while the cuticles represent 2%. The laboratory steps are as follows:

- transition to cuticles and creation of grain sizes;
- mixing with natural alloys;
- firing;
- mechanical considerations.

After weighing and evaluation, we baked and weighed them again. The tested mixtures were each time mixed with different percentages of hazelnut shell and then baked in an oven at 150° (Fig. 4).

All the materials produced and tested were mixed with natural elements such as potato starch and glycerol. The first step in the lab was to sift and pulverize the material to create different particle sizes (1, 2, and 5 mm) (Fig. 5). The objective in fact was to use as much waste as possible to obtain samples of material suitable for the realization of a new element. From here, the blends were reformulated and, while the process remains the same, the only change is the increase in firing time from 1 to 1 h and 30 min.

In the laboratory phase, we tested 17 samples for each type of natural waste (hazelnuts) in different paste percentages. The first test did not produce samples with characteristics suitable for our objectives. The waste shells and the binder did not mix: the former remained on the surface and the binder settled to the bottom. The product had poor mechanical strength capabilities and was jagged and uneven (Fig. 6). The firing times proved to be insufficient. In addition, the percentage of waste used was too low. By increasing the percentage of natural waste, hazelnut shells, much more stable and homogeneous samples were obtained from the point of view of consistency. Repeating the analysis with the percentages between 40 and 70%, we obtained the best results; beyond these percentages, we obtained unstable samples.

Compared to the research work above, the same materials and proportions between them were maintained but we replaced the waste. In the thesis, hazelnut and cocoa cuticles were used; instead, our blend foresees the use of hazelnut shells (in three grain sizes) because, from the research, it was more important to use shells than cuticles because shells represent 50% of the fruit, whereas cuticles represent 2%. Below we report the values of the blends that were obtained, with different percentages of hazelnut shell waste product, the best results (Table 3).

For each waste particle size, we made a sample (three specimens), from mixture 2 to mixture 5 to understand what the maximum possible amount of usable waste was. The maximum amount of usable reject in the mix to obtain homogeneous and strong samples is 70%. In sample 7, the low percentage of binder (80%) makes the material too brittle (breakage at the exit of the mold).

The same procedure has been applied to the manufacturing process for pistachio shells and almond shells. Always using as a working objective, the use of natural raw materials mixed with the waste from the agri-food production of dried fruit. In the laboratory tests with pistachio shells (Fig. 7), we worked on an experimentation of an organic resin with pistachio shells. In the study of pistachios, and in the reuse of the shell, it has emerged that, compared to other shells, this one is much denser and inclined to be used for materials subjected to higher stress. By analyzing scientific literature, we can say about pistachios that chemically, shells are made of triglycerides and cellulose without any trace of inorganic compounds. Cellulose concentrations vary according to the

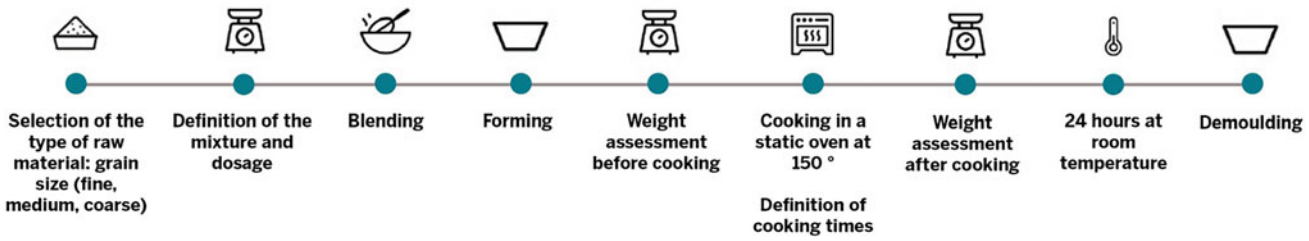

Fig. 4 Laboratory work phases © © by the Authors

Fig. 5 Pulverizing phases © (Manzella, 2020)

Fig. 6 Samples on hazelnut shells © (Manzella, 2020)

Table 3 Mixture experimentation

Mixture 2	Mixture 3	Mixture 4	Mixture 5
50% Waste	60% Waste	70% Waste	80% Waste
50% Binder	40% Binder	30% Binder	20% Binder
Hazelnut shells 50%	Hazelnut shells 60%	Hazelnut shells 70%	Hazelnut shells 80%
Potato starch 30%	Potato starch 24%	Potato starch 18%	Potato starch 12%
Glycerol 10%	Glycerol 8%	Glycerol 6%	Glycerol 4%
Wine vinegar 10%	Wine vinegar 8%	Wine vinegar 6%	Wine vinegar 4%
Water 70% (extra)	Water 70% (extra)	Water 70% (extra)	Water 70% (extra)

Fig. 7 Granulometry of pistachios © (Maniaci, 2021)

Fig. 9 Pistachio test samples © (Coniglio, 2021)

depth of the shell in accordance with the function of the shell at that depth (Piness, 2010).

In the laboratory, we carried out analysis on the particle size of the waste product, ground pistachio shells, and we obtained a particle size curve where there is the presence of elements from 1–4 mm up to 8 mm. About 1,500 gr of shells were taken, divided into three samples of about 500 gr and 1,000 cm3 each, calculating the respective densities, obtaining an average density of 0.50 gr/cm3. The three samples were screened individually through a stack of sieves, having diameters of 16, 12.5, 8, 4, 2, and 1 mm, as required by the ISO3310-1 standard (Fig. 8).

The latter has responded well to the experiments, the sample realized is homogeneous and very resistant, little smelling and compact. In addition to pistachio shells, the natural mixture consists of potato starch, glycerol, vinegar, and water (Fig. 9).

Regarding almond shells, the part of the fruit that is called "Almond Drupxa" was used in the analysis steps. Once crushed and passed through the sieve, the mixture was mixed to create a homogeneous mixture with the natural binder and water. In the same case of hazelnut shells, we had very good results in the composition of the element; in fact after several trials, we obtained a consistent product to be verified mechanically and physically. Regarding the almond shells, we had the best results with two grain sizes 1 and 2 mm of waste product at a percentage of 70% (Fig. 10).

Among the four samples, it can be noticed that the ones made with drupes are more likely to compact, this is because they have sugars which with heat should unify the material, whereas shells remain pulverized. The best sample of the two obtained from drupes is the one made from fine granules, i.e., 1 mm, this is because the finer granules allow the compound to compact more easily unlike the one made from thicker powder which finds it more difficult to compact

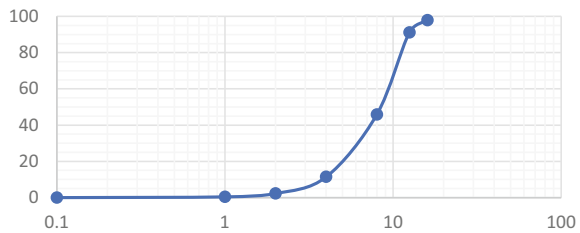

Fig. 8 Granulometric curve of pistachio shells

Fig. 10 Almond test samples mix 2 mm © © (Coniglio, 2021)

Fig. 11 Samples detail mixture n.5 © (Manzella, 2020)

(Fig. 11). The almond shell from sample 2 responded well in the experimental stages, it can easily be mixed with potato starch or glycerol, and a homogeneous mixture is created that can be used in a variety of ways.

6 Results

The experimentation, on hazelnut shells, allowed us to evaluate as the most suitable sample for our needs mixture n.4, containing 70% waste material and the remaining 30% potato starch, glycerol, and wine vinegar (Table 3). This amount turned out to be the maximum possible, because by increasing the amount of waste further (80%) the sample broke down with mechanical stress. Mixture n.4 allows the sample to be stressed without reaching breakage.

In addition, the sample at the end of the laboratory steps is well defined, the different colors of the waste are visible, the outside is homogeneous, the inside is dry and the edges are regular (Fig. 11). As for the mixtures with almond and pistachio shells, although treated only in the analysis phase, we can say that the same applies to them as to hazelnut shells. In fact, even in their experimentation with a very small particle size of waste product (1–2 mm) and with a percentage of 70%, we obtain a product workable and resistant, with homogeneous color and well-defined edges (Fig. 12).

Fig. 12 Almond test samples mix 1 mm © (Coniglio, 2021)

7 Discussion

The waste of hazelnut shells, as well as the reuse of waste from agri-food production, has a strong ability to repropose in the market, identified in a path of circular economy, very wide. The prototype created is perfectly preserved in all its characteristics, it does not present mold or signs of deterioration, even the smell remains unchanged. A number of suitable applications for the almond, hazelnut, and pistachio shells were identified as part of the investigation project, ranging from building material and construction components to cosmetics.

In particular, the bio-based waste material derived from the Sicilian agri-food industry was considered for the production of thermal insulation panels, sound absorption indoor coverings, and insulating plaster. The hazelnut and pistachio shells may also be used as an inert within the mixture of a mortar. The above hypothesis was based on the quality results obtained from the laboratory processing activities of the pistachio shells and the observations on the early prototypes. The qualitative studies have demonstrated that pistachio shells could be an excellent by-product suitable for building and construction applications. The technical characteristics of the raw material have shown excellent insulating capacity alongside a strong mechanical capacity and fire resistance. It is envisaged that the bio-based thermal insulation panel made of pistachio shells, would have an excellent thermal performance comparable to petroleum-based insulation material. Outcome of the laboratory processing activities on the almond shells has shown that this by-product could be very suitable for the production of wall plaster with high thermal performance. Additionally, once processed, the almond shells could also be used as an aggregate for standard plaster, or as an inert for the mortar.

Almond, hazelnut, and pistachio shells may also be considered for the manufacturing of indoor finishes, and specifically, acoustic plaster, sound absorption indoor cladding, and furniture. In addition, another possible use of the nut shells that was considered was for the production of pots for growing plants. in this case, one of the cons of these materials is that easy deterioration becomes the most important property of this type of product (Fig. 13).

The implementation of an integrated system that allows the valuable use of the bio-based waste material derived from the Sicilian agri-food industry would have positive impacts from the point of view of the supply–demand relationship in the construction market in terms of the qualification of existing resources and processes (De Curto et al., 2015). It is envisaged that this would encourage the creation of new business models that replace or integrate the current ones, skills and new roles in the supply chains capable of guaranteeing the circularity of material flows to boost the transition towards a resource-efficient circular model while converting unused food-waste in valuable nutrients for industry, products, components, and building technologies.

As part of this research project, the potential applications of the bio-based waste material derived from the Sicilian agri-food industry were also analyzed in the context of the fast-growing green building market. In particular, compatibility and compliance of the individual applications (i.e., thermal insulation panels, sound absorption indoor finishes, and insulating plaster) with the industry-accepted green building certification rating systems were assessed.

Fig. 13 Jars of hazelnut shells © (Manzella, 2020)

The green building rating systems (GBRS) such as LEED, WELL, BREEAM, Estidama, etc., provide project teams, building owners, and operators with a framework for identifying and implementing practical and measurable green building design, construction, operation, and maintenance solutions. Despite the GBRS are mostly voluntary tools, they are also widely adopted in more the 190 countries and territories worldwide and recognized by the industry as a mark of excellence for high-performance sustainable building and property industry.

Implementing the GBRS requires project teams to carefully select healthy building materials and products (i.e., indoor finishes, furniture, and ventilation systems). To be identified as eligible and installed in buildings pursuing green building certification, building materials and indoor finishes have to comply with a number of environmental criteria and standards as identified by the GBRS in use.

In particular, project teams and specifiers are asked to identify building materials that minimize the environmental impact, human exposure to hazardous chemical ingredients, and eliminate toxic compounds in indoor spaces. Thus, great emphasis is placed on the material ingredients that can impact human health and well-being as well as the environment and building carbon footprint.

The assessment was performed using Product MAP, a data-driven multi-criteria analytic software solution developed by On greening which considers a set of 11,000 sustainability criteria and 59 international GBRS to identify the strengths and advantages offered by the products in the field of certification of sustainability and, more generally, of the green building market.

The above aspects were considered critical in order to further explore and facilitate the future uptake of the Sicilian bio-based waste material-derived building applications in the context of the green building and the circular economy.

Outcome of the product compliance assessment study has highlighted the most important factors and criteria that should be considered while designing and manufacturing the potential building applications derived from the bio-based waste material of the Sicilian agri-food industry. They are summarised in Table 4, below.

The possible building applications, as identified during the early stage of the research project, were subdivided into two groups:

- Outdoor applications
- Indoor applications

In the context of the GBRS, requirements, selection criteria, and relevant standards may vary significantly according to the application of building materials and components.

As recently highlighted in the recent study by the World Green Building Council, many types of chemicals including volatile organic compounds (VOCs), both engineered and naturally occurring, are usually released into the air from numerous architectural finishes and building materials—

Table 4 Green building product criteria

Suitable Building Applications	Main Criteria					Impact
	Recycled Content (post-consumer)	**Recycled Content** (pre-consumer)	**Recyclability**	**LCA** (Life Cycle Assessment)	**VOCs** (volatile organic compounds)	
Outdoor applications						
Thermal insulation panels	n/a	■	■	■	n/a	Recycled content: Significant high recycled content embedded; Recyclability: hazardous treatment of the by-product to be avoided;
Insulating plaster (outdoor)	n/a	■	■	■	n/a	
Malta/agglomerate inert	n/a	■	■	■	n/a	
Indoor applications						
Insulating plaster (outdoor)	n/a	■	■	■	■	Recyclability: See above Manufacturing restriction: No added hazardous chemicals such as VOC and SVOC compounds, halogenated flame retardant treatments, urea–formaldehyde based binders, phthalates, etc
Thermal and acoustic insulation	n/a	■	■	■	■	
Sound absorption indoor finishes	n/a	■	■	■	■	
Indoor coverings	n/a	■	■	■	■	
Furniture	n/a	■	■	■	■	

some of them natural, human-made and plant-based (Alkerc, 2015). The prolonged exposure to high concentrations of some VOCs and other indoor air pollutants may significantly impact the health and well-being of the building occupants. For this reason, all GBRS impose rigorous requirements when it comes to select indoor finishes or building materials that may affect the indoor air quality, in order to reduce concentrations of chemical contaminants that can damage air quality, human health, productivity, and the environment.

In line with the principles of the circular economy, and the current EU action plan "Closing the loop", all GBRS provide strong rewards to encourage the use of building materials and components produced with recycled materials (pre-consumer and post-consumer). In relation to this research investigation, a number of potential building products and components may be created by using a by-product, the nut shells, derived from the Sicilian bio-based food industry. The proposed new building products, for both indoor and outdoor building applications, have a significant high-recycled content (pre-consumer) ranging from 50 to 80%. For the purpose of this investigation, post-consumer recycled content was reckoned as not applicable at this stage. The percentage of the recycled content has to be evaluated according to ISO14021 (Environmental labels and declarations—Self-Declared Claims—Type II Environmental Labeling) and demonstrated in the form of self-certification confirmed by a third party certification body (Pacheco-Torgal et al., 2012).

Recyclability of the proposed building product, material, or component at the end of its useful life, was a further aspect that was considered. Alongside the recycled content, recyclability is an important aspect of the products that has to be carefully considered in order to promote the circularity of the material resources.

The raw material considered by this research is a by-product derived from the Sicilian bio-based food industry. If the bio-based material is treated by using hazardous chemical substances, it will be unlikely that that material is recyclable or reusable. Therefore, in order to ensure full recyclability, no harmful chemicals (i.e., formaldehyde-based binders, halogenated flame retardants, and phthalates) has to be added while manufacturing of the future nut shells-derived building products. Many building products and components currently available on the market are made as zero-VOC and free-formaldehyde products. Therefore, the above is not considered a real challenge. As introduced above, hazardous chemicals such as VOC and SVOC compounds, halogenated flame retardants, urea–formaldehyde, and so on, are also carefully considered by GBRS as critical indoor air pollutants that may significantly impact the health and well-being of the building occupants. As a result, the manufacturing process is a critical phase to consider, especially when producing building materials and components designed for indoor applications. Life Cycle Assessment (LCA) of the identified possible products is also a further subject that requires attention in order to drive carbon reduction in building. While the LCA assessment of the products was not included at this stage, gathering a good understanding of the impact of the product across its lifetime via LCA is reckoned as a critical step to design new building products that promote net zero carbon construction targets. Therefore, LCA will be included among the further investigation to be carried out in the future, even because LCA represents an additional aspect that is rewarded by all GBRS.

8 Conclusions

Today, the current construction legislation also requires the inclusion of percentages deriving from waste materials for the creation of new building products. This condition has meant that these materials, in order to be reused and explain the best-required performances, usually in past are mixed with synthetic binders. In most of the analyzed literature, it is clear that the best results are obtained through the use of materials that potentially also produce harmful emissions for living environments, being not very sustainable and difficult to recycle. From the study of the contemporary literature regarding this topic, it emerges that the experimentation of binders of natural origin with zero emission is still in the verification and validation phase. Today, the current construction legislation also requires the inclusion of certain percentages deriving from waste materials for creating new building products. This condition means that these materials, in order to be reused to reach the best performances, usually are mixed with synthetic binders. In most of the analyzed literature, it is clear that the best results are obtained thanks to the use of materials that potentially produce harmful emissions for living environments, making them not very sustainable and difficult to recycle over time. The study of the contemporary literature regarding this topic shows that the experimental use of natural binders with zero emission is still in a phase that is to verificate and validate.

This research focused on the feasibility of reusing waste coming from Sicilian and zero-km agri-food production, not currently reused in other sectors, using low energy-intensive laboratory processes and analysis. Laboratory experiments demonstrate that the best results mixture (in mechanical and physical terms) is made by the 70% of waste material and using also 20% of natural binder. A comparison between the different produced blends and the evaluation of the examined study cases shows how it is possible to overcome the limits of using synthetic binders meanwhile creating a prototype of a new building component, realized using hazelnut shells, glycerol, and potato starch.

