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Social Innovation in Sustainable Urban Development

Edited by

Harald A. Mieg

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Contents

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Editorial

Social Innovation in Sustainable Urban Development

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The publication of a Special Issue on social innovation is not without surprise. The topic has already been widely researched [1] and critically analyzed [2], including in connection to sustainable urban development [3]. Some aspects were to be expected, for example, the discussion about smart cities, including the relationship between technological and social innovation. However, readers may not anticipate the topic of urban heritage, which now occupies some space in this Special Issue. One paper discusses a former convent in Naples, which was later repurposed as a prison and can now be used as a community space thanks to a civic bottom-up initiative and legislative change [4]. This obviously has a lot to do with urban society, identity, and social innovation.

What is social innovation? Probably, the best-known definition of social innovation is: " . . . innovations that are social in both their ends and their means" [5]. Social innovation is intended to serve the common good. Models of social innovation, as propagated at the EU Commission level, include social entrepreneurship or social experimentation [6]. However, from my point of view, in these cases, it would be more appropriate, for the time being, to speak of social invention rather than innovation. According to Schumpeter [7,8], from whom our modern understanding of innovation derives, an invention must have proven itself in practice and in the market in order to be considered an innovation. Therefore, the initial question in the call for papers for this Special Issue was: How can a city advance from social invention to social innovation to achieve sustainable urban development (SUD)?

My assumption was that we need more institutional innovation to advance SUD [9]. This seemed to me particularly necessary to promote the diffusion of social innovation and thus ensure its success. One example was participatory budgeting, as it had developed in Brazil and—due to its sufficient degree of institutionalization—became transferable throughout South America [10]. In the discussions on innovation, particularly in the context of smart cities, social innovation is sometimes seen as secondary. The argument is that any successful technological innovation involves a social innovation, since—in order to be successful—it must change people's behavior. In contrast, protagonists of social innovation emphasize that social innovation is, first and foremost, pro-social innovation and adds value for the community. Thus, we can consider the potential tension between technological and social innovation as another dimension of international sustainability policy—besides the global vs. local and North vs. South dimensions [9].

The articles that make up this Special Issue cover a wide range thematically and geographically. The authors come from Africa, Asia, and Europe, and the case studies also involve Australia and North America. South America remains a blind spot in our Special Issue. The themes range from smart cities [11–13] and heritage [4,14] to policy options for regions in transition [13,15–17]. In my call for papers, I raised five specific questions to which the submitted papers made valuable contributions:

(1) New, successful models of urban governance for city administration and sustainable urban development (SUD): Indeed, such examples of new governance models for SUDs can be found, but they are usually earmarked, such as for wastewater management in Milan [18] or urban rehabilitation through targeted support for coworking among the creative industries in Lisbon [19].

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(2) Innovation forms and discourses on social vs. technological innovation in SUD: There is a discussion of forms of innovation in the context of people-centered smart city approaches. Calzada [12] sees social and technological innovation as a means of policy experimentation to implement digital rights for citizens (in the sense of institutional innovation). In the context of urban planning, Grafe and Mieg [18] argue that financial innovation is used as a means to both circumvent and achieve SUD. Huang et al. [16] present institutional innovation in the context of informal land use practices in China.

(3) Diffusion of social innovation for SUD: Erdogan et al. [20] discuss the diffusion of social innovation from urban to rural contexts to help disadvantaged youth. Alterman and Pellach [21] provide a global overview of legal options to ensure access to water, and show impressive evidence of how formal innovations are transferable. In a similar vein, the development of indices for evaluating citizen-centered innovation proves transferable, such as in the context of smart cities [11].

(4) The moral dimension of social innovation: The call for papers allowed for contrasting perspectives on the question: Do we need better citizens or better institutions? The contributions to our Special Issue show great moral restraint; the focus is on economic and legal control. An important topic is inclusion, e.g., of NEETs (i.e., persons not in employment, education, or training) [20], or vulnerable groups (such as in Lisbon, [19]). Tan et al. [13] state that innovative governance of socio-technical transition, which relies on entrepreneurship, would also need to be supplemented by a (pro-)social dimension.

(5) The role of design in social innovation and SUD: This theme was included because architecture and planning also provided impulses for the discussion on social innovations [22]; unfortunately, there were no contributions on this subject. Figure 1 presents an overview of the topics addressed in our Special Issue, from which it can be seen that mobility and transportation are a task area that also fosters social innovation for SUD [13,17].

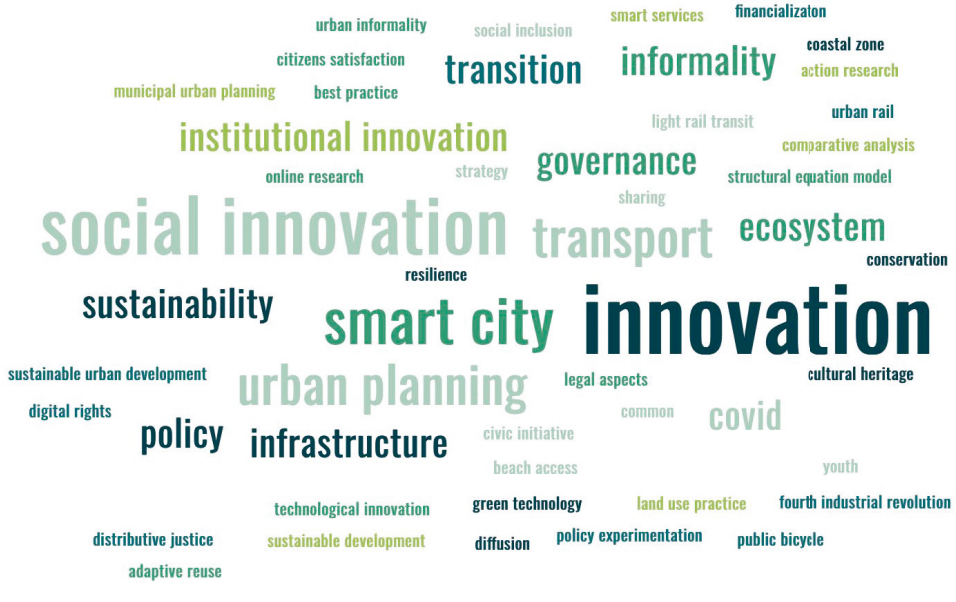

Figure 1. Word cloud of keywords for the articles in this Special Issue (with minor alterations, introduced by: https://monkeylearn.com/word-cloud/, accessed on 26 April 2022).

Finally, I would like to return to the general question: Does SUD need a transition from social to institutional innovation? It turns out that it is precisely the area of legal innovation that can greatly promote their transfer. However, our papers also show that

the solutions should be simultaneously robust and flexible. Resilience is the keyword here. An exemplary resilient solution is the development of urban ecosystems, supported by bottom-up processes and institutionalized by community-based organizations [4,14,19]. What we learn from this Special Issue is that, instead of a comprehensive integrative SUD, robust sectoral solutions—or even phased solutions—are more likely to be sought. It seems all the more important to me that these solutions, in order to be transferable, should also be given a formal structure.

I would like to thank all the authors who contributed to this Special Issue. I am also grateful to the EU OpenHeritage project, whose support allowed this Special Issue to be completed with the care it deserved. It would have been presumptuous to seek a clear answer on the sustainability of socially innovative processes for urban development through just a collection of articles. However, it was invaluable to see that new tasks are coming into play, such as adaptive reuses of urban heritage, which both rely on socially innovative processes and contribute to sustainable urban development. It is also encouraging to see that there are cities such as Lisbon and Milan in which municipalities are open to innovative and sustainable urban development. As is true of innovations in general, for many of the examples and ideas gathered in this Special Issue, we require a few more years in order to clearly assess how socially innovative and sustainable they may prove to be.

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Article

Measuring Citizens-Centric Smart City: Development and Validation of Ex-Post Evaluation Framework

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Abstract: This research aims to present a standardized evaluation system to review and further enhance users' levels of satisfaction with technologies, facilities, and services of a modern smart city at a time when the smart city paradigm has shifted from the focus of its infrastructural features to citizens. The study also seeks to verify the standardized system, so as to explore the possibility of its future application. For the goals, this research established the Structural Equation Model (SEM) based upon the basic structure of the Customer Satisfaction Index, which is a widely used ex-post assessment model, and upon implications of related studies. To verify the SEM, this study chose two cities, which are located far away from one another and employ different business methods, and conducted a survey of 212 and 197 residents, respectively, with the results being applied to the model for analysis to ascertain if the SEM is reliable and adequate. The analysis results showed that the model secures explanatory power in statistical terms, partially proving that it can be developed into a post-evaluation system for a citizens-centric smart city down the road. However, as meaningful differences were spotted in accordance with characteristics of each urban project, this study tried to come up with the background information of and reasons for such variations, to present implications for urban planning.

Keywords: smart city; smart service; citizen satisfaction; sustainable smart city; structural equation model; urban planning

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1. Introduction

A smart city used to be defined in the 1990s [1] as a city that theoretically adopts newly invented technologies. However, for the past 20 years, its definition and perspectives have been diversified in line with its academic, technical and spatial applications [2] to better reflect infrastructural, economic and social changes and the subsequent needs. Despite such variation, there exists a consensus in that the smart city aims to promote a sustainable city by advancing it through the introduction and the utilization of Information Technologies (IT), and information and communication technologies (ICT) [3].

Such a consensus could have well been maintained because widely publicized projects for the smart city construction [4] have drawn attention for their introduction of large-scale advanced technology infrastructure in major countries and cities around the world. In particular, the smart city has emerged as a new alternative for resolving the side effects of sudden urbanization in such fields as transportation, water and waste, safety and security, and healthcare [5], on the back of the development of ICT, as well as the sustainable development advocated by multinational institutions [6,7].

As such, the smart city has sometimes served as a barometer of the competitiveness of a country [8] or a city in terms of its sustainability from the outset to date [9]. Accordingly, companies and multinational research institutes that lead the development and the distribution of the aforementioned technologies have devised and applied standardized indices to evaluate the smart city based on major social and economic indicators of various countries and cities [10]. This indicates that a smart city project has been a useful tool to

judge the competitiveness of an entity [11] and assess its development potential, as well as its marketing means.

However, despite the overall focus on competitive factors, there have been growing calls in the academic circle for the importance of citizens, who are members of a city and the end-users of technologies [12], rather than the technology itself and its usefulness as a marketing tool. Just as many scholars have mentioned before, including [13–15], that the smart city has been highlighted as a means to enhance city dwellers' quality of life, rather than for bureaucracy, who ultimately consume technology [16]. The authors of [17–19] and others also stressed the significance of both tangible and intangible end-products, including technology, facilities, and services (TFS) from citizens' point of view, while shedding the competitive comparison between technologies adopted by different cities.

It is noteworthy that the first-generation smart cities, armed with new technologies, became outdated, and the time has come to determine how to maintain and manage them; for example, by improving, replacing, or deleting existing technologies. As an alternative, some have stressed opinion gathering from citizens to solve the unequal supply of infrastructures and services of a smart city. However, quantitative research in this field, just as stated before, is still confined to the distribution of technologies among states or cities, or the performance of specific technologies. In other words, the methodology that puts a focus on citizens has not achieved much progress despite the recent emphasis on the people in this discourse, which has served as a stumbling block to drawing practical alternatives to discussing the sustainability of a modern smart city.

Against this backdrop, this study aims to evaluate technology, facilities, and services of an established smart city from citizens' perspectives and draw implications for smart city-related policy measures in the future, which is expected to be a practical alternative to a sustainable smart city. For the goal, the theoretical review on a citizens-centric ex-post evaluation system, including satisfaction levels, is carried out, and a research model is to be established so as to present a standardized evaluation system for existing smart cities. In addition, a survey is conducted involving citizens of two cities, both of which adopt smart city-related TFS but employ different ways in implementing urban planning projects.

After analyzing the results, the study explores the possibility of whether the evaluation model presented here could serve as a basis for a citizens-centric assessment model in the future. It also states the implications for urban planning policies by interpreting the differences between the two cities in line with their geopolitical locations and business methods.

2. Literature Review

2.1. Paradigm Shift in the Smart City

The smart city was defined in terms of the creation of the urban environments of a city, along with advanced information technologies, such as ICT technology and innovation [20], as well as changes in the urban paradigm of globalization [21]. Then, in the following decade, the concept expanded to include such keywords as integration, citizens, and public services. After it developed further, considering knowledge and community factors, among other things, the smart city gained a new goal of ensuring the wellbeing of citizens and the promotion of their quality of life [22].

More researchers in the field shed have light on smart cities' socioeconomic aspects, while criticizing current studies on smart cities that have failed to consider citizens as a key factor [23–26], though they acknowledge that centering on physical infrastructure is easier to draw tangible results.

Recent studies, including [18,27,28], also highlighted the need to devise a citizens-centric smart city and services, as well as to set up separate organizations in charge of its maintenance, and to devise an evaluation system, noting that citizen-centered services cannot exist without the consideration of the citizens who reside within it.

These views contributed to defining the smart city, even in the technical circle, as a consolidated infrastructure that provides various services to citizens in both technological and social terms based on ICT technology [29,30]. Moreover, the trend also led private

companies, such as [31,32], to emphasize that urban dwellers are a key element of a smart city, calling them the "smart citizen". After a series of discussions, a "smart citizen" currently means an individual who consumes services installed in a city or via his or her individual devices, as well as a subject who evaluates and interprets those services and then directly affects the related decision making.

In this regard, the citizens-centric smart city, which is the key focus of the modern smart city discussions, is meant to supply technology, facilities and services for citizens. In addition, the public sector, as well as private firms and organizations, improve ways to produce, supply and sell related goods by monitoring citizens' consumption patterns and analyzing their feedback. A series of such acts allows those private entities to secure sustainability. Accordingly, citizens are direct consumers of goods in a smart city and, at the same time, are those who produce important information that can be used by suppliers. This paradigm shift indicates that the smart city can be maintained by seeking changes from its top-down development strategies to its bottom-up systems, as well as through proactive communication with smart citizens [33].

Likewise, supplies of technology, facilities and services of a smart city are required to establish a fresh bottom-up system. Various studies including [23,34,35] also suggest that the need is urgent to establish a system to measure and evaluate the value of smart city goods currently used, in order to advance the city from its development and infrastructure construction stage, which is expected to ultimately generate co-creation between users, i.e., citizens and stakeholders.

2.2. Criticism and Emergence of Citizens-Centric Smart City

Over the past decade, the concept of a smart city has changed its focus on infrastructure to a focus on citizens, which brought some projects—both ongoing and completed—under criticism.

For example, Masdar of Abu Dhabi, so called Smart City 1.0, was criticized for lacking sustainability of the project itself [36], and the business model for the city of Songdo in South Korea came under criticism for its employment of the top-down methodology that is frequently used for existing ubiquitous cities, as well as for its failure to achieve stated economic and social goals [37,38]. Other cases have also been cited for their lack of educational programs and services for citizens to induce their practical participation in smart city projects [25]. Such criticism has sparked controversies as well as new implications in two perspectives:

First, such criticism is based on differences in the perception of a smart city in the past and at present. As mentioned above, recent studies see citizens as a key element of the smart city in the era of Smart City 2.0 or above, but the so-called first-generation smart cities, presented from the late 1990s to the early 2000s, were meant to be experimental cities that introduced intelligent infrastructure with a goal to improving their technological and engineering performances. The notion has since undergone changes, such as a digital city, an intelligent city, a ubiquitous city, a knowledge city, and a sustainable city, by taking into consideration both technologies and human beings [39].

Therefore, smart city-based urban development and regeneration projects of the past did not review human (or citizen) factors [40,41] and ended up missing technologies, facilities and services that citizens directly experience and use [42,43], which became a source of criticism.

Second, critics focus on incomplete smart city projects due to their "excessive" future-oriented perspectives. The authors of [44,45] claimed that current smart city projects are concentrating only on the introduction of new technologies while failing to fully consider how to contribute to making a civil society, and to guaranteeing its sustainability. However, they may have overlooked the fact that ongoing smart city projects bear high chances of being modified over the course of their execution. Especially when a project is kicked off from scratch to combine the development of a new town or city with smart city infrastructures, it will take quite a long time before the urban space is equipped with human and material resources to have it actually serve its due role. In addition, changes in

financial situations, such as planned budget; urban-, architectural-, and information-related policies; and political circumstances could become a considerable stumbling block to the completion of well-organized smart cities both in internal and external terms, just as many theories and studies have pointed out. In this regard, any criticism against smart city projects should be made based on goals pursued by each city. Its focus also needs to be on whether a city is being created to meet the needs of its actual users.

Taken the above-mentioned points together, the criticism for established smart cities was due largely to different viewpoints among studies. There are limitations to fitting a wide spectrum of notions into a singular notion of an "ideal" smart city. However, those critics are on the same page in that they emphasize the lack of attention to citizens and civil societies [46,47], and call for providing appropriate technologies, facilities, and services for users [48]. In this context, it is necessary to establish evaluation criterion which fully considers citizens, and this will be a way to promote the sustainability of many smart city projects in the future [49]. Studies on citizens who reside in places where smart city projects have already been implemented can be a starting point to achieve the citizens-centric smart city in real terms.

3. Research Methodology and Materials

3.1. Research Framework and Model

It is necessary to listen to citizens, who are end-users of services and the subject of reproducing public information, in order to build a citizens-centric smart city. In the field of academic research, the establishment of a method to systematically perform their opinion gathering is also needed. As [50] stated, there exists a wide range of differences in interpreting a smart city in terms of system, governance, information, space, and design, and even some theories clash. However, in the area of an actual smart city project, the standardization of its technologies, facilities, and services has been called for [51,52].

As such, this study aims to present a standardized research model, which is expected to present the analysis of citizens' use of related goods, as well as the implications for promoting their continuous utilization when related entities create, operate, and manage a smart city. It also aims to establish an evaluation model based on a widely used ex-post evaluation research model for consumers, and to lay the groundwork for standardizing tools to collect and assess citizens' opinions on smart city infrastructures. This research will also verify the evaluation model by carrying out surveys and their quantitative analysis based on the population and samples to discuss their future applications.

In order to establish the evaluation model, this study adopted the basic structure of the Customer Satisfaction Index. The structure of this research model differs according to usages by each entity, but this has significance as it would be a tool to explore consumers' cognition on public or private goods both in the past and at present; their experiences, and the possibility of their continuous use down the road.

Just as shown in Figure 1, major Customer Satisfaction Indexes include ACSI (American Customer Service Index), SCSB (The Swedish Customer Loyalty Barometer), ECSI (European Customer Loyalty Barometer), and NCSI (National Customer Service Index). They are based on the Structural Equation Modeling (SEM), which began to be discussed in the 1970s and was expanded to analyze service quality, or SERVQUAL, in 1980s [53].

These SEMs are used not only to measure corporate products, but also to evaluate the level of satisfaction [54] of both tangible and intangible goods provided by private and public entities as well as their brands. Despite some differences depending on countries, cities and evaluation agencies, the basic SEM structure for each index bears similarities [55].

Looking into details, the variables—"Customer Expectations" with goods, "Perceived Quality" that they evaluate after use of the goods and services, and "perceived value" of the goods for consumers' expenses—affect the overall and comparative "satisfaction," and those variables are defined as being interconnected. "Satisfaction" is also linked to "complaint", which means that users' satisfaction can be affected by suppliers' responses when they have problems with the goods. It also indicates their expectations of the responses

they receive when they have complaints. "Complaint" can then lead to sustainability, as the handling of complaints would affect consumers' decisions on whether to continue to use the supplies and/or recommend them to others. In this regard, the SEM structure is expected to help discover the perceived advantages and disadvantages of goods, which consumers felt in the past, feel at present, and will feel in the future, and to draw implications for the improvement of the goods.

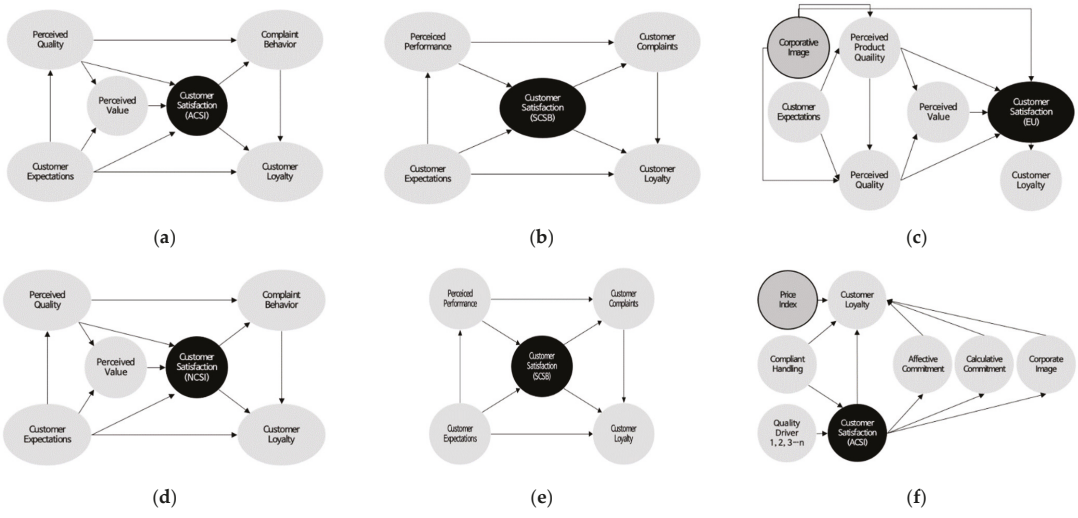

Figure 1. Expected research model and directions of the paths; (**a**) United States (ACSI); (**b**) Singapore (CSISG); (**c**) EU(ECSI); (**d**) Republic of Korea (NCSI); (**e**) Sweden SCSB; (**f**) Norway (NCSB).

In other words, it enables a diachronic point of view in learning the formation of consumers' cognition regarding goods in the past; their current satisfaction; and a will to use in the future. Each item of the variable is also placed on a Likert scale, which could lead to various implications through the selective analysis of items when necessary, without using the SEM. In terms of standardization, the SEM in particular could show some differences between results shown in advanced nations and in emerging nations, just as [56] pointed out. However, it is noteworthy that the very basic structure is still effectively applicable to diverse industry fields within a country or a city [57]. In this context, if the SEM structure is applied to the evaluation of a citizens-centric smart city and it could secure statistical explanatory power, the smart city can be regarded as a kind of new goods, industry, or service of a country or a city. However, the traditional SEM model was modified here, as follows, to evaluate a smart city from citizens' point of view, just as shown in Figure 2.

First, the relationship among variable groups was re-established. The SEM for the above-mentioned Customer Satisfaction Index has already been verified through various studies. However, this study specifically considered citizens, who consume technologies, facilities and services of a smart city and produce related information. As such, "User Characteristics (UC)" was added to the modified version, just as shown in A, to see if each respondent's demographic, economic, and social features can be well reflected to the service evaluation model. In addition, the study directly linked the 'User Characteristics' to "user Satisfaction" to determine if citizens' characteristics affect their levels of satisfaction with a smart city, and if so, how much impact it would have, through which the research can draw implications for related studies on a citizens-centric smart city.

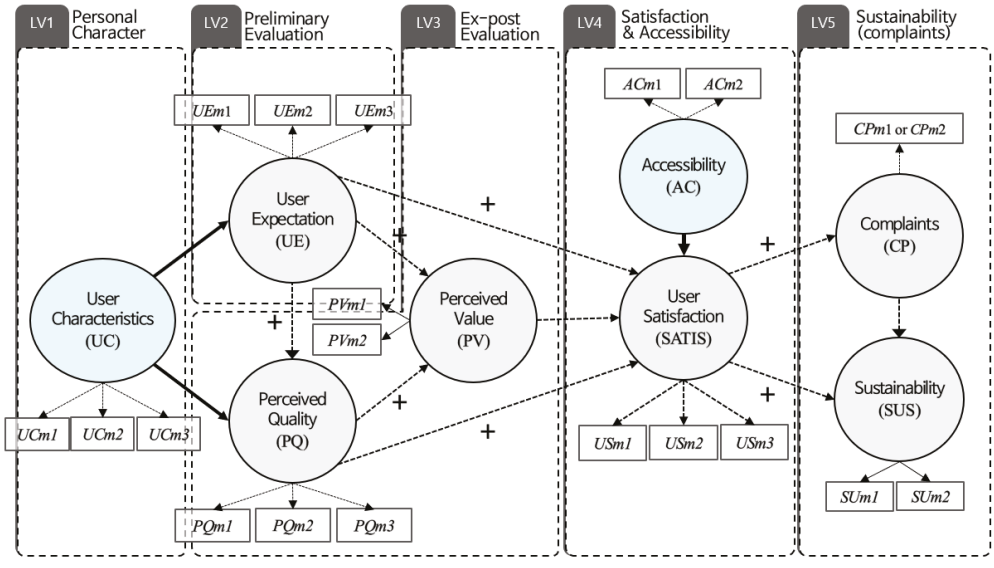

Figure 2. Expected research model and directions of the paths.

Second, evaluation items to measure the accessibility of a smart city's TFS from the citizens' point of view were added and verified. The insertion of these variables is based on revelations that smart city-related services provided in each country, city or region have not been frequently used, in case they are not well recognized by the people due to their low accessibility or usability [58,59]. This concept is similar to "affordance", a behavioral psychology term, which means a way to define individuals' behaviors through a series of experiences and knowledge. This study, however, puts a greater value on the accessibility to discuss users' overall access to a number of goods, rather than on a single item with a clear intention. In fact, smart city-related studies have concentrated on accessibility in multiple aspects, such as its improvement in order to promote citizens' mobility both indoors and outdoors [60]; the consideration of a greater number of populations to achieve a smart but still inclusive city [59,60]; and the public access to data collected, processed and disclosed through smart city tools.

In terms of the creation of a citizens-centric smart city, no matter how many technologies, facilities and services are adopted, they would ultimately be unsustainable if they fail to actually be utilized. So, smart city-related services are bound to be affected by their accessibility as well as being linked to citizens' intentions to experience them, and the citizens' satisfaction. Therefore, this study constructed the SEM by directly connecting "accessibility" with "satisfaction" and "complaint", just as shown in Figure 2. The variables and items of each group are stated in Table 1.

Indicators here are similar or identical to those in the above-mentioned consumer satisfaction model, and they are presented in the form of questions to enhance respondents' understanding. All the items are on the Likert 11 scale, ranging from 0 to 10, and all items are required to be answered. In case of "complaint", however, the items are designed to assess respondents' expectation of suppliers' problem solving because they may not have any complaints with the TFS of a smart city.

Along with the establishment of the evaluation model, this study presented for the questionnaire comprehensive information on the technologies, facilities and services of the smart city established in the target sites, to help respondents better understand what the TFS means, as some might have not recognized them even though they have used the items. So, the list of their TFS was drawn up based upon their administrative information, related

reports, and academic documents. Second, interviews were conducted with government officials, scholars, and researchers in the related fields of each city to redefine the TFS currently in operation, as is shown in Table 2 below. Third, the subjects of the survey were confined to those who have had hands-on experience with TFS, so as to increase the objectivity of this research and the verification ability of the evaluation model. In order to make sure that they have used the TFS, photos and other visual materials of the infrastructure were provided to the respondents.

Table 1. List of Evaluation Criteria.

L.V.	Index	Items	Class.
User Characteristics (UC)	UCm1	Respondents' gender	Male/Female
	UCm2	Respondents' age	Age
	UCm3	Respondents' income level	Income level
User Expectations (UE)	UEm1	Overall expectations for SC	Likert 11pts.
	UEm2	Expectations for SC demand satisfaction	Likert 11pts.
	UEm3	Expectations for SC service reliability	Likert 11pts.
Perceived Quality (PQ)	PQm1	Satisfaction for overall expectations	Likert 11pts.
	PQm2	Satisfaction of overall demands	Likert 11pts.
	PQm3	Satisfaction of overall reliability	Likert 11pts.
Perceived Value (PV)	PVm1	Price appropriateness compared to SC facilities	Likert 11pts.
	PVm2	Facility appropriateness compared to costs	Likert 11pts.
Accessibility (AC)	Am1	Accessibility to SC's TFS	Likert 11pts.
	Am2	Readability of SC-TFS guide, signs	Likert 11pts.
Satisfaction (SATIS)	USm1	Overall satisfaction with SC-TFS	Likert 11pts.
	USm2	Satisfaction compared to SC-TFS expectations	Likert 11pts.
	USm3	Satisfaction compared to highest SC-TFS expectation level	Likert 11pts.
Complaint (CP)	SCm1	Dissatisfaction or satisfaction with SC problem solving	Likert 11pts.
	SCm1-2	Dissatisfaction or expectations for SC problem solving	Likert 11pts.
Sustainability (SUS)	SUm1	Reuse intention of SC-TFS	Likert 11pts.
	SUm2	Recommendation intension of SC-TFS	Likert 11pts.

Table 2. List of Smart City Technology, Facility, and Service (TFS) of Barcelona and Songdo.

L.V.	Items	List of Smart City Technology, Facility, and Service
Barcelona (A)	Disclosure of public information; Smart education and tourism; Exchanges/Promotion; Urban planning projects; Life/community; Ambulation/traffic monitoring.	Visualization of city operating system and solution energy use/costs; General civil petition/administrative computer processing; CCTV for crime prevention; AWCS (Automated Waste Collecting); smart trash can; smart street light; public WiFi; smart-tech education program; smart city conference; public relations center; smart city tourism; tour guide app; R&D and support center; protection/management of elderly people; location-based local information sharing; public bicycle; car sharing; smart traffic management; real-time bus guide signboard.
Songdo (B)	Data collection and Provision; Smart street furniture; Urban development and construction projects; Safety-, health-, traffic-, environmental-monitoring system.	e-General civil petition/administrative computer processing; integrated living info (parking, medical institutions, tourism, restaurants, and educational institutions, etc.); real-time air quality, water quality, and weather info (traffic/environment/safety/disaster); real-time air quality/weather information; real-time traffic/public transportation info; information-providing kiosks and media boards; public WiFi; real-time CCTV web camera; CCTV for crime prevention; public relations center; R&D and support center; integrated control; emergency care for the elderly living alone; public and shared bicycles; real-time traffic violation control and traffic safety services.

3.2. Study Areas and Data Collection

In addition to the research model presented above, this study conducted a survey of residents and visitors in two cities, which have often been cited as prime examples of modern smart city projects in related studies, so as to evaluate their smart city technologies, facilities and services in a comprehensive manner.

Barcelona (A) is where the TFS projects have been gradually conducted in traditional urban spaces by local governments, while Songdo (B) is where a large-scale new city development project was implemented along with the TFS introduction at the same time. However, as this study is mainly aimed at examining and verifying the applicability of the research model based upon the analysis of citizens' responses, the name of the cities and the detailed services, advantages and disadvantages of each smart city project, and their satisfaction level will not be described here. Instead, the description will be based on the figures needed to analyze the research model and survey results. Specific research sites in the two cities were chosen through discussions with experts and civil servants in each city in order to secure valid samples. The spatial scope for the survey was set within a 2-km radius of where major TFS projects were carried out. The center of City A is where support facilities for knowledge-based industries were established as part of smart city projects, and the center of City B is where a center for the smart city operation, management and experience is located.