The use of waste deriving from agri-food production, such as dried fruit shells for the creation of building components, it could solve the shortage of raw materials, as well as reduce the environmental problems that arise from this waste. Furthermore, the reuse of dried fruit waste could mean a further economic stream for both farmers and producers.

This research has currently reached a definition point that opens up new scenarios for the creation/production of new materials, having repercussions on various sectors. The proposed research on the reuse of dried fruit waste can be extended both to the wide range of waste from agri-food production and to the experimentation of mixtures, exploiting different and innovative natural binders, also transferred from other technological sectors. This can be done in many research contexts since the set of solutions able to revive a waste embraces a heterogeneous field of development, projected to achieve the same eco-sustainable result.

References

Ahring, B. K., Ahring, B., Biswas, R., Ahamed, A., & Teller, P. (2015). Making lignin accessible for anaerobic digestion by wet-explosion pretreatment. *Bioresource Technology, 175*, 182–188.

Alkerc, J. (2015). *Health, Wellbeing & Productivity in Offices.* World Green Building Council.

Angelidaki, I., Treu, L., Tsapekos, P., Luo, G., Campanaro, S., Wenzel, H., & Kougias, P. G. (2018). Biogas upgrading and utilization: Current status and perspectives. *Biotechnology Advances* 36(2), 452–466.

Bolzonella, D., Gottardo, M., Fatone, F., & Frison, N. (2017). Nutrients recovery from anaerobic digestate of agro-waste: techno-economic assessment of full scale applications. *Journal of Environmental Management* (216), 111–119.

Cătălin Barbu, M., Sepperer, T., Mariana Tudor, E., & Petutschnigg, A. (2020). Walnut and Hazelnut Shells: Untapped Industrial Resources and Their Suitability in Lignocellulosic Composites. *Applied Sciences*. Retrieved from https://www.mdpi.com/2076-3417/10/18/6340.

Charlotte, L., Eberhardt, M., & Birgisd, H. (2019). Potential of circular economy in sustainable buildings. *IOP Conference Series: Materials Science and Engineering*, 479–9.

Ciancio, P., Miglietti, C., Tortia, M., Ponti, A., & Valpreda, F. (2019–20). *Bùgia: da scarto a risorsa. Aproccio DIY applicato al mondo delle bioplasticheper la realizzazione di una soluzione sistemica locale.* Torino: Università degli studi di Torino.

Coniglio, M. (2021). *Gusci di Mandorle riutilizzo di un materiale di scarto.* Palermo.

Cöpür, Y., Güler, C., Akgül, M., & Tasçioglu, C. (2006). *Some chemical properties of hazelnut husk and its suitability for particleboard prodcution.* Duzce: Turkey.

Cruz Lopes, L., Martins, J., Esteves, B., & Teixeira de lemos, L. (2012). New products from hazelnut shell. *Ecowood 2012 – International Conference on Environmentally-Compatible Forest Products.* Oporto.

De Curto, B., Marano, C., & Pedeferri, M. (2015). *Materiali per il design. Introduzione ai materiali e alle loro proprietà. ", CEA Casa Editrice Ambrosiana.* CEA Casa Editrice Ambrosiana.

Fan, Y. V., Lee, C. T., Lim, J. S., Klemeš, J. J., & al., e. (2019). Cross-disciplinary approaches towards smart, resilient and sustainable circular economy. *Journal of cleaner production, 232*, 1482–1491. Retrieved from https://agris.fao.org/agris-search/search.do?recordID=US201900374294.

Gontard, N., Sonesson, U., Birkved, M., Majone, M., Bolzonella, D., Celli, A., & Angellier-Coussy, H. (2018). A research challenge vision regarding management of agricultural waste in a circular bio-based economy. *Environmental Science and Technology, 48*(6), 614–654.

Gothard, N., Sonesson, U., Birkved, M., Majone, M., Bolzonella, D., & Celli, A. (2018). A research challenge vision regarding management of agricultural waste in a circular bio-based economy. *Taylor and Francis Online*, 614–654.

INSTAT. (2020). *DATI ISTAT*. Retrieved from https://www.istat.it/.

Maniaci, L. (2021). *Materiali naturali dagli scarti delle mandorle, pistacchi e nocciole.* Palermo.

Manzella, I. (2020). *Nuovi materiali naturali dagli scarti delle nocciole.* Palermo.

Müller, C., Kües, U., Schöpper, C., & Kharazipour, A. (2007). Natural Binder. In *Wood prpduction, wood technology, and biotechnological impacts* (pp. 347–381). Göttingen: Ursula Kües.

Müller, M., Valášek, P., Linda, M., & Petrásek, S. (2018). *Exploitation of hazelnut (Corylus avellana) shell waste in the form of polymer-particle biocomposite*. Prague: De Gruyter.

Pacheco-Torgal, F., Jalali, S., & Fucic, A. (2012). *Toxicity of Building Materials*. Woodhead Publishing.

Piness, J. (2010). Physical and chemical structural analysis of pistachio shells. *Jumr* 39–42.

Queiròs, C., Cardoso, S., Lourenço, A., & Ferreira, J. (2020). Characterization of walnut, almond, and pine nut shells regarding chemical composition and extract composition. *Biomass Conversion and Biorefinery, 1*. Retrieved from https://www.springerprofessional.de/en/characterization-of-walnut-almond-and-pine-nut-shells-regarding-/16713416

Salvador, R., Karyn de Carvalho Araújo, C., Moro Piekarski, C., Cristiane Sokulski , C., Carlos de Francisco , A., & Kyene de Carvalho Araújo Camargo , S. (2019). Circular Economy Practices on Wood Panels: A Bibliographic Analysis. *Sustainability, 11(4)* 1057. Retrieved from https://doi.org/10.3390/su11041057

Senol, H. (2019). Biogas potential of hazelnut shells and hazelnut wastes in Giresun City. *Biotechnology Reports*. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6715884/

Singh, R., Kumar, R., Singh, M., & Preet, P. (2020). *On compressive and morphological features of 3D printed almond skin powder reinforced PLA matrix.*

The Circular Economy Innovation Potential Behind the Scarcity of Raw Materials—A Literature Review

Elisabeth Kraut, Wanja Wellbrock, and Wolfgang Gerstlberger

Abstract

The aim of the paper is to analyse the attention and relevance of circular economy in research with a special focus on the innovation potential arising from the scarcity of resources. Therefore, the main research question of the paper is if raw material scarcity leads to a higher innovation level in circular economy approaches. For this purpose, a systematic literature review was conducted. According to the JCR ranking of the Academic Journal Guide, a keyword analysis was carried out in the relevant journals to determine a selection of papers that were clustered by means of a headline, abstract and full paper analysis in terms of terminology and content. As a result, we can say that current research considers the mentioned topic only very limited. However, especially aspects such as waste reduction and the carbon footprint are frequently mentioned as reasons for the introduction of circular economy.

Keywords

Raw materials • Circular economy • Sustainability • Innovation

1 Introduction

As the world's population is expected to grow and will reach nearly ten billion by 2050 (The World Bank, 2018), the global consumption of materials such as biomass, fossil fuels, metals and minerals is also increasing, which leads to a growth of the annual waste generation by around 70% till 2050 (European Commission, 2020; Kaza, 2018). The traditional understanding of economic activity, developed by Porter in his value chain theory (Barnes, 2001), is based on the principle 'take, make, waste'. Companies extract materials, expend energy and labour to fabricate a product and sell it to a consumer who disposes of the product after using it (Ellen MacArthur Foundation, 2013). Not only research and science have understood that this type of economic activity cannot continue in the long term without having a negative impact on our environment. The emission of greenhouse gas has never been higher than in 2017, and the levels of carbon dioxide, methane and nitrogen have reached record levels and quadrupled since the 1960s. As a result, the temperature on earth and oceans reached the second highest level in 2017 since records began (Hartfield et al., 2018). 'Climate change, energy and fuel, material resource scarcity, water scarcity, population growth, urbanization, wealth, food security, ecosystem decline and deforestation' (KPMG International, 2012) are considered the greatest sustainability challenges of our time, which will affect everyone in the future. Recent movements such as Fridays for future have generated a generally higher attention for sustainable development, for example, circular economy. The great hope is that companies together with other organisations and institutions can develop solutions to face these ecological challenges. This requires innovative approaches that establish new technologies and in addition, new business models for new sales strategies (Bocken et al., 2019). Balancing traditional economic goals with environmental and social concerns has created a new measure of corporate performance. Therefore, creating a sustainable industrial system in the new context is necessary to specify a new quality in product, process and facility design. This development can be called the next industrial revolution, which is defined with the three words equity, economy and ecology. Equity refers to social justice by taking responsibility for all people along the supply chain. As an example, it has to be ensured that all people involved in the value creation process have an

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appropriate standard of work. They should not be exposed to chemicals, for example. Economy refers to market viability. Intelligent designs and new business models can be a solution for challenges of the future. Ecology refers to environmental intelligence. The new industrial revolution should also rethink materials and set new design criteria (McDonough & Braungart, 2009).

The main objective of circular economy is to reduce all environmental impacts through a methodological approach based on eco-efficiency that looks at each step of the life cycle of a product, process or service in order to design or redesign it with lower negative impacts (Beaulieu et al., 2016). At the same time, the approach aims to limit the consumption of resources. Circular economy can be seen as a way to overcome the described traditional production model based on continuous growth and increasing scarcity of resources. Encouraging the adoption of closed-loop production patterns within our economic system that aims to increase the efficiency of resource use should be highlighted (Ghisellini et al., 2016). However, for a truly significant change towards circular economy a lot of time and comprehensive measures both in research and business are needed. The field of interest in circular economy innovations is shown in Fig. 1. It describes the interrelationship between sustainability management, innovation management and the circular economy.

This literature review focuses on the rapidly growing demand for raw materials and the resulting innovation potential towards circular economy. As the security of raw material supply has become a priority issue on the political agenda, the European Union has started to take measures to secure access to these resources. It is assumed that supply shortages will have an impact on the future competitiveness of the European Union. Therefore, an action plan for circular economy is a part of the European Green Deal (European Commission, 2013). Governments and companies started to consider circular economy not only as a precaution against resource scarcity but also as a driver of innovation and growth. Nevertheless, today our economy system is still acting in a linear model of production and consumption. However, resource scarcity and tighter environmental standards will become more and more important in the next years, which leads to a higher preference for circular business models (Ellen MacArthur Foundation, 2013). To reach this target, a rethinking must be started about the company's values, entrepreneurial approaches and strategies (McDonough & Braungart, 2002).

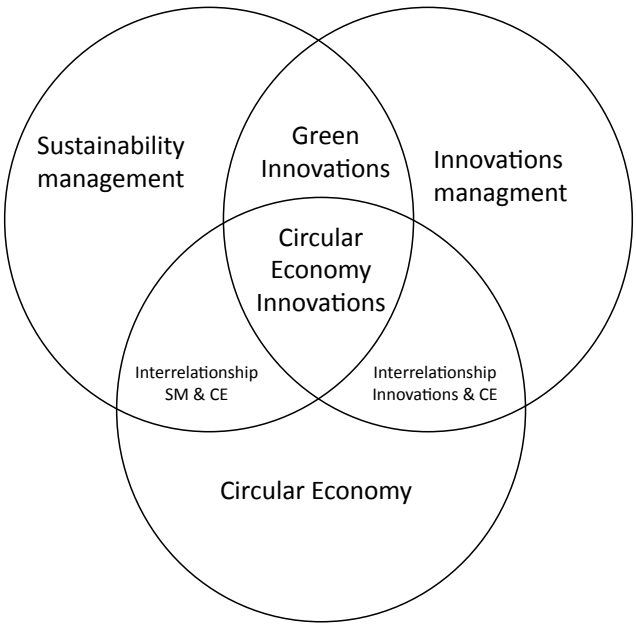

Fig. 1 Field of interest of circular economy innovations

2 Methodology and Data Sample

This paper screens the current state of research on the subject of raw material shortages and the resulting innovations in the direction of circular economy. The keywords 'scarcity of raw materials', 'circular business models', 'circular economy', 'cradle to cradle', 'circular product innovations', 'closed loop systems', 'closed loop value', closed loop economy', 'circular design' and 'circular product design' are derived on an examination of the current legal framework. These keywords are used to identify topic relevant literature regarding the research question if there is an increased interest in research on the topic of innovations in circular economy due to resource scarcity. In total, 56 papers could be identified to be part of the literature review. The way of identifying the relevant literature is described in Fig. 2.

Articles used for the literature review will comprise the most prominent and suitable journals in the subject of circular economy innovations and raw material scarcity. These journals were identified by using the ranking of the Academic Journal Guide (AJG) (2018), which is based upon peer review, editorial and expert judgements following the evaluation of many hundreds of publications (Chartered Association of Business Schools, 2018). For the selection of the journals, the JCR ranking illustrated in the AJG was used and applied to the sector 'regional studies, planning and environment'. Finally, the seven best-ranked journals from the described sector were used. In addition, it could be identified that many articles on the topic are published in the Journal of Cleaner Production. Therefore, this journal was also integrated into the literature review. In total, the following journals were analysed: Global Environmental Change, Environmental Science and Technology, Business Strategy and the Environment, Journal of Environmental Management, Environmental Science and Policy, Journal of

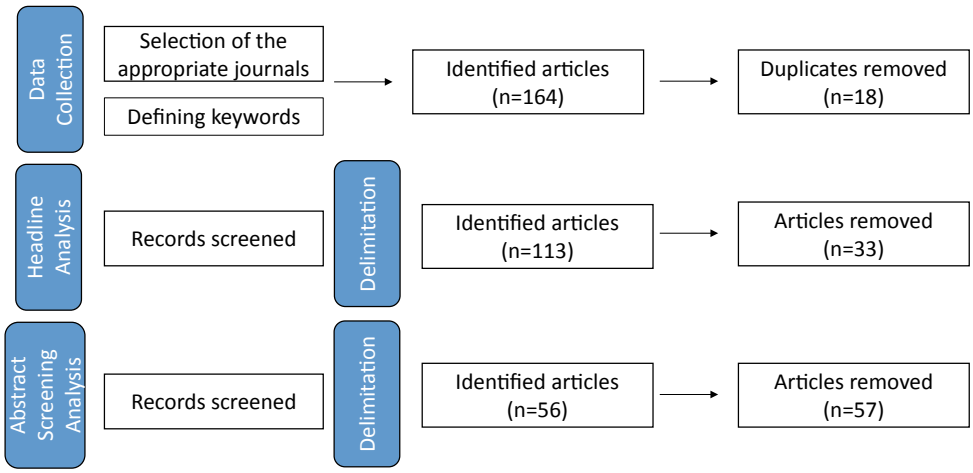

Fig. 2 Research Process to identify relevant literature (modified based on Bernard & Ryan, 2009; Moher et al., 2009)

Industrial Ecology, Corporate Social Responsibility and Environmental Management and Journal of Cleaner Production. The literature review only includes papers from 2010 to 2020.

3 Results of the Literature Review

In this chapter, the different outcomes of the literature review are analysed.

Main journals and methodology of the analysed papers.

As Table 1 shows, the Journal of Cleaner Production publishes the majority of topic relevant papers. Therefore, this journal is the main source for the literature review.

In addition, the literature review shows that—starting from 2010 to 2020—circular economy attracts more and more interest in research. As seen in Fig. 3, the turning point occurs around 2017. Especially case studies increased in the last years, which reflects a higher degree of acceptance in business practice. From 2010 to 2020, the scientific work turned mainly from theoretical approaches to more practically oriented empirical studies in the form of case studies, etc.

Content Analysis regarding the analysed papers.

While screening the selected papers, it could be identified that questions about why circular economy should be introduced and what circular business models are currently available frequently emerged. Hence, the answers from the selected articles are examined in more detail in the following sections:

Why should circular economy be introduced in a business context?

Business model innovations for sustainability are defined as innovations that create significant positive impacts on the environment or society or at least significantly reduce negative impacts in these areas (Bocken et al., 2014). In a world with a resource-based economy and decreasing resources, it is obvious that the economy has to change towards circular economy (Wiebe et al., 2019). Circular economy has positive impacts on today's main challenges:

- Companies must take responsibility and significantly reduce their environmental impact. They have to protect the natural environment by ensuring responsible natural

Table 1 Number of papers regarding the evaluated journals

Journal	Number of papers
Global Environmental Change	0
Environmental Science & Technology	0
Business Strategy & the Environment	3
Journal of Environmental Management	1
Environmental Science & Policy	0
Journal of Industrial Ecology	0
Corporate Social Responsibility and Environmental Management	0
Journal of Cleaner Production	52
Total	**56**

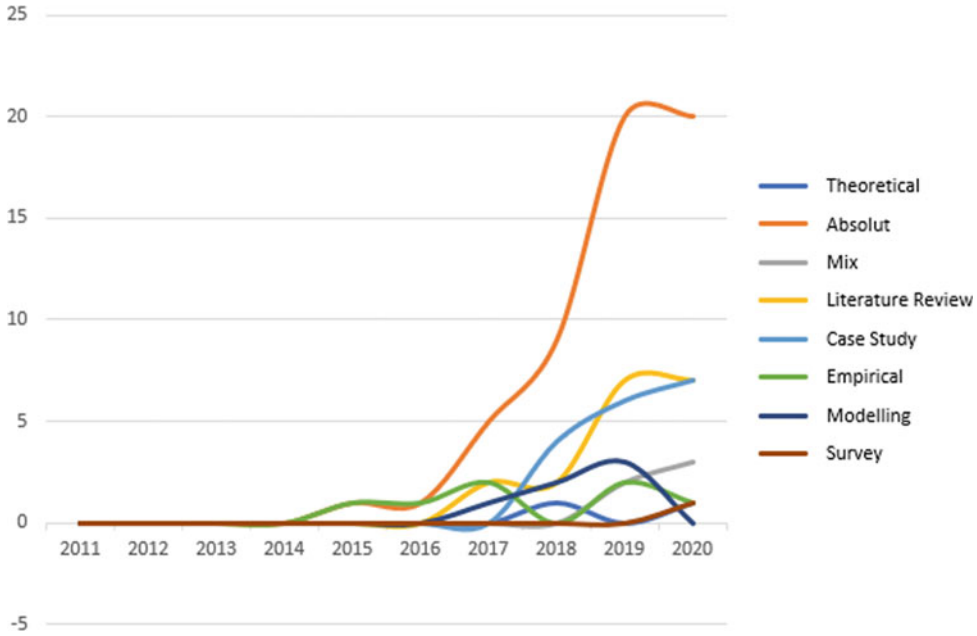

Fig. 3 Used methodology from 2010 to 2020

resource consumption through changing production patterns (Bonsu, 2020).