This study also fixed the number of respondents through stratified sampling based on the population of each administrative district and their age. However, the population setting and sampling were limited, to involve those aged between 15 and 65 in Barcelona, and those aged between 20 and 65 for Songdo. Both represent around 65.8 percent of the total population on average. The questionnaire was translated into English and the language used in each nation. The pilot survey was carried out including 52 officials in related fields in Barcelona and 73 in Songdo, in May 2018. Following the revision and review of the questionnaire, the main and additional polls were conducted from July 2018 until January 2019. Responses from 211 out of 421 people (Barcelona) and 197 out of 522 (Songdo) people were used for analysis.

3.3. Methodology

This study adopted the Partial Least Square (PLS) to analyze the SEM. As a data modeling technique for spectral data, PLS performs ordinary least squares (OLS) regressions with the least square algorithm, and it is achieved by extracting from the predictors the latent variables. As it is meant to improve the rationale of the model based on the coefficient measurement that maximizes R^2, the PLS is suitable for the development and the verification of a theoretical model and is widely used in such fields as behavioral science, marketing, and organization [61].

Given that "User Characteristic" in Figure 2 is not a reflective indicator but a formal indicator, the PLS-SEM is deemed suitable for this research. As an analysis program, SmartPLS ver.3.2 was employed, and the internal consistency, reliability, validity, and the discriminant validity, among others, were applied in a comprehensive manner for its assessment. However, the composition reliability (*CR*) was mainly used in evaluating the internal consistency reliability of measurement variables, and the equations are as follows.

$$CR(P_c) = \frac{\left(\sum_{i=1}^{M} L_i\right)^2}{\left(\sum_{i=1}^{M} L_i\right)^2 + \sum_{i=1}^{M} var(e_i)}, \frac{\left(\sum_{i=1}^{M} L_i\right)^2}{\left(\sum_{i=1}^{M} L_i\right)^2 + \sum_{i=1}^{M} (1 - L_i^2)} \quad (1)$$

where L_i is the standardized outer loadings of the latent variables, e_i is the error of measurement variable I, var(e_i) is the variance $(1 - L_i^2)$ of measurement error, and M is the number of variables.

As the PLS adopted here is mainly used for non-parametric statistics, the t-value was calculated through bootstrapping to verify the significance of each path coefficient. The evaluation criteria to verify the SEM and each variable are shown in Table 3 below.

Table 3. List of Criteria for Measuring SEM's Reliability and Validity.

Criteria	Items	Evaluation Criteria
Reliability	Cronbach's Alpha Dijkstra-Henseler's rho_A (pA) CR (composite reliability, pc)	Cronbach's Alpha $\geq$ 0.65 pA $\geq$ 0.7 pc $\geq$ 0.6
Convergent Validity	Outer Loading Relevance (L) Average Variance Extracted (AVE)	L $\geq$ 0.4 accepted (0.4 $\leq$ L < 0.7 judgment required) AVE $\geq$ 0.70 (variable removal when falling short)
Discriminant Validity	Fornell-Larcker Criterion (FLC) HTMT (Hetorotrait-Monotrait Ratio)	Adopted when AVE is higher than the greatest value of correlation HTMT $\geq$ 1 abandonment (lack of Discriminant Validity)
Inner VIF	Collinearity Statistic	VIF $\leq$ 5 adoption (no Variance Inflation Factor in variables)
Outer VIF	Collinearity Statistic	VIF $\leq$ 5 adoption (no Variance Inflation Factor in variables)
Bootstrapping	P T Coefficient of determination (R2) Q2	$p \leq 0.05$ (95%) t $\geq$ 1.96 (95%) R2 $\geq$ 0.50 (moderate) Q2 $\geq$ 0.00 (cross-validated redundancy)

4. Results

4.1. Overview

In order to examine smart city technologies, facilities and services in the two cities for the evaluation of the SEM, this study conducted a survey on statistically significant samples, and analyzed the results. As shown in Table 4, the target site encompassed four administrative districts within a 2-km radius, and all the respondents either resided or stayed in the area. The survey was conducted face-to-face by researchers from both countries.

Table 4. Overview of Descriptive Statistics of Respondents in Barcelona and Songdo (n = 408).

Class. 1.	Class. 2.	Barcelona (n = 211/172,780)		Songdo (n = 197/121,988)	
Gender	Male	108	51.00%	102	52.00%
	Female	103	49.00%	95	48.00%
Age Group	(15, Barcelona) 20–29	44	21.00%	45	23.00%
	30–39	65	31.00%	53	27.00%
	40–49	51	24.00%	47	24.00%
	50–59	40	19.00%	35	18.00%
	60–65	11	5.00%	16	8.00%
Income Levels (monthly)	Under 150 USD	25	12.00%	16	8.00%
	150–250 USD	32	15.00%	30	15.00%
	250–300 USD	63	30.00%	33	17.00%
	300–400 USD	53	25.00%	83	42.00%
	Over 400 USD	38	18.00%	35	18.00%
Administrative Districts of Sample	District 1	71	33.82%	37	18.83%
	District 2	46	21.82%	61	31.09%
	District 3	55	26.00%	49	25.09%
	District 4	38	18.00%	49	25.00%

Reponses made by those who had experienced smart city TFS or were currently using them were chosen for analysis: In Barcelona, 211 out of a total 421 respondents were selected, and 197 out of 522 people were chosen in Songdo. The sampling error stood at ±6.74% (Barcelona, n = 211) and ±6.98% (Songdo, n = 197), at the 95 percent confidence level for 172,780 respondents each.

When asked if they know or have ever heard of a smart city, 73% of respondents (n = 421) in Barcelona (n = 437) and 84% (n = 309) of respondents in Songdo (n = 522) said that they have heard about a smart city, including such terms as digital city and ubiquitous

city. However, the number of those who actually used the technologies, facilities and services installed or distributed in a smart city came far lower, at 211 (50%) and 197 (38%), respectively. Despite the low utilization rate of smart city infrastructures in overall terms, the survey showed that each respondent has used or currently uses an average of 5.27 TFSs in Barcelona and 4.12 in Songdo. The mean values for each variable collected according to the aforementioned survey are shown in the Table 5.

Table 5. Comparison of Mean Values by the Indicators (n = 408).

L.V.		M.V	Barcelona	Songdo
User Expectations (UE)	UEm1	Overall expectation for SC	7.69	7.43
	UEm2	Expectations for SC demand satisfaction	7.63	7.58
	UEm3	Expectations for SC service reliability	7.40	7.66
Perceived Quality (PQ)	PQm1	Satisfaction for overall expectations	7.84	6.78
	PQm2	Satisfaction of overall demands	8.06	7.33
	PQm3	Satisfaction of overall reliability	7.90	6.94
Perceived Value (PV)	PVm1	Price appropriateness compared to SC facilities	6.19	6.77
	PVm2	Facility appropriateness compared to costs	6.87	7.96
Satisfaction (SATIS)	USm1	Overall satisfaction with SC-TFS	8.03	7.68
	USm2	Satisfaction compared to SC-TFS expectations	7.23	6.92
	USm3	Satisfaction compared to highest expectation	6.84	6.21
Accessibility (AC)	Am1	SC-TFS accessibility	8.01	7.04
	Am2	Readability of SC-TFS guides, signs	7.64	6.36
Complaint (CP)	SCm1-2	Expectations for problem solving	7.18	7.11
Sustainability (SUS)	SUm1	SC-TFS reuse intention	7.42	6.60
	SUm2	SC-TFS recommendation intention	7.30	7.30

Looking into the details, people in Barcelona turned out to be nearly unaware of such non-exposure services as the city's comprehensive control centers, and energy and traffic management, despite the authorities' PR efforts. In the case of Area B, people do not know or utilize the real-time information on air and water quality and weather provided by websites or applications, as well as media boards that provide local news and information, and the safety management service for elderly citizens living alone, according to the survey. The results could have been caused by different types of TFS introduced in each city, their arrangement, PR campaigns, differences in local culture, and citizens' way of life. These factors also can create different results in different regions, even though the same or similar TFS are installed.

4.2. Review of Research Model

In order to evaluate technologies, facilities and services of a smart city from the citizens' point of view, this research, using the SEM and the results of the survey on each item, was applied to the model to assess their suitability and generality. The verification of this SEM was made in two phases.

First, the entirety of the samples from Barcelona and Songdo were put to the SEM to check their suitability. Second, samples of each city were inserted for analysis. If differences are spotted between the cities, the research will analyze their causes to discuss ways for improvement. If the analysis results are similar to the modeling of the existing Customer Satisfaction Index, this SEM can be said to prove its value, at least in part, as a standardized model for a citizens-centric smart city in the future. If this model that deals with multiple technologies, facilities and services of a smart city is statistically significant, it means that it can serve as a tool to evaluate users' satisfaction by regarding multiple TFSs as one smart city, as well as to measure their evaluation on each service or technology at the same time.

4.2.1. Review of Research Model

In this part, the survey results of all respondents (n = 408) in both cities were inputted. As mentioned above, the convergence validity of the SEM was determined based on the outer loadings (L_i), the reliability of the measurement variables (L_i^2), and the Average Variance Extracted, or AVE.

According to the analysis of the initial model shown in Table 6, the outer loadings (L_i) came below 0.5 in case of "the expectation level for reliability", which corresponds to variable No. 3 within "user expectation." Accordingly, this research excluded the variable from the research model, and carried out the analysis again, which led to the results that the outer loading value stood at 0.07 or higher, and therefore proved its validity and reliability. The analysis of reliability L_i^2 showed the level of 0.5 or higher to guarantee its credibility, and the AVE value also comes to 0.5 or higher to secure the reliability of the individual variables and the validity of latent variables.

Table 6. Convergent Validity Result of Barcelona and Songdo (n = 408).

L.V.	M.V		Outer Loading	Reliability	Ave
			Over 0.70	Over 0.50	Over 0.50
UserCharacteristics (UC)	UCm1	Gender of respondent	0.756	0.572	0.775
	UCm2	Age of respondent	0.774	0.599	
	UCm3	Income level of respondent	0.789	0.547	
User Expectations (UE)	UEm1	Overall expectation for SC	0.880	0.774	0.789
	UEm2	Expectations for SC demand satisfaction	0.896	0.803	
Perceived Quality (PQ)	PQm1	Satisfaction for overall expectations	0.870	0.757	0.695
	PQm2	Satisfaction of overall demands	0.799	0.638	
	PQm3	Satisfaction of overall reliability	0.830	0.689	
Perceived Value (PV)	PVm1	Price appropriateness compared to SC facilities	0.917	0.841	0.864
	PVm2	Facility appropriateness compared to costs	0.942	0.887	
Satisfaction (SATIS)	USm1	Overall satisfaction with SC-TFS	0.778	0.605	0.684
	USm2	Satisfaction compared to SC-TFS expectations	0.853	0.728	
	USm3	Satisfaction compared to highest expectation	0.848	0.719	
Accessibility (AC)	Am1	SC-TFS accessibility	0.899	0.808	0.758
	Am2	Readability of SC-TFS guide, signs	0.841	0.707	
Complaint (CP)	SCm1-2	Expectations for problem solving	1.000	1.000	1.000
Sustainability (SUS)	SUm1	SC-TFS reuse intention	0.863	0.745	0.795
	SUm2	SC-TFS recommendation intention	0.919	0.845	

The internal reliability evaluation of each variable is shown in Table 7, and the Cronbach's Alpha, rho_A and CR values came to 0.6, 0.7, and 0.6 or higher, respectively, indicating that all potential variables have internal reliability. Moreover, the results of the discriminant validity by Fornell-Larker and the Chi-square test also turned out to be suitable, though they are not presented in this research. As the cross-validity of latent variables by HTMT criteria did not include one within the 90% confidence interval, each variable can be said to secure the discriminant validity. As such, the SEM proposed in this study secured consistency, reliability and validity for each item. Then, the PLS-SEM algorithm and bootstrapping were executed to analyze the SEM and derive the outer loading (regression coefficient).

As shown in Table 8, "satisfaction" revealed the highest explanatory power (0.694) based on the modified R2 criteria, which means that this research model is best optimized for measuring the actual satisfaction level. In addition, the VIF values of all variables in this SEM came to less than five, and no inter-multicollinearity occurred. Each measuring variable included in the structural model also came to less than five, indicating that there was no inter-multicollinearity.

Table 7. Result of Reliability-Validity of SEM's Latent Variables (Barcelona and Songdo, n = 408).

L.V.	Cronbach's Alpha	Dijkstra-Henseler's rho_A(pA)	CR	Heterotrait-Monotrait Ratio (HTMT) [1]
	(Over 0.60)	(Over 0.70)	(Over 0.60)	(Not Includes 1)
User Characteristics	-	0.705	0.915	Y
User Expectation	0.732	0.734	0.911	Y
Perceived Quality	0.780	0.789	0.881	Y
Perceived Value	0.844	0.863	0.937	Y
Satisfaction	0.770	0.781	0.869	Y
Accessibility	0.684	0.705	0.766	Y
Complaint	0.997	0.991	0.996	Y
Sustainability	0.745	0.866	0.915	Y

[1] Not includes 1 in Confidence Interval.

Table 8. Result of Coefficient of Determination on Latent Variables (based on R2 and Adj. R2).

L.V.	R^2	Adjusted R^2
User Expectation	0.142	0.14
Perceived Quality	0.531	0.529
Perceived Value	0.261	0.258
Satisfaction	0.697	0.694
Complaint	0.309	0.307
Sustainability	0.414	0.411

As shown in Table 9, all the single paths presented in this study model were found to have explanatory power within the scope of being statistically accepted. When setting the respondents' satisfaction as a final path, the highest value (based on t-stat.) turned out to be "cognition" of technologies, facilities, and services of a smart city, which was emphasized by this study; this was followed by "Perceived Value (PV)", "User Characteristics (UC)" and "User Expectation (UE)".

Table 9. Result of Paths on a Pair of Latent Variables (Barcelona and Songdo, n = 408).

Path	Original Sample	Mean.	STD.EV	t Stat.	p	VIF
Cognition→Satisfaction	0.324	0.324	0.043	7.505	0.000 **	1.924
Complaint→Sustainability	0.139	0.139	0.042	3.333	0.001 *	1.000
Perceived Quality→Perceived Value	0.203	0.203	0.069	2.949	0.003 *	2.071
Perceived Quality→Satisfaction	0.131	0.132	0.048	2.750	0.006 **	2.559
Perceived Value→Satisfaction	0.262	0.263	0.049	5.373	0.000 **	1.363
User Characteristics→Perceived Quality	0.128	0.13	0.037	3.500	0.000 **	1.165
User Characteristics→Satisfaction	0.173	0.171	0.035	4.929	0.000 **	1.223
User Characteristics→User Expectation	0.377	0.381	0.047	8.077	0.000 **	1.002
Satisfaction→Complaint	0.556	0.556	0.041	13.419	0.000 **	1.000
Satisfaction→Sustainability	0.556	0.557	0.054	10.235	0.000 **	1.447
User Expectation→Perceived Quality	0.671	0.671	0.036	18.89	0.000 **	1.165
User Expectation→Perceived Value	0.345	0.346	0.065	5.335	0.000 **	2.071
User Expectation→Satisfaction	0.212	0.211	0.051	4.172	0.000 **	2.381

** $p < 0.000$, * $p < 0.05$.

That is, citizens' satisfaction can be maximized by the fair level of cognition of and accessibility to the smart city elements (t = 7.505, p = 0.000). This also indicates that the value of each TFS that citizens think of for their expenditure (t = 5.373, p = 0.000), socioeconomic features such as age, gender, and income level of citizens (t = 4. 929, p = 0.000) and their overall expectation level with a smart city (t = 4.472, p = 0.000), can lead to their higher satisfaction. These results suggest that there is a need to better consider such factors as citizens' age, gender, and income (based on questions about how much each smart city infrastructure is exposed to citizens), when drawing a plan regarding smart city elements

from citizens' perspectives. It also means that, if charging for those technologies, facilities and services are needed, and economic reviews on whether the price was affordable for the current residents are needed. It is safe to say that the level of satisfaction formed through this consideration would lead to their continuous use and utilization of smart city materials (t = 4.929, p = 0.000) based on its reliability (t = 13.419, p = 0.000).

4.2.2. Analysis of All Paths of Research Model (Barcelona and Songdo)

The individual paths are determined by the mediating effect of each variable inserted into the structural model. The path model presented by this research as well as the value and the flow of the path set by 5000 times of bootstrapping are shown below. As previously mentioned, this research model is based on the SEM that evaluates images of traditional goods, services, or their suppliers, and it involves users' expectations for smart city elements, perceived quality and value of goods after use, and chances of their future utilization based on the level of satisfaction. In this regard, as shown in Figure 3, this research model proves that technologies, facilities and services of a smart city can be considered as traditional goods and services and they can be evaluated from the users' viewpoint.

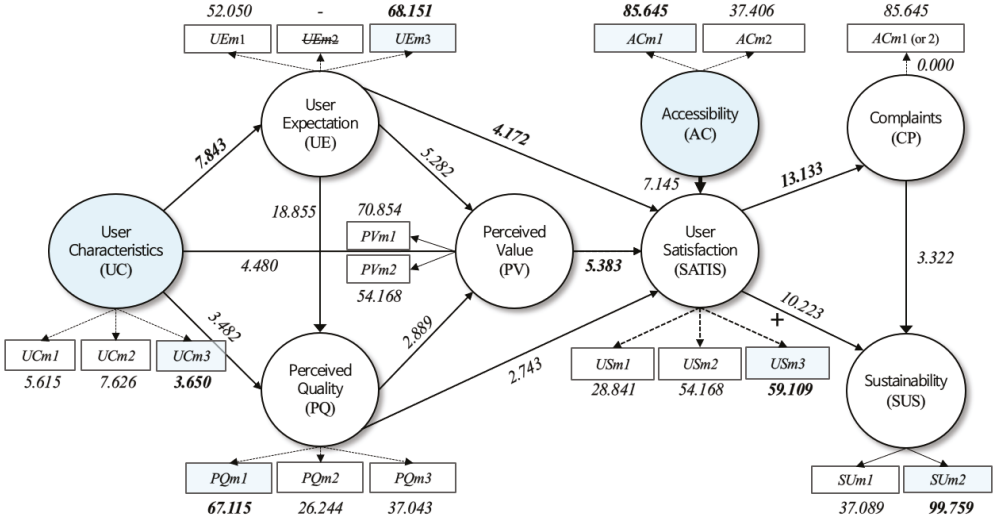

Figure 3. Overall result of SEM based on Expected Research Model (n = 408, based on T-stats. and bootstrapping).

There exists a lot of research models, paths and analysis methods presented by bootstrapping. As the latent variable in each index group shows the generalized representation in accordance with the increase in the value, however, this study is to take the upper value of each index group and their index variables which affect the satisfaction for interpretation. First, each citizen's characteristics affect their satisfaction with the TFS, with the impacts becoming greater according to their gender, followed by age and income level. Second, (1) user expectation, (2) perceived quality after use, and (3) perceived value based upon the perceived quality all affect their satisfaction, but the perceived value, which combines (1) and (2) turned out to have greater impacts on users' satisfaction. That is, the perceived value, which measures how appropriate their payment for those smart city elements was, impacts on their satisfaction the most. Third, "Accessibility" to each facility and service directly affects users' overall satisfaction. Access directly to goods when necessary contributes more to the improvement of their satisfaction than any other indirect methods, such as promotion campaigns. Fourth, users' intention of continuing the use of the TFS can be boosted when the goods were better than what users expected. Given that the installation of smart city infrastructure is still in the early stage, and many see chances of

its development further, it is crucial to improve the quality of the TFS beyond people's expectations, rather than focusing on quantitative satisfaction.

4.3. Analysis Results of Research Model for Each City

When the analysis results of the two cities were combined and then inserted into the research model, it was identical to the initial model presented by this study. However, as mentioned in the beginning, o this structural model may reveal differences when the results of each city are separately put into the research model to consider the fact that there are differences in their business methods.

In particular, it is necessary to note that the above-mentioned various Customer Satisfaction Indexes are similar in their basic structure, but have been modified and sometimes improved to fit for each country or an institution. So, the chances are that, considering business characteristics of urban planning projects or economic and cultural differences caused by their geopolitical locations, the basic model proposed above may be different among cities. Accordingly, in this section, the two subjects were analyzed in the same way through the execution of bootstrapping based on the SEM used before.

In the analysis process, based on the evaluation results of the significance and the suitability of each path presented by the bootstrapping results, the low value among the variables within the statistically insignificant latent variable group was first removed. In case the result was not significant, the same process was repeatedly executed—after removing the latent variable group and re-executing bootstrapping—until significant results were derived. The results and differences of the two cities using this process are as follows.

4.3.1. Evaluation and Comparison of Measurement Model

Through the above-mentioned process, analysis continued by roving variables until the statistical suitability was obtained. One variable group (LV) was removed from each research model of the two cities, and the final verification results for the validity showed that both cities show higher values in the outer loading (L_i), reliability (L_i^2) and AVE (Average Variance Extracted) than the average. In regard to the details, all measurement items in the "Perceived Quality" of Barcelona were removed as they failed to explain the path of the SEM, and all items in the "user characteristics" in Songdo were taken out due to their failure to explain the path of the structural model.

After excluding the variable group that does not match the research model as shown in Table 10, the review of the reliability and discriminant validity (HTMT) of the measurement indicators for the results of the two cities were conducted, which showed that the receptive reliability and the validity were secured in most items. In the case of Songdo, Rho_A, an item for evaluating the reliability in the Accessibility group, came below the standard value. However, it still satisfied the CR value (0.6 or more) which is the baseline of the representative reliability set by this study. It also exceeded the standard value in the calculation of Cronbach's Alpha value (0.6 or more) and HTMT (90% confidence interval 1), which are deemed to have the strictest explanatory power, so that it was determined to be acceptable (see Table 11).

After removing groups with a low explanatory power and verifying the consistency and reliability of each city, this study conducted bootstrapping 5000 times with the results, and analyzed the structural model and then derived the outer loading (standardized regression coefficient) as follows.

Here, as shown in Table 12, the approach is a control variable of the "Satisfaction" so that it was not included in calculating the regression coefficient. The analysis results showed that the satisfaction has the highest explanatory power for both models in terms of R^2 standards, proving that both research models are suitable for measuring the satisfaction of technologies, facilities and services of a smart city. In addition, the value of multicollinearity (variance inflation factor, or VIF) of all variables included in the SEM of the two cities came between 1.000 and 2.555 to hover below 5, which was an acceptable result because each variable was not highly correlated with others.

Table 10. Convergent Validity Result of Barcelona and Songdo (n = 408).

L.V.	Barcelona			Area B		
	Outer Loading (L_i)	Reliability (L_i^2)	Ave.	Outer Loading (L_i)	Reliability (L_i^2)	Ave
	>0.70	>0.50	>0.50	>0.70	>0.50	>0.50
User Characteristics (UC)	−0.719 0.748 0.700	0.517 0.560 0.490	0.991	- - -	- - -	-
User Expectations (UE)	0.879 0.912	0.773 0.832	0.802	0.876 0.892	0.767 0.796	0.782
Perceived Quality (PQ)	- - -	- - -	-	0.862 0.791 0.822	0.743 0.626 0.676	0.681
Perceived Value (PV)	0.932 0.954	0.869 0.910	0.889	0.898 0.931	0.806 0.867	0.837
Satisfaction (SATIS)	0.838 0.862 0.864	0.702 0.743 0.746	0.731	0.675 0.838 0.835	0.456 0.702 0.697	0.619
Accessibility (AC)	0.897 0.826	0.805 0.682	0.728	0.896 0.798	0.803 0.637	0.720
Complaint (CP)	1.000	1.000	-	1.000	1.000	1.000
Sustainability (SUS)	0.838 0.862	0.702 0.743	0.832	0.797 0.922	0.635 0.850	0.743

Table 11. Result of Reliability and Validity of SEM's Latent Variables.

Area	Criteria	Std.	UC	UE	PQ	PV	SATIS	AC	CP	SU
Barcelona	Cronbach's α	>0.6	0.662	0.754	-	0.877	0.817	0.629	1.000	0.798
	rho_A(pA)	>0.70	0.710	0.766	-	0.877	0.826	0.640	1.000	0.807
	CR	>0.60	0.766	0.823	-	0.969	0.891	0.689	1.000	0.861
	HTMT	Not include 1	Y	Y	-	Y	Y	Y	Y	Y
Songdo	Cronbach's α	>0.6	-	0.722	0.766	0.808	0.692	0.619	1.000	0.668
	rho_A(pA)	>0.70	-	0.724	0.777	0.828	0.719	0.703	1.000	0.724
	CR	>0.60	-	0.71	0.823	0.913	0.767	0.759	1.000	0.796
	HTMT	Not include 1	-	Y	Y	Y	Y	Y	Y	Y

Table 12. Results of Each Model's Coefficient of Determination on Latent Variables (based on R^2 and Adj. R^2).

L.V.	Barcelona		Songdo	
	R^2	Adjusted R^2	R^2	Adjusted R^2
User Expectation (UE)	-	-	0.505	0.503
Perceived Value (PV)	0.274	0.270	0.367	0.361
Perceived Quality (PQ)	0.186	0.182	-	-
Satisfaction (SATIS)	0.750	0.745	0.627	0.620
Complaint (CP)	0.373	0.370	0.262	0.258
Sustainability (SUS)	0.453	0.448	0.414	0.411

The suitability of each single path is as shown in the Tables 13 and 14, and all the paths were found to be statistically significant, and no multicollinearity problem was generated, which guarantee the explanatory power for each path. Similarities and differences drawn from the results between the two cities in terms of each independent path are as follows. First, in the single route that ends with the satisfaction, accessibility has the greatest impacts on the satisfaction in both cities, which is the same result as the analysis of their converged data. This reaffirms that the TFS of a smart city will be able to boost the satisfaction of users or consumers when they are properly placed at a location they want or appropriately guided.

Table 13. Results of Paths on a Pair of Latent Variables (Barcelona).

Path	Original Sample	Mean.	STD.EV	t Stat.	P	VIF
Cognition→Satisfaction	0.321	0.325	0.057	5.614	0.000 **	1.957
Complaint→Sustainability	0.136	0.134	0.048	2.831	0.005 *	1.595
Perceived Value→Satisfaction	0.238	0.240	0.064	3.707	0.000 **	1.279
User Characteristics→Satisfaction	0.212	0.212	0.050	4.219	0.000 **	1.538
User Characteristics→User Expectation	0.523	0.529	0.044	11.914	0.000 **	1.000
Satisfaction→Complaint	0.611	0.608	0.054	11.302	0.000 **	-
Satisfaction→Sustainability	0.582	0.584	0.077	7.548	0.000 **	2.179
User Expectation→Perceived Value	0.432	0.433	0.084	5.132	0.000 **	1.000
User Expectation→Satisfaction	0.325	0.319	0.069	4.742	0.000 **	1.934

** $p < 0.000$, * $p < 0.05$.

Table 14. Results of Paths on a Pair of Latent Variables (Songdo).

Path	Original Sample	Mean.	STD.EV	t Stat.	P	VIF
Cognition→Satisfaction	0.316	0.318	0.073	4.297	0.000 **	2.072
Complaint→Sustainability	0.161	0.161	0.071	2.272	0.023 *	1.355
Perceived Quality→Perceived Value	0.338	0.337	0.09	3.752	0.000 **	2.021
Perceived Quality→Satisfaction	0.162	0.166	0.076	2.123	0.034 *	2.338
Perceived Value→Satisfaction	0.294	0.297	0.079	3.714	0.000 **	1.589
Satisfaction→Complaint	0.512	0.511	0.06	8.477	0.000 **	-
Satisfaction→Sustainability	0.497	0.5	0.077	6.492	0.000 **	1.355
User Expectation→Perceived Quality	0.711	0.714	0.047	15.035	0.000 **	1.000
User Expectation→Perceived Value	0.318	0.319	0.094	3.395	0.001 *	2.021
User Expectation→Satisfaction	0.179	0.172	0.090	1.990	0.047 *	2.645

** $p < 0.000$, * $p < 0.05$.

Second, in the single path of Barcelona, the relations between socioeconomic characteristics of citizens (t = 11.914, $p = 0.000$) and their satisfaction, as well as the satisfaction and expectation for resolving complaints (t = 11.302, $p = 0.000$), showed quite high values. That is, given that citizens' age, gender, and income levels affect the satisfaction level, it is crucial to introduce technologies, facilities and services that best fit for citizens' characteristics in case of established cities. It also can be inferred that listening to users' complaints and providing a swift resolution could enhance the sustainability of a smart city from citizens' perspective. Therefore, smart city-related technologies, facilities and services in established cities should consider the current status of the urban space and features of citizens, such as their age, gender, and income level, and it is advised to supply fresh technologies, facilities and services, which proactively reflect the citizens' opinions. This implies the need for the comprehensive consideration of both physical and social factors of a city, including its form, related policy measures, and unique characteristics.

Third, in the single path of Songdo, the path between user expectation and perceived quality (t = 15.035, $p = 0.000$) showed a particularly high value compared to others. This indicated that perceived quality, which means the level of satisfaction of individuals' expectations, is crucial in Songdo, in contrast to Barcelona where the factor was excluded. Citizens' personal features are important in both areas, but their current social and economic circumstances turned out to specifically affect the satisfaction in Barcelona, while users' judgments on individual values is the decisive factor in Songdo.

In comparison to Barcelona, Songdo excludes the demographic and economic features of each citizen from the structural model. What this suggests is that a project to build a new city needs to identify a wider range of demands expected to be made by an unspecified number of people, and to prioritize advanced functions, design, and the usability of advanced smart city infrastructure.

4.3.2. Analysis Results of Research Model Routes

The value of an individual path is determined by the mediating effect of each variable inserted into the structural model. The results of the two cities, as shown in Figures 4 and 5, which are summarized in accordance with the path model presented here, and the value and the path flow determined by 5000 times of bootstrapping, are as follows. As explained in the survey results involving the two cities, the level of satisfaction with smart city elements in both cases is set by users' expectations before their usage and their perceived value after the experience, based upon accessibility, and the satisfaction has a series of paths affecting the possibility of their continued use. This highlights the need for the TFS of a smart city to be considered as just the same as traditional public goods, and from the perspective of users, i.e., citizens.