- Companies must reduce energy and limit the greenhouse gas effect within their own company and the total value chain (Ali et al., 2019; Bonsu, 2020; Lahane et al., 2020; Massaro et al., 2020).
- Companies must rethink the phrase 'waste equals food' (Braungart et al., 2007; McDonough & Braungart, 2002). Waste has to be seen as a profitable opportunity to generate new businesses (Millette et al., 2020). Due to the global scarcity of natural resources and their asymmetrical geographical distribution, circular economy will become more and more important in the future (Ghisellini & Ulgiati, 2020). Reducing resource throughput will also improve inefficient waste management practices (Rosa et al., 2019) and an increased circulation of products and materials within the economic system will consequently reduce the consumption of new materials (Tunn et al., 2019).
- An additional benefit of introducing circular economy is that companies get more information about their products and the underlying supply chain. Multiple stakeholders along the supply chain need to interact in order to provide critical information for a circular economy approach, such as material compositions or countries of origin. Furthermore, the benefit along the supply chain will increase due to a higher degree of interaction between the stakeholders (Millette et al., 2020).
- In closed-loop value chains, companies have a better overview of possible opportunities and risks. This enables innovations and can improve the sustainability performance of product and material supply chains (Kalverkamp & Young, 2019).

Current business model innovations regarding circular economy.

Circular business models rethink the whole life cycle of a product, its materials or the design, and implement new technologies and production systems. A rethinking of the distribution of products should also be included in circular business models. The consumption and use of products have to be transferred towards a service-on-demand approach. The collection, recycling and final disposal methods have to be modified completely. The question of health risks becomes more and more relevant in the new development process, too (Leal Filho et al., 2019; Paletta et al., 2019). To develop closed loops processes, companies can position themselves in mainly two different ways (Henry et al., 2020; Salvador et al., 2020):

- Design-based companies pursue the goal of achieving innovations in the actual technology, minimising material and making the process more efficient.
- Waste-based companies use recycled materials mostly produced from post-consumer products (secondary material).

Organisations that are striving for a more sustainable orientated business model are not only trying to avoid any environmental damage but also seek to maintain and improve the provision of products and services based on natural ecosystems and nature-based solutions. In addition, companies can also set themselves up on a service basis. This financially incentivises the companies to invest in the durability and reuse of products and materials as they control and increase the usage efficiency of their own products. In

addition, the entire dataset gains information content and can be used additionally by the company. Platform-based circular economy approaches can build a marketplace around this information and get access to different resources (Henry et al., 2020). Overall, circular economy business models can be divided into three different categories:

(1) Product-oriented business models

- Product-related services or advice: companies encourage the consumption of products; small services (e.g. insurance and maintenance contracts) can be booked additionally.
- Multiple subsequent owners: the aim is to encourage consumers to use the product for a longer period (e.g. second hand use and remanufacturing). Sharing platforms are the dominant innovation type in this category (Henry et al., 2020).
- New circular product design: use of biodegradable or secondary raw materials, substitution of chemicals with safe and environmentally friendly alternatives and evaluation of the product life cycle (life cycle assessment) (Mura et al., 2020).
  Providing appropriate after-sale support or aftermarket services as well as better reparability allows a longer use of the products and therefore, increases the reliance of the consumers (Salvador et al., 2020). Circular product design or product replacement rates are possible indicators, which can be used to measure circular economy approaches (Franco, 2019).

(2) Use-oriented business models.

- Leasing, renting and sharing or subscription of products.
  The shift towards a use-oriented business model intends to encourage companies to offer products of higher quality (Alcayaga et al., 2019). The classic long-life model focuses on delivering long product life by maximising high quality and reuse (Salvador et al., 2020).

(3) Result-oriented business models.

- Pay per service unit, functional results, separated waste collection systems or incentives for the return of old products (Munaro et al., 2020; Mura et al., 2020).

In the analysed literature, the question often arose to what extent ownership will still play a role in the future and whether the market or the end consumer is ready for the sale of service units (Tunn et al., 2019).

The literature review shows that current researches are not really considering the potential of the scarcity of raw materials in the implementation process of circular economy. However, aspects like waste reduction and the carbon footprint are frequently mentioned as reasons for the introduction of circular economy. Therefore, a research gap for further analyses has been identified. However, benefits coming from the implementation of circular economy are not always clear to manage (Rosa et al., 2019). Therefore, future research should also include the question of how companies can implement circular economy and what kind of hurdles are there to overcome during the implementation process. Innovations are needed, which include system thinking, mindset change, diversity, effectiveness, resilience and long-term strategies for all stakeholders (Rossi et al., 2020). Upcoming research work should also include why resource scarcity has played a subordinate role in the past. Furthermore, the question arises as to which of the above-mentioned business models the impending scarcity of resources can counteract and whether there are already practical examples based on it. In addition, consideration of why resource-intensive companies have not yet intensively dealt with the introduction of circular economy models should be paid attention to.

4 Conclusion

The paper gives a detailed overlook of literature concerning circular economy and scarcity of raw materials. As the results show, the combination of both areas is a quite undiscovered research gap. The study also has some limitations. The paper focuses only on the best-ranked journals from the JCR ranking. It would be interesting if other results occur by analysing different journals, for example, in a web of science. Another point to further discuss is the derivation of relevant keywords to identify further literature. The paper should be seen as a first step towards the topic innovation potential of raw material scarcity towards circular economy. Further research projects can build on the results.

References

Alcayaga, A., Wiener, M., & Hansen, E. G. (2019). Towards a framework of smart-circular systems: An integrative literature review. *Journal of Cleaner Production, 221*, 622–634.

Ali, A. K., Wang, Y., & Alvarado, J. L. (2019). Facilitating industrial symbiosis to achieve circular economy using value-added by design: A case study in transforming the automobile industry sheet metal waste-flow into Voronoi facade systems. *Journal of Cleaner Production, 234*, 1033–1044.

Barnes, D. (Ed.). (2001). *Understanding business: Processes*. Psychology Press.

Beaulieu, L., Durne, G., & Arpin, M. (2016). *Circular economy: A critical literature review of concepts*. CIRAIG, Polytechnique Montréal.

Bernard, H. R., & Ryan, G. W. (2009). *Analysing qualitative data*. SAGE Publications Inc.

Bocken, N., Ritala, P., Albareda, L., & Verburg, R. (2019). *Innovation for sustainability*. Springer International Publishing.

Bocken, N., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production, 65*, 42–56.

Bonsu, N. O. (2020). Towards a circular and low-carbon economy: Insights from the transitioning to electric vehicles and net zero economy. *Journal of Cleaner Production, 256*, 120659.

Braungart, M., McDonough, W., & Bollinger, A. (2007). Cradle-to-cradle design: Creating healthy emissions – a strategy for eco-effective product and system design. *Journal of Cleaner Production, 15*, 1337–1348.

Chartered Association of Business Schools (2018). *Methodology for the academic journal guide*. https://charteredabs.org/topic/academic-journal-guide/.

Ellen MacArthur Foundation (2013). *Towards a Circular Economy-Economic and Business Rationale for an Accelerated Transition*. https://ellenmacarthurfoundation.org/towards-a-circular-economy-business-rationale-for-an-accelerated-transition.

European Commission (2013). *Security of supply and scarcity of raw materials. Towards a methodological framework for sustainability assessment*. Publications Office of the European Union.

European Commission (2020). *Circular Economy Action Plan. For a cleaner and more competitive Europe*. Publications Office of the European Union.

Franco, M. A. (2019). A system dynamics approach to product design and business model strategies for the circular economy. *Journal of Cleaner Production, 241*, 118327.

Ghisellini, P., & Ulgiati, S. (2020). Circular economy transition in Italy. Achievements, perspectives and constraints. *Journal of Cleaner Production*, *243*, 118360.

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production, 114*, 11–32.

Hartfield, G., Blunden, J., & Arndt, D. S. (2018). State of the climate in 2017. *Bulletin of the American Meteorological Society*, *99*(8), Si-S310.

Henry, M., Bauwens, T., Hekkert, M., & Kirchherr, J. (2020). A typology of circular start-ups: An analysis of 128 circular business models. *Journal of Cleaner Production, 245*, 118528.

Kalverkamp, M., & Young, S. B. (2019). In support of open-loop supply chains: Expanding the scope of environmental sustainability in reverse supply chains. *Journal of Cleaner Production, 214*, 573–582.

Kaza, S. (2018). *What a waste 2.0. A global snapshot of solid waste management to 2050*. World Bank Group.

KPMG International (2012). *Expect the unexpected: building business value in a changing world*. https://home.kpmg/content/dam/kpmg/pdf/2012/08/building-business-value-part-1.pdf.

Lahane, S., Kant, R., & Shankar, R. (2020). Circular supply chain management: A state-of-art review and future opportunities. *Journal of Cleaner Production, 258*, 120859.

Leal Filho, W., Saari, U., Fedoruk, M., Iital, A., Moora, H., Klöga, M., & Voronova, V. (2019). An overview of the problems posed by plastic products and the role of extended producer responsibility in Europe. *Journal of Cleaner Production, 214*, 550–558.

Massaro, M., Secinaro, S., Dal Mas, F., Brescia, V., & Calandra, D. (2020). Industry 4.0 and circular economy: an exploratory analysis of academic and practitioners' perspectives. *Business Strategy and the Environment*, *30*(2), 1213–1231.

McDonough, W., & Braungart, M. (2002). Design for the triple top line: New tools for sustainable commerce. *Corporate Enviromental Strategy, 9*(3), 251–258.

McDonough, W., & Braungart, M. (2009). *Cradle to cradle*. Vintage.

Millette, S., Eiríkur Hull, C., & Williams, E. (2020). Business incubators as effective tools for driving circular economy. *Journal of Cleaner Production, 266*, 121999.

Moher D., Liberati, A., Tetzlaff, J., & Altmann, D. (2009). *Prefferd reporting items for systematic reviews and meta-analyses: the PRISMA statement*. https://journals.plos.org/plosmedicine/article?id=https://doi.org/10.1371/journal.pmed.1000097.

Munaro, M. R., Tavares, S. F., & Bragança, L. (2020). Towards circular and more sustainable buildings: A systematic literature review on the circular economy in the built environment. *Journal of Cleaner Production, 260*, 121134.

Mura, M., Longo, M., & Zanni, S. (2020). Circular economy in Italian SMEs: A multi-method study. *Journal of Cleaner Production, 245*, 118821.

Paletta, A., Leal Filho, W., Balogun, A.-L., Foschi, E., & Bonoli, A. (2019). Barriers and challenges to plastics valorisation in the context of a circular economy: Case studies from Italy. *Journal of Cleaner Production, 241*, 118149.

Rosa, P., Sassanelli, C., & Terzi, S. (2019). Circular business models versus circular benefits: An assessment in the waste from electrical and electronic equipments sector. *Journal of Cleaner Production, 231*, 940–952.

Rossi, E., Bertassini, A. C., Ferreira, C. d. S., Neves do Amaral, W. A., & Ometto, A. R. (2020). Circular economy indicators for organizations considering sustainability and business models: plastic, textile and electro-electronic cases. *Journal of Cleaner Production*, *247*, 119137.

Salvador, R., Barros, M. V., Da Luz, L. M., Piekarski, C. M., & Francisco, ACd. (2020). Circular business models: Current aspects that influence implementation and unaddressed subjects. *Journal of Cleaner Production, 250*, 119555.

Tunn, V. S. C., Bocken, N. M. P., Hende, E. A. v. d., & Schoormans, J. P. L. (2019). Business models for sustainable consumption in the circular economy: an expert study. *Journal of Cleaner Production*, *212*, 324–333.

Wiebe, K. S., Harsdorff, M., Montt, G., Simas, M. S., & Wood, R. (2019). Global circular economy scenario in a multiregional input-output framework. *Environmental Science & Technology, 53*(11), 6362–6373.

The World Bank (2018). *World's population will reach nearly 10 billion by 2050*. https://datatopics.worldbank.org/world-development-indicators/stories/world-population-will-continue-to-grow.html.

The 'Human Sphere' and the Figure of 8 as the Enabler of Circular Economy in Developing Countries: A Case Study

Michael Maks Davis, Andrea Vallejo, Paulina Criollo, and Teresa Domenech

Abstract

Circular Economy (CE) models offer an alternative to linear production processes that lead to resource depletion, waste management problems and environmental degradation. This is particularly true for End of Life Tires (ELTs), which at the end of their use in the automobile industry are generally burnt or dumped. The use of whole ELTs in civil engineering can be a successful, low-cost application. This is especially relevant for emerging economies, and in this context, a case study was carried out through the construction of a gravity retaining wall in Llano Chico, a low-income urban area of Quito, the capital of Ecuador. The transformation of whole ELTs into a raw construction material required nothing more than human ingenuity, making the most of the ELT's inherent mechanical properties. In addition, the loops of the technical and biological spheres of the common CE 'butterfly diagram' were critically assessed. In the case study, the ELTs were cycled through the technical sphere in a collection and recycling process. The human sphere processes transformed the ELTs from being a waste product into a retaining wall. However, once constructed, the retaining wall from ELTs serves as a matrix for local flora to take root. This is in stark comparison to a traditional concrete retaining wall, which has little ecological value. The endpoint of the ELT wall is its incorporation into the environment, where its cycle ends in the biological sphere. The authors argue that the technological and biological spheres of CE do not always function as two independent cycles. The human sphere can link the two loops, drawing tires through one sphere and into the other. This is a newly defined, 'figure of eight' cycle.

Keywords

Participatory circular economy • Community-driven CE • 'Human sphere' • ELT management • CE in developing countries

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1 Introduction

The extensive use of natural resources since the rise of industrialisation in the mid-eighteenth century has led to environmental degradation (Wit et al., 2018). Worldwide, 92.8 billion tons of resources are used annually and only 9.1% of this use is circular, whilst the lack of material management at end of life (EOL) accounts for 67% of global greenhouse gas emissions (Wit et al., 2018). Additionally, uncontrolled landfilling has negative impacts on population health and the environment, as well as leading to greenhouse gas emissions in the form of methane. This is of particular importance, where the effects of human activity are now well known to lead to climate change and the coining of the term The Anthropocene Era. The term is becoming more and

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more widely accepted, and is related to the sudden changes that are happening to the Earth's climate due to human activities. Lewis and Maslin (2015) highlight how the human species has released enough carbon into the atmosphere to delay the next glaciation event (555 petagrams since 1750). They also state the associated acidity increase in the oceans has been unprecedented for at least the last 300 million years. Not to mention the mass extinction of species and the homogenisation of global organisms (due to their transportation across oceans in boats across the oceans), novel techniques from antibiotics, pesticides and genetically engineered organisms. All of these phenomena can compete with processes that would otherwise be left to evolution. In short: 'Human activity has clearly altered the land surface, oceans and atmosphere, and re-ordered life on Earth' (Lewis and Maslin, 2015, pp. 172).

As one of the responses to this, the circular economy (CE) approach argues for a new form of consumption that mitigates human's negative effects on the Earth. CE has been put forward as essential to promote efficient production and sustainable consumption (EC, 2014; EC, 2015). The Ellen MacArthur Foundation (EMF, 2013) defines a circular economy as 'an industrial system that is restorative or regenerative by intention and design' (P. 8)., Kirchherr et al. (2017) analyse the concept in the realm of scholars and practitioners. The review of over 114 definitions concludes that the CE embeds at its core the concepts of reducing, reusing, recovering, remanufacturing and, finally, recycling materials in the different processes of the supply chain: production, distribution and consumption. The review highlights that the CE concept can operate in different realms: companies, industries, cities and regions.

Transitioning to CE is a highly complex process which requires diverse but consistent routes of action involving changing new business and market models, policy frameworks as well as consumer behaviour (EC, 2014; Wit et al., 2018). A number of countries, cities and organisations have developed CE route maps and strategies to transition towards the CE. These strategies address ways to ensure the efficient use of resources, promotion of cycling opportunities and strategies to restore natural capital. Within those, Extending Producer Responsibility schemes have played an important role. In most cases, they involve a financial responsibility of end-of-life products and systems to take back or recover products, with the aim to promote reuse, and recycling and prevent pollution from inadequate treatment of waste products (Preston & Lehne, 2017).

In developing and emerging economies, implementation of Circular Economy policies faces several important barriers. Often waste regulations are weak and infrastructure for waste collection, treatment and recovery is to a large extent lacking (ETRMA, 2011; Toffel, 2003). Whilst the CE model is based on increasing the circularity of the flows of biological and technical materials, it is important to acknowledge the social, policy and infrastructural dimensions that shape the flow of resources. It is also an important role that the informal sectors play in waste management processing (Preston & Lehne, 2017).