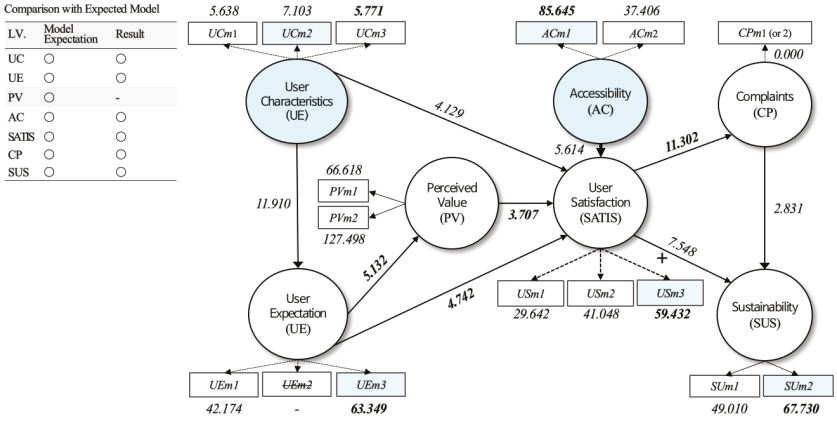

Figure 4. Overall result of SEM (Barcelona, n = 212, based on values of T-stats. and bootstrapping).

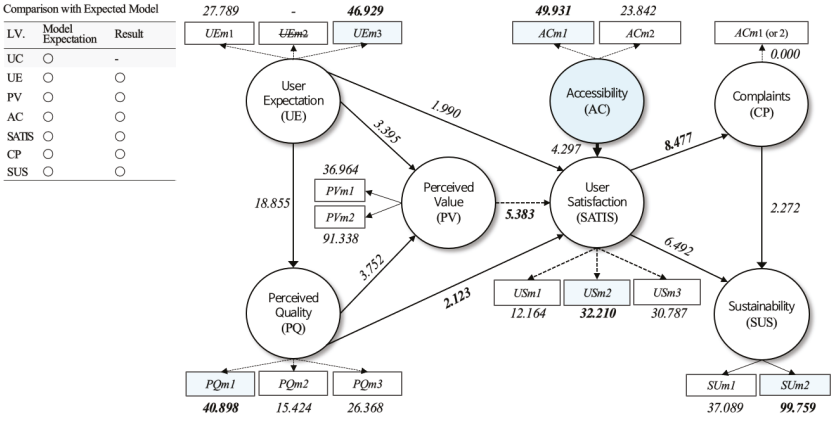

Figure 5. Overall result of SEM (Songdo, n = 197, based on values of T-stats. and bootstrapping).

However, the two cities showed structural differences. First, the satisfaction in Barcelona, where the TFS were introduced in existing urban spaces, was decided by

users' expectations before their firsthand use and their perceived value after the experience, which was affected by individual's characteristics. In the case of Songdo, where a new city development project is under way, individual user's characteristics are not factors to be considered, but the quality of the goods evaluated after use leads to their perceived value and satisfaction. However, given that perceived quality is not suitable for the structural model in the case of Barcelona, smart city infrastructures in an established city are needed to be chosen after taking into consideration the features of each citizen, because their expectations for the goods and their value in comparison with users' payment could boost their satisfaction in such an established city.

Among major variables, first, in terms of users' expectation, the importance of the reliability of smart city infrastructures was emphasized in both Barcelona and Songdo. Reliability is expected to improve their level of satisfaction with their expenditure for the goods. Second, the perceived value, which is decided after their experiences, was significantly higher in both cities in terms of "the appropriateness of the price set for facilities" than "the appropriateness of facilities compared to costs." This could indicate that individuals may drop their intention to use the smart city facilities and services in case the price set is higher than the amount they are willing to pay. So, any decision to charge goods or to add additional charges would be required to be made carefully, in order that they do not incur the improvement of the goods.

Third, "overall satisfaction" is the most important factor, among its three items, for technologies, facilities, and services for a smart city to be introduced to existing urban spaces, such as Barcelona. However, in the case of newly built cities, such as Songdo, their satisfaction "compared to the best level of the goods" was higher than their overall level of satisfaction or previous expectations. This result implies that if this research model is verified through further studies as a tool to compare a new city with an established one, the quality improvement in the form, design, and service of the smart city elements could enhance users' satisfaction, as it will better reflect citizens' expectations.

5. Implication and Discussion

This study aims to monitor users' level of satisfaction with the technologies, facilities, and services of a smart city at a time when the paradigm and the focus of a modern smart city has been changing from technology to citizens. It also aims to present a standardized evaluation system and verify it, so as to explore the possibility of its application down the road. For this purpose, the Structural Equation Model was established based on the basic structural model of the Customer Satisfaction Index, which has been widely used across the world, as well as on recent theories. A survey was also conducted involving citizens in two cities to compare their results. In order to draw implications in terms of urban planning, analysis results of the two cities were compared: one is where a smart city infrastructure was established in an existing urban space, and the other is where a smart city project was implemented in a newly built town.

As a result, the combined results of the examination of Songdo and Barcelona showed the identical structure to the prediction model based on the Customer Satisfaction Index. In other words, from citizens' point of view, the level of satisfaction with a smart city is affected by users' expectations for its technologies, facilities, and services before having first-hand experiences, their perceived quality after use, cost of the goods, and the accessibility to each facility. Those factors, as well as individuals' socio-economic characteristics, were found to have guaranteed the possibility of their continuous use. The results indicate that it is important to prioritize the introduction of facilities that residents want in order to achieve a citizens-centric smart city, just as highlighted in many studies. Such a phased introduction is advised in accordance with each city's demographic, social and economic features, rather than applying advanced technology-based platforms competitively in a drastic manner, as was called for by some previous studies and companies.

Second, the results of the analysis of each city through the research model revealed differences from the basic model, just as forecasted, but their structural features bore

similarities. In Barcelona, each citizen's socio-economic characteristics well explained their satisfaction with smart city infrastructures and their sustainability, while "Perceived Quality" was not suitable for the model. This means that characteristics of each dweller and their expectations can affect satisfaction. In the case of Songdo, where a new city development and construction project takes place, city members' socio-economic features do not fit for the model. Instead, the reliability of the goods, and moves to meet their personal expectations, were found to boost their satisfaction. From urban planning perspectives, these results indicate that that it is important to adopt credible and high-quality technologies, facilities, and services for a smart city, given the influx of unspecified people, while affordability for existing residents is key to effectively enhancing their overall satisfaction, just as many studies, such as [62,63], pointed out.

This study, however, has limitations in that the comparison of two cities, rather than multiple ones, could not ensure cited academic implications, so follow-up studies are deemed required by involving more entities of a similar scale, form, and conditions to expand this discourse. Many previous studies point to differences among smart cities in accordance with different urban spaces and business methods. At a time when discussions on the establishment of a citizens-centric smart city have expanded, it is crucial to spot differences among the technologies, facilities, and services of a smart city over the course of urban regeneration, redevelopment, and restoration projects, and to make suggestions to come up with proper policy measures suitable for each project [64]. Further requirements are the establishment and/or the revision of related legislation and systems in public sector, such as an opinion gathering system for planning, a monitoring and ex-post evaluation system focusing on citizens, and a certification and evaluation mechanism to maximize the application of those results to wider projects such as a national land planning. In order to create and manage a 'Sustainable Smart City', it is also necessary to extend financial support for the private companies or organizations which produce and distribute the smart city technologies, facilities, and services, as well as the expansion of partnerships between public and private entities, among other things [65]. This is the way to Smart City 2.0 and above, where citizens can actively participate and experience, going beyond Smart City 1.0, where citizens were limited to passive participation by technocracy.

In this regard, the research carries significance as it examined the standardized framework to evaluate smart cities from the citizens' point of view and carried out their basic verification to highlight that smart city infrastructures can be seen as a new commodity of a city and, at the same time, a means of improving the quality of citizens' lives. Moreover, this study has shed light on the point that a smart city would not be a matter of international competition but a useful way of improving the sustainability of a city or a region, which could be further examined by additional studies down the road.

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The Right to Have Digital Rights in Smart Cities

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Abstract: New data-driven technologies in global cities have yielded potential but also have intensified techno-political concerns. Consequently, in recent years, several declarations/manifestos have emerged across the world claiming to protect citizens' digital rights. In 2018, Barcelona, Amsterdam, and NYC city councils formed the Cities' Coalition for Digital Rights (CCDR), an international alliance of global *People-Centered Smart Cities*—currently encompassing 49 cities worldwide—to promote citizens' digital rights on a global scale. People-centered smart cities programme is the strategic flagship programme by UN-Habitat that explicitly advocates the CCDR as an institutionally innovative and strategic city-network to attain policy experimentation and sustainable urban development. Against this backdrop and being inspired by the popular quote by Hannah Arendt on "the right to have rights", this article aims to explore what "digital rights" may currently mean within a sample consisting of 13 CCDR global people-centered smart cities: Barcelona, Amsterdam, NYC, Long Beach, Toronto, Porto, London, Vienna, Milan, Los Angeles, Portland, San Antonio, and Glasgow. Particularly, this article examines the (i) understanding and the (ii) prioritisation of digital rights in 13 cities through a semi-structured questionnaire by gathering 13 CCDR city representatives/strategists' responses. These preliminary findings reveal not only distinct strategies but also common policy patterns.

Keywords: digital rights; smart cities; people-centered smart cities; social innovation; institutional innovation; technological innovation; policy experimentation; action research; online research; COVID-19

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1. Introduction: 'The Right to Have Digital Rights'

COVID-19 has hit citizens dramatically, not only creating a general risk-driven environment encompassing a wide array of economic vulnerabilities but also exposing people to pervasive digital risks, such as biosurveillance, misinformation, and e-democracy algorithmic threats [1–3]. Furthermore, it has inevitably raised the need to resiliently and techno-politically respond to threats that hyper-connected and highly viralised societies produce [4]. Consequently, over the course of the pandemic, a debate has emerged in several global *People-Centered Smart Cities* [5–9] regarding the appropriate techno-political response when governments use disease surveillance technologies to tackle the spread of COVID-19 [10–15], pointing out the dichotomy between state-Leviathan cybercontrol and civil liberties [16–18].

In many ways, the pandemic, has unprecedentedly brought into sharp relief digital rights issues on which several agents had been working for years in cities worldwide [5,19–21]. Thus, the digital rights' claim could be directly seen as a social innovation that is evolving towards an institutional innovation [22–24]. The digital rights' claim, articulated via city networks, is currently offering new modes of urban governance for policy experimentation in city administrations worldwide [6–8,25]. As such, these kinds of digital rights-driven projects based on policy experimentations attempt to subvert the

ongoing urban politics and governmentality that lack sustainability, with traditional siloed city administrations remaining a central obstacle to sustainable urban development and people-centered smart cities [26]. Digital rights are fundamental rights in the digital age related to privacy protection in smart cities [27–30]. In this vein, it has encouraged the United Nations to take an advocacy role regarding the 'right to have digital rights' and create the Hub for Human Rights and Digital Technology [31] (p. 1): 'Together, as we seek to recover from the pandemic, we must learn to better curtail harmful use of digital technology and better unleash its power as a democratising force and an enabler'.

In 1949, Hannah Arendt [32] wrote a phrase that has gradually become one of her most quoted and often interpreted: 'the right to have rights.' The phrase summed up her scepticism about the concept of human rights—those rights that, in theory, belong to every person by virtue of existence [31–36]. According to Arendt, the only way for these rights to be guaranteed was being not only a person but also a citizen [37]. This quotation may resemble the current post-COVID-19 algorithmic times, when, in the age of digitisation and datafication, dealing responsibly with citizens' rights and data poses a dilemma: on the one hand, there is the tangible added value of processing citizens' personal data by private sector organisations, but on the other hand, there is the claim that individuals should retain control over these data and consequently derived civilian rights [38–42]. Amid surveillance capitalism and beyond a human rights-based approach of Artificial Intelligence (AI) governance [43,44], state-based dataveillance mechanisms like biometrics [45], vaccine passports [46–49], biobanks, and the Internet within the context of citizenship inevitably force us to reclaim 'the right to have digital rights' [49–53].

Calls for the protection of citizens' digital rights have resulted in countless reports, manifestos, organisations, projects, and political declarations in different regional, national, supranational, and global contexts [5,19,54–57]. Citizens have traditionally reasserted their positions in relation to the state by claiming human and civil rights and making rights claims. However, the triangle between the state, the market, and the citizenry requires careful balance to protect civic digital rights and liberties and to enable participation and active citizenship [58,59].

The globally widespread phenomenon of the algorithmic disruption has led to new consequences—such as hyper-targeting through data analytics, facial recognition, and individual profiling—received by many as threats and resulting in not-so-desirable outcomes, such as massive manipulation and control via a surveillance capitalism push in the United States (US) [60,61] and the 'Social Credit System' in China [62–64]. In contrast, these techno-political concerns raised a debate in Europe that crystallised into the General Data Protection Regulation (GDPR), which came into force in May 2018. The emergence of the algorithmic disruption has spurred a call to action for cities in the European Union (EU), establishing the need to map out the techno-political debate on 'datafication' or 'dataism' [1,65,66]. Moreover, the disruption has also highlighted the potential requirements for establishing regulatory frameworks to protect digital rights from social innovation and institutional innovation. Such policy experimentation frameworks for urban governance cover demands for privacy, ownership [67], trust, access, ethics, AI transparency [68], algorithmic automatisation [69], and, ultimately, democratic accountability [70].

Alongside the algorithmic disruptive phenomena, data technologies alter not only the corpus of citizens' rights but also the way in which cities conceive and deliver public policy and services to protect these rights [71]. This digital transformation pervasively encompasses all angles of policy experimentation in city administrations: the provision of services, the assignment of resources, the approach to solving social problems, and even the complex decision-making process are increasingly shifting to software algorithms and evolving toward considering citizens as merely data-providers rather than decision-makers [67,72]. This transformational process, stemming from a 'black-boxed' algorithmic momentum, is often perceived as a mechanism that increases the efficiency of existing approaches or as simply a process of policy adjustment [73]. However, further policy experimentation

and advocacy stemming from social innovation and institutional innovation seem to be necessary in light of the current demands from city administrations worldwide (Figure 1).

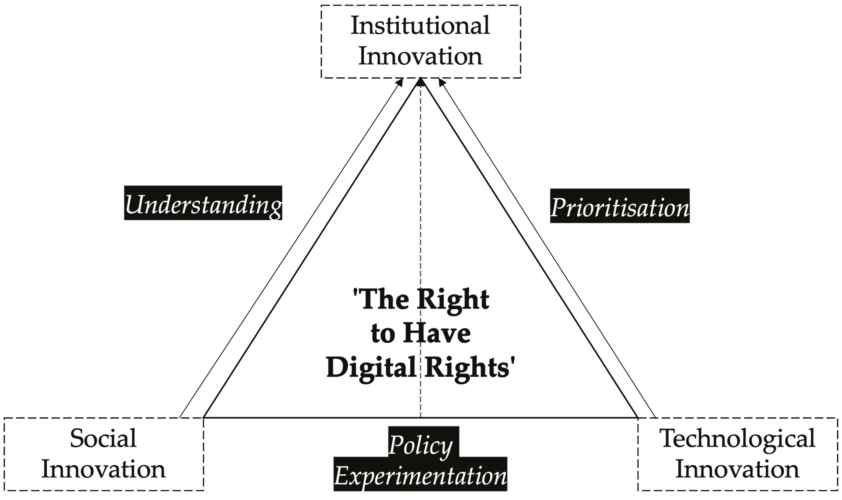

Figure 1. Social, institutional, and technological innovations: Policy experimentations to explore understanding and prioritisation of digital rights.

A direct outcome of this policy advocacy was the Declaration of the Cities' Coalition for Digital Rights [74] manifesto, which was translated into data policy by building networked data infrastructures and institutions alongside policy recommendations for 'people-centered smart cities' [75]. The CCDR, an international alliance of global, people-centered smart cities, was formed in 2018 by the Barcelona, Amsterdam, and New York City (NYC) city councils to promote citizens' digital rights on a global scale. This broad movement has gradually expanded under the leadership of Barcelona, Amsterdam, and NYC [76]. Today, the movement comprises an additional 46 cities—including Athens, Balikesir, Berlin, Bordeaux, Bratislava, Cluj-Napoca, Dublin, Glasgow, Grenoble, Helsinki, La Coruña, Leeds, Leipzig, Liverpool, London, Lyon, Milan, Moscow, Munich, Nice, Porto, Rennes Metropole, Roma, Stockholm, Tirana, Turin, Utrecht, Vienna, and Zaragoza in Europe; Amman in the Middle East; and Atlanta, Austin, Cary, Chicago, Guadalajara, Kansas City, Long Beach, Los Angeles, Montreal, Philadelphia, Portland, San Antonio, San José, Sao Paulo, and Toronto in the Americas; and Sydney in Australia.

Hence, this article aims to explore what 'the right to have digital rights' may currently mean in a sample consisting of 13 CCDR global people-centered smart cities' strategic formulation (Barcelona, Amsterdam, NYC, Long Beach, Toronto, Porto, London, Vienna, Milan, LA, Portland, San Antonio, and Glasgow) by analysing (i) the understanding of digital rights and (ii) the degree of priority of the several digital rights.

Consequently, the research question of this article is: How are 13 CCDR global people-centered smart cities implementing their city strategies advocating digital rights? The article focused on two digital rights-related factors: (i) the understanding and (ii) the prioritisation of digital rights. In response to this research question, this article provides preliminary findings and an overview through an exploratory and progressive action research process carried out via online fieldwork research by collecting specifically responses and strategic formulations around digital rights from 13 CCDR city representatives/strategists on 18 November 2020. Data collection was articulated through a semi-structured questionnaire consisting of 11 questions (7 closed-ended questions and 4 open-ended questions; Appendix A) resulting in a comparative, exploratory, and in-depth examination of the two digital rights-related factors. Specifically, the 13 responses and strategic formulations from

the city representatives/strategists were collected directly during the General Assembly of the CCDR on 18 November 2020 at the Smart City Expo World Congress 2020 (SCEWC2020) in a session accurately tailored for data collection that was called the 'Survey Filling Party'. The way in which this exploratory and progressive action research was conducted through an iterative and cyclic design, will be broadly explained in the Section 3 of this article entitled 'Methods: Progressive and Exploratory Action Research Process'.

The article is structured as follows: (i) in the Section 2, a literature review about digital rights is presented; (ii) in the Section 3, the methods through an exploratory and progressive action research via online fieldwork research are presented including their rationale, research design, and sample; (iii) in the Section 4, results and preliminary findings of this action research around CCDR will be presented and discussed; and finally (iv), the article concludes with several final remarks and future research avenues in relation to digital rights as new modes of urban governance for city administrations.

2. Literature Review: Digital Rights

Over the last decade, the increasing propagation of sensors and data collection machines in so-called 'smart cities' by both the public and the private sector has created democratic challenges around AI, surveillance capitalism, and protecting citizens' digital rights to privacy and ownership [4,72,77–79]. The demise of democracy is clearly already one of the largest policy challenges in the post-COVID-19 hyperconnected and highly viralised societies for global 'people-centered smart cities' [80]. There is no question that the political and regulatory choices related to digital technologies in the so-called smart cities raise a variety of human rights concerns, ranging from freedom of expression to access, privacy, and other political and ethical questions. Invasions of privacy, increasing dataveillance, and digital-by-default commercial and civic transactions are clearly eroding the democratic sphere by undermining citizens' perception of their digital rights [81].

Against this backdrop, the concept of the smart city, having been highly contested from a critical academic standpoint stemming from social innovation [82–84] was recently reframed and coined by the UN-Habitat program as 'people-centered smart cities' [4,6,8]. The new categorisation creates not only an urban paradigm for the Global North but also for the Global South by decolonising the urban standpoint [85–87]. The use of the term 'people-centered smart cities' supports UN-Habitat's endeavour to back (among other city networks) the CCDR global cities, thus shaping a digital future that puts people first and helps bridge the social, digital, and data divide [7,47]. UN-Habitat's 'people-centered smart cities' definition—clearly resonating with social innovation—highlights the fact that smart cities should serve the people and improve living conditions for all. Far from being bypassed, the key aspect of this definition is the acknowledgement that national governments are overwhelmed by the complexity of digital policies, while municipalities rarely have the in-house skills to create 'people-centered smart city' projects or to execute holistic impact assessments on the agreements they sign with private companies. For UN-Habitat, digital rights are intrinsically in the core of 'people-centered smart cities' insofar as cities are in a privileged position to strategise institutional innovation and deploy digital rights-related aspects among their fellow citizens.

Recently, a range of literature about digital rights has appeared in different disciplinary perspectives [37,39,41,44,51,59,81,88] alongside a large corpus encompassing high-profile reports, institutional declarations in different supranational [56], national, regional, and global contexts as well as empirical datasets such as atlases [89] and rankings [90]. On the one hand, for several authors, algorithmic disruption has raised the question of how citizenship can be redefined through the incorporation of new digital rights related to the status of a citizen in cyberspace—access, openness, net-neutrality, digital privacy, data encryption, protection and control, digital/data/technological sovereignty [75,85,91]. On the other hand, the authors of recent declarations include not only civil society organizations but also various coalitions of states, international organisations, industry actors—framing

digital rights in terms of corporate social responsibility—as well as city coalitions such as the one examined in this article: The Cities' Coalition for Digital Rights (CCDR).

Digital rights have been rather present in academic debates over the last years particularly under the banner of 'Digital Rights Management' understood as a systematic approach to copyright protection for digital media [92]. This approach focuses on a set of access control technologies for restricting the use of proprietary hardware and copyrighted works. More recently, though, the digital rights have been understood in a complementary fashion as follows: Pangrazio and Sefton-Green argued that 'digital rights are human and legal rights that allow citizens to access, use, create, and publish digital content on devices such as computers and mobile phones, as well as in virtual spaces and communities' [81] (p. 19). Currently, digital rights are not only a set of rights in and of themselves but are also related to other human rights, particularly freedom of expression and the right to privacy in online and digital environments [93]. In practical terms, human rights can be thought of as protection against standard threats—such as oppression, deprivation, and violence—that jeopardize human interests very much related to the notion of alienation and data justice [44,85,93].

Complementing the previous approaches, according to Daskal [94] (p. 241), 'civil society organisations have been advocating digital rights aiming to construct the social-political-cultural identity of a generation who are knowledgeable, politically active, and aware of their rights in the digital age.' Daskal concluded that civil society organisations attempt through advocation of digital rights to (i) deliver accurate technological and political information, (ii) propel citizens towards participation, and (iii) sell merchandise to citizens.

Timelier though, is Kitchin's [18] suggestion that in the early response to COVID-19, there was no sufficient consideration of the consequences for civil liberties, biopolitics, or surveillance capitalism, whether the supposed benefits outweighed any commensurate negative side effects, or whether public health ambitions could be realised while protecting civil liberties.

Inevitably, in the aftermath of COVID-19, and even in a resilient quick reaction to an emergency, the response given by CCDR people-centered smart cities shows how relevant it has become for policymakers to elucidate how data are collected, by whom, for what purpose, and how they are accessed, shared, and re-used [95]. CCDR cities including Amsterdam (implementing 'Unlock Amsterdam' to check on which tech could be used to ease the lockdown process), Barcelona (opting for the extension of Telecare for elderly people living alone), Helsinki (emphasising the need to have the right data on health, social life, and the economy), NYC (distributing tablets to vulnerable and disconnected communities), and San Antonio (developing an open data hub for citizens and interested stakeholders to access updated statistical information on COVID-19 on a daily basis) are just a few examples to show the importance of claiming digital rights in pandemic times.

Digital rights capture the techno-political tension among 'subjects of rights, objectives, constraints, and governance framework' [41] (p. 312). Thus, beyond their status as existing legal obligations, digital rights can be articulated through a variety of political issues and employed by different actors for different purposes. As such, from a critical standpoint, remarkably, Karppinen and Puukko [41] criticise those current debates for failing to acknowledge that rights are not simply rules and defences against power: rights claims might often emerge from civil society, but they can also be used as vehicles of power, and structures of governance. Furthermore, these authors consider that concept of digital rights itself 'remains vague and malleable' [41] (p. 309). Nonetheless, in line with the examination of the CCDR city cases in this article from the social and institutional innovation perspective, they also argue that 'actors that take part in these initiatives and processes all contribute to a discursive exchange where the principles are crystallised and perhaps eventually institutionalised' [41] (p. 324), as is clearly the case with the CCDR.

Probably the more comprehensive contribution to the contextualisation of digital rights was made by Isin and Ruppert [88]. For them, five digital rights have emerged in cyberspace

so far: (i) expression, (ii) access, (iii) privacy, (iv) openness, and (v) innovation. Their position stems from Arendt's [32] understanding of rights in legal and not performative terms, which essentially means that there can be no human digital rights without citizenship rights: either human digital rights are the rights of those who have no digital rights or the rights of those who already have digital rights, being citizens. Thus, Isin and Ruppert [88] define a comprehensive list and definitions of five digital rights: (i) expression as blocking censorship of Internet; (ii) access as promoting universal access to fast and affordable networks; (iii) openness as keeping the Internet an open network where everyone is free to connect, communicate, write, read, watch, speak, listen, learn, create, and innovate; (iv) innovation as protecting the freedom to innovate and create without permission; and (v) privacy as protecting privacy and defending people's ability to control how their data and devices are used.

Insofar as this literature review is eminently focused on digital rights rather than smart cities, several key references on smart cities have been explicitly cited so far [28–30], Table 1 depicts several taxonomies about digital rights: first, the taxonomy by Isin and Ruppert [88]. Second, the taxonomy on the Charter of Human Rights and Principles for the Internet [86] shows a comprehensive list of 19 digital rights. Third, the taxonomy of the book Smart City Citizenship by the author of this article encompasses 14 digital rights [4]. These references by the author, like others that are illustrated [65,67,75,82,85,96], are essential to situate this article, insofar as it stems from these references. Eminently, these references build the argument of this article, and these previous works contribute to providing the necessary literature review about smart cities. Furthermore, this literature review on digital rights and its connection with smart cities should not be taken for granted in the literature about the latter. Accordingly, the fact that smart cities have been eminently portrayed as an essential technocratic term should not be bypassed. This aspect is broadly a novel turning point [4] and an approach worth pointing out in this article in light of the new smart city reframing by UN-Habitat called 'people-centered smart cities' [6,8]. Fourth, and ultimately, the operational taxonomy formulated by the CCDR [76], which encompasses five digital rights, will be the only one used from now onwards to directly serve the purpose of this article.

Table 1. Digital rights' taxonomies.

DIGITAL RIGHTS' TAXONOMIES			
Being Digital Citizens [88]	**Charter of Human Rights and Principles for the Internet [86]**	**Smart City Citizenship [4]**	**CCDR [76]**
1. Expression 2. Access 3. Openess 4. Innovation 5. Privacy	1. Right to access to the Internet (choice, inclusion, neutrality, and equality) 2. Right to nondiscrimination in Internet access, use, and governance 3. Right to liberty and security on the Internet (protection) 4. Right to development through the Internet (sustainability and development)	1. Right to be forgotten on the Internet 2. Right to be unplugged 3. Right to one's own digital legacy 4. Right to protect one's personal integrity from technology 5. Right to freedom of speech on the Internet 6. Right to one's own digital identity	1. Right to universal and equal access to the internet, and digital literacy 2. Right to privacy, data protection, and security 3. Right to transparency, accountability, and non-discrimination of data, content and algorithms 4. Right to participatory democracy, diversity, and inclusion

Table 1. *Cont.*

DIGITAL RIGHTS' TAXONOMIES			
Being Digital Citizens [88]	**Charter of Human Rights and Principles for the Internet [86]**	**Smart City Citizenship [4]**	**CCDR [76]**
1. Expression 2. Access 3. Openess 4. Innovation 5. Privacy	5. Freedom of expression and information on the Internet (freedom to protest, right to information, freedom from censorship, and freedom from hate speech) 6. Freedom of religión and belief on the Internet 7. Freedom of online assembly and association 8. Right to privacy on the Internet (anonymity, freedom from surveillance, and freedom from defamation) 9. Right to digital data protection (protection of personal data, use of personal data, and obligations of data collectors) 10. Right to education on and about the Internet 11. Right to culture and access to knowledge on the Internet 12. Rights of children and the Internet 13. Rights of people with disabilities and the Internet 14. Right to work and the Internet 15. Right to online participation in public affairs 16. Rights to consumer protection on the Internet 17. Right to health and social services on the Internet 18. Right to legal remedy and fair trial for actions involving the Internet 19. Right to appropriate social and internatioanl order for the Internet (governance, multilingualism, and pluralism)	7. Right to the transparent and responsible usage of algorithms 8. Right to have a last human oversight in expert-based decision-making processes 9. Right to have equal opportunity in the digital economy 10. Right to consumer rights in e-commerce 11. Right to hold intellectual property on the Internet 12. Right to universal access to the Internet 13. Right to impartiality on the Internet 14. Right to a secure Internet	5. Right to open and ethical digital service standards

3. Methods: Exploratory and Progressive Action Research Process

This section shows the methodological process employed by this research following action research guidelines stemming from social innovation [97]. First and foremost, it is worth defining 'action research' as an umbrella term which covers a variety of approaches to 'action-oriented' research. Action research involves researchers and participants working together to examine a problematic situation, take action to change it for the better, or simply analyse the implications of a strategic formulation. The latter option applies to this article. Based on the same idea, Reason and Bradbury define action research as 'a democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes which involves action and reflection, theory, and practice, in participation with others' [98] (p. 1). This action research process was built in collaboration with the CCDR core team from the very beginning of it, in May 2020, involving practitioners and academics.

The first wave of action research was developed in the 1940s; Kurt Lewin coined the term. The second wave followed in the 1960s and 1970s when Brazilian educator Paulo Freire developed community-based research processes. It was in the 1980s that

action research gained traction in community development and international development contexts. In the 1990s, action research gained popularity within minority world institutions and was blended with critical social sciences.

Action research combines both (i) action—the research encompasses activity and generates changes—and research—which actively engages people in the whole research process and cycle. Participants in action research are not subjects, informants, and researched people. Participation in action research varies from project to project and, at certain points of the research, by permanently questioning who participates, when, and why. Action researchers and participants can use qualitative and quantitative techniques. This point is clarifying in the context of this article insofar as the semi-structured questionnaire presents 11 questions—4 of which are opened-ended questions without any indications (Q1, Q4, Q5, and Q10), while the remaining 7 closed-ended questions offer specific options to select as answers. In light of the designed action research method of this article, this clarification is rather remarkable insofar as this exploratory and progressive action research process responded through qualitative and quantitative modes to the research question. This article seeks to answer the following research question: How are 13 CCDR global people-centered smart cities implementing their city strategies advocating digital rights? Thus, this article aims to explore, rather than simply compare, cities, and the broad and insightful phenomena of the right to have digital rights in smart cities.

Consequently, the rationale, sample, and research design through action research aimed to explore how these 13 cities were dealing with this phenomenon. The author of this article would therefore like to clarify that action research, to some extent, blurs the separation between the qualitative and the quantitative. This article assesses the strategies formulated by their key actors: the city representatives/strategists that encompass the core team of the CCDR. By no means is this article committed to presenting any survey representing the opinion of citizens or communities in the examined cities. Thus, action research as a methodology makes total sense for this purpose. The research design was followed by insights and knowledge generated through interactions between researchers and participants. However, few projects fully involve participants throughout the entire research process. Rather than theory generation, the aim of this action research was to explore how strategy was formulated by hearing directly from the main characters: city representatives/strategists.