An example of wasteful use of resources is scrap tires. Every year an average of one-billion tires reach EOL and nearly four billion are in landfills and stockpiles worldwide (WBCSD 2008). The objective of this work is to explore the role of the human component (human sphere) in enabling CE practices. We do this through an analysis of how material, energy and human contribution interact and shape End of Life of Tires (henceforth ELTs) in a developing country through a case study in Ecuador. Based on this, a new conceptual framework is put forward that is appropriate for the human sphere in relation to the realities faced by the Global South.

2 Circular Economy: From the Butterfly Diagram to the Human Sphere

2.1 The Butterfly Diagram

The concept of waste being an unnecessary product unique to modern society has been put forward by a number of schools of thought. Industrial Ecology seeks to optimise socio-economic systems to become 'ultimately sustainable', building on the analogy between industrial systems and biological ecosystems, based on cyclical uses of resources in the way that the waste of one component becomes a resource for another (Jelinski et al., 1992). Regarding Biomimicry, the founder Benyus (1997) calls for humanity to learn from nature, where amongst other things 'Nature Recycles Everything' (P. 7) and sees a future based around the closed-loop, feedback systems that are common in the natural world (Benyus, 2019 in Pawlyn, 2019). McDonough and Braungart (2010) argue Waste equals Food in their Cradle-to-Cradle Philosophy, where they identify two main types of loops: one technological and the other one biological. The Circular Economy movement joins this call to arms that 'Waste' has become an outmoded concept that needs to be laid to rest. The Ellen MacArthur Foundation (EMF) has propagated the concept of CE in a butterfly diagram (Fig. 1), where a continuous flow of technological and biological materials functions in a value chain approach (EMF, 2013).

The left side of the butterfly diagram shows a circular flow of biological resources emphasising the recovery of nutrients and restoration of natural capital. At this sphere, as

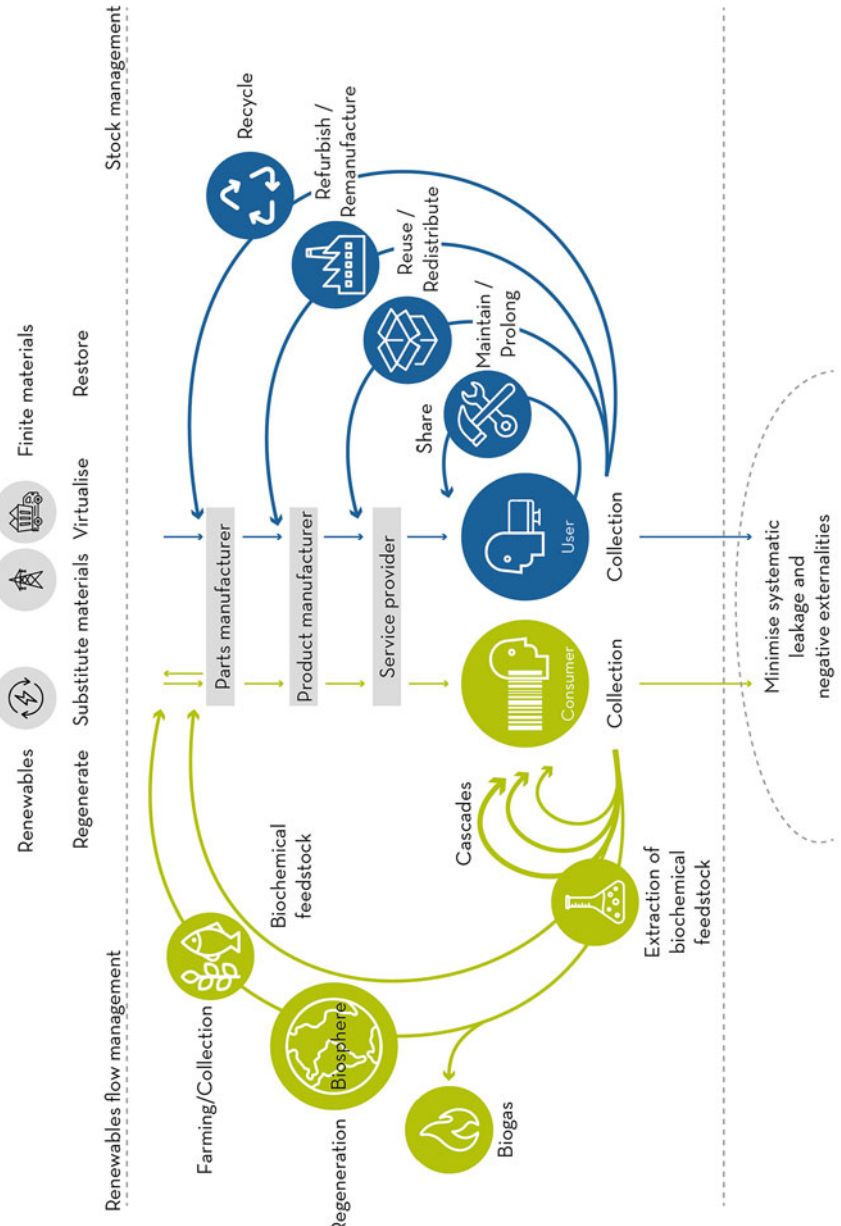

Fig. 1 The Circular Economy Butterfly Diagram. Source: Ellen MacArthur Foundation (2013)

detailed by van der Voet (2002) natural cycles of ingestion, digestion, excretion and reproduction are depicted. On the other side, the techno sphere on the right-hand side of the diagram describes stocks and flows, products and services, of technical components, whose management is controlled by humans. In both spheres, the aim is to eliminate the production of waste insofar as is possible, promoting an efficient use of resources whilst preserving or restoring natural capital. Waste in the techno sphere is redefined as resources that feed new processes. The same is true for the biosphere, which replicates ecosystems found in nature. But this then begs the question: What is the role of humans?'.

2.2 The Human Sphere

Lemille (2017a) argued that the concept of the elimination of waste needed to be carried out hand in hand with the eradication of poverty and inequality. Furthermore, Schröder et al. (2020) highlighted the lack of clarity regarding the human dimension of CE, where people were considered mainly in terms of being consumers or users. In this context, Schröder et al. (2020) incorporated the Human Development Index (HDI) into the traditional CE butterfly diagram (Fig. 2). The HDI is of particular importance in judging the success or failure of CE methodologies applied in emerging economies. The HDI indicators of a long and healthy life, being knowledgeable and having a decent standard of living offer more hope for populations attempting to claw their way out of poverty. This moves beyond trickle-down economics, which is based on orthodox models centred on national Gross Domestic Product (GDP). Mishra et al. (2019) identified the 'human sphere' as a new dynamic, unique concept to developing countries, which serves as a means of transitioning from a linear to a circular economy in a manner that provides opportunities of employment for the informal sector. In the context of emerging economies, the informality rates in Ecuador are one of the highest in Latin America, with over 60% of workers operating in the informal sector (Canelas, 2019). Within this sector, one of the employment areas is related to inorganic waste, which is collected and sold to recycling companies or associated intermediaries. As such, the informal workforce working in this field in Ecuador plays a key role in the development of CE, because it already operates in the field of converting waste into technological nutrition flows.

According to Schröder et al. (2020), the human sphere interacts with the bio and the techno spheres, in order to strengthen the objectives of the HDI (see Fig. 2). This interaction consists of four additional loops, which are outlined below (mainly based on Schröder et al. (2020), unless stated otherwise) to provide a theoretical framework for the case study of ELTs in Llano Chico, Ecuador.

The outer loop refers to the macro-economic policies that are related not only to resource efficiency but also to consumption and production systems in general. The government and its macroeconomic policy formulation is crucial for developing a 'human embedded circular economy', by creating economic incentives or changing certain taxation programs towards the use of non-renewable resources. For instance, Sweden was the first country to pass a law that provides preferences to human-based activities such as repairing.

The second outer loop is based on inclusive circular economy business models, consisting of viable ventures that embrace business values that have a positive social impact. It considers several areas (especially in emerging economies) such as informal workforce, role of female entrepreneurs and others.

The third loop is related to CE community initiatives. This includes bottom-up initiatives in rural and urban areas, which were especially created by communities to incentivise citizen participation in activities such as recycling, repairing or remanufacturing. For instance, the participation of waste-pickers in cities is being recognised by municipalities and citizens as valuable in the creation of jobs, which in turn implies the right to improved working conditions. This adds a sphere that is related to the human action itself, working with the materials that avoid ending up in landfill, whilst also providing environmental, social and economic opportunities.

The fourth loop talks about sustainable lifestyles and livelihoods. CE develops opportunities for consumers to change consumption habits that are rooted in a linear economy. This is especially true for emerging economies, to avoid the lock-in into linear consumption patterns. These new business models are designed to enable lifestyle leapfrogging. For example, an advantage of emerging economies is small businesses for repairing products still exist, opening up opportunities for products to be in use for longer before ending up in landfill.

The opportunity lies in finding a new paradigm where human beings are an integrated element with nature (Schröder et al., 2020). As Lemille (2017b) explains, the human sphere refers to rethinking about the function of the human being as energy and as a resource towards the biosphere. It is imperative to talk about the function of humans

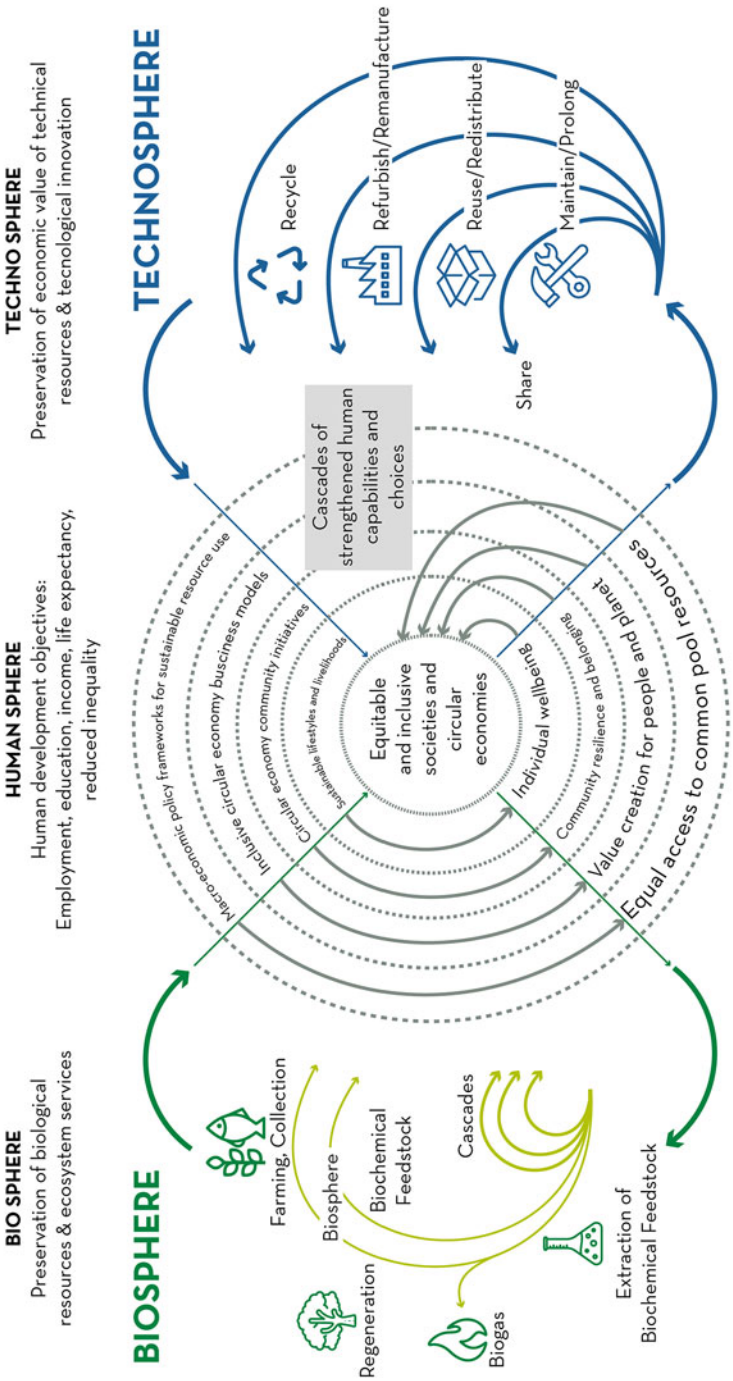

Fig. 2 Framework for a Human Development focused Circular Economy (Schröder et al., 2020)

in the biosphere, not only for environmental remediation but also for regenerative processes that can help nature thrive. Human beings can change their role with adaptive strategies and rebuild the ecosystem.

The development of the human sphere within the CE is essential to combat poverty. It is also a way of integrating the CE concept into emerging economies, where social inequality and environmental problems abound (Lemille, 2017b). For example, governments can establish laws that support and allow social inclusion; companies can get involved in a manner that informal workers are empowered; industry leaders can ensure that smaller actors are accounted for in all sectors; consumers can give rise to a demand for fairer products; and employers can adopt commercial models of labour integration (Lemille, 2017b).

2.3 The Need for Community Resilience in Ecuador

The vulnerability of the local population is given by social, cultural and economic factors that are accelerated by the presence of the local mountain ranges (Demoraes & D'ercole, 2001). Mass movements are one of the main natural disasters to which the population is exposed. Taking into account that the city is crossed by rivers and streams, there are sectors susceptible to landslides, such as stream edges and on slopes greater than 30 degrees (MDMQ, 2017). Likewise, these natural factors are accelerated by the intervention of people, who bring about deforestation and carry out excavations that destabilise slopes, as well as construction projects using heavy materials in areas at risk from landslides (especially populations who live in conditions of poverty and are unable to afford to build their homes anywhere else. For example, there are neighborhoods located close to slopes and urban developments that cut into slopes to liberate space for construction, without taking into account the stability calculation of the slope (D'Ercole et al., 2003). Additionally, climate change has caused a lag in the beginning of the rainy seasons, generating a greater risk of landslides and this has been more evident since 2000 (MDMQ, 2017). In Quito alone, around 185 neighborhood sectors that are susceptible to mass movements have been identified, with 51% are at a high-risk level, whilst 49% are at a medium-risk level (D'Ercole et al., 2003).

In this context, Lemille's (2017a) argument gains strength, with the need to promote a model that generates a population that is resilient to natural disasters. In these conditions, the CE goes beyond an optimisation of resources, but argues that a system is needed that promotes social justice with equity and inclusion through the circular economy model, where added human value becomes a key factor of change.

3 End-Of-Life Tires (ELTs) in Ecuador, the Case Study of Llano Chico and the Human Sphere in Practise

3.1 End-Of-Life Tires (ELTs) in Ecuador

End-of-Life Tires (ELTs) are typically an example of the Linear Economy. In Ecuador, 3.4 million new tires enter the country every year and of all discarded tires, only 18% are properly managed (Cecchin et al., 2019). However, certain companies do work towards the sustainable management of Ecuador's ELTs. For example, Tractomaq[1] has a recycling plant for the management and treatment of used tires, where the tires are first broken down and the metals separated from the rubber. Second, the rubber is crushed at room temperature, and the collected pieces enter a pyrolysis process that produces a gas similar to propane. However, scholars argue that promoting energy recovery from waste may conflict with measures that aim to further reduce carbon dioxide emissions and use of resources (Malinauskatie et al., 2017). Additionally, since it is a downcycling process, it is debatable whether this process enters into the concept of circular economy. In Ecocaucho,[2] 95% of the material used comes from recycled ELT. The company processes 900 tires weekly and reuses around 50 thousand tires per year through material recovery. Likewise, Apci-Aliboc[3] produces granulated rubber powder used as an aggregate and mixed with asphalt or concrete to construct roads, create ecological floors and improve the resulting final product quality. However, of the nearly 40 tire recycling companies in Ecuador, only a few produce high-quality granulate sizes. Furthermore, limited demand for this material in the country is an impediment to the industries towards operating at their design capacity (Cecchin et al., 2019).

Cecchin et al. (2019) described how in 2013, Ecuador implemented an Extended Producer Responsibility (EPR) policy for used tires with recycling targets. Producers and importers were required to provide an annual ELT management report. The authors also highlighted that the results showed a weakness in achieving the recovery targets set by the local authority, leaving one third of tires not properly managed. This was due to a lack of control over tire importers and producers, as well as complex geography for territorial organisation. For this reason, in a joint effort from the importers and producers, the SEGINUS group was established in 2018 to improve the management of tires (Cecchin et al. 2019).

[1] Http://www.grupotractomaq.com/reciclaje/
[2] Https://www.ecocaucho.com.ec/
[3] https://apci-aliboc.com/caracteristica_caucho.html.

3.2 The Case Study of Llano Chico and the Human Sphere in Practise

In the case of Llano Chico, a gravity retaining wall was constructed using unprocessed ELTs. Llano Chico is a parish located in the North of Quito, with an urban nucleus of 13.5 km^2 around its main park and a population of approximately 13,734 inhabitants (MDMQ, 2017; PDOT, 2012). Cecchin et al. (2019) pointed out how Llano Chico is characterised by having a large population working in the informal sector and classed as low-income (poor). The authors also highlighted the population in the Parish living in areas vulnerable to landslides. The retaining wall project was carried out as a pilot study in a private plot of land of a family that relied on unstable employment and faced a potentially unstable slope towering next to their house.

At the time of the paper of Cecchin et al. (2019), the project had been financed through social and research work in the PUCE University of Quito, Ecuador, as well as through running a series of training workshops for students and professionals. By the time, this article was written the wall had been brought to completion as a not-for-profit initiative of Evolution Engineering, Design and Energy Systems Ltd., UK. Throughout the project, the ELTs were reused without the need for complex processing systems, or high-tech machinery. The tire rims were partially removed in order to provide ease of compacting the soil infill, where the rims were then re-used for small adjustments to each line of tires of the retaining wall. In terms of materials for the construction of the retaining wall, these consisted of: the tires (donated by a tire importation company); a soil infill (obtained from excavations at other construction sites); rope and cabling (used as ties to form a matrix between the tires); gravel and PVC piping (for the drainage system). Approximately 1000 ELTs were used in total, representing approximately 10 tonnes of waste, or around 90 m^3, avoided to landfill (or illegal dumping).