This article argues that a less positivist approach should be followed when judging the validity of action research where social innovation processes are involved. Consequently, as the data collection step shows (the 6th methodological step of the research design), the degree of influence of city representatives/strategists in their smart city strategies is considerably high—a fact that cannot be overlooked or ruled out from the more quantitatively pure perspective. A methodological lesson of the process this article covers is that strategies of smart cities should be understood and contextualised comparatively with other cities. As the 6th methodological step of the research design shows, the 'Survey Filling Party' event that was organised for 18 November 2020, city representatives learn from each other and their responses were given in relation to how other cities were constructing their own smart city strategies. The entire process took 12 months (May 2020–2021).

In this article, social, institutional, and technological innovation are analysed through the specific lenses of digital rights. In doing so, action research challenges positivism, which focuses on knowable truths, prediction, quantification, control, and elimination of biases [99]. Actually, action research can even challenge the idea that the researcher is the expert and raise questions about how cities generated their own digital rights and smart city strategy. Another critical aspect in action research processes is the fact that research operational questions (i.e., questions of the semi-structured questionnaire in this article) can be changed and are designed or co-produced by both researchers and participants. The author of this article and the CCDR core team members were researchers, and in parallel, the CCDR core team members and the 13 city representatives/strategists were actually practitioners [99].

Action research is a cyclical, flexible, and iterative process that in this article adopts a progressive and exploratory form to better adapt to the research question. As Section 3.2 shows, this cyclical approach was undertaken through eight methodological steps from May 2020 to May 2021. It is also worth clarifying the following methodological observation: because of the uncertainty around the evolution of the pandemic, in May 2020, the research design adopted the form of online research. Since then, an entire research design following action research principles was evolved towards a new online format [100]. It goes without saying that online action research is an unexplored methodology at present, despite the fact that the proliferation of tools and software is remarkable [101]. Nevertheless, and being directly related to the topic of this article, we cannot overlook the ethical and privacy-related aspects that online action research may entail by using such a format. Not surprisingly, though, the more researchers employ the 'Zoom' platform, the more concerns that surface around privacy and ownership issues [102,103]. Stemming from this article and the action research methodology used, future research avenues may expand these methodological implications around online research or internet research [104].

Action research in socially distanced postpandemic times requires new exploratory principles, social innovations, and ethics. Furthermore, at present, action research as a method is clearly being affected by the implications of conducting qualitative research remotely and at a distance by collecting data in real-time through online modes. There is a potential for creative new approaches in order to engage with communities, policymakers, stakeholders, and participants in the context of the COVID-19 global pandemic [105]. The eight methodological steps of the action research cycle and process that will be presented under Section 3.2 were adapted to these new online synchronous forums to facilitate the participant response to the semi-structured questionnaire. It is worth considering, however, that this new modality of the online action research process tends to grapple with the following issues: (i) selection of the platform; (ii) ethics and informed consent; (iii) respondents/interviewees; (iv) and online communication including the absence of social clues; (v) data protection; (vi) trust; and (vii) privacy.

To some extent, online action research shows several advantages, as has been the case with the methodology used for this article [100–104]: (i) the improved internet access and increased use of electronic devices globally, such as with online semi-structured questionnaires; (ii) convenience and cost-effectiveness of online methods compared to in-person interviews or focus-groups, particularly when conducting research with participants over a large geographical spread; (iii) online methods that can replicate, complement, and possibly improve upon traditional methods; and (iv) for participants—as was the case during the session on 18 November 2021, called the 'Survey Filling Party'—online methods may be more attractive than in-person interviews due to convenience, efficiency, cost-effectiveness, and flexibility.

Disadvantages also exist: (i) some participants may not have access to technology, the internet, or the required skills to use the software selected; (ii) due to technical issues, online may not necessarily mean less time-consuming; (iii) there are issues with connections and time-lags in communication; (iv) the remote and detached nature of face-to-face communication online can worsen the research process; and (v) finally, there are still many open questions regarding which technologies and software should be used to collect data, given the stringent data privacy issue with participants.

As a conclusion of this methodological introduction regarding the use of online action research in the current postpandemic context, this article argues that it is not as straightforward as just transferring the same face-to-face method to an online technology and setting up for action research. In light of the methodological process conducted to carry out online action research, we must ask how this data collection process would have been different if conducted face to face. Given that the data collection process was organised as a specific slot amid the SCEWC2020 online event, we did not identify any hindrances, misalignment, or apparent bias. As Section 3.2 will present, the online action research design consisted of eight methodological steps that allowed for an iterative,

cyclical, progressive, and exploratory process to respond to the research question of this article [106].

3.1. Rationale

In 2018, the CCDR, an international alliance of global people-centered smart cities which currently encompasses 49 cities worldwide, was formed by the Barcelona, Amsterdam, and NYC city councils through a declaration to promote citizens' digital rights on a global scale.

The CCDR creates policies, tools, and resources, in keeping with the Declaration of Human Rights and the principles of the Internet, established within the framework of the UN Internet Governance Forum and in coordination with the United Nations Human Settlements Programme (UN-Habitat), the Office of the High Commissioner for Human Rights (UN Human Rights), United Cities and Local Governments (UCLG) and EUROCITIES.

The CCDR formulated its "Strategy 2020: Action Plan and Roadmap" in 2019 based on five strategies [76]: (i) to build the coalition and promote the five digital rights of the declaration; (ii) to share best practices and know-how, to learn from each other's challenges and successes; (iii) to coordinate common initiatives, actions, and joint events among member cities; (iv) to advocate for relevant international policy processes; and (v) to build communities of digital policy makers to help cities lead by example on digital rights.

Against the backdrop of COVID-19, with the increased use of technologies for contact-tracing, video conferencing, geographic mapping, and surveillance, the CCDR recently attempted to go even further in safeguarding digital rights and released a statement regarding the responsible use of technology with regard to pandemic response. While technologies could be leveraged during the pandemic crisis, the CCDR assisted governments and organisations in using them responsibly through 10 principles tied to the CCDR's core values: (i) nexus and proportionality (neither the technologies nor the data collected may be used for purposes other than those deemed strictly necessary for crisis response); (ii) impermanence (once the risk of the pandemic has decreased to insignificant levels, these technologies must no longer be used and all personal data should be deleted); (iii) consent and trust (these technologies cannot be imposed under any of coercion or reward system); (iv) privacy by design (privacy should be evaluated in the context of the real risks of re-identification or other privacy loss, especially when using highly sensitive information such as healthcare data); (v) control (where applicable, technologies should empower citizens to be stewards of their own data); (vi) openness and transparency (technologies must be developed using open technologies, data models, formats, and code, so that the code can be audited, verified and adopted by other cities and organizations, fostering transparency); (vii) responsiveness (technologies for COVID-19 should not be stand-alone measures but should draw upon the existing expertise, needs, and requirements of public health authorities and society, culture, and behaviour, if they are to be effective in combatting the pandemic); (viii) participation (the development of such technologies should consider the needs of all people and include strong feedback loops between policymakers and citizens, with opportunities for iteration); (ix) social innovation (the successful and equitable use of these technologies requires a focus on social innovation, rather than on technological innovation, when they are to be used in everyday life in our societies; and (x) fairness and inclusion (technologies must be accessible and serve all communities, assuring equal accessibility and equal treatment across communities).

Since the start of the pandemic in early 2020, the CCDR tracked and reported observations and lessons learned as various cities confronted the pandemic. Amid these initiatives, the author conducted exploratory action research by collecting data through a semi-structured questionnaire. The data collection process was conducted by gathering responses to the questionnaire from the city representatives of 13 CCDR cases during November 2020, particularly amid the General Assembly that took place on 18 November 2020, held within the policy framework of the Smart City Expo World Congress 2020

(SCEWC2020), which was employed to complete the sample. Consequently, the sample consisted of the responses provided by the 13 city representatives/strategists who were in charge of formulating the digital rights strategies in their respective cities by 18 November 2020, as the data collection day.

3.2. Research Design: Eight Methodological Steps for an Online Action Research Iterative, Cyclic, Progressive, and Exploratory Process for an Enquiry on Two Digital Rights-Related Factors

From the very beginning, the research design was elaborated in close collaboration with the CCDR core team by following action research methodological guidelines [106]. This research design thus adopted an online action research format consisting of eight methodological steps. The online action research process was designed between the author of this article and the CCDR core team as an iterative, cyclic, progressive, and exploratory process. The aim of this process was to respond to the research question of this article by looking into how 13 CCDR cities were developing and deploying their digital rights strategies around the five digital rights defined by CCDR [76]. The eight methodological steps are depicted in Figure 2:

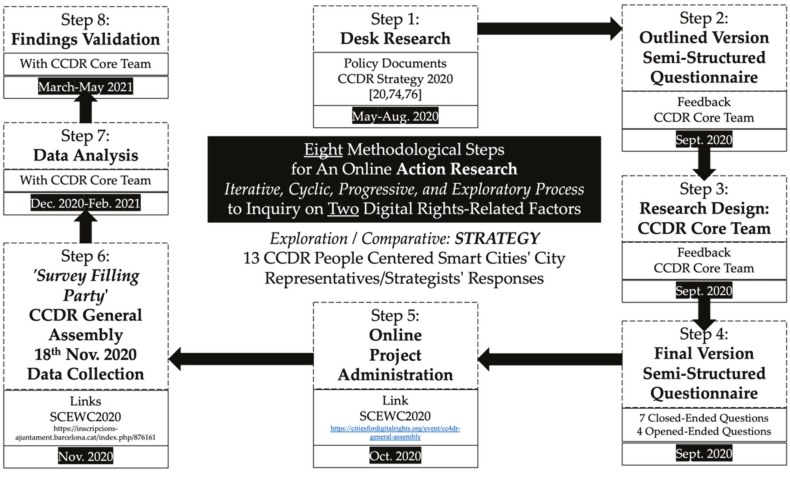

Figure 2. Eight methodological steps for an online action research iterative, cyclic, progressive, and exploratory process for an enquiry on two digital rights-related factors.

This research design based on the eight methodological steps allowed the author of this article respond to the research question insofar as the process specifically focused on the findings around two digital rights-related factors: (i) the understanding of and (ii) priority of digital rights. Below are explanations for how the semi-structured questionnaire was developed and how it was actually undertaken:

(i) In the first methodological step, desk research was conducted from May to August 2020 to analyse policy documents jointly developed by city-members of the CCDR. This policy analysis was undertaken among the CCDR core team and the author of this article.

(ii) As a result of the first methodological step, in September 2020, the second step took place: an outlined version of a semi-structured questionnaire was designed in its permanent iteration and received feedback from the core team of the CCDR.

(iii) The third step took place in September 2020, when, in collaboration with the CCDR core team, the research design was decided. Despite the fact that the beginning the format was a face-to-face interaction with each city representative/strategist of the 13 CCDR cities, the aftermath of the pandemic prevented the research design from adopting an offline format.

(iv) The fourth step was achieving the final version of the semi-structured questionnaire. Given the importance of action research principles, the questionnaire included both closed-ended and opened-ended questions. The semi-structured questionnaire was developed through this formal process. It goes without saying that previous publications from the author of this article very much contributed to elaborating some key questions of the questionnaire. In addition, the questionnaire was refined with several trial activities within Barcelona City Council. The involvement of Barcelona City Council during this process was remarkably important.

(v) The fifth step referred to the online project administration. Here, the key collaboration offered by the CCDR core team should be acknowledged. The action research process was managed entirely as an online project administration, both handing over the questionnaire to the 13 city representatives/strategists and arranging an ad hoc event for data collection. That was the next step.

(vi) The sixth step was the data collection through the event organised for 18 November 2020, entitled the 'Survey Filling Party'. This event was included as a core activity in the agenda of the CCDR General Assembly held inside the Smart City Expo World Congress 2020 (SCEWC2020). The process was straightforward, and data collection occurred without any hindrances. Given that it was a separate session inside the whole programme of SCEWC2020, the responses were recorded online in real time, which was essentially a very efficient manner for data collection. In addition, before respondents started responding to the semi-structured questionnaire, the author of this article provided some context around smart cities and digital rights but without influencing how different city representatives/strategists could have answered. Each city representative/strategist received the link to self-complete the questionnaire. The author of this article chaired the whole session by controlling the time allocated to responding and filling in the semi-structured questionnaire online. An important methodological detail was that the respondents had the opportunity to converse among themselves about the opened-ended questions (Q1, Q4, Q5, and Q10), which in itself provided insightful data. The closed-ended responses were not influenced insofar as they involved total self-completion. However, the opened-ended questions sparked interesting discussion that could be seen through the responses received. It should be specified that, from the very beginning of its foundation, the CCDR as a city-network has regularly brought city representatives/strategists together. Thus, they all could follow up on the projects, initiatives, and activities around digital rights that city-members implemented. The semi-questionnaire, by contrast, aimed to explore and focus on the strategic standpoint, probably an aspect that comparatively may have not received enough attention amid the CCDR. The session was efficient, positive, and fruitful.

(vii) Consequently, the seventh step addressed data analysis. This step, again, was undertaken in collaboration with the CCDR core team from December 2020 to February 2021.

(viii) Ultimately, the eighth step validated the findings received through the semi-structured questionnaire. The CCDR core team focuses on the two digital rights-related factors that this article explores: (i) the understanding of and (ii) the priority of digital rights.

3.3. Sample: 13 CCDR Cities' Representatives/Strategists' Responses/Criteria

Rather than analysing the different actions performed up to now by the coalition, the methodological rationale behind this article is to explore what 'the right to have digital rights' may currently mean for 13 CCDR city representatives/strategists. The semi-structured questionnaire (Appendix A)—as part of an iterative, cyclic, progressive and exploratory online action research process—was designed to operationalise the response to the research question: How are 13 CCDR global people-centered smart cities implementing their city strategies advocating digital rights? The semi-structured questionnaire was therefore the 6th step of this process. Furthermore, how CCDR global people-centered smart cities are articulating their strategies to advocate the right to have digital rights and

policies to protect citizens was also studied. In the end, this research will contribute to our understanding of how the coalition is impacting city governments in their exercise of advocating for citizens' digital rights.

To respond to the research question formulated in this article, an exploratory action research via online fieldwork research by collecting data from a sample of 13 CCDR cities' representatives/strategists was designed. The research design entirely focused on the operational approach considering five digital rights as the official standpoint of the CCDR (Table 1). The operational taxonomy formulated by the CCDR encompasses five digital rights [76]: (i) right to universal and equal access to the internet, and digital literacy, (ii) right to privacy, data protection, and security, (iii) right to transparency, accountability, and non-discrimination of data, content, and algorithms, (iv) right to participatory democracy, diversity, and inclusion, and (v) right to open and ethical digital service standards.

The selection of the sample encompassing 13 CCDR cities is justified by the fact that these 13 CCDR cities actively governed the General Assembly 2020, during which the data collection was conducted in November. The semi-structured questionnaire (Appendix A) was filled in by 13 city representatives/strategists appointed for this role by each CCDR city. Regarding response rate, consequently, all the CCDR cities attending the General Assembly filled in the semi-structured questionnaire. Thus, we could consider these 13 cities as the leading and avant-garde group of cities among the rest of the members as they were pushing strategically ahead of the whole CCDR. Figure 3 and Table 2 depict the location and provide insights, respectively, about the 13 CCDR cities in detail.

Figure 3. Sample: 13 CCDR smart cities.

Table 2 shows specifically (i) the smart city approach of each city, (ii) the name of the department, and (iii) the list of strategic projects related to digital rights from the social and institutional innovation perspectives [26].

Table 2. Description of the sample of the 13 CCDR smart cities (links accessed on 11 October 2021).

CCDR Smart City	Department	Strategic Projects related to Digital Rights https://citiesfordigitalrights.org/cities
1. Long Beach https://citiesfordigitalrights.org/city/long-beach	Technology and Innovation	• Digital inclusion and digital divide: ○ http://longbeach.gov/ti/digital-inclusion/ ○ Digital Inclusion Trailblazer • Data goveranance and privacy: ○ https://whatworkscities.bloomberg.org/ • Transparency and accountability: ○ DataLB: http://datalb.longbeach.gov/ ○ Justice Lab: http://www.longbeach.gov/iteam/priorities/justice-lab/ • Participatory democracy, diversity and inclusion: ○ Office of Equity: http://www.longbeach.gov/health/healthy-living/office-of-equity/ ○ Language Access Policy: http://www.longbeach.gov/globalassets/health/media-library/documents/healthy-living/office-of-equity/language-access-resolution-and-policy-update-2018---english
2. Toronto https://citiesfordigitalrights.org/city/toronto	Technology Services	• Improving transit reliability, speed and capacity by trying out new ideas like the King Street Pilot • Adjusting traffic signals to respond to real-time traffic patterns like the Smart Traffic Signals Pilot • Understanding your water use by day week, month, or year through the MyWater Toronto app • Making inspection results transparent for more than 15,000 restaurants on the DineSafe map • Using open data to help solve civic issues on the City's Open Data Initiative • Establishing a new role of Chief Information and Security Officer (CISO)
3. Porto https://citiesfordigitalrights.org/city/porto	Communications, Networks, and Infrastructures	• Participatory democracy, diversity, and inclusion: ○ Porto Innovation Hub ○ ScaleUp Porto programme ○ Hackacity Porto ○ Desafios Porto
4. Amsterdam https://citiesfordigitalrights.org/city/amsterdam	CTO/CIO	• DataLab: https://www.amsterdam.nl/bestuur-organisatie/organisatie/overige/datalab-amsterdam/ • OpenCity: https://www.amsterdam.nl/bestuur-organisatie/meedenken-meepraten/openstad-online/ • Decode: https://decodeproject.eu/
5. London https://citiesfordigitalrights.org/city/london	Chief Digital Officer Office	• Smarter London Together Roadmap: https://www.london.gov.uk/sites/default/files/smarter_london_together_v1.66_-_published.pdf • London Datastore: https://data.london.gov.uk/ • Crowdfund London: https://www.london.gov.uk/what-we-do/regeneration/funding-opportunities/crowdfund-london • Mayor's Civic Innovation Challenges: https://www.civicinnovation.london/ • Digital Talent Programme: https://www.london.gov.uk/what-we-do/skills-and-employment/skills-londoners/digital-talent-programme • Sharing Cities with European Cities: http://www.sharingcities.eu/ • Data Trust with the Open Data Institute: https://theodi.org/article/uks-first-data-trust-pilots-to-be-led-by-the-odi-in-partnership-with-central-and-local-government/

Table 2. *Cont.*

CCDR Smart City	Department	Strategic Projects related to Digital Rights https://citiesfordigitalrights.org/cities
5. London https://citiesfordigitalrights.org/city/london	Chief Digital Officer Office	• Smarter London Together Roadmap: https://www.london.gov.uk/sites/default/files/smarter_london_together_v1.66_-_published.pdf • London Datastore: https://data.london.gov.uk/ • Crowdfund London: https://www.london.gov.uk/what-we-do/regeneration/funding-opportunities/crowdfund-london • Mayor's Civic Innovation Challenges: https://www.civicinnovation.london/ • Digital Talent Programme: https://www.london.gov.uk/what-we-do/skills-and-employment/skills-londoners/digital-talent-programme • Sharing Cities with European Cities: http://www.sharingcities.eu/ • Data Trust with the Open Data Institute: https://theodi.org/article/uks-first-data-trust-pilots-to-be-led-by-the-odi-in-partnership-with-central-and-local-government/
6. Vienna https://citiesfordigitalrights.org/city/vienna	CIO Office	• Digital Humanism: https://www.ec.tuwien.ac.at/dighum2019 • Digital Agenda Wien: http://www.digitaleagenda.wien/
7. Milan https://citiesfordigitalrights.org/city/milan	Office of the Deputy Mayor for Digital Transformation and Services to Citizens	• Digital Folder: http://www.comune.milano.it/wps/portal/ist/it/servizi/fascicolocittadino • School-Work Alternation Program: http://www.comune.milano.it/wps/portal/ist/it/news/primopiano/archivio_dal_2012/educazione_istruzione/miur_alternanza_scuola_lavoro
8. Barcelona https://citiesfordigitalrights.org/city/barcelona [67,107]	CIO Office	• Ethical Digital Standards: https://www.barcelona.cat/digitalstandards • Decidim: https://www.decidim.barcelona/ • Barcelona Open Data portal: https://opendata-ajuntament.barcelona.cat/en/ • Decode: https://decodeproject.eu/ • Chief Data Officer
9. Los Angeles https://citiesfordigitalrights.org/city/los-angeles	Mayor's Office of Budget and Innovation	• Information Technology Agency: https://ita.lacity.org/
10. Portland https://citiesfordigitalrights.org/city/portland	Smart City PDX–Bureau of Planning	• Digital Equity Action Plan (DEAP): https://www.smartcitypdx.com/guiding-principles • City of Portland Privacy and Information Protection Principles
11. San Antonio https://citiesfordigitalrights.org/city/san-antonio	Innovation	• CivTechSA: https://www.civtech-sa.com/ • SmartSA: https://www.sanantonio.gov/smartsa
12. New York City https://citiesfordigitalrights.org/city/new-york-city	Mayor's Office of the CTO	• Cities Open Internet Pledge: https://actionnetwork.org/letters/sign-to-email-your-mayor-set-net-neutrality-protections-in-my-city • Library Privacy Week: https://libraryprivacyweek.nyc/
13. Glasgow https://citiesfordigitalrights.org/city/glasgow	Chief Executive Department	• Digital Glasgow Strategy: https://www.glasgow.gov.uk/councillorsandcommittees/viewSelectedDocument.asp?c=P62AFQDN2UUTDNUT81

4. Results and Discussion

In order to provide further rich insights about the results and findings from this primary research, the responses given by each city representative are contextualised with the description provided in Table 2.

4.1. Digital Rights' Understanding

Question 1 (Q1): Digital rights are associated mostly by all European cities with digital inclusion awareness as a direct result of the GDPR, whereas in the case of North American cities, they reflect the value of public consultations in reference to Toronto and the so-called case of Sidewalk Labs [108–110], the explicit concern about selling personal

data (Los Angeles), the claim for the universal broadband (NYC), and the relationship with broader universal rights and anti-racism (Portland).

For instance, through the open-ended response, Toronto referred to digital rights policies through the open-ended response provided as a way to 'reflect community and stakeholders input (gained through consultation), that actually are understood by residents, supported by decision-makers, and embraced through implementation by the municipality'. Toronto shows an interesting turning point through several strategic projects (e.g., the King Street Pilot, Smart Traffic Signals Pilot, MyWater Toronto app, DineSafe map, and Open Data Initiative) and the newly established role of Chief Information and Security Officer (CISO).

In a similar vein, but by contrast in Europe, Porto indicates that the city administration has appointed 'the Data Protection Officer in the early stage following the GDPR guidelines and enforcing anonymity in the citizen related data insofar as cloud ecosystems are avoided and in-house cloud independent solutions are the current practices preventing external corporate access'. Porto shows a plethora of initiatives related to participatory democracy: the Porto Innovation Hub, ScaleUp Porto Programme, Hackacity Porto, and Desafios Porto (see Table 2).

The understanding of digital rights, in both the US and in Europe, is therefore associated with privacy issues, where data are stored and which stakeholders have the access to that data. Sooner rather than later, data sovereignty will more than likely be included in the CCDR policy agenda given the responses received by city representatives/strategists [85].

Question 2 (Q2): The understanding of digital rights is very much associated with the following CCDR priority areas: The first option is clearly digital inclusion followed by privacy regulation. The priorities of open technologies and data economy were ranked equally as third and fourth options. The option less ranked by cities was the one related to accountable decision-making in AI. City representatives/strategists thus show a clear concern regarding the algorithmic disruption and the side-effects of lack of privacy in social inclusion. Digital and data divides are clearly two notions that are part of the 'people-centered smart cities' formulation as well [6,8,47].

Given the analysis of the responses received, this article interprets that AI is seemingly not yet in city administration policy agendas. Only Barcelona and Los Angeles ranked AI as a priority. However, it seems rather likely that local administrations will start including government measures for municipal algorithms and a data strategy for the ethical promotion of AI, as recently has been the case in Barcelona [111–118].

Question 3 (Q3): All the cities were actively implementing projects, with the exception of a few early members. Table 2 shows a thorough detailed description of the cities' strategic projects related to digital rights. Most of them seems to evolve from the Open Government Data approach towards data protection and digital rights. This research attempted to unpack the multistakeholder composition as a crucial factor to better infer how data ownership and flows were arranged at the city level (See Q10 and Q11).

Question 4 (Q4): Regarding the nature of projects, several cities mentioned 'big community engagement component' through 'community advisory groups' with 'volunteer residents,' whereas others are combining 'start-up ecosystems' with 'municipality citizen cards' and 'emerging technology charters' by highlighting the paradigm of 'digital humanism.' Several cities were actively launching knowledge exchange activities through workshops and festivals bringing together experts and citizens, by and large involving universities and civil society. Nonetheless, some hindrances and barriers were found also for implementing such projects: public trust, financial support, and sponsorship. Institutional innovation sometimes bumps into barriers not only inside of the city administration but also outside it [22,24,26].

Digital commons was an approach mentioned by several city representatives in relation to the way city administrations were opening their internal processes to involve residents in civic technology testing and design. That was the case in Long Beach, although there were other cases taking a gradual approach, such as Toronto: A Community Advisory

Group consisting of 25 volunteer residents that had interest in the digital infrastructure of the city prepared a broader consultation with the community. Social Innovation can thus effectively blend with technological innovation, resulting in institutional and digital innovation through digital rights (Figure 1).

Alternatively, cities like Porto show another approach: relying on a citizen card as a basic form to nurture digital citizens. Another example is Amsterdam, which has been working with an AI register, creating a local permit for sensors, launching a document on digital rights aimed at citizens, and broadly coordinating with the national government, acting as its flagship testbed. London was developing its 'Emerging Technology Charter', which was outlining what the city administration expected emerging technologists could contribute to the city. Vienna launched a new brand called 'digital humanism' by developing dissemination activities. Milan launched 'Citizen Voices Citizen for Digital Rights', which is a program of workshops with experts and citizens. Barcelona City Council in collaboration with Xnet, has established an 'Ecosystem for Digital Rights' as a repository of 46 initiatives stemming from civil society.

Question 5 (Q5): Ultimately, regarding specific contextual issues, the city of Toronto acknowledges that 'the Sidewalk Labs smart city proposal on Toronto's waterfront certainly put a spotlight on these issues' and added that 'it gained significant media attention, which helped raise awareness of the importance of digital rights amongst residents and decision-makers.' As such, this testimony by the city representative of Toronto makes an extremely relevant point regarding the failure of the surveillance capitalism in favour of the active claim to the 'right to have digital rights' [108–110]. It is probable that future research on the nexus between digital rights and smart cities might need to provide in-depth ethnographic analysis by including multi-stakeholder framework mapping as a way to provide further insights about the real options around institutional innovation [95,96].

However, institutional innovation probably requires going beyond the institutional barriers. Whereas Porto, by focusing on the internal context of the city administration, identified the local authority's 'workers as a point to start bringing knowledge and a better understanding of digital rights'; Portland shows an entirely different direction by focusing on the external context of the city administration: 'Portland is looking at digital rights from an anti-racism and universal perspective. We are working on a legal framework around the concept of Digital Justice. By using the term "citizenship" in the US, many groups are automatically disenfranchised, particularly immigrants and indigenous communities (Native Americans). We intentionally avoid using citizens and instead we focus on universal rights.'

COVID-19 was another contextual factor that was a relatively common pattern. According to San Antonio's city representative/strategist, the 'pandemic has elevated the importance of digital inclusion for distance learning'. The same representative/strategist later added, 'since the most of our services must be virtual during the pandemic, specific attention is being paid to the digital divide'.

4.2. Digital Rights' Prioritisation

Question 6 (Q6): When it comes to prioritising the five digital rights that CCDR focuses on, disparities surfaced among cities. Despite the fact that (i) the universal and equal access to the Internet and digital literacy overall were ranked in the first position; Long Beach and Porto prioritised in second position at a similar level, (ii) open and ethical digital service standards and (iii) privacy, data protection, and security; (iv) participatory democracy, diversity, and inclusion were equally prioritised in second position by cities including Toronto, Vienna, Milan, Barcelona, and NYC. Ultimately, cities put (v) transparency, accountability, and non-discrimination of data, content, and algorithms as the final option. This result shows the clear existing alignment between UN-Habitat's people-centered smart city emerging approach and the CCDR advocacy in terms of the substantial importance about digital divide and literacy. Again, algorithmic transparency very much related to AI seemed to not yet be a priority given that city representatives/strategists were pretty much

consistent with the response provided in Q2 (in relation to the lowest rank for the option 'Accountable decision-making in AI').

Questions 7 and 8 (Q7/Q8): At present, all CCDR cities are embedding the formulation of digital rights in projects, initiatives, and internal dynamics. Table 2 provides a clear indication of the active approaches of the 13 CCDR cities. That shows a strategic intention being part of the CCDR but also equally shows that there are different strategic pathways to activate initiatives at the city level. The strategic implementations of these digital rights rely on the multistakeholder composition in each city [95,96]. These projects, initiatives, and internal dynamics are extremely different from city to city and demonstrate that changing the technopolitical awareness through social innovation is not essentially a matter related to altering digital infrastructures. As the literature review on digital rights and smart cities elucidates, a policy experimentation as the joint attempt that the CCDR, as a global city-network, is trying to implement will require changes in the way technological innovation relates to data ecosystems in cities [75].

Question 9 (Q9): Regarding the expectations of the cities to achieve strategic implementation of digital rights, Amsterdam, Vienna, San Antonio, and Glasgow had 'high' hopes of reaching completion, whereas the rest showed 'medium' hopes. Not surprisingly, and being entirely realistic, none of the cities expect 'full' or 'low' or even 'no' evolution of their implementations.

Question 10 (Q10): When asking about the most critical stakeholder to achieve more protection for digital rights, the responses given by city representatives/strategists significantly vary, even the context particularising in-depth and acknowledging that local contextual conditions matter [95,96]. We could group the responses as follows: (i) several cities, including Long Beach, Toronto, NYC, London, Los Angeles, and San Antonio, responded 'residents and community-based organizations'; (ii) others, such as Milan and Barcelona clearly indicated 'private tech companies providing public services'; finally, (iii) cities like Porto mentioned 'specific research groups from the academia,' Amsterdam mentioned the 'Waag Society as the key strategic partner,' and Portland and Glasgow cited current 'political leaders.'

Toronto, being again a paradigmatic case due to the so-called case of Sidewalk Labs, indicated that the most critical stakeholders were undoubtedly communities and residents. Given the opened-ended questions asked, the progressive and exploratory action research process provided the following rich insights. The reason given by Toronto's city representative/strategist was because 'successful policy and strategic formulation requires active community engagement and consultation'. The Toronto city representative/strategist added later that 'residents must first understand these complex issues, before they can actively provide their input. Residents must then be able to see their input reflected in the output of this process through policy formulation. If they do not, then the process will fail in two ways: First, it will not reflect the position of the community, and subsequently, is unlikely to be supported by decision-makers'.