Cecchin et al. (2019) described the Llano Chico case study as a reflection on the End of Life (EOL) management of products in Ecuador. Additionally, they highlighted the potential of promoting resistance and social sustainability in informal settlements exposed to natural disasters. The authors explored the possibilities of collaboration with governmental agencies to promote improved ELT management through public policies that could emancipate collaboration with the informal sector. In this paper, the Llano Chico case study is studied from a different angle. We examine the relationships between the CE in theory (as part of the 'human sphere') and in practice when applied to a poverty-stricken population living in a developing country. The objective is to offer a critical examination of the state of the art of circular economy theory through lessons learnt in the field. In order to reach this objective, it is important to understand the construction process of the retaining wall, which is shown in Fig. 3 as an introduction to looking at the four loops of the human sphere applied in a practical example.

The four loops of the human sphere can be analysed in this context within the framework of developing countries (or as Schöder (2020) puts it, emerging economies). The outer loop of 'macroeconomic policy framework for sustainable resource use' was present in the End-of-Life (EOL) legislation of the Ministry of the Environment, which enabled the private sector to donate ELTs to the project. Additionally, as this paper is being written, a formal CE law is being debated by the Ecuadorian government (Pichincha Comunicaciones, 2020). Its main objective is to incentivise and control the activities of the business sector in order to manage their waste properly and reinforce CE opportunities. The CE law includes opportunities to recognise waste pickers as formal employees and as an important part of the whole chain of waste management in cities. Since 2008, there has been in Ecuador the National Network of Waste Pickers (RENAREC[4]), which brings together more than 50 associations nationwide that welcomes more than 1500 waste pickers and their families. Waste pickers seek recognition, appreciation and be supported by inclusive public policies for their development. It is necessary the government recognition and support for these groups and their importance in the circular economy in order to create a more equitable and inclusive policy, by recognising the value of each link within the process chain.

The second loop is based on inclusive circular economy business models. In this case, Llano Chico showed the potential for ELTs to become a raw construction material led by the informal sector. Additionally, the training workshops served as a link with the community, not only to teach good construction practices but also to create a social fabric that can serve to replicate this type of initiative further afield. The mentorship and the 'know how' of how to build a wall with ELTs could become a novel business model, with the potential to be applied in different communities.

The third outer loop is related to CE community initiatives. The Llano Chico retaining wall is an initiative in an emerging economy (the informal sector). Moreover, it works with ELTs that are not subsequently dumped in landfill or otherwise (with associated negative environmental impacts) whilst using ELTs as a raw construction material potentially opens social and economic opportunities. Likewise, it creates the opportunity for making resilient communities, a problem shown by D'Ercole et al., (2003), It takes into account the need to control landslides due to the city's high risk. Also, the most vulnerable groups are those in situations

[4] Https://renarec.com/

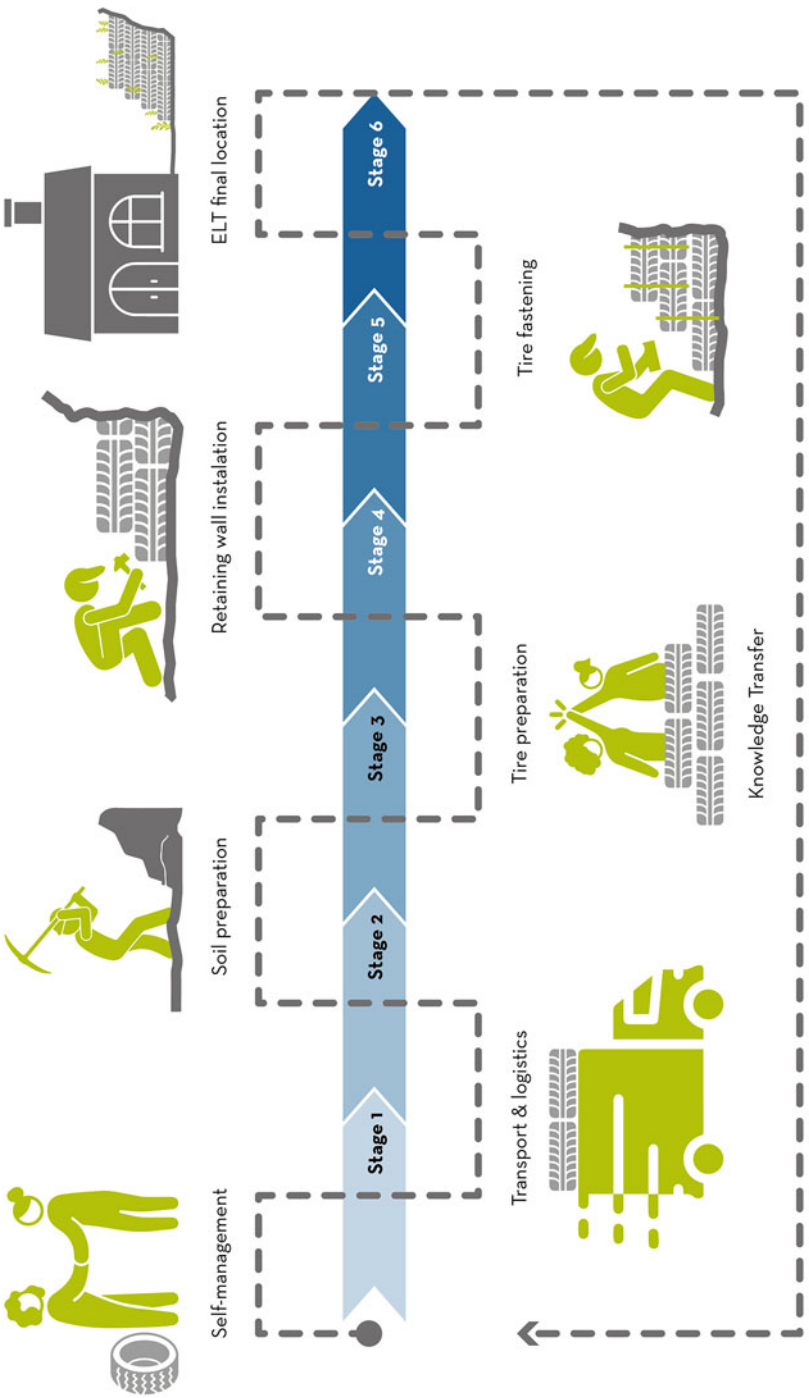

Fig. 3 Stages for the construction of a retaining wall based on ELT material in Llano Chico

of poverty and informality. They cannot afford conventional retaining systems to protect their homes and even their lives. The Llano Chico wall has proven to be an option of equity for these groups, becoming part of their home with a sense of belonging and social well-being as the community participates in its construction. In addition, with the possibility of implementing plants on the wall, it allows new interactions to take over the place. The fourth loop is about sustainable lifestyles and livelihoods. A change in behaviour can be seen in relation to environmental services. The retaining wall was built with ELTs, which were otherwise perceived as being a waste material with little intrinsic value and of low quality. However, the construction of the retaining wall for the case study demonstrated that ELTs could compete with reinforced concrete for slope stabilisation projects. The authors of this paper estimated the wall to have been up to 70% cheaper than its reinforced concrete counterpart. As such, the ELT retaining wall promoted sustainable lifestyles by eliminating a waste product and mitigating the use of energy-intensive concrete civil works. It is also linked with community resilience regarding slope stability works for low-income urban inhabitants, as well as providing employment from the potential construction of ELT retaining walls within a CE paradigm.

Overall, the Llano Chico ELT retaining wall provides an interesting case study to examine how CE and the four loops of the Human sphere can be put into practise in emerging economies.

4 From Loops to Figures of Eight

An interesting overall point to note is how the case study offers a new perspective regarding CE cycles. The state of the art of the CE describes two cycles; the technological sphere and the biological sphere. These cycles are facilitated through the loops of the human sphere. Let us consider paper, for example. Paper use can be maintained in the technological sphere: people use the paper; it is cleaned, shredded and reduced to a raw material; new, fresh paper is made; people use the paper. It can also be fed into the biological sphere: people use the paper (admittedly non-bleached); it is cleaned, shredded and reduced to a compostable material; the paper becomes a nutrient source that is re-incorporated into Mother Nature. However, the ELT retaining wall flows through both the technological and biological cycles, more in a figure of eight with the human sphere at its centre than in a 'loop'. The ELTs are transformed in the technological sphere from being a waste product that has no further use in the automotive industry, to being a raw material for the construction industry and civil engineering works (the retaining wall). This does not occur through a technical transformation of the tire, but through an innovative perception of the potential of ELTs in the human sphere. This change of perception leads to the reuse of the tire as raw material for the construction of a retaining wall. Once completed, the tire retaining wall acts as a matrix that not only retains the soil slope but also provides a structure that can be populated by a range of local flora (from plants to trees). In this aspect, there is a stark difference between a traditional reinforced concrete retaining wall and those built from ELTs. A reinforced concrete retaining wall has little post-construction ecological value; it merely completes its function of slope stability. In contrast, the gravity retaining wall of Llano Chico has an ecological value following construction. In this manner, the ELTs come out of the technological cycle, and become an element of the biological cycle. The endpoint of the ELT retaining wall is a matrix for local flora, in addition to its function as a retaining wall. This combined series of cycles can be represented as a figure of eight. It starts in the technological cycle, where the tires are produced for their use in the vehicle industry and eventually come to the end of their life as a tire for the automobile sector. The ELTs then come into contact with the human sphere, which transforms the ELTs from being a waste product to a raw construction material with inherent qualities that are particularly suited to retaining walls (durability, friction between layers, ease of construction, etc.). It is important to note that human ingenuity allows the tires to be used practically 'as is', without any need to undergo physical transformations through the use of high-end technologies. This is especially important in emerging economies, which may not have ready access to those technologies or infrastructure (especially for populations in the informal sector and/or living in poverty), but do have access to manual labour. Following their use as a raw material for the retaining wall, the endpoint for the ELTs is to become an integral element in the biological sphere. The wall is transformed into a slope-stabilising ecological matrix for local flora. Figure 4 illustrates this process.

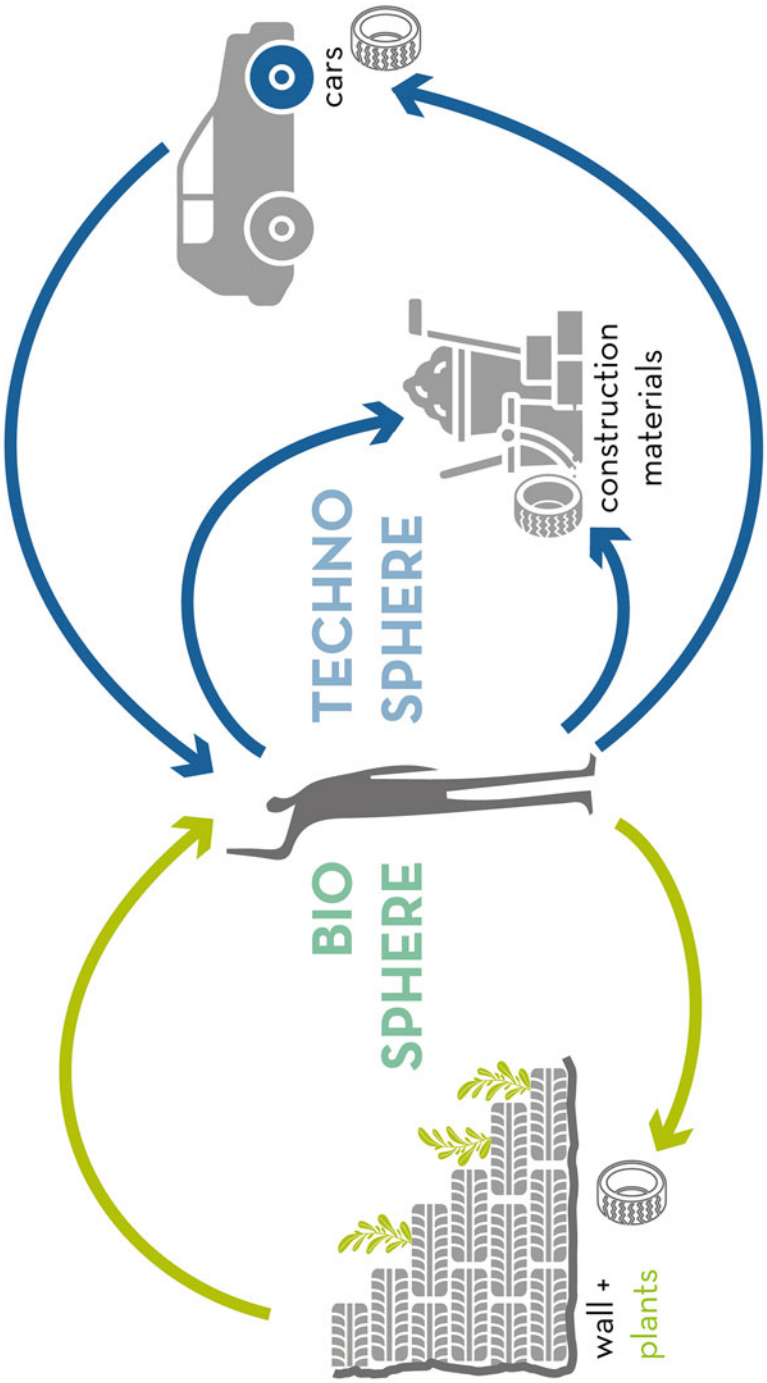

Fig. 4 Loops and cascades of the human sphere in Llano Chico

5 Conclusions and Recommendations

Circular Economy (CE) models offer a powerful alternative against linear production processes that lead to resource depletion, waste management problems and environmental degradation. This is particularly true for End of Life Tires (ELTs), which at the end of their use in the automobile industry are generally burnt or dumped. CE innovation includes the breakdown of ELTs to being a granulated rubber, or even to their core materials. However, this entails a high-energy expenditure and certain environmental impacts. As an alternative, the use of whole ELTs in civil engineering applications can be a successful, low-cost alternative. This is especially relevant for emerging economies, and in this context, a case study was carried out through the construction of a gravity retaining wall in Llano Chico, a low-income urban area of Quito, the capital of Ecuador.

The transformation of whole ELTs into a raw material for civil engineering works required nothing more than human ingenuity, looking at the ELTs from a different perspective regarding their inherent base mechanical properties. In this sense, the human sphere currently at the frontier of CE thinking was highlighted. In addition, the loops of the technical and biological spheres of the common CE 'butterfly diagram' were critically assessed. In the case study, the ELTs were cycled through the technical sphere in a collection and recycling process. The human sphere processes transformed the ELTs from being a waste product into a retaining wall. However, once constructed, the retaining wall from ELTs serves as a matrix for local flora to take root. This is in stark comparison to a traditional concrete retaining wall, which has little ecological value. The end point of the ELT wall is its incorporation into the environment, where its cycle ends in the biological sphere.

Overall, the case study invokes the need for further research into CE practical applications in low-income communities in emerging economies. Additionally, it calls us to critically assess the loops of the technological and biological spheres in the current academic debate surrounding CE. This article argues that the case study highlighted the importance of the human sphere in drawing out the potential of End-of-Life Products (ELP), without necessarily having to radically change those products through energy-intensive industrial processes. Furthermore, the observation is raised that the technological and biological spheres do not always function as two independent cycles. The human sphere can link the two loops, drawing tires through one cycle and into the other. This is a newly defined, 'figure of eight' cycle.

6 Further Research

The research has highlighted three points that would be of interest to explore in greater detail. First, there is the human sphere and its role in the application of circular economy models in low-income communities. In this case, people take on becoming points of innovation, far beyond the traditional role of a consumer. This article presented the Llano Chico retaining wall case study. However, it would be of interest to look for further case studies where a similar logic has been used to the one presented here with ELTs. In doing so, the human as innovator and their role in circular economies could be extended to different contexts and applications, and thus draw out more general tendencies and lessons learnt. Second, the same is true for the concept of mitigating the need to use energy-intensive technologies in order to reduce a product to its raw materials. This ELT study highlighted the particular advantages that used tires have in the construction of retaining walls. However, extending the research to other products and their use in different end applications would be of interest. Third, the Figure of Eight cycle is presented as a new term. It is not wished to mean that this is a 'better' or 'worse' condition for circular economy models than the commonly used butterfly diagram. However, once again, it would be of interest to explore the concept in further detail through other case studies.

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References

Benyus, J. M. (1997). *Biomimicry: Innovation inspired by nature*. Morrow.

Canelas, C. (2019). Informality and poverty in Ecuador. *Small Business Economics, 53*(4), 1097–1115.

Cecchin, A., Lamour, M., Joseph Maks Davis, M., & Jácome Polit, D. (2019). End-of-life product management as a resilience driver for developing countries: A policy experiment for used tires in Ecuador. *Journal of Industrial Ecology*, *23*(5), 1292–1310.

De Wit, M., Hoogzaad, J., Ramkumar, S., Friedl, H., & Douma, A. (2018). The Circularity Gap Report: An analysis of the circular state of the global economy. *Circle Economy*, 1–36. https://www.circularity-gap.world/2018.

Demoraes, F., & d'Ercole, R. (2001). Cartografía de las amenazas de origen natural por cantón en Ecuador.

d'Ercole, R., Trujillo, M., Zucchelli, M., & Portaluppi, C. (2003). Amenazas, vulnerabilidad, capacidades y riesgo en el Ecuador: los desastres, un reto para el desarrollo. In *Amenazas, vulnerabilidad, capacidades y riesgo en el Ecuador: Los desastres, un reto para el desarrollo*. Cooperazione Internazionale (COOPI); Institut de Recherche pour le Développement (IRD); OXFAM GB.

European Commission (2014). *Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions. Towards a circular economy: A zero waste programme for Europe*. European Commission, 206–211. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614.

European Tyre & Rubber Manufacturers' Association (2014). *ETRMA. End Of life Tyres. A valuable resource with Growing Potential 2011 edition*. European Tyre & Rubber Manufacturers' Association. https://www.etrma.org/wp-content/uploads/2019/09/brochure-elt-2011-final.pdf.

European Commission (2015). Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions. Closing the loop – An EU action plan for the Circular Economy. European Commission, Brussels, 614. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614.

Jelinski, L. W., Graedel, T. E., Laudise, R. A., McCall, D. W., & Patel, C. K. (1992). Industrial ecology: Concepts and approaches. *Proceedings of the National Academy of Sciences, 89*(3), 793–797.

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling, 127*, 221–232.

Lemille, A. (2017b). *5 Guiding Principles for an Inclusive Circular Economy*. https://www.linkedin.com/pulse/5-guiding-principles-inclusive-circular-economy-alexandrelemille/?lipi=urn%3Ali%3Apage%3Ad_flagship3_profile_view_base_post_details%3B%2FPOo%2BoW1Rq6cvU7UN9M83g%3D%3D.

Lemille, A. (2017a). Circular Human Flows. Enhancing Humans as an Integral Part of Circular Economic Flows. *Circular Economy*, *2.7*. https://www.linkedin.com/pulse/circular-human-flows-alexandre-lemille/.

Lewis, S. L., & Maslin, M. A. (2015). Defining the anthropocene. *Nature, 519*(7542), 171–180.

MacArthur, E. (2013). *Towards the circular economy, economic and business rationale for an accelerated transition*. Ellen MacArthur Foundation, (pp. 21–34). Brussels. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614.

Malinauskatie, J., Jouhara, H., Spencer, N. (2017). Waste prevention and technologies in the context of the EU waste framework directive: Lost in translation? *European Energy and Environmental Law Review*, *26*(3), 66–80.

McDonough, W., & Braungart, M. (2010). Cradle to cradle: Remaking the way we make things. North point press.

MDMQ (2017). *Plan de prevención y respuesta ante eventos adversos en el DMQ-IV trimestre año 2017 (Inundaciones y movimientos en masa)*. 2017. http://www7.quito.gob.ec/mdmq_ordenanzas/Circulares/2017/.

Mishra, J. L., Chiwenga, K. D., & Ali, K. (2019). Collaboration as an enabler for circular economy: A case study of a developing country. *Management Decision*, *8*(59), 1784–1800. https://doi.org/10.1108/MD-10-2018-1111.

Pawlyn, M. (2019). *Biomimicry in architecture*. Routledge.

Pichincha Comunicaciones (2020). *Ley de Economía Circular podría ser una alternativa en estos momentos de emergencia*. http://www.pichinchacomunicaciones.com.ec/ley-de-economia-circular-podria-ser-una-alternativa-en-estos-momentos-de-emergencia/.

Prefectura de Pichincha. (2012). *Plan de Desarrollo y Ordenamiento Territorial de la Parroquia Llano Chico* 2012–2025. http://181.112.151.230:8081/attachments/download/570/PDOT%20LLANO%20CHICO%202012.pdf.

Preston, F., and Lehne, J. (2017). A wider circle? The circular economy in developing countries. Chatham House, the Royal Institute of International Affairs, London, UK.

Schröder, P., Lemille, A., & Desmond, P. (2020). Making the circular economy work for human development. *Resources, Conservation and Recycling, 156*, 104686.

Toffel, M. W. (2003). The growing strategic importance of end-of-life product management. *California Management Review, 45*(3), 102–129.

Van der Voet E. (2022). Substance flow analysis methodology. *A Handbook of Industrial Ecology*, *91*(101).

WBCSD. (2008). Managing End-of-Life Tires, World Business Council for Sustainable Development, Conches-Geneva. https://www.wbcsd.org/Sector-Projects/Tire-Industry-Project/Resources/Managing-End-of-Life-Tires.

Nature Based Solutions: Lessons Learned from Two Case Studies in El Salvador and Ecuador

Lizeth Marcela Lozano Huera and Michael Maks Davis

Abstract

Within the discourse of sustainability and sustainable development, Nature-based Solutions (NbS) were developed by the International Union for the Conservation of Nature (IUCN). The concept was put forward in the IUCN, and United Nations Framework Convention on Climate Change (UNFCCC) Position Paper in 2009 and had been gathering strength ever since. A formal definition was agreed on in 2016, and an international standard was given in 2020, based on eight criteria to determine how strong or weak an application of NbS are. This article looks at the findings of two case studies from El Salvador and Ecuador. The results highlight how many win–win situations can be achieved for the project, nature, and society. Nevertheless, the study also shows how far NbS still have to go. We can only skim the surface of our complex systems and interactions found in nature. It is challenging to design an NbS project when we understand little of the implications of the solution being applied in the complex system within which it operates. It calls on the academic community to continue studying ecosystems and their interactions.

Keywords

Nature-based solutions • Ecosystem-based adaptation • Ecosystem-based management approaches

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1 Introduction

Within the discourse of sustainability and sustainable development, Nature-based Solutions (NbS) have multiple definitions in circulation to date. Among them, the concept of the International Union for the Conservation of Nature (IUCN) and the European Union (EU) stand out. On the one hand, the EU, in the Final Report of the Horizon 2020 expert group on "Nature-based solutions and re-naturing cities," conceptualizes NbS as follows:

> They are actions inspired by, supported by, or copied from nature. Some involve using and enhancing existing natural solutions to challenges, while others explore more novel solutions, for example, mimicking how non-human organisms and communities cope with environmental extremes. (European Commission, 2015, p. 5).

The European Union (2015) also points out that the NbS use the characteristics of complex processes of nature to achieve the goals set. In this context, it is highlighted that maintaining and improving natural capital is crucial when implementing strategies, in addition to the efficient use of resources, together with resilience to change and adaptation to local conditions. In this conceptualization, the objective of NbS, according to the European Union (2015), is to help societies face environmental, social, and economic challenges in a sustainable way.

On the other hand, the IUCN defines NbS as "actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human wellbeing and biodiversity benefits." (Cohen-Shacham et al., 2016a, p. 5). The same authors argue that the main objective of the NbS is to safeguard human wellbeing and address social challenges such as food security, climate change, water security, human health, disaster risk, and social and economic development. As such, the actions and proposals that contemplate this concept reflect social and cultural values while

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simultaneously improving ecosystems' resilience, capacity for renewal, and the provision of services.

The concept of the EU and the IUCN is based on a common objective: to face the challenges of today's society and, at the same time, achieve benefits for both human beings and nature, together with the vision of maintaining and improving natural capital. The definitions differ when expressing which actions can be considered NbS. In the case of the IUCN, they are actions to protect, sustainably manage, and restore natural or modified ecosystems, providing benefits for human wellbeing and biodiversity. Therefore, for a project to be considered an NbS by IUCN, it must work with solutions that involve better use of ecosystem services or solutions aimed at managing, restoring, or creating new ecosystems. In contrast, the conceptualization of the EU refers to the fact that NbS are actions that are inspired by, supported by, or copied from nature, which allows solutions that do not necessarily produce a net gain to biodiversity to be considered as NbS. Exemplifying this situation, we speak of building projects inspired by a termite nest for which energy expenditure is optimized. This would be NbS following the EU definition (a solution inspired by nature), but not in the case of the IUCN definition (because it does not necessarily promote benefits for biodiversity). Nevertheless, both conceptualizations are correct and necessary to promote sustainable development today. Still, when we design a project, the context and landscape in which the project is developed are decisive factors when we choose the conceptual direction mentioned above. It is observed that the conceptualization of the EU is more appropriate for territories that have modified their natural state for the most part, such as cities. At the same time, the IUCN concept is recommended for projects developed in territories that retain their natural characteristics.

This document works with the IUCN conceptualization of NbS. This concept was presented in 2019 within the position paper on the United Nations Framework Convention on Climate Change (UNFCCC) COP 15 for 2012; the IUCN formally adopted the concept and became part of one of the three lines of the IUCN Global Program 2013–2016 (Cohen-Shacham et al., 2016b). The concept of NbS appears in documents of other organizations throughout the first decade of this century, such as the World Bank report of 2008. Still, it was not until 2015 that the concept took hold in the scientific literature (Cohen-Shacham et al., 2016b). In 2016, IUCN launched the book Nature-based Solutions to address global societal challenges, which establishes a formal definition for NbS along with eight principles of NbS to promote the implementation of these strategies.

These principles are (1) embrace nature conservation norms, (2) can be implemented alone or in an integrated manner with other solutions to societal challenges, (3) are determined by site-specific natural and cultural contexts that include traditional, local, and scientific knowledge, (4) produce societal benefits fairly and equitably, in a manner that promotes transparency and broad participation, (5) maintain biological and cultural diversity and the ability of ecosystems to evolve over time, (6) are applied at a landscape scale, (7) recognize and address the trade-offs between the production of a few immediate economic benefits for development and future options for the output of the full range of ecosystems services, and (8) are an integral part of the overall design of policies, and measures or actions, to address a specific challenge (Cohen-Shacham et al., 2016a).

Establishing a treatise with the formal definition and the principles of NbS constituted a breakthrough for the definitional framework. This process was consolidated with the development of operational parameters. In this context, the IUCN Global Standard for nature-based solutions was born in 2020, which seeks a shared understanding and interpretation of the NbS concept along with quality controls for the design and implementation of projects (UICN, 2020). In turn, the standard provides a guide for design, improvement, and evaluation so that projects implementing NbS achieve the desired results and seek to reduce the risk that actions that harm biodiversity are considered NbS (UICN, 2020).

The IUCN Global Standard for nature-based solutions is a broad concept that allows for standardizing the design and implementation of NBS without neglecting the characteristics of the specific context, participatory processes, and the various factors that impact social challenges (UICN, 2020). The standard is made up of eight criteria based on the principles of NbS, where each criterion has specific indicators. These are listed below in accordance with IUCN (2020):

- Criterion 1: The NbS respond effectively to social challenges.
- Criterion 2: The design of the NbS is adapted to the dimension.
- Criterion 3: The NbS result in a net gain in terms of biodiversity and ecosystem integrity.
- Criterion 4: The NbS are economically viable.
- Criterion 5: The NbS are based on inclusive, transparent, and empowering governance processes.
- Criterion 6: The NbS provide a fair balance between achieving their main objectives and the constant provision of multiple benefits.
- Criterion 7: The NbS are managed adaptively, based on data.
- Criterion 8: The NbS are sustainable and are integrated into an appropriate jurisdictional context.

The criteria set out above support the development of methodological tools to strengthen the focus of projects

within a specific thematic framework, with the objective that more projects on a global scale take NbS into account. This article answers the research question: "What happens when two Latin American case studies with different ecosystem-related approaches are evaluated using the IUCN global standard?".

It compares two case studies from El Salvador and Ecuador with different ecosystem-related approaches. The first is a project that was carried out within the NbS paradigm. The second is a project is an ecosystem-related approach that was not created based on NbS. However, by looking at the second case study through the lens of NbS, the implementation of the project might be strengthened. By offering some insights into NbS being carried out in reality, the authors hope to enrich the current academic debate and offer possible lessons learned for practitioners seeking to embark on new projects in the field. Overall, the results highlight how many win–win situations can be achieved for the project, nature, and society.

2 Methodology

The NbS concept is considered an umbrella concept for ecosystem-related approaches, where ecosystem-related approaches are conjugated with societal challenges. Five main approaches unfold from this relationship (Cohen-Shacham et al., 2016a):

- Ecosystem restoration;
- Issue-specific ecosystem-related;
- Infrastructure-related;
- Ecosystem-based management;
- Ecosystem protection.

This work revisits two case studies from the Latin American region, which were evaluated using the NbS Global Standard. The case studies have been selected considering three main categories of NbS approaches.

Case study A focuses on issue-specific ecosystem-related approaches addressing the ecosystem-based Adaptation (EbA) implementation. It examines the AVE project: Adaptation, Vulnerability, and Ecosystems implemented in the Aguacate River micro-basin, located in El Salvador. This case study was selected considering the project was designed with the NbS paradigm, so the implementation of the standard allows evaluating the degree of compliance for each criterion and, in turn, identifying the credibility of a project classified as NbS.

Finally, case study B explores the actions implemented by the Global Sustainable Seafood Supply Chains (GMC) applied to the Small and Large Pelagic Platforms of Ecuador. This project has been selected to review the Ecosystem-based management approaches (EbMgt). This case analyzes how implementing Integrated water resources management strategies strengthens the project. Case B was chosen to exemplify how a project that has not been designed from the NbS approach can identify possible deficiencies and opportunities for improvement by applying the standard. In other words, in this case, an evaluation of the degree of compliance with each criterion was used to give a retrospective view on NbS applied to an EbMgt project.

The standard is applied in the two case studies, taking as a guide the first edition of the IUCN Global Standard for NbS (2020). Each criterion (also known as orientation factors) listed in the standard can be classified as solid, adequate, partial, or insufficient; the criteria have indicators and a guideline for their evaluation. In order to do this, a qualitative evaluation was carried out based on the ranges that the standard assigns to each criterion, which are given below (UICN, 2020):

Solid: a compliance of $\geq$ 75%;
Adequate, a compliance of $\geq$ 50% and $<$ 75%;
Partial, a compliance of $\geq$ 25% and $<$ 50%;
Insufficient, a compliance of $<$ 25%.

Each criterion (orientation factor) is accompanied by a corresponding set of indicators. However, these require being able to carry out on-site verification of documentation, etc. As such, verification of the groups of indicators was outside the scope of this article. Nevertheless, it could be a possible area for further research to compare similar case studies in greater detail. A summary of the contents of the criterion used for this work is offered below (UICN, 2020a).

Criterion 1 is qualified by considering the orientation of the IUCN global standard for this topic. This criterion evaluates if the NbS have been designed in response to one or several social challenges. The social challenges identified by the IUCN are food security, climate change, water security, human health, disaster risk reduction, and social and economic development.

Criterion 2 considers whether the design of the NbS recognizes the complexity and uncertainty of landscapes and their multidimensionality, examining the existing interactions in living landscapes between economy, society, and ecosystems.

Criterion 3 refers to NbS generating net gains for biodiversity and ecosystem integrity. The guidance for this criterion indicates that NbS goods and services come from ecosystems, so they must be designed to prevent the integrity of the system from deteriorating and promotes the improvement of its functionality and connectivity.

Criterion 4 assesses whether NbS are economically feasible. The orientation of the standard for this criterion refers to the fact that an NbS must consider economic viability during design and implementation, aiming that a proposal under the NbS paradigm does not become a short-term project. The aim is that following the project completion, it continues to be able to sustain itself into the long term.

Criterion 5 indicates that NbS are based on inclusive, transparent, and empowering governance mechanisms. The guidance for this point refers to the fact that NbS must respond to the concerns of stakeholders, with an emphasis on rights holders, towards whom the project facilitates good governance processes based on mutual respect and equality.

Criterion 6 refers to the NbS reaching their main objectives and providing multiple benefits. Considering the orientation for this criterion, it relates to the complexity of ecosystems and recognizes that actions implemented maximize some of the ecosystem services and reduce the quantity and quality of others. Within this criterion, a balance is sought between the strengthening of ecosystem services and the benefits obtained for the interested parties, with the idea that the parties involved receive multiple benefits or at least necessary compensations.

Criterion 7 contemplates that NbS are managed adaptively with databases. The orientation for this criterion identifies that ecosystems are complex and dynamic by nature. Consequently, they are subject to levels of uncertainty, so to maintain a project in the long term, continuous monitoring and evaluation are required to use this information for the adaptive management of the solution.

Criterion 8 seeks NbS that are sustainable and integrated within an adequate legal context. Regarding the orientation for this criterion from the standard, it is pointed out that for a project to be sustainable in the long term, it must contemplate the local and international regulatory frameworks.

3 Results

3.1 Case Study "A"

The first case study is from El Salvador. This initiative is part of the AVE project: Adaptation, Vulnerability, and Ecosystems, which has been developed since 2015 in Mexico, Guatemala, Honduras, El Salvador, Costa Rica, and Panama (UICN, 2016). This section summarizes the key points of the project, where further detail can be found at https://panorama.solutions/es/solution/fortalecimiento-del-liderazgo-comunitario-para-la-restauracion-de-manglares-y-la-seguridad.

One of the AVE Project processes is contextualized in the Aguacate River micro-basin that is part of the Paz River basin, a border area between El Salvador and Guatemala. In the upper part of the basin, the most significant amount of forest is located, and in it, the cultivation of coffee is carried out. As a consequence of agricultural processes and deforestation, the risk of erosion is high due to timber species in the intermediate part of the basin areas, pastures for extensive livestock and grain cultivation, while in the lower middle part, coffee and fruits are sown. In the lower zone of the basin where the Aguacate micro-basin is located, sediments accumulate due to the geography and human activities of the higher zones. This increases the risk of soil and nutrient loss and decreases water retention capacity. Additionally, in this area, the effects of climate change become visible as floods and prolonged droughts, in addition to the increase in sea level, salinization of the land, the loss of crops, and the reduction of fresh water (one of the main concerns of local communities) (Marín et al., n.d.).

To understand the case of the Aguacate River micro-basin, it is essential to point out that the course of the La Paz River was modified, which affected the arrival of water at the mouth of the basin and the coastal ecosystems. These are also degraded by deforestation and unsustainable agriculture carried out mainly in the upper areas of the basin but also affect the lower part of the basin on a grander scale. Furthermore, this situation is compounded by inefficient freshwater management processes that produce conflicts between the communities and the authorities (Marín et al., n.d.). In addition, the decrease in provisioning ecosystem services affects 74% of families whose livelihood depends on fishing and harvesting crustaceans (Gallo & Rodríguez, 2010).