However, London provided an interesting response insofar as citizens can be reached if city administrations are necessarily devolved, which means that data devolution [4] should be ensured to deliver digital services to citizens. Thus, even if the most critical stakeholders are citizens, the way to reach these citizens through multi-level governance and data devolution is similarly critical. According to the city representative/strategist of London, 'The most critical stakeholder accessing our citizens are the 33 London boroughs that are within the area administered by Greater London Authority. These 33 boroughs deliver services directly to citizens and collect their data, so they are extremely relevant intermediaries to the protection of digital rights'. This response shows the importance of having a democratic ecosystem to strike a balance between data governance and ownership.

Multi-stakeholder framework compositions vary significantly from city to city by showing distinct strategies regarding the priority given to each stakeholder group [96]. However, this article interprets that common policy patterns arose insofar as all the cities considered a wide multi-stakeholder policy framework beyond the so-called and hege-

monic private-public-partnership (PPP), which in itself shows a socially innovative institutional and strategic mindset in CCDR cities.

Question 11 (Q11): Hence, as the final question examining multi-stakeholder composition following the Penta Helix framework in each city in terms of which stakeholder group creates or supports the existing ecosystems for digital rights protection, the general ranking shows a clear picture in favour of public institutions, followed by civil society (civil groups, associations, and NGOs) showing an active civilian fabric in all CCDR cities [96]. In second and third positions are ranked these groups, respectively: on the one hand, academia and research centres, and on the other hand, social entrepreneurs, urban activists, and change-makers. Not surprisingly, private companies are less likely to be supportive stakeholder groups in all cities, being in the last position of the given options. Nonetheless, remarkably, there are nuanced distinctions from case to case by showing this trend: Whereas Amsterdam, London, Milan, Portland, and Glasgow favoured public institutions, San Antonio and NYC gave high rankings to academia and research centres. Porto ranked social entrepreneurs, urban activists, and change-makers in the highest position.

The Penta Helix policy framework has been proven to be a dynamic way to map out stakeholders in city ecosystems [96]. The different responses provided by each city representative/strategist may show how the strategic route towards digital rights in each city is clearly reliant on the interplay among stakeholders and their intrinsic power to influence and mobilise resources and agencies.

5. Conclusions

COVID-19 has been a trigger for accelerating the side effects of digital transformations on the daily operations of people-centered smart cities and by directly affecting citizens' awareness of their right to claim their digital rights [32].

From an urban perspective, 13 CCDR cities showed that a multistakeholder approach is necessary to deal with datafication processes in smart cities to avoid the hubris of large digital corporations when it comes to engaging with people, cities, and real life. The advocacy of digital rights essentially resonates not only with the need to understand the idiosyncrasies of urban development but also with the nitty-gritty details of the technopolitics of data governance models in each place [4,119,120]. Striking cases such as Sidewalk Labs in Toronto have been at the forefront of such technopolitical debates that CCDR are trying to deal with at the global level and in a collaborative manner through its city-network [121]. The longer-term consequences of COVID-19 could also contribute to an erosion of the tech ecosystem that Big Tech corporations usually depend on. As Zukin argues, city administrations pushing ahead institutional innovation demands 'a mayor and a city council united behind a muscular strategy of economic development, environmental adaptation, and business regulation that no one has yet imagined.' [122] (p. 27).

The main contribution of this article is threefold: methodological, empirical, and conceptual, respectively. First, it uses exploratory and progressive action research in collaboration with the CCDR core team to obtain rich and unexplored insights directly by asking 13 CCDR city representatives/strategists. As a result of this, second, preliminary empirical findings revealed not only distinct strategic routes and pathways but also common policy patterns in order to implement digital rights projects and initiatives among CCDR cities. Consequently, third, this article conceptually renovates the technocratic and hegemonic discourse around smart cities by using real cases from 13 global smart cities that belong to the CCDR city-network. As such, this article argues that the understanding and prioritisation of digital rights in these 13 cases will probably lead by clearly influencing other cities and urban areas through a new strategic and policy formulation around smart cities worldwide. These three inputs altogether represent an essential, novel, and original research articulation to contribute to the academic literature in the following knowledge domains and fields: smart cities, digital rights, and action research.

This article, unlike other papers in the past, contributes to the literature by: (i) adding the direct and explicit testimony of city representatives/strategists in their attempt to formu-

late stringent and timely strategies to cope with digital-rights related issues; (ii) blending digital rights and smart cities through a new version advocated by UN-Habitat called 'people-centered smart cities'; (iii) exploring what digital rights may mean in practical terms for city representatives/strategists; (iv) unpacking strategic formulations related to digital rights; and (v) comparing 13 global cities in a way the findings reveal different strategies through common policy patterns.

This exploratory and progressive action research aimed to gather evidence of how the 13 examined CCDR cities were implementing their city strategies advocating digital rights [105,106,111,120]. City governments in these cities have demonstrated an active position in experimenting and pursuing the right to have rights for their fellow citizens by spurring their five strategic digital rights: (i) the right to equal and universal access to the Internet (digital literacy), (ii) the right to privacy, data protection, and security; (iii) the right to transparency, accountability, and non-discrimination in data, content, and algorithms; (iv) the right to participatory democracy, diversity, and inclusion; and (v) the right to open and ethical digital service standards.

To respond to the research question, this article took an exploratory and progressive action research approach to examining how Barcelona, Amsterdam, NYC, Long Beach, Toronto, Porto, London, Vienna, Milan, Los Angeles, Portland, San Antonio, and Glasgow are implementing their digital rights strategies and policies by acknowledging that these cities conceive and deliver these public policies and services to protect their fellow citizens' digital rights. Policy experimentation and institutional innovation though occurs in a distinct manner through a different set of strategies and priorities. Thus, this article concludes that contextual factors and the stakeholders' composition dimension in each city determine by and large the priority given to each digital right. Furthermore, we could argue that there is no one route for advocating digital rights in smart cities from the institutional innovation perspective. However, it has been demonstrated that several alliances among stakeholders may work better than others. The attempt of the new brand people-centered smart cities coined by UN-Habitat is a step forward in this forward-looking view from the social innovation perspective.

The main conclusion of this research is twofold.

First, the semi-structured questionnaire provided a rich diverse set of initiatives and projects in each city, which offer great potential as global influencers of other cities beyond the CCDR network [121]. Additionally, second, despite this broad and remarkable set of diversity in the implementations, this article found common policy patterns among them. Consequently, we can elucidate them as final remarks:

First, the understanding of digital rights was very much related to digital inclusion with a strong community engagement component but equally challenged by the lack of public and financial support. Furthermore, this understanding could be seen as a direct response to the excesses of surveillance capitalism (particularly among the U.S. cities belonging to the CCDR) and as active claims to 'the right to have digital rights' by fellow citizens. This conclusion is remarkable and novel by contrasting with the current literature on comparative research on smart cities insofar as digital rights-related aspects are clearly overlooked [123–129]. Primary research showed the post-GDPR influence in cities such as Porto, Amsterdam, London, Vienna, Milan, Barcelona, and Glasgow. Unlike previous research and publications that focused on benchmarking factors [130,131], this article directly approached city representatives/strategists by asking them to unfold their understanding around digital rights. Insofar as previous research revealed the need for enlarging the ecosystem of e-services in city administration to include citizens, the third sector, entrepreneurs, and activists; this article, by using recent research on Penta Helix model [96], not only included these stakeholders in the semi-structured questionnaire but also explored digital rights through these multistakeholder lenses. This article also elucidated the fact that despite the fact AI is not explicitly considered in city strategies yet, it is a matter of time. Barcelona as the CCDR leading city is paving the way in this direction [111].

Consequently, and second, the most prioritised digital right among the cities was the universal and equal access to the Internet and digital literacy, despite the fact that the identification of the most critical stakeholders in a city varied considerably, although 'residents and community-based organizations' were seen in several U.S. cities as a common pattern. Equally, CCDR cities overall depict an active civilian fabric that creates and supports the existing ecosystems for digital rights protection encompassing public institutions and civil groups, associations, and NGOs, both jointly advocating 'the right to have digital rights' as a vehicle for change and experimentation in digital policies from the social innovation perspective [24–26,31,58,120]. Primary research showed that there is an increasing concern around the way city administrations need to approach residents. Unlike previous research, this article may open a new manner to consider multistakeholder policy schemes from the digital rights perspective. In the interplay among stakeholders there are opportunities to nurture new data governance models such as data co-operatives. By providing empirical rich insights, the novel contribution of this article is to show how 13 global smart cities by leading a global movement in favour of digital rights from city administrations are more than willing to experiment with new technopolitical routes stemming from data sovereignty, to allow data devolution, to subvert data colonialism, and to foster data justice [85]. Overall, and against the post-COVID-19 backdrop, the rich insights of this article could be summarised with this statement: the advocacy of digital rights in city administrations worldwide may not represent any longer an option but a necessity given the unprecedented nature of the postpandemic algorithmic disruption embodied through surveillance capitalism and social credit systems' stringent human behavioural patterns.

This research, being exploratory by nature, was not meant to provide a full explanation on digital rights, but instead it contributes to opening new future and critical avenues in the techno-political research on comparative smart cities studies in relation to institutional, social, and technological innovations [22–26,121]. It shows that achieving institutional innovation by city administrations will inevitably require an understanding and prioritisation of an increasing set of digital rights as those established and implemented by the CCDR and advocated by UN-Habitat directly through the new brand 'people-centered smart cities' [6,8].

This article also may acknowledge a methodological limitation too. The sample consisting of 13 city representatives/strategists' criteria and responses could be seem as a limitation in itself. However, as clearly indicated throughout this article, the methodology carried out was action research consisting of eight methodological steps as shown in Figure 2. The semi-structured questionnaire provided a comprehensive and comparative standpoint around different strategies being implemented in 13 CCDR cities in November 2020. The validity and representativeness of such methods has been highly demonstrated in the methodological literature in social sciences [105,106]. However, this article equally acknowledges that this research should be completed with deeper investigations in the future to prove these conclusions. Thus, the validity of this method remains extremely crucial for further research in the field of digital rights and smart cities.

Regarding future research avenues, in the aftermath of COVID-19 and the algorithmic disruptive era in smart cites, new models of urban governance for city administration should pay further attention to digital rights as one of the key factors for sustainable urban development. It goes without saying that pandemic and algorithmic crises are two sides of the same coin with clear consequences for the sustainability of the urban living and citizens' digital rights. Stemming from and inspired by the CCDR smart city cases, future research could clearly evolve towards how these institutional reactions in city administrations around digital rights are taking place in different locations worldwide.

Against the backdrop of this Special Issue called 'Social Innovation in Sustainable Urban Development', several questions remain unanswered for future research in social, technological, and institutional innovation: (i) What are, in fact, the technopolitical arrangements being made between city administrations and Big Tech corporations [38]? (ii) What do these technopolitical arrangements look like and how does each side understand their

role in relation to the Penta Helix policy framework [96]? (iii) What power asymmetries and incongruences exist alone therein? and ultimately, (iv) what modes of communication are happening at the urban planning level?

To sum up, the people-centered smart cities approach, as demonstrated by the 13 CCDR cities, will elucidate a strategic pathway in which institutional innovation, exacerbated now in the postpandemic era, will include locally rooted understanding and prioritisation of digital rights. To sum up, this article has paid particular attention to the way digital rights discourse has been already embedded in the institutional digital strategies of 13 CCDR cities. The author hopes that this exploratory action research will invite additional research on social, institutional, and technological innovation studies and spark a debate about the need to include digital rights in the strategic and operational sustainable formulations of smart cities worldwide [132–135].

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Appendix A. Semi-Structured Questionnaire to Gather 13 CCDR Smart City Representatives/Strategists' Responses (November 2020)

1. CHARACTERISATION

Q0. Could you please provide the details to the following questions?

- City:
- Department:

2. UNDERSTANDING OF DIGITAL RIGHTS IN YOUR CITY:

Q1. Which is the most important priority of your city regarding digital rights? (Max 50 words).

Q2. From 1 to 5, being 1 low and 5 high, how could you rank each of the following five actions among the CCDR priority areas for your city?

a. Privacy regulation
b. Accountable decision-making in AI
c. Open technologies
d. Digital inclusion
e. Data-Economy

Q3. Is your city actively working on to raise citizens awareness on the need to protect their digital rights?

a. Yes, we already have projects
b. No
c. I do not know

Q4. If yes, how? What actions are being implemented by your public authority to raise awareness on the need for protecting digital rights? If no, are there any particular barriers that you would like to highlight? (Max 50 words)?

Q5. Is there any specific contextual aspect that could leverage the relevance of digital rights in your city? Which one? (Max 50 words).

3. PRIORITY OF DIGITAL RIGHTS IN YOUR CITY:

Q6. From 1 to 5, being 1 low and 5 high, please rank each of the following five digital rights for your city?

a. Universal and equal access to the internet, and digital literacy
b. Privacy, data protection and security
c. Transparency, accountability, and non-discrimination of data, content and algorithms
d. Participatory democracy, diversity, and inclusion
e. Open and ethical digital service standards

Q7. Are you embedding the formulation of digital rights in ongoing initiatives or projects?

a. Yes
b. No
c. I do not know

Q8. Are you embedding the formulation of digital rights in internal dynamics?

a. Yes
b. No
c. I do not know

Q9. How do you think the strategic implementation of these digital rights will evolve in your city in a year time? (Choose one). We expect to achieve:

a. Full
b. High
c. Medium
d. Low
e. No

Q10. Who is the most critical stakeholder in your city (other than the municipality) to achieve more protection for digital rights and why? (Mention just one please and answer why it is the most critical Max 50 words).

Q11. Could you rank the way stakeholders in your city create or support the existing ecosystem for Digital Rights protection (seeing from the Penta Helix framework) [95]. How would you rank the following stakeholder groups-helixes (being 1 low relevancy and 5 high relevance).

a. Public institutions
b. Private companies
c. Academia and research centres
d. Civil societies (civil groups, associations, NGOs . . .)
e. Social entrepreneurs, urban activists, and change-makers

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Commoning Adaptive Heritage Reuse as a Driver of Social Innovation: Naples and the Scugnizzo Liberato Case Study

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Abstract: The adaptive reuse of cultural heritage assets is often problematic. What emerges is the urgency of a thoughtful negotiation between built forms and emerging needs and requests. In this view, a fruitful trajectory of development arises in commoning heritage by means of adaptive reuse. Hence, the purpose of this article is to investigate how community-led adaptive heritage re-use practices contribute to social innovation in terms of new successful model of urban governance, by providing a specific focus on innovative aspects that emerge in both heritage and planning sectors. Therefore, it also aims to improve the knowledge in the innovative power of heritage when conceptualized as performative practice. To this end, the paper presents the adaptation process of a former church complex located in Naples, today *Scugnizzo Liberato*, one of the bottom-up initiatives recognized by the Municipality of Naples as part of the urban commons network of the city. The research results are based on desk research, a literature review, and interviews with experts and activists, conducted as part of the OpenHeritage project (Horizon 2020). Initial evidence shows that profound citizen involvement throughout the whole heritage-making process might generate innovative perspectives in urban governance as well as conservation planning practice.

Keywords: cultural heritage; adaptive reuse; commons; social innovation; urban planning and policy; conservation

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1. Introduction

The importance of the re-conceptualization of cultural heritage as a common good is solidly affirmed in the *European quality principles for EU-funded interventions with potential impact upon cultural heritage*, issued by ICOMOS in 2020 [1]. According to the document, this is a necessary precondition for advancing quality principles in EU-funded heritage conservation and management. As recalled in the Davos Declaration [2], the common good is also the main objective of transformation processes based on culture. By focusing on quality, what these policy documents share is the orientation towards a humanization of the built environment, often advocating for a different kind of ownership as much as the activation of new social constructions [3]. In this context, the role of communities in cultural heritage is increasingly recognized and fostered by the European commission. The Faro Convention on the Value of Cultural Heritage for Society ignites a revolution in the heritage field by placing on people the right and duty to actively recognize, participate in and benefit from heritage assets, opening up new patterns of social change and resilience [4]. Thereby, the broadening in nature and categories of what resources merit conservation has induced innovations (and complexification) in heritage planning also expanding the ways in which heritage is reckoned, managed and cared for [5].

Heritage is thus increasingly conceived (and valued) as a process. Beyond heritage objects and its representational values, van Knippenberg et al. argue [6] that the complexity of a co-evolutionary heritage approach is "more about identity, practices and immaterial aspects" (p. 12), shedding light on the interrelatedness and relatedness of urban components such as material/immaterial assets, local community and spatial development. In the redefinition of the heritage concept, the centrality of performative practices thus resonates in larger territorial aspects, making heritage regeneration work for or against displacement,

gentrification and inequalities. Hence, Smith draws on the policy of recognition to take a step forward towards the rejection of heritage meanings and discourse dominated by experts' assumptions and narratives, known as the Authorized Heritage Discourse (AHD) [7]. Assuming that heritage "is not simply a 'thing, place or site', but . . . [an] affective process and activity" [8] (p. 48) of knowledge and meaning-making, the implication of heritage in the policy of recognition becomes self-evident due to the process of assessment, negotiation and legitimation of the identities it underpins. From this viewpoint, heritage is a resource implicated in the struggles over recogni tion, redistribution and restorative justice.

It needs to be noted that the emotional reconnection between people and (historic) places, which generally drives grassroots movements against the privatization of the commons, plays a pivotal role [9] by shining light on the ways heritage affectivities can encompass political and ecological concerns [10,11]. In other words, valuing that aspects of proximity, largely recalled and reclaimed throughout the COVID-19 pandemic, are not only physical or local but are also interlinked with people's more intimate subjectivity. Inscribed within the framework of the commons, cultural heritage is thus reclaimed as a shared resource, aligning with a more democratic and critical conception of current heritage [12]. Although the correspondence between the performative nature of heritage and commons principles is straightforward, the connection of the two fields has received little attention. Whilst great emphasis has been given to legal and real estate experiments based on the commons [13], less is said about their innovative contribution in the realization of heritage, as well as its integration with the planning sector.

In this context, adaptive reuse has gained a considerable political momentum due to a more comprehensive capacity to tackle and integrate economic and social aspects of heritage. Dealing with multiple temporalities, adaptive approaches allow for more collaborative, neighborly stances, favoring the generation of relational values [14] but also of "opportunity" spaces for catalytic change [15]. Thereby, it contributes to create the conditions for social innovation, an under-researched area of studies in the heritage sector that, conversely, is more often understood as opposed to innovation and creativity [16].

From an ecological point of view, instead, heritage practices of reuse meet needs of waste reduction (*responsible consumption and production*, SDG 12), while their alignment to circular paradigms gives way to human-centered perspectives based on symbiotic, autopoietic and generative capacities [17,18]. According to Girard, these characteristics lie in the co-evolutions of both people and heritage through a continuous and non-linear process of adaptation-transformation, inducing mostly innovations in terms of heritage management [18]. Being adaptive, thus, not only denotes flexibility in terms of spaces, behaviors and uses, but it also embraces a process of value creation and enhancement that starts by *acting-from-within* people and places. The unfolding of this process thus entails a reflexive rationality for cultural heritage management that demands a shift in terms of values and aesthetics. For the sake of community involvement, a vernacular approach is increasingly recognized as possessing a heritage value [19]. From this viewpoint, the imperfect, decaying narratives of spontaneous interventions thus contribute to open conservation towards processes of amnesia and loss, deemed essential for dealing with contemporary realities [20,21].

Perhaps not surprisingly, building regulations and codes are recognized as being among the main barriers to creating heritage adaptive re-use [22,23]. Despite the degree of national secularization, the reuse project of European religious assets such as churches shows extremes and contradictions which lie under the ideal of "heritage as a resource" when it comes to dealing with strong values, identities and powers [24–26]. For the spatial, social and economic function of these assets to be re-evocated, re-signified or re-activated, an open and multidisciplinary approach is therefore required. Undoubtedly, this is a precondition to deal not only with conservation of heritage objects but also with those adjustments that will occur overt time [27,28]. On the other hand, it is acknowledged that bureaucratic and commercial dynamics play an increasingly important role in the enclosure of common spaces (and thus heritage spaces conceptualized within this framework), re-

ducing, discouraging or disregarding spontaneous forms of participation [29]. An attitude that all too often tends to be overshadowed or absorbed by capitalism, making informal lifestyle works for neoliberal purposes and eventually lining up with the production of new inequalities [30].

Although community involvement can easily become tokenistic, I argue that the implementation of common-oriented practices on heritage assets allow dominant heritage paradigms to be overcome, innovating the sector and reinforcing its integration in sustainable development. Drawing on commons and heritage studies and intersecting them with the reuse process, these argumentations thus define a conceptual framework that bridges commons and heritage fields in accordance with specific characteristics (Figure 1).

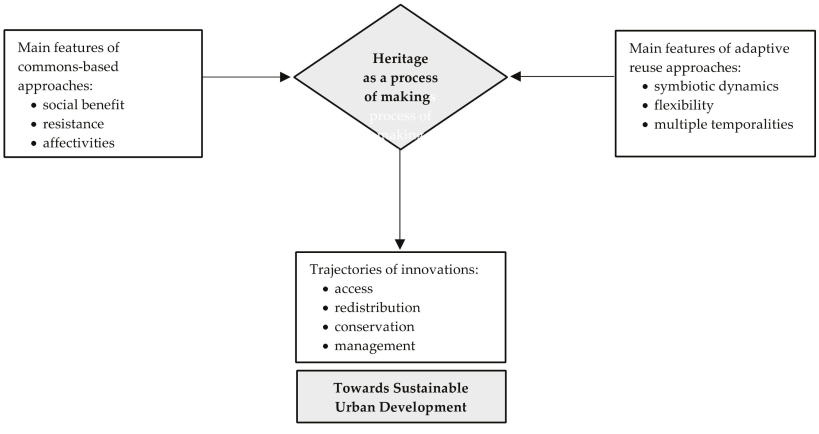

Figure 1. Synthetic view of the main characteristics extracted from the literature review.

To this end, the article presents a specific focus on the Italian context. Advancing a mounting number of experimentations grouped under the umbrella of the commons, it indeed seems to offer a particularly rich scenario. In the last decades, the rapidly growing number of community-led initiatives along with the growing abandonment of urban (public and private) stock have gained interest both from scholars and public institutions, while also fostering a copious body of research [31,32]. Whilst over past centuries, asset disposal often prevailed (and in many cases still does), in recent years, public administrations have started to invert this trend by experimenting with new enhancement strategies of their assets based on civic engagement. Public properties are entrusted to parties capable of social innovation [33,34]. In doing so, it can be affirmed that the re-conceptualization of urban commons has provided a theoretical and operational framework [35] within which administrative innovations have emerged, mainly at a local but also at a national level (see for instance art. 24 and 26 L. 164/2014 *Unblock Italy Decree*). When it comes to cultural heritage, though, collaborative reuse processes are particularly problematic and the link between this sector and innovation tends to be overshadowed.

Considering the Italian scenario, commoning heritage by means of adaptive reuse has offered the opportunity to test more open trajectories of development by inducing institutional innovations in both heritage management and planning. However, while civic uses have received much recognition from the legal-administrative viewpoint, less is said regarding their innovative contribution in heritage and planning as well as in the integration of these two fields. To shed light on these issues, the research questions that guide this study thus regards motivations, tools, methods and trajectories of development of one of the commons-based initiatives acknowledged by the Municipality of Naples as part of the urban commons network of the city, today known as Scugnizzo Liberato (SL). By showing an innovative approach to cultural heritage as a vector for both urban

regeneration and social innovation, the case study is part of the OpenHeritage research project (Horizon 2020).

The purpose of this article is primarily to illustrate how commoning practices contribute to social innovation in terms of new successful modes and regulations of city governance and planning and how this might impact on (cultural) heritage management. This thus serves to elucidate how commoning experiences contribute to reorienting the Italian conservation practice towards a more relational notion of cultural heritage. On the other hand, the article aims to improve the knowledge in the innovative power of heritage when conceptualized as performative process. The paper thus highlights potential ways of operationalizing power distribution by means of co-management; the materiality this approach implicates when it comes to integrate social benefit and heritage conservation; and the areas of possible upscaling of innovative local processes in both heritage and planning systems. Therefore, the paper contributes to the heritage and planning studies that envision a more integrated and participated approach to the urban legacy.

The paper is structured as follows. Section 2 presents the research methodology adopted to address the case study and critically analyses it within a larger territorial context (local and national). To fully understand the relevance of the SL, Section 3 frames it within the Neapolitan context from which it is indivisible. There follows (Section 4) the investigation of those emerging innovations that are deemed relevant for heritage transformations, not only at a city scale but also at a national one. Finally, the discussion (Section 5) concludes by arguing how commons practices serve to advance innovations in the field of heritage. Insisting on emerging trajectories within the framework of the commons, evidence shows that a profound citizen involvement throughout the whole heritage-making process might inform further generative policy as well as renovating the conservation-planning practice.

2. Materials and Methods

The study presented in this paper stems from a project entitled OpenHeritage—Organizing, Promoting and Enabling Heritage Re-use through Inclusion, Technology, Access, Governance and Empowerment—funded under the EU's Horizon 2020 research and innovation program [36]. The *openness* at the core of the project evokes the principles expressed in the aforementioned Faro Convention (2005), reinterpreting cultural heritage in the light of the complex, co-evolutionary [37] interrelations occurring between objects and communities, people and times. It strives for a governance model based on a plurality of actors, going beyond a private/public dichotomy [13] and thus creating the conditions for more inclusive and just processes of heritage reuse.

The SL (Naples, Italy) is 1 of the 16 Observatory Cases (OCs), i.e., ongoing community-led adaptive heritage reuse practices present throughout Europe, which provides the micro level of analysis of the project. Overall, the study was conducted along the three OpenHeritage pillars, i.e., community/stakeholder, resource and regional integration, with the aim of identifying sustainable and innovative ways of heritage governance, transformation and management, therefore gaining insights about how to expand participation and social benefit in these fields.

Methodologically, the research was based on the case study analysis of the SL to understand how adaptive heritage reuse works in practice throughout the entire cycle of transformation (from the launch of the initiative, to the decision-making stage, up to the construction phase) and management of the heritage site. This serves to understand the connections between the community, the place and the Municipal institution, as well as their present and future models of development in the three aforementioned domains. To this end, the analysis combined different sources of data. At first, it reviewed and drew on a large number of documents, including policy, administrative (e.g., resolutions), academic and communicative material (e.g., leaflets, website, social media) with the aim of reconstructing the administrative innovations and the research/cultural areas which had the most impacted. Secondly, 18 in-depth qualitative interviews were conducted with

activists (no. 8, group A), scholars (no. 3, group S), spokespersons (no. 3, group SP) and public officers (no. 4, group PO). The majority of interviews were held between 2018 and 2019, while two of them were conducted in July 2021. These latter serve in understanding how the COVID-19 outbreak impacted on the initiatives and how the community reacted to this stressor. Alongside gaining a profound understanding of the initiative itself, the ethnographic work allowed capturing the open-end nature of the process, likewise its social and reflexive dimension [38], outlining the impact perceived in the neighborhood/city/region on a qualitative basis. Moreover, with the purpose of providing critical results in the field of urban planning and cultural heritage, this contribution combines the data collected at a local level with insights gained in a study at a national level. In this case, interviews with practitioners and public officers (no. 8, group, P.R.) mainly allow to identify obstacles and potential supportive measures to adaptive reuse projects grounded in a social mission. Contrasting the two tiers helps to illuminate the types of innovations that are deemed relevant in the Italian context and the way commons-related practices act to renovate the system. The results are then presented with a specific attention to the innovative aspects of the case in relation to contextual characteristics. This latter study is part of the same project and was aimed at providing a complex overview of how community-led adaptive reuse (or not) works in European national contexts. Major results were published in the project website in December 2019 [39]. However, in attempting to deploy an inter-scalar discourse, I will also refer to unpublished materials and interviews collected during the research activity for the Italian case.

Finally, interviews to the SL community were accompanied with several site visits during which we produced a photographic report and a video, mainly devoted to a communicative purpose [40]. The SL detailed report was part of Work Package 2 Observatory Cases and was published in the OpenHeritage website in November 2019 [41].

3. The Scugnizzo Liberato and Naples Commons

The SL is located in one of the historic districts of Naples, the *Avvocata* district (part of the II Municipality of Naples), and is based in the former convent of *San Francesco delle Cappuccinelle*, a public property, recently listed as an Italian cultural asset. The central area of Naples has been part of the list of UNESCO assets since 1995, and it is included within the UNESCO Big Project [*Grande Progetto UNESCO*], namely, a renovation plan that embraces the entire area (about 720 hectares).

However, the *Avvocata* district is characterized by economic and social marginalization, and it has been subject to a spontaneous mix of urbanization due to different groups inhabiting the area (Figures 2 and 3). It has one of the highest unemployment rates in Naples [42] and its population is composed of a significant percentage of young people, particularly students (ibid).

Founded in 1585, the convent went through several transformations, adapting and thus changing forms and functions in relation to contextual circumstances. However, what marked its contemporary memory the most was its 1809 conversion into a juvenile detention center, the Filangieri Institute. Indeed, this use was maintained over the following century when, on 23 November 1980, it was severely damaged by the Irpinia earthquake, one of the most destructive seismic event of Naples that struck the entire region of central Campania and Basilicata.

Once abandoned, several attempts at adaptation and reuse occurred, ultimately failing to restore the enormous complex of 10,000 sqm (Figure 4). In this context though, it is worth recalling the partial renewal of the convent supported by Eduardo De Filippo, senator of the Italian Republic in 1985 and one of the most important figures of the Italian theatre of the past century. "Eduardo's dream", as it was known, was to transform the ex-detention centre into a social and cultural space based on workshop and educational activities. Although the project remained incomplete, its legacy has been collected and reinterpreted by the current project.

Figure 2. Top view of the San Francesco delle Cappuccinelle complex.

Figure 3. Street view towards *Salita Pontecorvo* where the ex-convent is located.

Figure 4. The convent and its courtyard. Credits: Federica Fava.

Activists of the *Scacco Matto* group entered the complex in September 2015, after about 15 years of abandonment. Even though a large-scale collaboration also started out of necessity, from the beginning, the intention of the group was to encourage the inhabitants' involvement in the space's management, turning the old convent into a mutual aid laboratory [*Laboratorio di mutuo aiuto*] where alternative forms of welfare are produced and delivered by the community itself. Therefore, the SL group has steadily grown to form a network of collectives that include various cultural associations, NGOs, individuals (e.g., artisans), students, minority groups (e.g., Sri Lankan and Cape Verdean communities), etc., giving back to the district its larger (indoor/outdoor) public space. This tension is what led the SL to be recognized (2016) as one of the common assets of the City of Naples.