The main stakeholders affected by the poor management of the basin are the populations of the Aguacate River micro-basin who, in the face of the decrease in water flows and the vulnerability of their livelihoods, agreed to implement Ecosystem-based Adaptation (EbA) strategies to restore the coastal forests and mangroves on which several families depend (Figs. 1 and 2) (Pérez de Madrid, 2021).

EbA is defined according to the Convention on Biological Diversity (2010) as a comprehensive strategy for adaptation to climate change that produces multiple benefits and encompasses the management, restoration, and conservation of ecosystems. In the case study proposed in this section, the Ecosystem-based Adaptation (EbA) is a helpful strategy to mitigate the adverse effects of ecosystem degradation and climate change through ecosystem services.

3.1.1 IUCN Global Standard Applied to the Case Study "A" (Fig. 3)

Criterion 1: The main challenges faced by NbS are those associated with water resources, erosion, pollution, deforestation to introduce sugarcane crops and livestock, flooding in the coastal plain, and salinization of the aquifers and mangrove water. These are caused by the basin's disorganized management, which directly impacts food security.

Fig. 1 Community mangrove surveillance Prepared by Pérez de Madrid (2021)

Fig. 2 Mangrove tour Prepared by Pérez de Madrid (2021)

Additionally, there are the effects of climate change, such as droughts and rainfall reduction. Finally, there is the challenge related to the lack of governance mechanisms for basins in El Salvador (Marín et al., n.d.) To face these challenges, a solution based on three approaches has been developed, based on: water governance, the implementation of EbA measures through the support of existing community organizations, and the "Aprender Haciendo" approach that includes training, fieldwork, participatory processes, and monitoring and an assessment of ecosystem services (Pérez de Madrid, 2021). Following the explanation of the criterion offered in the Methodology section, criterion 1 is considered **solid** for this case study.

Criterion 2: The project adapts adequately to the dimension of the landscape, in this case, the Paz River basin, which shows how the good or bad management upstream has repercussions downstream. On the one hand, the delimitation of the project contemplates the analysis of the Paz River basin to identify the problems that affect the interconnected water system, allowing priority axes of action for the economy, society, and ecosystems. On the other hand, it is also identified that each micro basin requires a specific solution for the context. This means the implementation of strategies is developed at an appropriate scale, which favors community participation. In this case study, the project adapts to the dimension by working from a hydrographic basin approach and delimiting that each micro-basin has specific needs despite being interconnected. Considering these aspects related to the complexity of the landscapes, scales of intervention, and societal elements, the project is classified as **solid** for Criterion 2.

Criterion 3: Several measures were implemented to generate a net gain in biodiversity in the Aguacate River micro-basin. First, the unblocking and eliminating of sediments in the mangrove channels allowed freshwater entry and restored the optimal salinity levels. Second, degraded mangrove areas were reforested. Third, community policing began at critical sites to prevent mangrove logging and over-extraction of local species. Fourth, activities started to protect seedlings in reforested areas. Finally, the design and implementation of a Local Plan for Sustainable Use was put in place, which regulates the extraction of fish, crustaceans, and mammals from the mangroves in line with sustainable

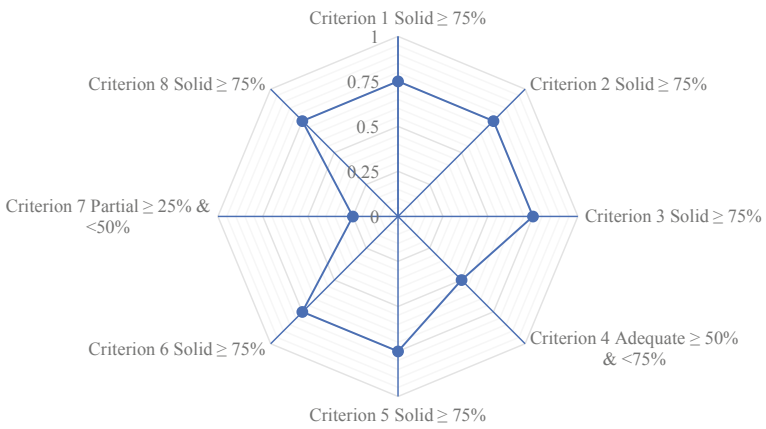

Fig. 3 IUCN global standard applied to the case study "A" Prepared by: The author

management of species (Pérez de Madrid, 2021). This means that in the case of the Aguacate River micro-basin case, strategies are applied to recover the mangrove ecosystem services and improve their functionality and connectivity. This led to the criterion being classified as **solid**.

Criterion 4: One of the project's strengths is that the population recognizes the multiple benefits of applying EbA measures. Their initiative has made them key actors in the project's sustainability, making NbS monitored and economically viable in the long term. Without an active community, this process could not be replicated, viable or sustainable, despite the appropriate mechanisms being in place. In study case A, the project is economically viable in the design stage thanks to the allocation of resources. However, in operation, the project depends on the community for its support to avoid reduced benefits. This parameter is classified as **adequate** due to this dependency relationship.

Criterion 5: Within the EbA measures to benefit local livelihoods and the resilience of the population to climate change, it is worth emphasizing the role played by the leadership and initiative of local associations who contributed to developing solutions to the problems identified under the motto: ``Río Paz: Life, Shelter, and Food'' (Pérez de Madrid, 2021). The project facilitated inclusive governance processes to guarantee its implementation. Community leaders were recognized, social awareness processes were carried out, and local groups were created, such as the El Aguacate micro-basin committee, water boards, and women's groups (Pérez de Madrid, 2021). The active participation of local actors against the weak government intervention promoted the development of policies through inclusive processes. This was decisive for the project's development. Considering the abovementioned factors, this criterion is qualified as **solid** since the project facilitated inclusive governance processes.

Criterion 6: As a whole, the strategies implemented by the project produced multiple benefits, among them the increase in the area of reproduction of the species of most significant economic and food interest. In addition, the restoration of the mangrove improves the protection of this territory against storms and waves. The lessons learned to allow us to recognize the need for EbA to be accompanied by policies, especially in the binational territory of the Paz River basin. Also, from the approach to implementing EbA measures, the need to carry out biophysical studies that accompany restoration practices and are complemented with local empirical knowledge has been identified. From the ``Aprender Haciendo'' approach, the importance of involving the entire community and not only the formal representatives was ratified. In this case, it is possible to affirm that the project seeks a balance between formalizing ecosystem services and obtaining multiple benefits for the community, for which the criterion is considered **solid**.

Criterion 7: The project implemented monitoring and evaluation systems in the Aguacate River micro-basin to generate evidence on the correlation between the application of EbA measures and the improvement of food security. In terms of this criterion, although monitoring and evaluation strategies are implemented, they are applied to a small sample (22 households), and consequently, the database is limited. Additionally, technical support is required to maintain the monitoring and evaluation in the long term, which does not guarantee that adaptive management processes are carried out throughout the project's life cycle. As such, the criterion is classed as **partial**.

Criterion 8: This project responds to the need to strengthen the implementation of projects that apply NbS with policies that support them to guarantee their sustainability over time. Especially in border contexts, such as the case of the El Aguacate micro-basin, where the inhabitants promoted the development of regulatory frameworks to resolve conflicts and strengthen mechanisms for water governance. Additionally, the project is supported by the Sustainable Development Goals 6 (Clean water and Sanitation), 12 (Responsible Consumption and Production), 13 (Climate Action), 14 (Life below water), and 15 (Life of Land). In conclusion, the project promotes the development of local regulatory frameworks and is linked to the SDGs mentioned above, for which the criterion is qualified as solid.

3.2 Case Study "B"

The oceans occupy 71% of the planet's area, and only 2% is protected compared to 12% of the earth's surface (Banco Mundial, 2014a, 2014b); these are responsible for providing a wide range of ecosystem services: provision, cultural, regulatory, and supportive. From an economic point of view, between 10 and 12% of the world population depends on fishing and aquaculture, and more than 90% of this population carries out small-scale fishing operations in developing countries (FAO, 2014). Additionally, at least 2 million fishing jobs are found in Latin America, making the region one of the most active in this sector globally (Banco Mundial, 2014a, 2014b). According to an FAO study (2014), in 2012, exports from the fishing sector reached more than 129 billion dollars, evidencing the importance of fisheries in the global economy. From a focus on food security, fishing contributed 16% of animal protein consumed globally (Banco Mundial, 2017a, 2017b), playing a pivotal role in feeding billions of people. The direct benefits related to food and the economy have caused overfishing and deterioration

in fish populations. According to FAO (2014), it is estimated that 57% of the populations have been fully exploited, and 30% have been overexploited, depleted, or are in a recovery process. Added to these adverse factors is the unequal distribution of fishing among nations since China, Spain, Taiwan, Japan, and South Korea account for 85% of the world's industrial fishing (BBC Mundo, 2018). The high demand for fish, mainly high-level predators such as tuna, overexploits not only the fish populations but also the workforce dedicated to the fishing, such as the violation of human rights related to forced and child labor (Monterey Bay Aquarium Seafood Watch, n.d.). Another factor that should be highlighted is the high levels of pollution in the oceans from garbage, pollution from cities, untreated agricultural nutrients, and plastic (Banco Mundial, 2014a, 2014b). Furthermore, much is unknown about the dynamics of ecological conditions of the oceans and the impacts of pollution on them.

Once the importance of ocean ecosystems is framed, various programs can be identified at a global level to protect them. One of them is the interregional project, The Global Sustainable Supply Chains for Marine Commodities (GMC), which is promoted by the United Nations Development Program (UNDP) and is active in the Philippines, Indonesia, Costa Rica, and Ecuador[1] (Figs. 4 and 5).

Its large-scale goal is to incorporate sustainability into seafood supply chains through market mechanisms, policies, and partnerships, to rebuild and protect fish stocks and livelihoods (Programa de las Naciones Unidas para el Desarrollo, 2020). The GMC has four components; the first is to increase the demand for sustainable seafood products for which the large buyers (the European Union, the United States, and Japan) signed the commitment WCPFC (Western & Central Pacific Fisheries Commission) and IATTC (Inter-American Tuna Commission Tropical). The second component is to facilitate the supply of sustainable fishery products, for which it seeks to promote the development of sustainable fishing platforms. Part three consists of publicizing the fishing improvement projects. The final element is to harness information systems for sustainable fisheries.

In Ecuador, the GMC project emphasizes the Small and Large Pelagic Shells and concentrates on its main marine products: tuna, dolphinfish (Coryphaena hippurus), and small pelagic. Ecuador is among the 25 countries with the highest fishing volumes, 715,357 million tons (Programa de las Naciones Unidas para el Desarrollo, 2020), equivalent to approximately 1,635 million dollars (Europa Azul, 2019). Its fisheries include the largest small-scale artisanal fleet in the southeast Pacific, consisting of the tuna purse seine fleet of 267 small pelagic purse seine vessels and a six-vessel Pole and Line tuna fleet (Programa de las Naciones Unidas para el Desarrollo, 2020).

Fig. 4 Ecuadorian fisheries Prepared by Global Marine Commodities (2020)

Fig. 5 Ecuadorian fisheries Prepared by Global Marine Commodities (2020)

For the project to be sustainable, it seeks to improve the governance supported by other programs derived from the UNDP, such as the National Fisheries Chamber and the National Fisheries Institute, which work together with the Ministry of Production, Foreign Trade, Investment, and Fisheries to create a robust framework of governance related to fisheries. Based on these governance efforts, Ecuador has been a pioneer in regulations such as the prohibition of ``aleteo'' (catching sharks, cutting off their fins, and throwing their bodies into the sea), which has been penalized since 1993 (Cámara Nacional de Pesquería, 2020).

[1] For more detailed information about the project, see the documentation from the First Lessons Learned for Small Pelagics Sustainable Fishery Improvement Project Ecuador **Invalid source specified.** or visit the official website https://globalmarinecommodities.org/en/home/.

The United Nations Development Program (UNDP, 2020) explains that the main objective of GMC Ecuador is to work with the critical aspects of market forces and national governance that directly impact overfishing. The UNDP (2020) adds that a specific aim of the project is for the production chain to incorporate the concept of sustainability to strengthen the management and conservation of hydrobiological resources. To achieve their objectives, an emphasis is placed on promoting the global demand for certified and sustainable marine products (eco-labeling) to pressure distributors and producers to adopt sustainable practices with scientific evidence (UNDP, 2020). This is coupled with multisectoral, inter-ministerial, and participatory dialogue platforms for sustainable fishing between retailers, traders, processors, fishers, and fisheries authorities (UNDP, 2020). The UNDP (2020) describes how the above measures are also accompanied by the strengthening of Fishing Improvement Projects (FIP) for small pelagic fish, dolphinfish (Coryphaena hippurus), and tuna. Finally, it also supports disseminating knowledge about sustainable fishing (Programa de las Naciones Unidas para el Desarrollo, 2020).

The GMC Ecuador project was selected for this analysis despite not being NbS. Taking national governance as a starting point and fostering market demand for sustainable fishery resources creates an excellent opportunity for NbS to be incorporated within its framework. Another critical issue for selecting this project was to identify that it recognizes that the lack of governance mechanisms and the over-demand for fishery resources translate into overfishing.

Additionally, this project fits in the Ecosystem-based management approach (EbMgt), particularly with Integrated water resources management. The EbMgt proposes integrative and transdisciplinary solutions that consider human beings and ecosystems together, which differs from regional planning that might be approached exclusively from ecology and in smaller-scale areas. This approach is applied in scientific research, policy, environmental and ecological management, ecosystem-based fisheries management, the ecosystem-based approach to marine and coastal management, and integrated water resource management (Cohen-Shacham et al., 2016b).

Once some examples of how overfishing affects the oceanic environment are recognized, the ecosystem approach is not just another option for projects like GMC Ecuador but a necessity.

Within its work framework, the large pelagic platform emphasizes fishing tuna by rods and nets of fences and fishing of dolphinfish (*Coryphaena hippurus*) by capturing the artisanal and longline industrial fleet. At this point, not having an ecosystem approach becomes a limitation for the project because it considers in an isolated way the species with which it is focused, solely on the basis that they represent the highest economic income for Ecuador. Any species of fish caught are not independent or self-sustainable but rather develop in the middle of an ecosystem with multiple interactions. Therefore, to establish sustainable fishing strategies, it is necessary to understand the interactions of living beings, their regulation processes within marine ecosystems, and the effects of fishing on these ecosystems (FAO, 2002). This will allow a more accurate evaluation of the capture potential, using new technologies for monitoring fish populations by age and quantifying fishing through electronic logs as a tool.

In the case of tuna and dolphinfish (Coryphaena hippurus), governance mechanisms exist that emphasize the protection of a single species, such as the Ministerial Agreement on Tuna with Pole and Line. Despite being an excellent example of governance efforts, it ignores the interactions between species and habitats within the marine ecosystem. The single-species approach is a general problem in conventional fishing systems and has frequently been used in fisheries to regulate fishing power (FAO, 2002). Currently, scientific efforts should focus on better understanding the dynamics of the marine ecosystems to understand how species interact, especially in such a complex way of life that allows displacements on a global scale. This might be brought about by incorporating continuous surveillance and periodic evaluation systems. This specific case could be directed toward large and small pelagic fish to understand their dynamics within the Ecuadorian maritime territory.

Another limitation found within the GMC Ecuador is that despite implementing closure mechanisms that are within the ecosystem approach considered as resource management, plus the efforts made by the Ecuadorian authorities through satellite control, verifications in the landing ports, and fishing inspectors, there is no guarantee that other fishing fleets that are not part of the Inter-American Tropical Tuna Commission (IATTC) abide by this measure. Added to this situation is that the protection measures are again focused on the Ecuadorian fishery's target species. It could be that spin-off positive results occur since these are umbrella species and regulate the trophic chain. However, considerable further work is needed to understand ocean dynamics and begin to quantify these effects. Within this point, it is also essential to point out the problem of illegal fishing that breaks through the efforts of governance and surveillance. The vast ocean extension is a limitation when enforcing these laws due to the strong economic impact of the fishing industry. Illegal fishing is a recurring catch that contributes to overfishing.

Finally, a good point within the framework of the GMC Ecuador is to recognize the impact on the ecosystems the different fishing mechanisms can have. These include the selection of sizes, choice of species, incidental mortality, ghost fishing, effects on habitat, energy efficiency, and catch quality (Organización de las Naciones Unidas para la

Agricultura y la Alimentación, 2005). For example, trawling systems are especially harmful as they destroy marine habitats and make selecting sizes and species difficult. In contrast, the fishing methods for tuna by Pole and Line and by purse seine mitigate these negative impacts on the ecosystem of the different fishing methods (Organización de las Naciones Unidas para la Agricultura y la Alimentación, 2005).

3.2.1 IUCN Global Standard Applied to Case Study "B" (Fig. 6)

Criterion 1: The project focuses on the challenge of food security, plus economic and social development. Overfishing directly affects artisanal fisheries by drastically reducing fish populations, which translates into a reduction in fishers' livelihoods and the degradation of the marine ecosystem and its biodiversity. The market is pressured to implement sustainability strategies by promoting demand and sustainable products. Although the project is not conceived as an NbS, criterion 1 is classified as **partial** because it recognizes in its objectives the link between fish populations and fishers' livelihoods and proposes spaces for dialogue to understand the most urgent needs of the various local actors. In other words, the project seeks to identify and understand the social challenges for rights holders.