As is widely documented, since 2011, Naples has been at the forefront of the mobilization of the commons, quickly attracting international appreciation; the City of Naples was the leading partner of Civic eState—URBACT III project, 1 of the 25 European transfer networks launched by URBACT in 2018. The process has been based on a series of resolutions (Table 1) that reinterpreted and updated the ancient device of "civic use" [*usi civici*], originally related to old rights of the collective enjoyment of earthly goods [43]. This ultimately updated and expanded the former right, from the original assets of pasture, hunting or firewood to abandoned real estates and urban contexts, giving back to the people *new lands* of self-appropriation and self-determination. Inspired by constitutional principles (i.e., art. 41, 42, 43 of the Italian Constitution), the newly defined framework of the commons has served the legitimation of those informal-illegal-emerging communities acting in the general interest by occupying and reusing public assets that were otherwise abandoned. The intent was to surpass the classic concession agreement model by recognizing and recording social value as being part of the economic value of heritage assets [44]. The dualism of the public–private regime was thus overcome, and a way of prioritizing social values and social utility over private interests was illuminated. Following the ex-Asilo Filangieri's experience, i.e., the first space to be formally recognized by the administration as a common good, the SL and six other places re-activated by squatting groups therefore

became part of an institutional process of legitimation due to the relational, social and civic capital generated by their active participation in urban life.

Table 1. List of the resolutions issued by the Naples City Council and their main topics.

Resolutions	
Aimed at Defining the Commons Framework	
no. 24, 22 September 2011	Introduction of the legal category of the commons in the City Statute
no. 48, 21 December 2011	Approval of the regulation "Adopt a flowerbed" for the allocation of public and private green spaces to non-profit entities
no. 8, 18 April 2012	Institution of the Naples Laboratory for the creation and regulation of the commons
no. 17, 18 January 2013	Approval of the regulation for the governance and the management of the commons
no. 7, 9 March 2015	Approval of guidelines to identify disused or underused public assets perceived as commons and their respective civic use declarations
no. 29, 16 July 2015	Approval of the regulation "Adopt a street" for supporting participated project and care of urban spaces
no. 458, 10 August 2017	Approval of guidelines for the social enhancement of public assets and for the temporary use of public spaces and assets; guidelines for the definition of pilot projects
Aimed at legitimizing informal initiatives	
no. 400, 25 May 2012	Guidelines for the allocation of the San Gregorio Armeno complex to the Ex-Asilo Filangieri community, according to commons principles
no. 893, 29 December 2015	Recognition of the Ex-Asilo Filangieri as common good, located in the San Gregorio Armeno complex, and approval of its civic use declaration
no. 446, 1 June 2016	Recognition of seven ongoing initiatives as common goods

The updating of this ancient mechanism has generated a city-wide innovation process, fostering a giant and international body of studies [45]. However, while this evidence has been widely discussed from the juridical, social or cultural viewpoint, it is useful to consider how it might contribute to informing and innovating the heritage discourse.

4. Results

As result of the aforementioned process, the commons paradigms currently inform the city planning of Naples. In the 2020 Orientation document, issued by the City of Naples [46], the guidelines for updating the city plan are designed on commons-related principles. Primarily, the aspiration of an environment that is more favorable towards heritage reuse culminates in the inclusion of different temporalities (i.e., time-based, interim) within the future urban planning tool (resolution no. 458/2017), operationalizing the idea of "urbanism as a collective project rather than as a program" [46] (p. 5). Whilst in the historic city the socialization of urban resources forces the definition of a more nuanced nexus between building typologies and (multiplication of) uses, the civic use seems to have a complex impact on the way collective facilities (have and) will be produced in the implementation of the city plan [46]. Resolution no. 458/2017 innovates so-called urban standards [*standard urbanistici*] by introducing "civic urban community" and regulating temporary uses for the social enhancement of public properties [47]. In doing so, it creates the conditions for an extensive experimental approach [48] that embraces the whole cityscape, and thus nurtures its (re)conceptualization as a resource *for* social innovation.

The universality of the commons approach relies on the idea of a constitutional-based urbanism. Particularly for cultural heritage, art. 9 of the Constitution makes its very mission explicit, namely, being a means to embodying critical cultures [49] and helping human abilities to flourish.

In this respect, it needs to be pinpointed that in Italy temporary uses are still in "a limbo between legality and illegality, lacking a specific juridical framework" within the planning system [50] (p. 160). Although the growing interest in urban regeneration has steered the initial updating of the Italian building activity norms on the matter (see, for instance, the 2020 updated version of the D.P.R. 6 June 2001, n. 380 *Testo Unico dell'edilizia*, art. 3, 6, 23 quarter), practitioners agree about the fact that the lack of a clear framework for temporary uses, on one side, and an overly strict regulatory environment, on the other, define the main obstacles to a socially oriented heritage adaptation. The need to inhabit the selected places and thus to develop ideas "from within" is a recurrent theme:

> *"The most critical factors affecting the success of community-led adaptive reuse projects are time and procedures. [. . .] Administrative delays often tend to reduce the energy needed to develop such projects. [. . .] Without hygienic permission, for example, you cannot cook or even dance. However, there are many possibilities for secure activities to be conducted outside the norms."*

> *"The regeneration of a heritage site is always a special act. Therefore, we never deal with a place without inhabiting it. You cannot think of addressing the complexity without living that condition. [. . .] The places where we work are not legally habitable, but this is just a formality because, in practice, they are secured. The sites we tackled were often burdened with critical economic and bureaucratic administrative issues. It is by overcoming these constraints that we can work."* (interviews group PR)

Although the ability of the commons to effectively resist neo-liberal approaches needs to be continuously confirmed [51], the recognition of Neapolitan squatting experiences as "emerging commons" defines a way to make room for a trial and error method, postponing some of the procedural aspects related to (cultural) heritage in a second moment. The commons framework thus assures the mediation of the local authority and a more flexible regime of security:

> *"The municipality functions as guarantor of the commons initiatives and this can help to solve problems that may arise with a Soprintendenze (the regional branches of the State for heritage conservation). When it is time to advance more consistent restoration work, we support and collect proposals by the local communities and discussed them with Soprintendenze, following the ordinary procedural path but also facilitating this relationship."*(interview group PO)

Within the commons network, the dialogue between citizens and public administration is renewed on a regular basis since public officers participate in the management assemblies conducted by the communities to run each project. Although "being on site" is generally deemed a pivotal governmental and political condition to steer a more responsive institutional ecosystem (OpenHeritage internal dialogue for the elaboration of Transferability Matrix, July 2021), in the Italian context, this assumes a peculiar role. Indeed, in the last decade, the growing impact of austerity measures in the cultural heritage sector has led to a significant reduction of the Soprintendenze's powers. On the other hand, a shift toward actions mainly focused on national strategic assets (e.g., *Grandi Progetti Beni culturali*, D.L. no. 83/2014) and tourism-oriented approaches have conveyed a progressive fragmentation of its heritage (reuse) policy, often detached from desires emerging from below. The lens of the commons also unveils a strategy of distribution which allows resource heritage assets on the basis of locally shared interest:

> *"Once a common good is acknowledged it becomes a priority, meaning that we start looking for resources to keep supporting its development. It does not mean that other projects are less important. But it is obvious that having a community that uses a certain site and wants to follow up with its project represents a significant determinant for the asset conservation itself."*

> *"The redevelopment program for the former Cappuccinelle convent provides municipal investment starting from its use. To some extent, the innovation lies in the ability to link potential funding, so much so that the complex was assigned with a restoration plan of 7,500,000 euros (2014/2020 EU Cohesion policy—Culture and Tourism plan)."* (interviews group PO)

Beyond heritage, what motivated the collective actions is a multiplicity of objectives. By means of the commons, heritage matters are thus addressed transversally, encouraging a cross-sectorial discourse:

> *"The concept of the commons [. . .] does not solely regard the "freed spaces", but it concerns all administrative policy [. . .]. We interface with the youth department for activities and policies that regard the youngsters. We have also worked with the tourism department, since the city of Naples is increasingly hit by tourist flows. Obviously, we interface with the heritage department because the initiatives use municipal properties that must serve the public arena."* (interviews group PO)

However, in the SL case, activists underlined a feeling of social redemption which pass through the need of a more narrowly relation with the district, its local youth and the (lack of) collective spaces:

> *"The goal was to give this space back to the citizens after decades of neglect—especially to the inhabitants of this neighborhood, who do not have a square or a meeting place and then provide a space where a series of mutualistic activities can happen. Moreover, this ex-convent is huge and has a very significant history for the neighborhood and today it has become a point of reference for young people, especially in terms of music."*

> *"The occupation was an attempt to rediscover a collective horizon that many people had to abandon because of work or other necessities. It was a matter of giving people trust, give them space."*

> *"It was Eduardo De Filippo's dream of turning the convent into a daily multi-functional center where different kinds of courses and craft labs can be hosted. Therefore, the goal was to create a shared knowledge and we have stuck with this endeavor [52]."* (interviews group A)

The preservation of historical and cultural value of the ex-Cappuccinelle convent were not the main objectives of the initiative. However, the opening of the asset towards forms of self-organization stimulated the rediscovery and appreciation of heritage values and the production of new cultural-social ones.

> *"The community is becoming conscious of the architectural and historical value of the Cappuccinelle. Thus, the program of activities needs to agree and proceed parallel to a restoration project, preserving the complex in its integrity. In order to attain this aim, we are cooperating with the public authority."*

> *"Originally, people were afraid of this place. By using it, though, the relationship with the convent has changed also thanks to new cultural productions among which many songs that significantly have help to chase away the ghosts that burden over the complex."* (interviews group A)

Along with the presence on site, this progressive expansion in terms of meanings but also actors (from the squatting group, to the neighborhood inhabitants and, more recently, local vendors) is encouraged through three components that significantly characterize the SL initiative and partially the commons network itself: the free and (mandatory) collective usage of the convent premises, its self-management process and self-construction.

To the formal recognition of the community indeed corresponds the opening of the decision-making process to its members. The governance and management of the asset follow the model firstly experimented in the ex-Asilo Filangeri and adopted by all the commons initiatives. In accordance with the local authority, this community's responsibility develops in weekly management assembly [*assemblea di gestione*], which is the only "agency" holding the power to enforce binding decisions for the community. It brings together the whole community, including public servants, and is organized around changeable thematic assemblies [*tavoli tematici*] (Figure 5) dedicated to specific topics and their respective members: internal and external communication, participative architecture and self-recovery, cultural programming, building community, common goods and alternative economies. The management assembly serves to arrange the routine management of the complex (programs, activities, etc.), its recovery work as well as communication and logistics.

Figure 5. An open-air assembly. Credits: Scugnizzo Liberato.

The process of self-determination has been also cultivated through the SL's Declaration of the Urban and Civic and Collective Use (for SL, approved by resolution no. 424/2021), presented by each initiative to the Municipality to sets the rules proposed by the community for the self-governance of the asset. In general, self-recovery and collective care of the space represent the cornerstones of civic use practices, the aim of which is to strengthen the capacities of the most fragile individuals in the city, in part by means of a more corporal approach to heritage making (Figure 6). For the SL, activists strongly agree on the value assumed by self-recovery activities both in term of space adaptation and community building [53]. DIY practices thus assume a pivotal role in the project as a way to combine commons ethics and open aesthetics. While at the beginning this has served the immediate and low-cost access to the convent, the inclusion of self-recovery practices in the SL's

Declaration is a "proactive" statement, ultimately aimed at overcoming time-consuming procedures, in Italy required also for minimal interventions in listed assets [54]:

> *"The building started to be restored, especially in the first period, thanks to people's efforts. When we arrived to the convent it was traumatic: both courts were completely covered with grass and trees that were rooted up to the internal rooms of the complex. In addition, the condition of the church clearly showed that many assets were plundered."*

> *"The complex is a cultural asset which means constraints are pending it over. We acknowledge and protect its cultural value but in the Scugnizzo Declaration (art. 16) we have also tried to assure the community with a minimum level of autonomy over the maintenance and the restoration of the asset. [. . .] In such a decaying and large complex as the SL, it should be the community that indicates the interventions and, when possible, intervening autonomously."* (interviews group A)

Figure 6. Collective work of cleaning. Credits: Scugnizzo Liberato.

The commons model has thus launched the implementation of guidelines to define a future DIY regulation for the City of Naples [55], opening up an additional field of innovation within the heritage-building sector. At the national level, indeed, the lack of rules to frame citizens' actions in terms of self-construction is perceived as one of the main barriers to bottom-up adaptive reuse [39].

5. Discussion

This paper began following recent European developments in matters of heritage and argues concerning the growing centrality assumed by community in the process of heritage recognition and care. Analyzing the Scugnizzo Liberato, and more generally, the process conducted in Naples under the umbrella of the commons, this article focuses on the innovate aspects of the presented actions. This shifts the attention towards innovations generated along the trajectory of the commons, understanding motivations, modalities and tools that might be upscaled in the heritage sector.

The analysis stresses the attention on the processes of self-organization that happen in an abandoned heritage asset that set the scene for new spatial and human organization. Interpreting the city assets as social infrastructures of public value and social impact [56], the socialization of heritage through commons enforces the use value of assets and revolutionizes prerequisites of accessibility. Although the physical transformation/conservation

of the cultural object might in some cases be endangered through the implementation of immediate uses and actions, mainly led by non-experts, the SL seems to contribute to the high-quality principle set by the ICOMOS [1] for interventions in cultural heritage in multiple ways. Alongside prioritizing the "public benefit" in terms of both citizenry and access to the cultural good, the convent occupation supports a process of knowledge building, one of the conditions to develop a conscious conservation project. Moreover, the focus on the process (e.g., good governance in the ICOMOS's words) and the inclusion of the project within the city strategy introduce long-term elements of sustainability. From this viewpoint, commoning heritage expanded the notion of urban standard showing a way to develop a more complex (cultural) approach to the quality of living, one that meets not only functional-spatial requirements but also social, psychological and resilience aspects.

Moreover, the analysis shows that power distribution is made possible through the recognition of the social and cultural value of performative heritage practices based on commons principles. The new organization in terms of self-management/organization and regulation starts with the opening of the process to a large arena of actors that works in dialogue with the public administration to redefine a shared set of values over preexisting ones. These evidences are particularly relevant in the Italian heritage system. Although the Italian Heritage Code [dl no. 42/2004] focuses on cultural heritage safeguarding [*tutela*] as a way to guarantee its conservation and public fruition [*fruizione pubblica*], the continuing prevalence of issues of materiality over real needs overshadows the very mission of preservation, i.e., the use of heritage [57]. In this context, the SL initiative demonstrates that the commons governance model has the capacity to make conservation instrumental for public fruition and, in doing so, defining a way to *heal* the fracture between conservation and enhancement which characterizes the national system [49,58].

To treat heritage as a common has material consequences motivated not only by social and economic purposes but also by uncertainties regarding present and future priorities. For heritage to be supportive of social change, ephemeral, informal or no interventions become tools of an adaptation strategy that proves to be relevant in facing and rewriting dark assets, territories and futures. The symbiotic relationship established between human and urban bodies through self-construction and organization functions as a detoxing agent against structural (managerial) dysfunctions [59], opening up the way to new areas of innovation in both heritage and planning. On the other hand, it serves as a decolonizing agent that creates a rupture, not only with racialized environments against minority groups (whether migrant, foreign or poor people) [60] but also with state-led violence and the domination of authorized heritage actors through in situ rationalities of mutual care.

To conclude, the reformulation of heritage within the framework of the commons contributes to challenge the prevalent heritage discourse through the transformative potential of collective desires and endeavor. In fact, despite interests in matters of heritage being initially surpassed by other priorities, the study shows practical modes to discover and (re)create uses and meanings that inform new heritage values by means of adaptive strategies of reuse. Beyond the specificity of the "civic use" model, however, it is important to underline the centrality of the adaptive approach to heritage reuse within larger process of urban transformation. It indeed requires participatory methods and tools that can generate further changes in the management and transformation of the build environment that do not end within commons-related frameworks.

In the face of the climate threats increasingly challenging urban-heritage contexts, further studies on this matter would be undoubtedly needed. What are, for instance, additional reasons, sectors and modalities to be taken into account in sustainable urban development grounded on commons-oriented practices? What is the role of commons practices of heritage reuse in building new memories and affective bonds with the territory, and how might they be instrumental to design trajectories of resilient building by means of heritage?

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Article

Flexibility and Adaptation: Creating a Strategy for Resilience

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Abstract: Civil society actors engaged in social innovation supporting activities provide crucial services that address unmet social needs and empower communities. Yet, creating a resilient framework that not only supports their activities but helps to sustain them as an organization is often difficult. It necessitates resilience strategies that help them survive and overcome crises even without former institutionalization. The paper identifies three distinct strategies that can be followed: adaptability, diversification and ecosystem building. While all three represent different ways of resilience, the latest provides the most complex safety net, allowing bottom-up organizations and partnerships to share resources, develop complementary services and sustain social innovation. Choosing the time of the first COVID-19 pandemic and the ensuing lockdown for the analysis, the paper illustrates with eight selected case studies how these strategies enfold during a crisis. The paper analyses the activities of different civic initiatives, gauging their capacity to adapt flexibly to radically new situations. While doing so, it brings together the concept of social innovation and resilience and enriches resilience studies with a less frequently found focus on small, civic initiatives.

Keywords: social innovation; resilience strategies; civic initiatives; COVID-19 pandemic

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1. Introduction

Focus on social innovation, both academic and policy-oriented, has increased substantially lately in the hope of offering (albeit partial) solutions to the unresolved challenges by dominant governing methods. Social innovation has been supported by governmental policies and institutions as well [1] and has become a "buzzword" in social policy [2], appearing in various high-level documents including even the collection of inspiring stories put forward by the European Commission [3]. In this policy environment, especially in pre-COVID-19 times, the approach of partially curtailing and decentralizing public welfare responsibilities, fostering social innovation and social entrepreneurship was regarded as an appropriate solution to tackle unmet welfare needs in a fiscally and socially prudent way, through which a socially inclusive market economy could be stimulated.

The concept of social innovation is old and has been evolving over a long period of time. In short, it "refers to localized social initiatives that address unmet social needs through a transformation of social relationships that empowers people" [4] (p. 1). It has been applied in various fields, among other things to describe the fundamental changes taking place in the field of governance, to analyze the transformation of the public sector's role as a decision maker and a service provider, or the increasing civic participation in policy development and delivery, particularly in the field of social policy [5–7]. It has also been used to describe the changing politicizing of cities, where new movements engaged in urban politics transformed the entire arena of local governance and local political dynamics [2]. In this context of urban movements, social innovation can also be viewed as an opportunity to change the local spatial dynamics, not only to develop new ideas (products, services or models) but to allow urban spaces to recover and renew, providing actors and institutions with the possibility to learn and evolve [8].

The process of social innovation can be supported and carried out by various bodies, moving on the spectrum between formal, well-established actors to non-formalized initiatives, transient in nature. NGOs, small-scale bottom-up citizen initiatives as well as more established third sector organizations or social enterprises are crucial players in the field, united by their goals with the aim to bring about social change. In fact, social enterprises represent a very particular mix between economic and social goals, where through their "transformative social ambition", the provision of goods and services becomes the means to support social objectives and initiate social change [9].

There is a less-talked-about "dark side" to social innovation, however [10]. Social innovation is by definition disruptive [11], providing its impact through viewing, understanding and approaching problems and issues through a new lens. It applies unconventional methods and even redefines the problems to be addressed. It also offers new coalitions of stakeholders to overcome the difficulties. However, the disruption of former boundaries can have adverse, unintended consequences. Disruptions in social relations can most acutely impact the vulnerable, despite the fact that a significant part of social innovation interventions aim to help exactly these groups. Additionally, the creation of a new normal, which is the higher goal of many initiatives [12], requires rebuilding new structures—even boundaries—and new governance systems to support them to become more resilient. A challenging task, fraught with internal and external complications that puts a strain not only on the recipient of services, but also on the organizations themselves, who embody social innovation. Resilience in their case means not only finding their role, but cementing it in the new environment, while allowing them to pursue their original path. This process can still include change, albeit a gradual one, in the sense of evolutionary resilience by Davoudi which incorporates cautious transformation [13].

The current article asks how civil society actors, as forbearers of social innovation, can create a resilient framework that not only supports their activities but sustains them as an organization. It focuses on the question of how social innovation can be maintained on the long run? How can the organizations pioneering social innovation become resilient, and what type of support do they need? The article uses the first wave of the COVID-19 pandemic and the ensuing lockdowns as a special occasion, which prompted organizations to react and at the same time amplified the key question of resilience: how can bottom-up initiatives survive? Through the lens of the first lockdown, this paper views the transformation of civic initiatives, gauging their capacity to adapt flexibly to new situations. It selects cases from all over Europe, where the first wave hit at approximately the same time, and analyses them. While doing so, it brings together the concept of social innovation and resilience, enriching resilience studies through this direction.

While there have been critical approaches to the combination of these two concepts, the current paper support the assumption of Westley that social innovation and resilience mutually enhance each other looking at "social innovation as a particular dynamic that increases the resilience of social systems and institutions, through introducing and structuring novelty in apparently "trapped" or intransigent social problem areas" [1,14,15]. The paper's emphasis on bottom-up initiatives during COVID-19 is also novel, as attention so far has tended to concentrate more on the adaptation efforts of big organizations or public authorities [16,17].

The structure of the paper is as follows. After a (2) brief introduction of the topic of resilience where it identifies three key strategies that bottom-up initiatives can follow, it lays out the (3) methodology how cases were selected and analyzed. Then, it describes the (4) resilience strategies followed by the selected civil society actors using the theoretical framework introduced. Finally, the paper (5) discusses the main findings and contributions and closes with (6) concluding remarks.

2. Identifying Resilience Strategies

The concept of resilience primarily comes from ecology and system theory, and its application today is still heavily influenced by its origins [18]. It can be understood as "the

capacity to adjust to threats and mitigate or avoid harm", as offered by Pelling [19]. He also notes that we can understand resilience in a number of ways, according to different disciplines, but the above definition corresponds to societal phenomena at times of crisis, referring to the ability of entities to withstand unforeseen challenges.

Resilience and its conceptual consequences have attracted special focus in urban studies, both on an academic and a practical (policy) level. The acceptance of resilience as a guiding theory into socio-economic governance frameworks has contributed to an approach where crisis and the need to change have become part of the daily discourse of public authorities and NGOs, and the need to adapt and prevail have become central guiding principles for cities and local communities/initiatives alike [20].

Resilience is also understood as a coping strategy, a systemic reaction to stress—such as the COVID-19 pandemic—supporting the evolution of new norms and values [21]. The pandemic has generally sharpened the scientific focus on resilience, bringing to the forefront how sudden events and the general rise in turbulent problems test governing capacities and require new governance strategies [16]. It highlighted the need for integrated, comprehensive approaches in resilience strategies and has also contributed to an increased awareness about the multi-faceted nature of resilience, showing that it was dependent on a variety of factors including territorial, political and governance characteristics [17,22].

To analyze the resilience strategies followed by social initiatives, the paper adopts an ecologically rooted understanding of the concept, which reflects how systems work in nature, thus stressing the importance of decentralized institutions that allow local adaptations and a responsive form of local governance [23]. It follows the footsteps of Davoudi [24] and uses her evolutionary resilience concept as a point of departure, stressing the importance of constant change, acknowledging that there are a multitude of ways to reach equilibrium/stability. The paper takes the concept a step further and argues that the resilience of these organizations requires flexibility and adaptation, which are essential characteristics that allow them to change and to face and overcome challenges of various kinds.

The concepts of flexibility and adaptation have both been used in connection with resilience before, emphasizing that an adaptive governance system has the ability not only to self-organize, but also to co-manage and transform. Similarly, flexibility is essential to support experimentation, as well as to accommodate changes on a multi-governance scale [25]. Flexibility is also directly linked with resilience and proactivity in risk management studies [26]. Finally, both flexibility and adaptation have long been associated with resilience in studies in psychology and business [27–29], but less has been said about their role regarding civic initiatives or even municipalities. Importantly, their role as possible building blocks in resilience strategies has not yet been explored.

This is exactly what the paper sets out to do when it defines three main strategies depending on the various degrees of flexibility and adaptation they require. Each of these strategies allow civic organizations to overcome crises and become resilient. The strategies, although separate, can build on and strengthen each other, and can be applied by different organizations or by different branches of the same organization in a similar environment, even simultaneously. Nevertheless, there are marked differences among them both in the amount of time their execution needs and the complexity of the task it creates, as described below and also shown by Figure 1.

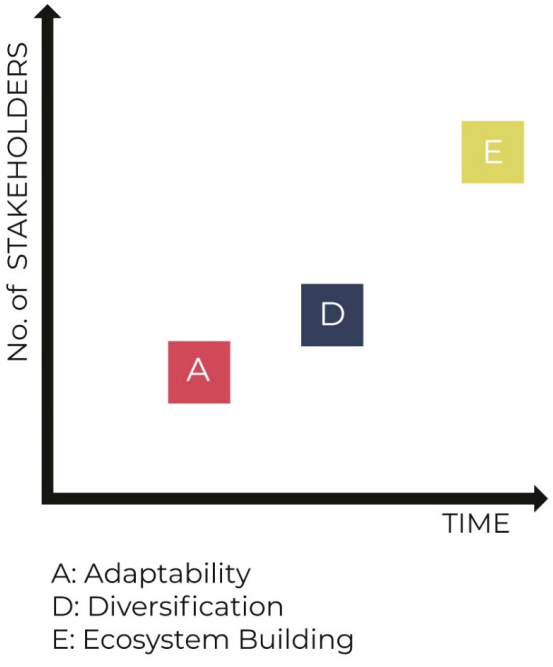

Figure 1. Three strategies in pursuit of resilience.

The first strategy is about increasing adaptability. This is defined as the capacity of an initiative or organization to adjust to changing circumstances even without intensive exchange with others and carry it out mostly relying on its own resources. While the advantage of such a strategy lies in the fact that it can be deployed alone, from an organizational point of view its application requires a very high degree of flexibility and the biggest adaptation/transformation in a short time span. Civic initiatives resorting to this strategy need to have reserves either financially or have appropriate knowledge, network and enough personnel, possibly including volunteers as well.

The strategy of diversification refers to the ability of an initiative to establish new connections within its social, economic and territorial context and to build resilience through the provision of new services or the creation of new goods. This requires both flexibility and adaptation, but to a lesser extent than previously. However, it also needs deep local embeddedness and knowledge about missing services or any niche activities.

Finally, the strategy of ecosystem building is focused on network building that enables individual organizations to join forces and complement each other by moving resources and capacities more efficiently according to emerging needs. While this is the most time-consuming strategy, this allows individual organizations to retain their original profile in face of a crisis and, thus, requires the least flexibility and adjustment from them.

3. Methodology

To validate the theoretical structure explained above, the paper employs a qualitative case study methodology. A qualitative approach in general is applicable to a small sample size and less standardized data collection methods [30], which is the case here. The case study methodology provides the opportunity for an in-depth understanding of how different initiatives managed to build up resilience strategies facing the COVID-19 crisis. This method is particularly useful to discern factors determining the success of these resilience strategies, but it also allows comparisons. The latter helps to see how the respective local environment influences the strategies chosen by the initiatives.

There were three main sources the cases for this paper were selected from:

- The Urban Development Network Program's (URBACT) Civic eState project (https://urbact.eu/urban-commons-civic-estate, accessed on 16 January 2022) which involved six city municipalities (Ghent, Amsterdam, Naples, Iasi, Presov and Gdansk) dispersed around the EU. The project focused on new models of urban co-governance based on the commons idea, with the goal of creating policies that support sustainable urban commons, enabling inhabitants and local communities to self-organize and collectively act for their common good.
- The webinar series "Cooperative City in Quarantine", which collected stories of civic activation during the first wave of the pandemic in the spring and early summer of 2020. The series was looking to see how COVID-19 and the ensuing quarantine measures were transforming cities around Europe. Each webinar focused on a specific topic, and in total 13 episodes were hosted, with the involvement of 69 experts from 36 different cities. The stories of these projects are also covered in the publication: "The power of Civic Ecosystem" (https://urbact.eu/sites/default/files/the_power_of_civic_ecosystems_full_book_vsm.pdf, accessed on 16 January 2022).
- The OpenHeritage project (www.openheritage.eu, accessed on 16 January 2022), which is an EU-funded research and innovation project, focusing on the adaptive reuse of buildings and sites by the local communities in marginalized areas. As such, it has worked closely with 6 labs and 16 observatory cases all over Europe for the past 4 years, each of them involving bottom-up initiatives embedded in their respective local communities.

From this rich source material, cases were selected for a closer inspection based on their relevance to the topic of the current paper. Primarily, we were looking for cases where the pandemic created a situation of a sudden challenge needing immediate intervention to sustain the organization itself, its community or both. We only looked at cases that involved social-innovation-focused initiatives as we wanted to see the specific patterns their actions showed. Secondly, the selection also took the various institutional backgrounds into consideration, supposing that the existence of a supportive environment strongly influences the resilience strategies chosen by the initiatives. Thirdly, we wanted to provide a relative difference in size of the initiatives, assuming that more established ones could react differently, having more financial and network resources at hand. Finally, we made the conscious decision of involving cities as cases, since their elaborate programs could influence the resilience strategies followed by the initiatives locally. Municipalities often realize their programs through activating local civic initiatives and their support is necessary for these initiatives to build their resilience strategies.

Using the above criteria, 8 cases were finally selected (see Table 1 for their list) for a more in depth inspection. They span geographically between Portugal and Hungary, allowing the collection of vastly different experiences and versatile strategies, all of which were effective in the same constrained timeframe of the first COVID-19 lockdown. They are either bottom-up initiatives themselves or are organizations/institutions working closely with bottom-up initiatives. Among the chosen initiatives, there are some which can rely on strong municipal support, whereas others were left more to their own devices during a crisis. All the initiatives selected use space—both urban and rural—as an opportunity to transform their surroundings and they all have basic social innovation aims, which is more apparent in some cases, while in others, it has been constantly in the background of many of their projects.

Table 1. Overview of the selected cases with brief case characteristics and the source of primary information about them.

Case Name and Location	Case Characteristics	Sources of Information
Les Grands Voisins (LGV) Paris, France	A collective experience, the transition project from the former Saint-Vincent-de-Paul hospital to the future district that will take place in 2023. Three different associations, Aurore, Plateau Urbain and Yes We Camp, are running the area of 34 thousand square meters	Martin Locret's—Project Manager at Plateau Urbain—presentation and contribution of Plateau Urbain to the online webinar; Cooperative City in Quarantine, episode 6 on Urban Commons [31–33]
Milan 2020 Adaptation Strategy Milan, Italy	A strategy for the so-called "Phase 2", which has been dominated by changes in the lifestyles of Milanese residents building and public-private partnerships to address the health crisis and future urban challenges	Official document [34]
Ex Opg Naples Italy	A former criminal asylum. The building was saved from abandonment and returned to its neighborhood (and the city) in the form of an autonomous social center.	[33,35]
Cascina Roccafranca (CR) Turin, Italy	Part of the Turin's Neighborhood Houses, CR is an innovative civic center, a place designed to make citizens protagonists, where the most significant values are those of participation and welcome.	Background interview with Stefania de Masi, project manager at Cascina Roccafranca, on 23 June 2021 and the background study on CR by the OpenHeritage project [36–39]
Gólya Budapest, Hungary	A co-operative bar and community house in the 8th district of Budapest, Hungary. It has a large inner space with a garden, a separate office space, houses a daycare establishment, a music rehearsal studio, an attic and a basement, currently used for storage.	Interview with András Szépe, founder of Gólya, October 2020 [40], and information on Gólya at the following sites [41–44]
Lazareti Dubrovnik, Croatia	In the year 2000, the Art Workshop Lazareti, one of the most significant Croatian organizations in the field of contemporary arts and culture, signed a long-term contract with the City of Dubrovnik	Petra Marcinko—Lazareti Art Workshop coordinator's presentation and contribution to the online webinar Cooperative City in Quarantine, episode 4 on Community Centers [45–47]
Desktop research on social activism and coping strategies during the pandemic [48–51] Naples' network of urban commons Naples, Italy	Self-managed or co-managed spaces of aggregation and mutualism realized thanks to Naples' community management scheme: the Civic Use	Presentation by Rui Franco, the Coordinator of the Community-Led Local Development Network (CLLD)—Lisbon, Portugal's presentation and contribution to the online webinar Cooperative City in Quarantine, episode 13 on Social Inclusion and interview with the "Forum Urbano" project designers [52]
BIP/ZIP Map Lisbon, Portugal	An online map of social initiatives from the "Energia BIP/ZIP" program fighting the social and economic crisis generated by the COVID-19 emergency.	Martin Locret's—Project Manager at Plateau Urbain—presentation and contribution of Plateau Urbain to the online webinar; Cooperative City in Quarantine, episode 6 on Urban Commons [31–33]

The data about the cases come from interviews with members/participants of the initiatives, but not from the local communities. As a result, these reflect their internal

views. Given the paper's focus on organizational strategies, this was not regarded as a problem. Interviews were always conducted with someone who had sufficient overview and knowledge to assess the internal operation of the initiative involved. The questions asked were divided between pre-COVID-19 activities and then emergency interventions.

Additional information comes from presentations and desktop research using background materials of the OpenHeritage, the URBACT projects, as well as the recordings and transcriptions of the Cooperative City webinar series. The following table (Table 1) summarizes the exact sources of information for every selected case.

In the following, the paper will examine these cases in light of the strategies followed to support resilience. For each resilience strategy, the paper gives various examples, explaining how it was executed by the organizations, also highlighting the role of flexibility and adaptation played in the development of these strategies.

4. Applying Resilience Strategies

4.1. Adaptability

For Keck and Sakdapolrak [53], adaptability (adaptive capacity) constitutes a dimension of social resilience: the ability to learn from past experiences and adjust to future challenges in everyday life. Considered as such, adaptability represents a dynamic quality empowering social system—including civic initiatives supporting social innovation—to respond and cope with crises as a normal rather than exceptional condition. In an urban environment, together with the transformative dimension of social resilience, adaptability proposes new scenarios for social and spatial development. In this sense, adaptability can be seen as a dimension of the type of open urbanism envisioned by Richard Sennett [54] and meant to represent a flexible environment, not over-determined or fully defined a priori. This kind of openness nurtures social innovation and leads to new ways of considering the city and the challenges society is called to face, allowing for quick and speedy reactions.

Adaptability is also a strategy that requires the least time to develop, but it can support social innovation organizations to prevail in difficult times, allowing them to change—even temporarily—the focus of their activities. Importantly, this strategy allows them to act alone. Such a strategy is exemplified by Les Grands Voisins (LGV) in Paris, a project which had formerly concentrated on the temporary reuse of a disused hospital complex. Between 2015 and 2020, they have created a social and cultural space in the heart of Paris where altogether 2000 people lived and/or worked, with additional emergency accommodation for up to 1000 people. They also created spaces for workshops and offices and involved more than 5000 volunteers a year.

Following the outbreak of COVID-19, the Municipality of Paris reached out and asked Les Grand Voisins if they could help with food distribution to the most vulnerable. The connection between LGV and the city had existed prior as well, since it was the city municipality that temporarily handed over the management of an unused area to three NGOs, allowing the LGV to be established in the heart of Paris. During the first wave of COVID-19, LGV not only became engaged in providing support, but could also do this task very efficiently despite its prior inexperience and the short notice. It could adapt very quickly because its mission of work for the common good was at the base of the organization, and such an adaptation came naturally. Additionally, architects and social workers play a very important role in LGV, and they had a specific know-how on how to adapt to this new scenario. Finally, flexibility and quick adjustment to changing circumstances was already at the core of the initiative, which utilized the methodology of temporary use to test new functions and activities in an existing site with little physical transformation. Therefore, in the context of COVID-19, adapting the space for a new purpose was relatively easy, and it became not just about giving food to people, but it also meant allowing the organization to develop.

As it was summarized by Martin Locret, a project manager:

> "*We have been contacted by the Municipality of Paris—they asked us if we could help with food distribution, as we run our activities in empty and/or abandoned buildings.*

> *We were able to immediately say yes because we always kept in mind the fact that urban commons should be able to respond and adapt as quickly as possible*".

The COVID-19 pandemic similarly required a high level of adaptability in other places as well, often meaning the sudden conversion of their spaces for entirely different purposes. In Naples, a new "informal welfare" system was created by social centers, community groups and bottom-up initiatives, which underwent a sudden change following the outbreak of the epidemic and the subsequent quarantine measures. With all the usual activities suspended because of the lockdown, social centers, self-organized spaces and urban commons such as Scugnizzo Liberato, ex Opg, Mensa Occupata, Sgarrupato Occupato and Zero81 reconverted their spaces into kitchens or food stores, and they packed parcels to be distributed once or twice a week, using small pickup trucks, motorbikes or simply on foot. Additionally, as there was the need to raise money, the organizations designed and carried out crowdfunding campaigns. Such was the case with ex Opg, which through a word of mouth and online communication raised more than EUR 42,000 to buy supplies, personal protective equipment and other primary goods to be given to poor families, migrants and the homeless.

Adaptability as a strategy could be followed by city municipalities as well, allowing them to intervene efficiently and quickly, and supporting both social innovation and civic initiatives. During COVID-19, many municipalities converted buildings for new uses to respond to the most urgent needs, while others reached out to local initiatives and developed emergency services together, using community spaces and mobilizing the skills and knowledge organized around these spaces. Such changes required flexibility both on the side of the initiatives and on the side of municipalities.

One particular city example is the case of Milano, where the importance of adaptability is reflected by official strategies, including the Milan 2020 Adaptation Strategy [34], which builds on public–private partnerships and recovery measures to address the current health crisis as well as future urban challenges. The strategy is aimed at supporting social innovation and social cohesion as a means to fight the effects of the COVID-19 crisis. One of the city's immediate actions during the crisis was to have a dual use of infrastructures with a temporary conversion of buildings to make a significant contribution to the emergency management: its "Open Schools" program turned school buildings, particularly during the summer months, into community areas and green spaces dedicated to educational activities; "Milano Abitare" transformed used vacant apartments as emergency housing; accommodation facilities and other public and private facilities were also used for emergency management. In Milan, the adaptability strategy was both a way to cope with the crisis and to prepare the city for future challenges. Additionally, it also helped the city to become more resilient by adapting the available spaces to new functions.

4.2. Diversification

The capacity of an initiative, organization or partnership to successfully react to the challenges that impact its operation and to build resilience partly depends on its ability to diversify its connections to its broader social, economic and territorial contexts. Such a diversification strategy is conceivable in various dimensions and at various levels of scale and governance. However, unlike in the case of adaptability, this cannot be carried out impromptu, rather it needs planning and preparation. The most common strategy of diversification is the development of various income streams, allowing civic initiatives to have a stable economic background.

This was performed by the Gólya cooperative in Budapest, which is a bar and community house in the 8th district of Budapest, Hungary. The cooperative was founded in 2011 and the bar was opened in 2013. In 2019, Gólya moved to a new location, an industrial building bought and renovated through loans and voluntary work by the organization's broader community. Today, Gólya combines the functions of a bar and office space, and has a daycare establishment and even a music rehearsal studio. It regularly hosts live music gigs, cultural programs, lectures, discussions, and other activities. It also hosts both public

and closed events of groups or organizations. The cooperative is a one-of-a-kind social initiative in Budapest with a clear and complex social mission. Members want to work towards a just and sustainable society. As part of this, its mission includes maintaining and developing further the cooperative model of organization and production and cooperating closely with similar projects. Additionally, Gólya also provides space for groups, projects and organizations with similar goals, hoping to support the cooperative scene. Finally, it wishes to actively engage against the process of gentrification in its neighborhood.

Gólya's original business model greatly relied on its music venue and bar. However, the arrival of the pandemic and the first lockdown drastically reduced the venue's events and revenues, and with debts to pay back to their creditors, Gólya members began to think about how to diversify their activities and make their enterprise more COVID-19-proof. Being closed also meant that they had time to think and reorganize. Gólya members aimed to expand their activities, rethink their revenue streams and create new building blocks in the cooperative's economic structure. As it was summarized by András Szépe, one of its founding members:

> "*We spent months with the venue closed and our revenue from the bar was greatly reduced in 2020. Therefore we needed to diversify our revenue streams. During the renovation process, we realized that we gained many construction and renovation skills. To put these new skills in the service of the cooperative, we launched a construction business and now we have some revenues from doing renovations in the neighborhood as the cooperative. We also established a bike delivery service as many of our members had experience working as couriers*."

Based on this process of integrating new knowledge in the organization's repertoire, Gólya was capable of moving its workers to the delivery and renovation services when COVID-19 hit the city and the community bar had to close. This shift allowed the organization to retain all its employees while many other businesses had to fire a part of their personnel. Having the flexibility to move their employees between different activities made the organization more resilient to both long-term changes and unexpected events. Payments among the partners were also relatively evenly distributed, which is in connection with the fact that Gólya is a cooperative. This, however, also means that the model might have limited applicability under different circumstances. In Gólya:

> "*Everybody works according to their skills, some with building, renovating, some with couriering. Each member gets paid according to their needs. This is how we are surviving the current pandemic period*."

A similar diversification strategy could be seen in Cascina Roccafranca (CR) in Turin, which is similar to Gólya in many respects, albeit on a larger scale. The initiative is a multi-functional community center operating in a building owned by the City of Turin in the outskirts. It includes a renovated old farm building and a giant courtyard. CR provides a diversity of services to locals and people from other parts of the city alike, including an area dedicated to informing and listening to citizens, a free help desk, a day care center, a restaurant and a cafeteria, all run by the same social cooperative. The place hosts a variety of cultural activities and different courses. Although CR was established with the help of European funding in 2007, the project strives for independence in an economic sense: by 2020 it could cover 66% of all of its expenses, a giant improvement from the original 33%. This was only manageable with the help of continuous diversification of their economic portfolio. Their income comes from the establishment of commercial activities in support of the project: the restaurant and the cafeteria are run by a social enterprise, the rental of space for activities, courses or private parties bring in important revenue for the organization, but they also do fundraising

However, next to its economic diversification, CR also pushed through the diversification of its decision-making process. As a result, its governance structure includes a variety of organizations besides the municipality, and a public–private foundation was created to manage it. It has a "Board of Directors" with five members: three of which are

nominated by the City of Turin (the Councilor for integration policies, the President of the 2nd District and one member appointed by the District) and two members are appointed by the "College of participants" (made by 45 associations and groups that operate in the Cascina). This structure ensures that a multiplicity of voices and ideas are heard in the decision-making process that concerns the future of the building complex. Such a diversity of voices helps the organization to remain open for a variety of opportunities and stay sensitive to changes that affect it.

This diversification was very important during the pandemic, when Cascina reconfigured itself into something different. The City of Turin asked them to become a strategic node for food distribution. (Here, there is a similarity to LGV mentioned above, showing that food distribution became of primary importance for many social initiatives during the first wave of the pandemic.) This sudden transformation required great flexibility, as it was acknowledged by Stefania Masi, the project manager of CR:

> "*A couple of things we already knew were consolidated, like the importance of flexibility. We have never stopped, when COVID arrived we tried to understand as fast as possible how we could adapt to the new situation and still be useful and relevant for our community. We didn't want to be strictly cultural and so we thought of adaptation with an open mind, using our networks, skills and resources to help our community*."

As a result of the successful transformation, CR could not only reach out better, but could also better understand the needs and problems of the locals. It also became very active during the first wave of the COVID-19 pandemic, providing counselling desks, working on psychological help, assisting women victims of violence and helping people that lost their job during the lockdown. Importantly, besides helping those in need, this strategy also helped Cascina to stay relevant for its own community and thereby supported its resilience on an organizational level. This latter point has been very important to Ms. Masi, who emphasized that:

> "*Finally, we understand the value of our work: during COVID, when we were not able to continue our activities, people missed us a lot. When we could reopen again it was beautiful to see the importance of our work. Frequently, social and cultural life is seen as a secondary thing, not so necessary to life, but this pandemic could show to everyone our importance*."

4.3. Ecosystem Building

The most complex and also most time-consuming resilience strategy is ecosystem building. Ecosystems connect civil societies and support social innovation while supporting unconventional collaborations between initiatives and organizations that are normally not in touch with each other. A civic ecosystem is multifaceted, including actors from different branches and groups of varying levels of institutionalization, between informality and volunteer associations to professional NGOs. They often have the tacit or even outright support of their local municipalities. As an ecosystem is based on connections and collaborations, the more the constituting organizations are connected and work in a complementary way, the better they can respond to new challenges, by distributing or pooling their resources when needed [55]. Additionally, such networks can help the building of synergies and the diversification of connections, thus relying on a variety of resources, audiences or revenue streams. Grouping or clustering initiatives in networks or umbrella organizations can also help to lower the operational thresholds of initiatives, reducing costs and other efforts, and enabling them to concentrate on their work. Such an ecosystem can also react very fast and with relatively little risk to challenges. Previous emergency situations have shown the importance of local networks and civic ecosystems. These could successfully complement municipalities in providing support and services to the local population. In turn, belonging to such networks could make individual initiatives and independent civic spaces stronger and better established.

In Dubrovnik, the lockdown during the first wave of the COVID-19 pandemic created an entirely new situation: with the immediate suspension of flights and ferries, the city suddenly found itself without tourists, a rare sight in this otherwise heavily touristified city, meaning severe economic consequences both for the city's industries and its civic sector. For Dubrovnik's civic ecosystems, the shift from physical to virtual has been fast, and their responses to the COVID-19 situation outperformed the slower and less-adaptive reactions of state structures, city departments and public institutions.

To respond to COVID-19, the cultural center of Lazareti in Dubrovnik mobilized its networks of makers to help the local community in various ways. The center itself is a historic complex renovated for social and cultural uses including hosting workspaces. While the complex was empty, the NGOs working there used their resources to provide relief for the community. Each organization started to do something different: they became engaged in producing 3D-printed protective shields and masks, but at the same time, youth workers and psychologists launched online services and educational courses. The already-existing connections with producers and service providers helped the center to protect its community and strengthen its role in Dubrovnik as a key player in the city's social infrastructure. Additionally, the Platform for Lazareti, which is the network organized around the community center, also began collecting daily memories and habits of people in its community. They organized an online exhibition displaying these, hoping to connect people during the insecure quarantine times and thus contribute to their psychological well-being by making people feel that they are part of a supportive community.

Such actions helped to strengthen already-existing connections in the city and build new ones around Lazareti. A stronger local ecosystem of cultural, creative and social actors made the city more resilient to unforeseen future events. As Petra Marcinko, the coordinator of the local art workshop explains about these times:

> "*Younger activists and volunteers are getting closer to older generations, listening more to their needs and doing their best to look after them. I actually think this played a crucial role in keeping the number of infections so low in the city*."

COVID-19 has also taught the group running the center to expand their thinking and involve public authorities in the process of ecosystem building, underlining the special role reliable funding streams play in the development of local ecosystems.

> "*We realized that we need to better communicate with the government, informing them about local needs and issues. We need to educate the government about the importance of our work, tackling cuts to funding. A lot of people remember the war, so they know the importance of services like ours, as in times of emergency the state didn't have the means and the time to follow local communities and especially disadvantaged groups*."

This more active public role in ecosystem building is also tangible in Naples, where the city has been experimenting with specific policies of a shared and participatory urban management system since 2011. They aim to identify and implement local policies inspired by the concepts of the commons. Commoning has become a central topic in local public policy, with a dedicated department, allowing the gradual development of a local ecosystem ripe with various organizations, many of them social innovation focused, that are closely connected. This proved very helpful during the first COVID-19 crisis, as even before the city could act, thanks to a wide network of associations, cooperatives, soup kitchens, social centers and urban commons, many inhabitants received concrete support early on. Using the ecosystem in place, activists, volunteers and social workers created solidarity networks to support the weakest groups of inhabitants from the first hours of lockdown with the distribution of food and small economic contributions. With the help of a dense interweaving of telephone calls, Facebook groups, Telegram chats, and wiki-based platforms such as viralsolidarity.org, it was possible to track down those in need and enabled active citizens to intervene house by house. Given this situation of isolation, several urban commons provided psychological support with dedicated telephone numbers (such as Villa Medusa) or legal assistance via chat or email (such as l'Asilo). Santa Fede Liberata opened its doors

to give shelter to the homeless. Giardino Liberato di Materdei, together with activists from other communities, contributed to the creation of Radio Quarantella, a web radio with an open editorial board that collected voices from quarantine – not simply from the districts of Naples but from all over the world.

The extraordinary situation faced by cities such as Naples during the pandemic highlights the essential role of self-managed or co-managed spaces of aggregation and mutualism. This was performed in Naples in adaptive reuse buildings where the political activism of some groups has led the administration to carry out a process of innovation in the government of the city with the recognition of civic uses for the activities carried out in seven properties led by the experience of L'Asilo (Villa Medusa, Ex Lido di Pola, Ex OPG, Santa Fede Liberata, Scugnizzo Liberato, Ex Schipa). In fact, the informal and community-based welfare system that active citizenships have been building in Naples for years has confirmed its capacity to react quickly and in a targeted way to the local needs, especially when emergency circumstances required a decentralized approach. This also confirms the important role of urban commons as viable ecosystems, social infrastructures capable of adapting themselves to different challenges, producing public services of social impact through solidarity, creative, collaborative, digital and circular economy initiatives. Finally, it also shows that due to their complexity, ecosystems do not lend themselves easily to central control and planning, but the role of a more central author in creating an enabling legislation or a support system is essential [25].

This last point is best exemplified by the city of Lisbon, which has shown a strong commitment to ecosystem building from an institutional side through its decade-old BIP/ZIP program. This program promotes local development and partnerships in the city's priority neighborhoods. In addition to establishing local governance structures that facilitate communication and shared decision-making between the public administration and neighborhood organizations, BIP/ZIP also includes an ignition funding program for community partnership initiatives with a strong local impact. Competitions for seed funding are opened in the priority neighborhoods and coalitions of local initiatives and organizations can apply. The actions are implemented by the civil society itself in the BIPs/ZIPs, with the financial and technical support of the City Council. The structure of these competitions encourages partnerships and networking in neighborhoods where new alliances are most needed. As pointed out by Rui Franco, one of the main architects of the program:

> *Politically, in Lisbon we started our BIP/ZIP strategy a decade ago. This strategy proved that it is way more efficient to resource bottom-up initiatives than directly acting from higher levels. Empowering bottom-up initiatives can create a more resilient city. What is happening now is that our ecosystem is much more organized and efficient. Moreover, communities are making their voices heard, influencing political decisions and contributing to a better distribution of funds for inclusive projects.*

During the first COVID-19 lockdown, Lisbon's Housing and Local Development Department together with the Fórum Urbano project used this BIP/ZIP program to provide immediate help for the residents but also to support local initiatives by giving them clients outside of their own neighborhood. As a result, an interactive online map was created, listing all the social initiatives that had been part of its long running BIP/ZIP program, as shown by Figure 2 below.

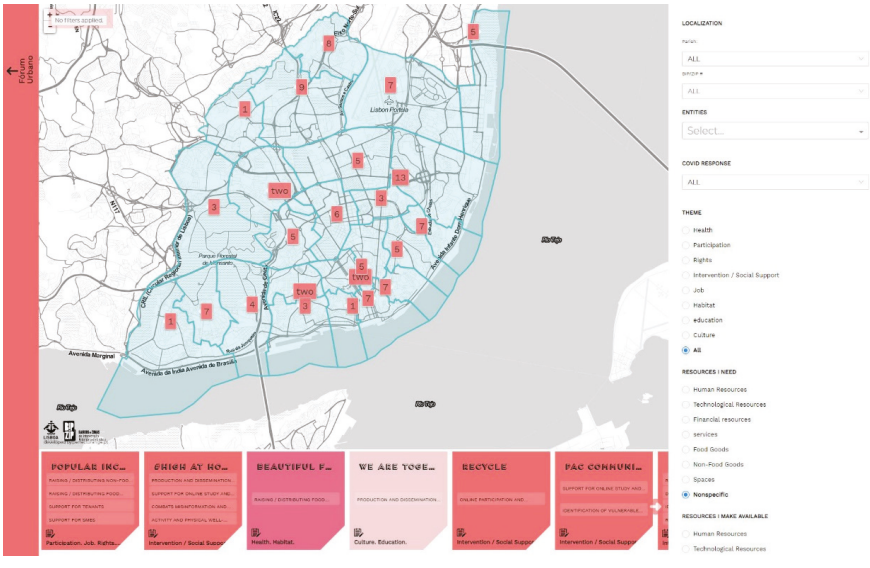

Figure 2. The interactive map of the Fórum Urban project. Available online: https://forumurbano.pt/COVID19 (accessed on 16 January 2022).

The initiatives were very different, and they provided a variety of services from psychological help to hospital equipment, and from food support to cultural services. At the same time the message sent by the Lisbon Municipality was clear: in such a moment of emergency crisis, projects from the BIP/ZIP program fostering local development in different priority areas, were called to demonstrate their social value.

> *"What we have been facing for the last three months here is that everyone with less stability and no savings tends to suffer way more than average citizens. For instance, a teenager from a wealthy family will not experience issues with e-learning access, while poorer kids will find themselves struggling to even get to participate in classes due to poor internet connection and/or die to the fact that poorer families with more kids may not have the chance to provide devices for all family members. This perpetuates the mechanisms of exclusion of the poorer layers of society. As we have always done, we are targeting the causes of inequality and we are working with the Municipality of Lisbon and with other stakeholders to give everyone the chance to build a decent and happy life."*

5. Discussion

A resilient organization is capable to "absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedback" [56]. It is also capable of learning and self-organizing, allowing the maintenance of its core functions, while responding to a crisis [57]. Organizations that are flexible and able to adapt can find it easier to face financial and political challenges and crises of various kinds and degrees, including the COVID-19 crisis. The cases introduced in the paper have all successfully survived the first wave of the COVID-19 pandemic. They have shown that social innovation-focused civic initiatives of different aims and sizes actively engaged with their local communities during the lockdowns and created strategies that have contributed both to their own resilience and to that of the community around them. Their actions taken mutually reinforced these two aims but also connected them better to their communities.

The question remains of if there is an ideal resilience strategy to follow for them among the three identified. The diverse cases introduced by the paper show that there is no best one, only an appropriate one. Nevertheless, there are certain elements that are

decisive regarding what resilience strategy seems to be fitting. These are time, the role of municipalities and the availability of resources.

Overall, there is a contradictory relationship between the time needed for a strategy and the sudden change its application requires. The more time there is to build and follow a sound strategy, the less flexibility and adaptation is required on an organizational level. While adaptability necessitates the capacity to change fast, ecosystem building allows stakeholders to undergo slow change while keeping their original profiles and aims practically unchanged. Adaptability is a strategy that focuses on one organization and can (often) be implemented in a relatively short time. Individual organizations can react fast, as the case from Paris has shown. Both diversification and ecosystem building are longer processes. They, however, create the foundations necessary to adequately respond both to slow-burning transformations and emerging challenges. In case of Naples or Lisbon, decade-long activities created a local scenery, where the individual groups could not only rely on themselves, but also exploit the resources of an entire ecosystem network. Importantly, organizations in the local ecosystems did not need to change their profile: as a result of the well-built ecosystem, only flexibility was required from them to adapt to a new clientele and not to change their profile.

While ecosystem building always needs more stakeholders, the strategy of diversification is possible to carry out as a single organization. Gólya in Budapest operates in an environment lacking the supportive policies of Milan, Naples or Lisbon, but it still managed to develop new business branches. Gólya was pushed into diversification by the long months, when its bar had very few guests. This also illustrates that the biggest bottleneck of success for diversification is time, as the development of new functions and services does not happen overnight. Importantly, diversification requires little public support, and if carried out well, it could be the basis of sustainable business development models in the future. For small initiatives, it is a conceivable strategy to follow even in places where the NGO scene is volatile or underdeveloped. All in all, despite the high level of flexibility shown, extreme challenges—such as a pandemic—can overstretch the capacities and possibilities of initiatives. The lesson from Turin's Cascina Roccafranca shows that even with well-diversified income sources, fundraising and public support are crucial once the initiative concerned is a large complex. Gólya in turn is a small organization needing less revenues, which was helpful when, due to the pandemic, important income sources simply fell out.

In the end, it is ecosystem building that provides the biggest and most complex safety net for various organizations both in the face of short-term and long-term challenges, allowing individual organizations to share their resources, support each other and develop complementary services. Well-functioning civic ecosystems are, by nature, more cooperative than competitive and instead of growth, they aim to build systemic resilience, encourage mutual support and enable both individual organizations and the ecosystem as a whole to respond to future challenges. Ecosystems thus support shifting from a competitive relationship to collaborative interdependence with each other. As shown by the case in Naples, small, bottom-up initiatives without solid legal and financial backing could survive and provide their services once part of a larger framework, such as a local ecosystem. However, this requires a well-established and active NGO scene as an ideal environment, unimaginable without a strong institutional commitment. It also requires many years of work and public support, as shown by the cases of Lisbon or Naples. It is possible to imagine a municipality being substituted by a foundation or some other independent and non-partial stakeholder. However, regardless of the main actor, this strategy requires both a long time and a very close cooperation between various actors throughout its implementation. These two requirements can become potential bottlenecks, as direct interests are often conflicting even if the overarching goals are similar. Additionally, the building of successful ecosystems cannot happen during a crisis. Rather, as shown by the examples above, the truly successful ones are the results of long-standing cooperation, where the crisis is rather a crash test of the already functioning ecosystem.

Generally, the role of municipalities is very important everywhere: they are seminal actors who have the capacity to create a nurturing local environment that supports social innovation. The diversification of activities and decision-making processes can also be supported by municipalities. Be it capacity building or a series of trainings, initiatives can grow more conscious of opportunities to better fund or manage their projects. A close monitoring of an initiative's operating context (from a viewpoint of a public administration) can also result in better sensitivity to invisible, structural changes in this context, such as demographic transformation resulting in different needs for community services. Municipal funds are good tools to encourage cooperation and ecosystem building, prioritizing collaboration in the local scene. Such "collaborative commissioning" or "participatory grant making" can help initiatives develop complementarity in their activities and better connect to each other. Such funds can also be completed by grants, tax breaks or loans, aiming at maintaining a civic tissue in a given neighborhood, city or region. Additionally, municipalities as well as non-profit private actors can help initiatives connect with each other, develop networks and build civic ecosystems that enable individual initiatives to grow more resilient.

The comparison of the cases also showed the extraordinary role of temporary use among the civic initiatives and their resilience strategies. Reusing these spaces and reaching out to the local communities through them plays an important role in the lives of social initiatives. It nurtures them, gives them space to develop further, to organize themselves, to adapt to their new environment and remain flexible to the extent that it contributes to their resilience. It also gives them time, as these buildings are typically not needed by other actors, at least not on a short term. In the development of the ecosystem around the Lazareti, the gradual refurbishment of the historic space and the presence of civic initiatives from early on was a crucial factor, while in Paris, a new world was created by LGV, completely reinterpreting relations between space and people.

Importantly, all cases show that resources—be them financial, knowledge or networks—are inevitable assets for the survival of these initiatives. They deployed them very skillfully during the spring of 2020, helping them to become more resilient. Non-financial ones are enough if a large actor is present—such as the municipalities of Lisbon, Naples and Paris—that provide a general supportive umbrella above the initiatives. However, for groups moving in a less-friendly environment, such as Gólya, financial stability is crucial. Additionally, even partially municipal projects such as Cascina Roccafranca need to financially plan ahead for sudden events.

The inspection through the lens of the COVID-19 pandemic has also shown that resilience is a hard-won characteristic, and resilience strategies do not appear overnight. While all initiatives studied needed to act fast, they all had prior experience and knowledge to build on. For the LGV in Paris, despite the short call from the municipality, their organizational structure, their knowledge and their networks made them capable to adapt and react flexibly, to change their focus and activities from one subject to another in a matter of days. Lazareti could count on the community of artisans and workshops with which it had a long-standing connection. Actually, all the initiatives that employed a strategy of diversification or ecosystem building changed their activities to some extent but stayed within their own networks reaching out to their community albeit with different methods.

All strategies have shown that successful resilience is not a fixed state, rather that of constant change, as suggested by Davoudi [13]. Additionally, civic initiatives, especially those focusing on social innovation, require some degree of flexibility and adaptability all the time. However, local embeddedness and a community to serve and receive support from are crucial for the development of a successful resilience strategy of a small initiative.

6. Conclusions

The paper identified three distinct strategies, adaptability, diversification and ecosystem building, which organizations and civic initiatives can pursue to support their resilience. The recognized strategies need various degrees of flexibility and adaptation from the side

of the initiatives, with the first one being applicable rather immediately and the last one requiring the most time. Through the selection of cases, the paper wanted to illustrate how the above-mentioned strategies play out in practice. The selected cases were all initiatives in the pursuit of social innovation; thus, the paper also fits into the line of inquiries that seek to understand better how these initiatives connect to each other and the public sector [5].

Focusing on the first wave of the COVID-19 pandemic gave the opportunity to see how various organizations, dispersed around Europe, reacted to the same challenge—namely the pandemic and the lockdowns—in a given timeframe. While describing the ways they operated and cooperated with each other, the paper sought to highlight practices and corresponding policies that enable separate initiatives and organizations, as well as partnerships to respond better to long-term transformations and unpredictable, short-term challenges. These strategies, while requiring flexibility and adaptation to various degrees, also enable the initiatives to achieve their goals even if with slight modifications. The choice of strategy depends a lot on the environment in which an organization is operating.