Criterion 2: The project adapts to the dimension within the limitations that ocean ecosystems entail since it constitutes one of the significant challenges for implementing NbS in the fishery. The GMC Ecuador begins considering the interregional scale until landing in Ecuador. The starting point to determine the dimension of these projects is to understand the need for agreements between countries since political limits cannot define marine ecosystems. In this case, the GMC macro project and GMC Ecuador form a solid base for implementing NbS. In terms of this criterion, the project is qualified as **partial** because it recognizes the social and economic dimensions by generating links between fishing countries. However, from the perspective of ecosystems, the project is directed to the fish populations of greater consumption in Ecuador and not from an ecosystemic vision.

Criterion 3: Resource management through closures, catch-by-age mechanisms supported by technological tools, surveillance, periodic evaluation, and the selection of fishing methods with less environmental impact constitutes a series of tools to reduce the adverse effects of fishing. However, as a specific example, accidental capture is difficult to avoid. The project's efforts are focused on regulating the consumption of ecosystem services within the pelagic zone, which constitutes an initial step that could be strengthened by applying the NbS approach. However, the strategies implemented by the program reduce the deterioration of the marine ecosystem but do not improve the system's connectivity or functionality. Therefore, it is concluded that the project is **insufficient** in this criterion**.**

Criterion 4: Regarding this criterion, the project is moderately favorable since, given the complex dimension of the marine ecosystem, monitoring and evaluation mechanisms represent high costs. However, when promoting the consumption of sustainable seafood by buyers, there is at least one tool for funding. Unfortunately, due to the complexity of the project and its scale, if foreign funds are withdrawn, it would not be economically viable in the long term and would stop the benefits created. Although the project has financing for its design, implementation depends on the allocation of funds. As such, this criterion is classified as **partial**.

Criterion 5: The project generated multisectoral, interministerial, and participatory dialogue platforms, where retailers, traders, processors, fishers, and fishing authorities also participated. Therefore, this criterion is considered **solid** since the project facilitated inclusive governance processes to collect the concerns of stakeholders.

Criterion 6: Through hydrobiological resource management strategies, the project seeks to establish mechanisms so that fish species can recover and thus avoid alterations in their food chains and environment. At the same time, fishers have tools to conserve their means of life. They consider that a regional and national governance framework makes it possible to face the complex problem of overfishing, thus benefiting fishers and fish populations. It is concluded that the project seeks a balance between its objectives and obtaining multiple benefits for humans and the small pelagic fish, but at the same time, does not consider the full complexity of the ecosystem within which they exist. For this reason, this criterion is qualified as **adequate**.

Criterion 7: This criterion is another of the significant challenges faced by the NbS for fisheries. There is still much to learn from ocean dynamics, and due to the scale of these ecosystems, the tools for continuous monitoring and periodic evaluation need to improve. Despite this, it was proposed that the GMC Ecuador project carry out monitoring processes using the research cruises that it has available and electronic logs for captures that help create databases. This criterion is qualified as **adequate** because monitoring strategies are delimited, and the creation of extensive databases is proposed. However, it is not established that this process is carried out during the project's entire life cycle, which does not guarantee long-term adaptive management.

Criterion 8: The project is integrated within a robust regulatory framework by signing international commitments by consumers, ocean treaties, and regulations at the national level. Additionally, these are supported by the Sustainable Development Goals (SDGs) 12 (Responsible Consumption and Production) and 14 (Life Below Water). It is concluded

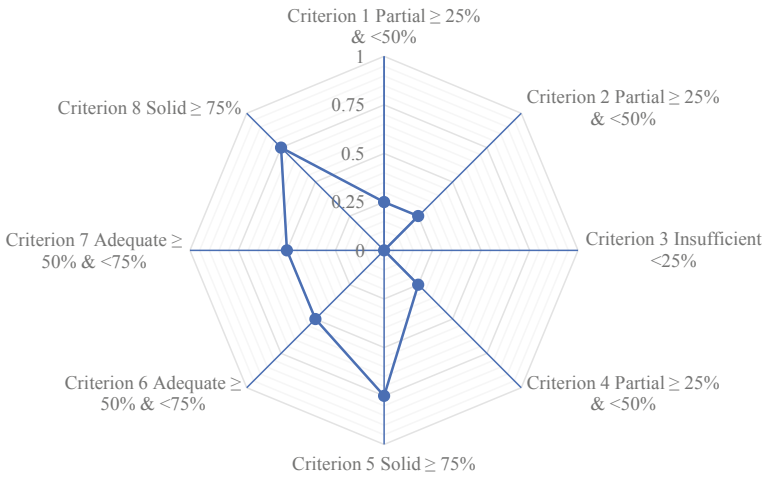

Fig. 6 IUCN global standard applied to the case study "B" Prepared by: The author

that this criterion is **solid** since it develops national regulations and is linked to the SDGs.

4 Discussion

Implementing the IUCN Global Standard for nature-based solutions allows us to identify the strengths and weaknesses of a project that takes the concept of NbS as a starting point. Additionally, NbS serves as a tool to strengthen projects that include the paradigm of an ecosystem approach, as in case study "B" (although this was limited to two specific species and therefore had inherent weaknesses as to being a study of an ecosystem or not).

The AVE project: Adaptation, Vulnerability, and Ecosystems implemented in the Aguacate River micro-basin presented as the case study "A" can be recognized as a strong NbS project. It is a clear example of how multiple benefits are generated since it mainly addresses the challenge of water security, food security, and mitigation and adaptation to climate change. Still, it affects the three remaining challenges (human health, disaster risk reduction, and social and economic development). In addition, it is adequately adapted to the dimension of the landscape, in this case, the Paz River basin, which shows how good or bad management upstream has repercussions downstream. It also proves how landscapes and ecosystems do not recognize geographical limits. This NbS contributes to a net gain in biodiversity in the Aguacate River micro-basin. However, these actions do not occur in the entire basin, meaning more programs are required to complement the project. One of the strengths of this initiative is that the local population recognizes the multiple benefits of applying EbA measures. As such, local actors have been empowered in the process against the weak intervention from the government. Additionally, the necessary policies for this territory have been developed through participatory processes. A key factor for this project has been the affected community. Unfortunately, there were detrimental consequences for the local population in pushing for taking care of ecosystems as a priority, even though the problems they face by large are due to bad practices in the area's upper part of the basin. Finally, the active community is a decisive element. In short, this process could not be replicated even if the exact mechanisms were to be established because, without community involvement, the project would not be viable or sustainable.

The case study "B" analyzed how the IUCN Global Standard can strengthen the GMC Ecuador project and found several challenges. As a starting point, sustainable fisheries cannot rely solely on NbS as it is a multiscale and multisectoral problem. However, the NbS approach is a necessary complement to understanding the relationship between ecosystems, fish stocks, and fisheries. Another critical point is that we are still a long way off from understanding ocean dynamics, not only because of its complexity and extension but also because quantitative methods with simple models of a single species were used until the twentieth century (FAO, 2002). Currently, there are positive advances; for example, there are studies where the direct interaction between the whales and the presence of plankton is identified. In this case, research was conducted into how both individuals contribute to capturing CO_2 with a direct impact on climate change (Chami et al., 2019). The new studies highlight the key role of understanding ocean dynamics to broaden the applicability of NbS, as it is challenging to apply NbS or ecosystem approaches if we do not know the ecosystem itself. The GMC Ecuador project, including the improvements, qualifies as a weak NbS. Although it seeks to generate the most negligible negative impact on the ecosystem, fishing will always produce an effect. Therefore, it is impossible to speak of net gains for biodiversity in industrial-scale fishing projects. It is also transcendental to point out the importance of facing the complex problem that overfishing represents and understanding its repercussions for both ecosystems and fishers. It

entails the degradation and loss of ocean biodiversity and, in turn, loss of livelihoods of those dedicated to fishing. The complexity that overfishing entails cannot be dealt with solely from the NbS approach; governance on a global scale is a starting point considering that the oceans interconnect dozens of countries. Furthermore, NbS must work with a set of interregional strategies, which must be multiscalar and multisectoral to face this problem.

The immediate need to understand the complex interactions of oceanic and terrestrial ecosystems is added to these two points. Understanding the dynamics of these biophysical environments and their interactions will amplify the possibility of finding NbS strategies with higher net gains to biodiversity. A significant step has already been taken through the study of whales and their impact on the presence of plankton, which absorbs around 37 billion metric tons of CO_2 (Chami et al., 2019). Although this is a significant step in ecosystem research (getting to grips with the interactions of two individual species), there remains an ocean of opportunities to be discovered.

5 Conclusion

This article set out to answer the research question: "What happens when two Latin American case studies with different ecosystem-related approaches are evaluated using the IUCN global standard?". The first case study was based on the Aguacate River micro-basin, part of the Paz River basin, a border area between El Salvador and Guatemala. The project was based on NbS, where it was found that the tool helped highlight the project's strengths and weaknesses. This was even though only a qualitative analysis could be made based on compliance with the main criterion (orientation factor). The same finding was true for the second case study, which focused on the Global Sustainable Supply Chains for Marine Commodities (GMC) project in Ecuador based on tuna, dolphinfish (Coryphaena hippurus), and small pelagic. Despite the project not being NbS in its inception, looking at it through the lens of the criterion brought to light several strengths and areas for further research.

The IUCN NbS concept is helpful to address development challenges such as climate change, risk management, water, and food security, but when we talk about sustainable urban development and taking into account that this challenge has a place mainly in places where most ecosystems have already been modified the concept of the EU allows generating more accurate project guidelines for urban contexts. The IUCN concept better addresses these territories' complexity in contexts where ecosystems have not become urbanized. The main challenge is integrating public policy projects that address the needs of both ecosystems and human beings inhabiting them. It is essential to highlight that the ecosystems to be protected, managed sustainably, and restored coexist together with socio-spatial characteristics so complex that they require transdisciplinary solutions and from multiple approaches, where the critical role of ecosystems is recognized and how they can address different lines of action within these territorial dynamins, which also generally produce numerous benefits due.

The second challenge that is identified is the delimitation of the scale of the landscape in the projects since the ecosystem interactions do not recognize the geographical limits, and for years the development of projects has exclusively recognized these delimitations, which does not allow to see the complete perspective of the situation of the ecosystem as such. Implementing projects that recognize this need is a positive guideline for creating new initiatives that address the real scale of the various problems faced by ecosystems and generate mediation mechanisms and collaborative work on a national and international scale.

NbS is a relatively new concept, so academic efforts to understand ecosystems and document these projects that apply its principles are fundamental to disseminating this successful way of implementing initiatives on ecosystems that need to be protected, restrained sustainably, and restored. The verification and dissemination mechanisms allow the community to recognize successful experiences, identify possible problems, and recognize guidelines and technical treaties to implement these principles that simultaneously generate net gains for biodiversity and human wellbeing.

Finally, in addressing complex problems such as food safety, NbS must be part of the range of solutions that constitutes the comprehensive response to a situation; this is supported by NbS principle 2, which states that they can be implemented alone or integrated with other solutions to face social challenges (Cohen-Shacham et al., 2016a). The NbS are a group of solutions within a broad spectrum of possibilities that allow facing complex problems such as climate change or water security. The aforementioned is exemplified in case study B, where NbS alone cannot face the problem of overfishing, so it is necessary to observe this approach as one more link that constitutes the solution and not as a single link approach. However, considering the inseparable connection between ecosystems and the challenges facing humanity, Nature-based Solutions represent an essential element when designing projects that adapt to contemporary reality and recognize the uncertainty inherent to ecosystems.

6 Further Research

This research was based on a qualitative analysis of the criterion (orientation factors) of NbS. In the future, it would be interesting to dig deeper, carrying out fieldwork to assess the indicators that correspond to each criterion for similar case studies that were presented here. This would be useful to validate the hypothesis that was proved in this article: that projects can be strengthened and weak points identified that would otherwise have remained hidden. It would also validate how the complexities of interrelated ecosystems can or cannot be taken on board.

References

Azul E. (2019). La pesca en Ecuador genera 1.635 millones de dólares producción pesquera estando entre los 25 primeros. Retrieved from https://europa-azul.es/ecuador-produccion-pesquera/

Banco Mundial. (2014a). *El actual ritmo de pesca es una amenaza para la salud de los océanos*. Retrieved from Banco Mundial: https://www.bancomundial.org/es/news/feature/2014a/02/03/pesca-oceanos-america-latina.

Banco Mundial. (2014b). *Banco Mundial*. Retrieved from El actual ritmo de pesca es una amenaza para la salud de los océanos: https://www.bancomundial.org/es/news/feature/2014b/02/03/pesca-oceanos-america-latina.

Banco Mundial. (2017b). *Los océanos, la pesca y las economías de las zonas costeras*. Retrieved from Banco Mundial: https://www.bancomundial.org/es/topic/environment/brief/oceans.

Banco Mundial. (2017a). *Los océanos, la pesca y las economías de las zonas costeras*. Retrieved from Banco Mundial: https://www.bancomundial.org/es/topic/environment/brief/oceans.

BBC Mundo. (2018). Los mapas que muestran cómo solo 5 países acaparan el 85% de la pesca industrial del mundo. *BBC Mundo*. Retrieved from https://www.bbc.com/mundo/noticias-43177526#:~:text=imagen%2C%20Getty%20Images-,Pie%20de%20foto%2C,Jap%C3%B3n%20y%20Corea%20del%20Sur.

Cámara Nacional de Pesquería. (2020). Ecuador impulsa y defiende la pesca sostenible. Obtenido de. *Cámara Nacional de Pesquería*. Retrieved from https://camaradepesqueria.ec/ecuador-impulsa-y-defiende-la-pesca-sostenible/.

Chami, R., Cosimano, T., Fullenkamp, C., & Oztosun, S. (2019). Nature's Solution to Climate Change. *Finance & Development, 56* (4), 34–38. Retrieved from International Monetary Found: https://www.imf.org/external/pubs/ft/fandd/2019/12/natures-solution-to-climate-change-chami.htm?fbclid=IwAR30q6H3MdE16vt0q92jHSU4-3V7UVxgYdyQoZre0TzPs6CQHwu__F19DUQ.

Cohen-Shacham, E., Maginnis, S., Smith, M., Andrade, A., Jones, M., Dudley, N., et al. (2016a). Defining NbS. In E. Cohen-Shacham, G. Walters, C. Janzen, & S. Maginnis, *Nature-based Solutions to address global societal challenges* (pp. 5–11). UICN.

Cohen-Shacham, E., Walters, G., Janzen, C., & Maginnis, S. (2016b). *Nature-based solutions to address global societal challenges*. IUCN.

Convention on Biological Diversity. (2010). *X/33 Biodiversity and climate change, Decision Adopted by the Conference of the Parties to the Convention on Biological Diversity at its Tenth Meeting*. UNEP/CBD/COP/DEC/x/33: 29 October 2010, Nagoya, Japan.

European Commission. (2015). *Towards an EU research and innovation policy agenda for nature-based solutions & re-naturing cities: Final report of the Horizon 2020 expert group on 'Nature-based solutions and re-naturing cities.* Publications Office of the European Union.

FAO. (2002). El estado mundial de la pesca y la acuicultura. In FAO, *Temas de interés para los pescadores y acuicultores: Apliación del enfoque de ecosistemas en la ordenación de la pesca de captura* (Vol. Parte 2). FAO.

FAO. (2014). *El estado mundial de la pesca y la acuicultura Oportunidades y Desafíos.* FAO.

Gallo, M., & Rodríguez, E. (2010). *Humedales y medios de vida en la cuenca baja del río Paz.* Wetlands International.

Global Marine Commodities. (2020). *First Lessons Learned for Small Pelagics Sustainable Fishery Improvement Project Ecuador*. United Nation Development Programme.

Marín, M., Tristán, M. C., & Padilla, A. (n.d.). *Adaptación basada en Ecosistemas y seguridad alimentaria en la cuenca baja del río Paz, El Salvador.* UICN. Retrieved from https://www.iucn.org/sites/dev/files/content/documents/s4_evidencia_07_riopaz_web.pdf.

Monterey Bay Aquarium Seafood Watch. (n.d.). Aquarium *¿Qué es el marisco sostenible?* Retrieved from Monterey Bay Aquarium Seafood Watch: https://www.seafoodwatch.org/seafood-basics/what-is-sustainable-seafood.

Organización de las Naciones Unidas para la Agricultura y la Alimentación. (2005). Guía del administrador pesquero: Medidas de ordenación y su aplicación. In Å. Bjordal, & K. Cochrane (Ed.), *Uso de medidas técnicas en la pesca responsable: regulación de artes de pesca.* Roma. Retrieved from http://www.fao.org/3/y3427s/y3427s04.htm

Pérez de Madrid, M. (2021). *Panorama Solutions for a Health Planet*. Retrieved from Fortalecimiento del liderazgo comunitario para la restauración de manglares y la seguridad alimentaria del río Paz, El Salvador: https://panorama.solutions/es/solution/fortalecimiento-del-liderazgo-comunitario-para-la-restauracion-de-manglares-y-la-seguridad.

Programa de las Naciones Unidas para el Desarrollo. (2020). *Cadenas Mundiales Sostenibles de Productos del Mar*. Retrieved from El Proyecto: Cadenas Mundiales Sostenibles de Productos del Mar: https://globalmarinecommodities.org/es/el-proyecto/.

UICN. (2016). *Proyecto AVE: Adaptación, Vulnerabilidad & Ecosistemas*. Retrieved from UICN: https://www.iucn.org/es/news/mexico-central-america-and-caribbean/201607/proyecto-ave-adaptaci%C3%B3n-vulnerabilidad-y-ecosistemas-en-tegucigalpa-honduras.

UICN. (2020a). *Estándar Global de la UICN para soluciones basadas en la naturaleza. Un marco sencillo para la verificación, el diseño y la extensión de SbN* (Primera). UICN.

UICN. (2020b). *Orientación para usar el Estándar Global de la UICN para soluciones basadas en la naturaleza. Un marco fácil de usar para la verificación, diseño y ampliación de las soluciones basadas en la naturaleza* (Primera). UICN.