By placing the resilience of organizations at the center of our analysis, the paper was able to provide valuable insights into the role of their flexibility and ability to adapt to changing environments. However, there are many ways the current inquiry could be developed further. One line to pursue would be to change the case selection method and compare the current initiatives with a selection of those who could not survive the lockdowns of the pandemic or had to—at least temporarily—stop their activities. It could be interesting to see what the fundamental differences between them and the cases described here were. If they reacted differently, what was the reason behind this, and why could the resilience strategies outlined in the current paper not work in their case?

Additionally, the role of municipalities as a supporting agency could be inspected further. One particular thread of interest would be about seeing to what extent their role can be substituted by other actors in an environment where public authorities are not so supportive. The example from Gólya is very valuable in this respect, as the initiatives that strive to build up a network from other similarly thinking cooperatives. This can also be interpreted as an attempt to build an ecosystem.

Finally, the relationship between the resilience strategies and adaptive reuse could be questioned further. The fact that many of these cases are embedded into adaptive reuse processes—e.g., the Lazareti in Dubrovnik, Cascina Roccafranca in Torino, Les Grand Voisin in Paris—provides an interesting framework for further analysis. Conceived in itself as a process of change, adaptive heritage reuse requires simultaneously physical (focusing on the building and the site) and organizational (who runs it and what is the purpose) adaptation and flexibility. Many adaptive reuse projects are central components of urban redevelopment strategies, and they have become key in repurposing urban centers, co-producing public spaces, and helping the sustainability and contributing to the resilience of lived heritage, while providing opportunities of engagement for communities and bottom-up initiatives [24]. They have also become important testing grounds for change, allowing organizations of different sizes, backgrounds and purposes to develop flexibly and to adapt. Finally, both tangible and intangible heritage have the capacity to adapt to changes as they transform and develop through time. Meanings and understandings metamorphose, which helps to maintain the significance of cultural heritage, a process that contributes directly to its resilience [58,59].

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Urban Rehabilitation, Social Innovation, and New Working Spaces in Lisbon

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Abstract: This study brings together three subjects: urban rehabilitation, social innovation, and new working spaces, envisaging an intersectoral viewpoint, focusing on a European city, Lisbon, arguing that the public sector holds the capacity to consistently drive positive achievements in this respect. This study involves analyzing policy, governance, and urban planning documents in force, observation and spatial analysis using open-source databases, and stakeholder interviews. The result is in line with the primary research plea applied to the case study, and conclusions show that public intervention, whenever applied systematically from the city vision to local plans, resorting to close bonds between the sites and the communities in a participatory and collaborative way, may lead to urban rehabilitation and social innovation through the inception and development of new working spaces. The study was designed while researching as a member of COST CA18214 (The Geography of New Working Spaces and the Impact on the Periphery).

Keywords: urban rehabilitation; social innovation; new working spaces; municipal urban planning; Lisboa/Lisbon

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1. Introduction

This study addresses the municipal interplay between urban rehabilitation and regeneration, the location of new working spaces (NWS) [1], and the promotion of social innovation, putting design and urban sustainability at the forefront of the city's strategy. Cities are contextual. Therefore, the study applies to Lisbon, highlighting this specific 21st-century approach to urban planning and design practice.

Following a preliminary study of the location patterns of NWS in Lisbon, it became clear that a new angle could be explored if NWS were observed through the lens of urban rehabilitation and social innovation. Such hypothesis would be confirmed by a systematic review of public policies and urban planning aiming at the development of NWS, at the municipal level, together with funding aimed at Social Innovation projects. The work was developed under the scope of COST CA18214—The Geography of New Working Spaces and the Impact on the Periphery.

Background

This study brings together three subjects: urban rehabilitation, social innovation, and new working spaces, envisaging how public sector action can affect all three in a particular city.

Although the correlation between these factors has emerged due to current urban realities, the scientific literature linking them is often lacking. In this case, we aim to look at Lisbon. We wish to bring about particular interventions with a view to social innovation and the creation of new working spaces, taking into account a multilevel perspective (looking at the metropolitan level) whenever possible.

Some authors imply that the creation of new working spaces should germinate from the overall urban planning architecture, which then leads to social innovation. However,

this article will show that bringing the public institutional realm to the forefront of the debate, as Mieg supports in [2], is crucial.

It is not uncommon to find that the scientific literature tends to be detached from the planning practice due to its specificity. According to Stiftel [3], in some cities it does not even interact with the academic urban and planning realm to work towards general social, economic, and environmental advances.

There is considerable consensus regarding the need for the rehabilitation and repopulation of older city centres [4,5]. Jacobs (1961) [6] and Gehl (1971) [7] introduced the advantages offered by older, traditional districts characterised by diversity and liveability —in a nutshell, this fits the post-modern view of the 15-min city, or even the previous 'vicinity unit' concept. The conditions necessitated by COVID-19, e.g., lockdowns and quarantining, along with the absence of daily commuting, raised the public's awareness of neighbourhoods and the diverse commercial services and amenities they could offer to the public.

Urban rehabilitation and urban regeneration have been addressed in urbanism, specifically in countries with a Romanistic background, where the material quality of space, by design, is synonymous with cultural practices in the construction and the life of a city [8]. However, there are differences between urban rehabilitation and regeneration that are meaningful under the remit of urban planning cultures in terms of the institutional, spatial, urban planning, and design domains [9].

Under this umbrella, urban rehabilitation is promoted publicly, envisaging the material improvement and the functional update and activation of the pre-existing urban fabric—buildings and public spaces—safeguarding residents and improving their quality of life, i.e., avoiding gentrification [10].

Thus, methodologies, technical teams, partnerships, and participation are vital in this process. This has become a consistent practice in historical centres and suburban areas, where public space qualification and the introduction of functional diversity and jobs is used to promote the public's involvement in the rehabilitation of their own neighbourhoods [10].

In this specific sense, one may argue that urban rehabilitation is intrinsically related to social innovation, when the strategies and planning involved address an urban–social ecosystem driven by different actors seeking to build capacity within the different social layers, through a specific co-creation driver that allows for a positive transformation towards local and interpersonal innovation, bringing effective transformation to the area [11,12].

Furthermore, choosing co-creative environs as drivers of urban fabric rehabilitation and involving local communities in the improvement of their quality of life and wellbeing introduces the third factor that we aim to address, i.e., publicly promoted new working spaces. In the context of this study, international agendas [13], social innovation, and co-creation as a participatory process come together in the design of the public realm [14–16].

Therefore, social innovation emerges as a relevant target for a diverse and inclusive city, strengthening the economy and diversifying the ecosystem of activities—bringing a city back to life. It could be said that social innovation is framed towards a European public policy view, as since the 1980s the regional economic approach has been looking for a way to balance regional disparities. Moulaert (see Chapter 1 (*Social Innovation*: *Institutionally Embedded*, *Territorially*) [17]) argues that, concerning territory, social innovation seeks, among other goals, to transform social relations and the interlinks between space, identity, and culture (what architects and other urban-related professionals address as "place") and to establish governance structures, either regional or local. Domanski [18] refers to social innovation as a critical topic in Horizon 2020, the latest European Union (EU) Framework and, since most of the funding is dependent on EU agreements, goals, and policies, several policies address it specifically.

Conversely, Roberts and Sykes [19] focus on urban regeneration under the Anglo-Saxon Land Use Management wings, stressing the economic and funding aspects of urban development, resorting to the agency model. In the chapter *Evolution*, *Definition and Purpose*,

Sykes refers to the need for "a comprehensive and integrated vision", i.e., strategy, aiming to provide lasting "economic, physical, social and environmental" improvement (p. 17) [19]. From this line of thought, one finds a direct thread to the importance of economic activities as supporters of jobs and communities and, often, to the involvement of the private sector, such as the real estate market and the international networks of NWS providers.

This study builds on the typology of NWS as considered by COST CA18214—The Geography of New Working Spaces and the Impact on the Periphery—funded by Horizon 2020. This includes (i) collaborative and creative working spaces (coworking spaces and smart work centres); (ii) makerspaces and other technical spaces (fablabs and open workshops); (iii) other new working spaces (hackerspaces, living lab, and corporate labs); (iv) informal new working spaces (coffee shops and libraries) [1].

COST CA18214 provides robust evidence of new working spaces' typology and their location patterns. The location of new working spaces in Lisbon (using open databases such as Google Maps and CoWorker) appear to follow the open real estate market, either as company networks (e.g., international such as Regus) or in older, more traditional districts at a smaller scale, or in more experimental spaces as an option to rent places that have lost their commercial or housing prospects [1,19–25].

Nevertheless, when the intention is to look for new working spaces' role in concrete urban rehabilitation, their capacity to contribute is limited without the will of a public stakeholder, such as a municipality, that has the capacity to draw links between strategy, urban planning, and further implementation and has the leverage to find funding.

Having secured the urban rehabilitation spark, following the waves of free-market choices is an easier way to catalyse urban regeneration, thus following and interacting with a comprehensive set of local urban plans and designs for the city.

Hence, in a welfare state, as in the case study addressed below, the vision of a city usually provides the strategic location for NWSs, considering that:

- Creative and knowledge-based workers share a specific social profile, including a preference for flexible working hours and environments, such as vivid, walkable neighbourhoods. These workers enjoy the diversity of cafes and restaurants, dynamic nightlife, active street life, and cultural events.
- NWS spaces often occupy pre-existing deprived structures, i.e., social-economically peripheral—industrial sites in former urban fringes or current buildings in urban centres—that became inadequate in some way for their previous usage and are thus available.

2. Materials and Methods

From an architectural and urbanistic point of view, ethnographic research methods often imply site observations and analysis, especially when seeking to go beyond a morphological approach. This process is phenomenological at its core [25–28].

In urbanism with an architectural and social background, the aesthetic options are erudite, stereotyped, or vernacular. This is what happens in research projects or problem solving-oriented urban design and planning studios and workshops.

In this study, we consider the following: (1) urban practices in Bairro Alto; (2) Urban Design Studios in Mouraria, Marvila, Bairro Alto, as well as international workshops under the aegis of the ISOCARP/Young Planning Professionals; and (3) research spanning the past 20 years addressing the urban transformation of the Lisbon Metropolitan Area. These contribute to our ethnographic perceptions of the places and examples referred to in the study, notably within the historical centre and eastern/oriental territorial units as expressed in the cartographical results. These activities involved local authorities, communities, field trips, observations, and the review of various documents (historical, cartographic, and/or urban planning).

In the conceptualisation of the article, these experiences lay the foundations for how the city of Lisbon was approached. We used (1) literature, especially the contributions from the research network COST CA18214 (The Geography of New Working Spaces and

the Impact on the Periphery) (see 1. Introduction; The Background); (2) a systematic review of the Lisbon City Council official documents regarding governance and urban planning, such as the analysis of municipal strategy and urban planning documents and interviews with urban planning stakeholders (see 3. Results; 3.1. Governance and Urban Planning in Lisbon: A review) (see (3) spatial analysis and geocoded datasets, official and open source (3. Results; 3.2. Where do the City Vision and the Local Plans Meet?), highlighting the territorial expression of NWS within the Urban Rehabilitation Area of Lisbon (see Figure 1), Administrative and Territorial Units of Management, the current Status of the Urban Development and Detail Plans in Lisbon (see Figures 2 and 3, Table 1), and the concomitancy of the NWS promoted as drivers of social innovation in Detail Urban Rehabilitation plans, the levels of ageing and vulnerability and the concentration of creative industries (see Figure 4 and Table 2).

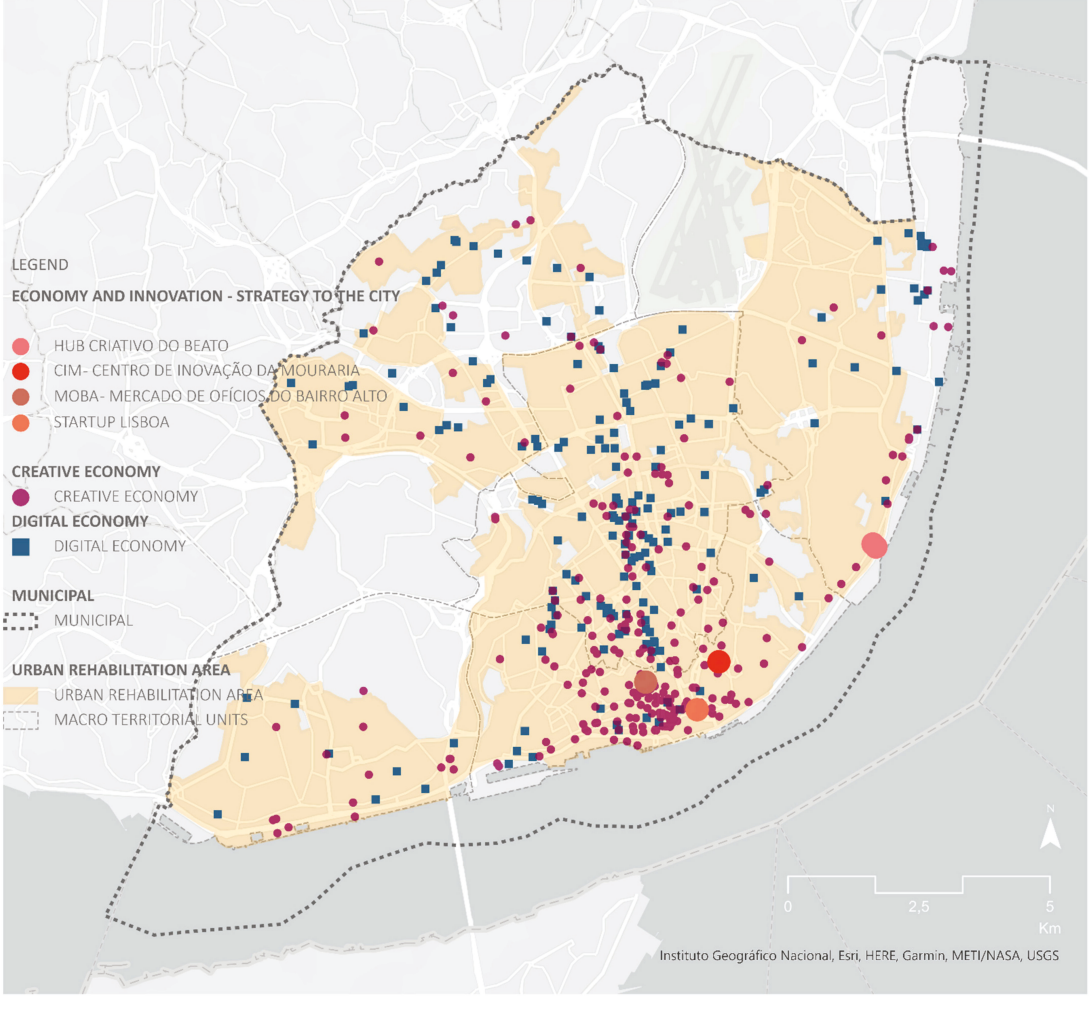

Figure 1. Lisbon rehabilitation area: Creative hubs with a role in urban rehabilitation, creative and digital economy overlap with the urban rehabilitation area, Lisbon City Council. Sources: Adapted from the Lisbon City Council (CML) official open-source dataset (see Back Matter). Basemap source as embedded in figure: Instituto geográfico Nacional, Esri, HERE, Garmin, METI/NASA, UGS.

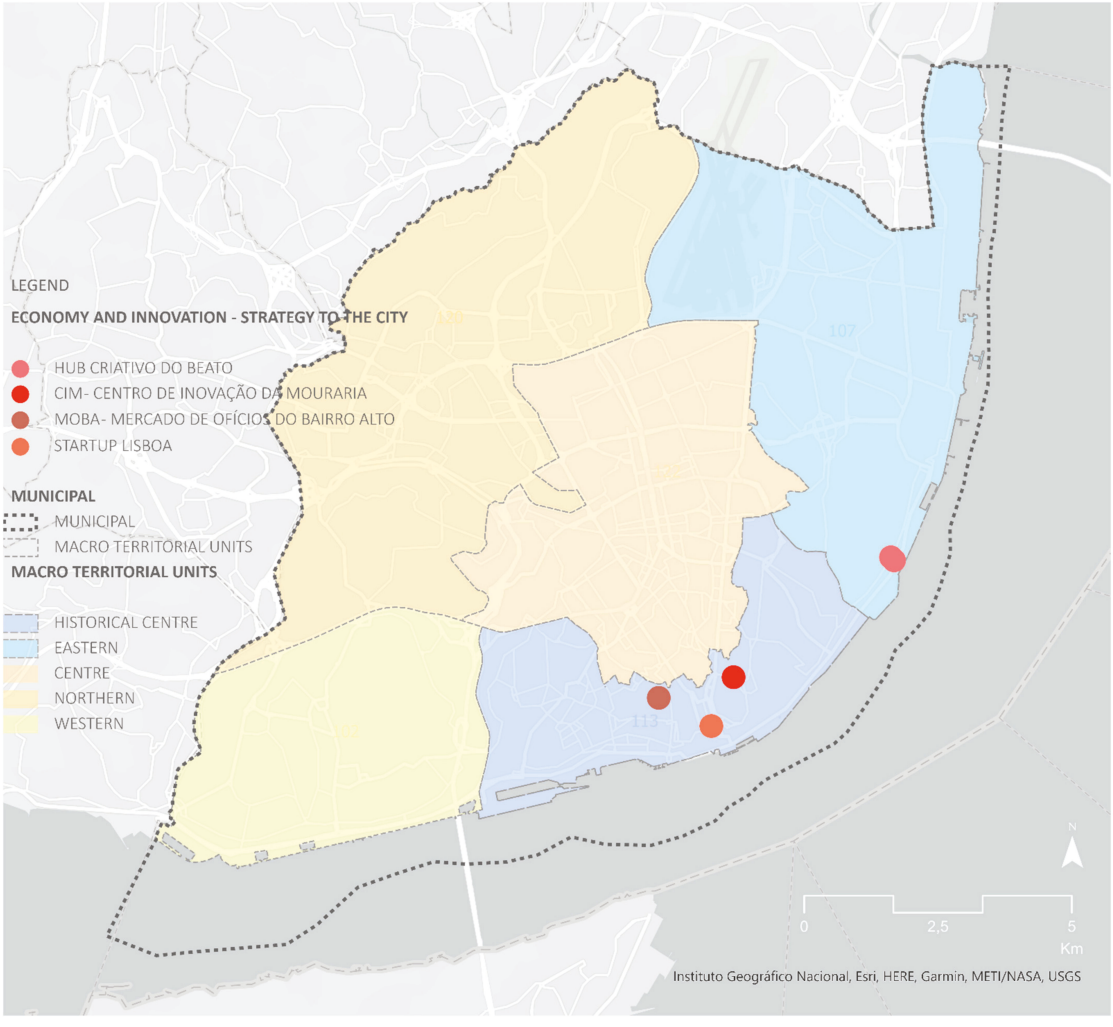

Figure 2. Macro territorial unit boundaries: Creative hubs with a role in urban rehabilitation overlap with the historical centre and eastern/oriental territorial units, Lisbon City Council. Sources: Adapted from the Lisbon City Council (CML) official open-source dataset (see Back Matter). Basemap source as embedded in figure: Instituto geográfico Nacional, Esri, HERE, Garmin, METI/NASA, UGS.

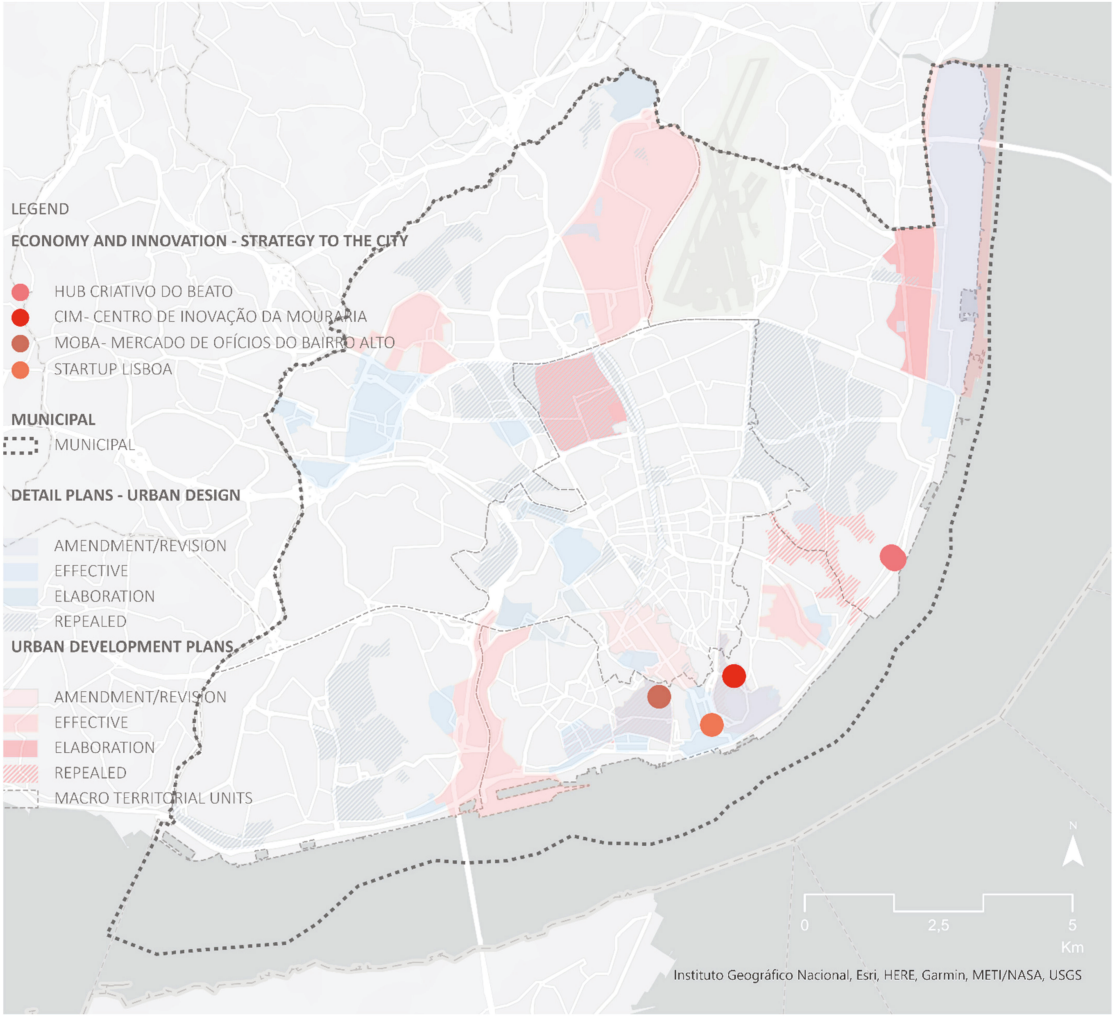

Figure 3. Urban development plans and urban detail plans under various enforcement status: Creative hubs with a role in urban rehabilitation overlap with macro-territorial unit boundaries, by the Lisbon City Council. Sources: Adapted from the Lisbon City Council (CML) official open-source dataset (see Back Matter). Basemap source as embedded in figure: Instituto geográfico Nacional, Esri, HERE, Garmin, METI/NASA, UGS.

Table 1. City Government strategy and urban planning: Review of major options of plan and the municipal master plan and local urban rehabilitation plan applied to the case study (selection of the relevant material to the study). Sources: Adapted from different official documents and websites of the Lisbon City Council (CML).

Major Planning Options of the City of Lisbon 2020–2023 City Government Axis A—To improve quality of life and the environment Axis C—To strengthen the economy Axis D—Lisbon a global city. Topic Creative City (ERU)/Lisbon Rehabilitation Strategy—2011–2024 **Intersectoral** **Municipal Sectoral Areas**		
Economy, Innovation, Creative Industries, Culture	**Urban, Heritage, Rehabilitation**	**Urbanism**
		Urban Planning / *Public Space*
Municipal Master Plan—Urban Rehabilitation Area		
Social Innovation New Working Spaces	**Urban Rehabilitation Detail Plans**	**Public Space Design and Rehabilitation**
Startup Lisboa	Heritage Urban Detail Plan Baixa Pombalina	Public Space Design New Accessibilities to the Castle Hill (soft mobility including public free urban lifts)
CIM-Mouraria Creative Hub FabLab Lisboa H2020 Project HUB IN (Alfama e Mouraria)	Urban Rehabilitation Detailed Plan Castel Hill	
MOBA-Bairro Alto Creative Hub H2020 Project EU Interreg URBAN M (Bairro Alto)	Urban Rehabilitation Detailed Plan Bairro Alto e Bica	
Beato Creative Hub	Rehabilitation of a former Factory Military Site	Waterfront Public Space Design and Rehabilitation

Table 2. Population Variation, Census 2011–2021. Portugal NUTS II, Lisbon Metropolitan Area, Lisbon Municipality (preliminary results, July 2021) Source: INE/Statistics Portugal, INE/Statistics Portugal, Preliminary data, Census 2021, available at https://censos.ine.pt/m accessed 29 September 2021.

NUTS II	**Population (No. Inhabitants)**		**Variation 2011–2021**	
	2011	**2021**	**No**	**%**
Portugal	10,562,178	10,347,892	−214,286	−2.0
Norte	3,689,682	3,588,701	−100,981	−2.7
Centro	2,327,755	2,227,912	−99,843	−4.3
Lisbon Metropolitan Area	**2,821,876**	**2,871,133**	**49,257**	***1.7***
Alentejo	757,302	704,934	−52,368	−6.9
Algarve	451,006	467,495	16,489	3.7
Azores Autonomous Region	246,772	236,657	−10,115	−4.1
Madeira Autonomous Region	267,785	251,060	−16,725	−6.2
Municipality	Population (No. Inhabitants)		Variation 2011–2021	
	2011	2021	No	%
Lisboa	**552,700**	**544,851**	**−7849**	***−1.4***
Districts [1]	Population (No. Inhabitants)		Variation 2011–2021	
	2011	2021	No	%
Arroios	31,653	33,055	1402	4.40
Marvila	35,463	37,793	2330	−6.20
Misericórdia	13,044	9645	−3399	−26.10
Santa Maria Maior	12,822	9997	−2825	−22.00
São Vicente	15,339	13,896	−1443	−9.40

[1] Only the districts where the creative hubs headed by the municipality are included. In 2013, administrative reform led to the merging of several old parishes into larger districts.

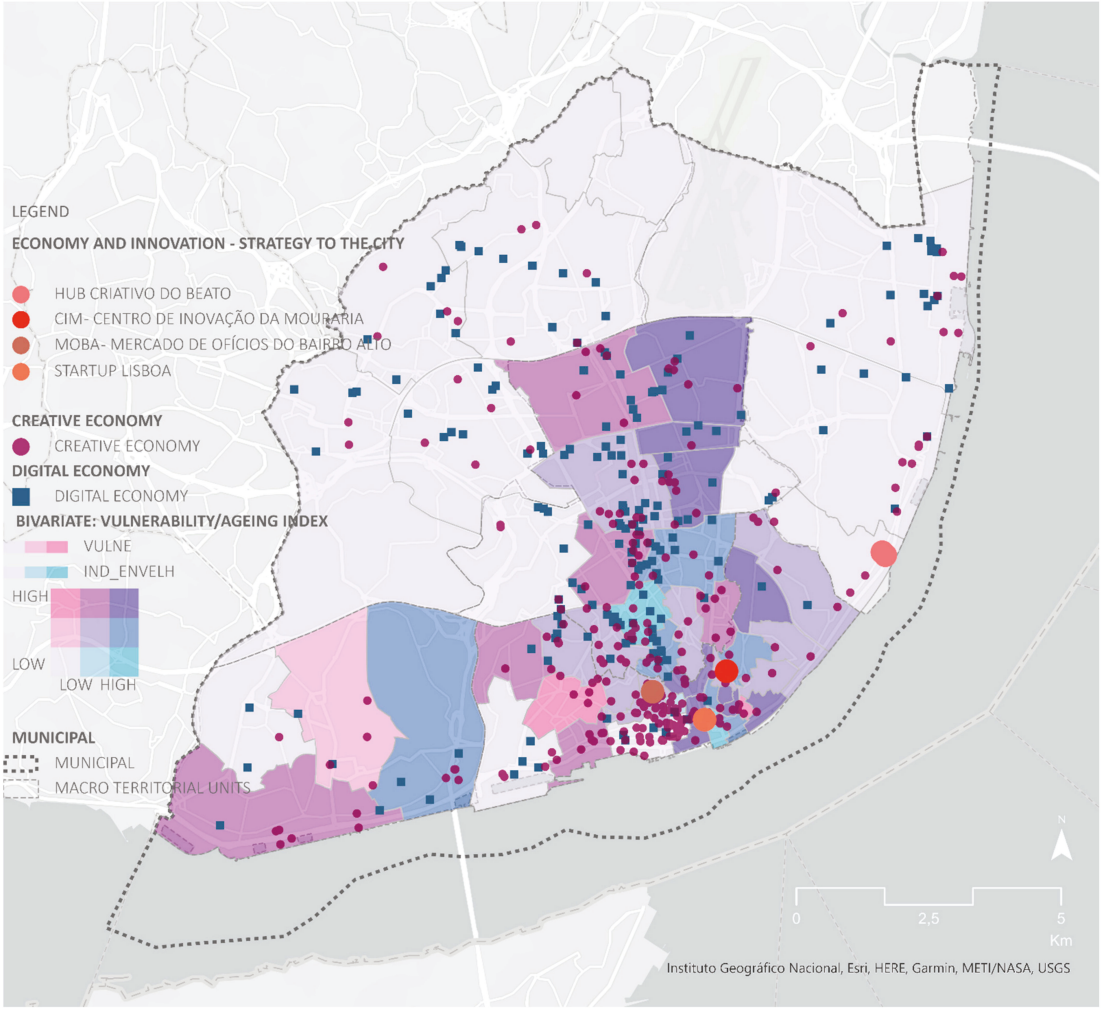

Figure 4. Vulnerability and ageing indexes: Creative hubs in urban rehabilitation, creative and digital economy, overlap bivariate (INE/Statistics Portugal, Census 2011, available at www.ine.pt, 29 September 2021) Sources: Adapted from the Lisbon City Council (CML) official open-source dataset (see Back Matter). Basemap source as embedded in figure: Instituto geográfico Nacional, Esri, HERE, Garmin, METI/NASA, UGS.

3. Results

3.1. Governance and Urban Planning in Lisbon: A Review

The ties between urban rehabilitation, social innovation, and new working spaces were explored in two fundamental governance documents: the Major Planning Options of the City of Lisbon 2020–2023 (GOP—Grandes Opções do Plano para a Cidade de Lisboa 2020–2023) and the Municipal Master Plan (PDM—Plano Director Municipal) [29,30].

From the urban planning viewpoint, addressing innovation in Lisbon, notably social innovation, requires a comprehensive review of the core strategic and planning documents that address the government of Lisbon at different levels of planning and across sectors of governance. In its institutional organics, the review encompasses the intersectional nature

of core areas of the council architecture: (i) urbanism (including urban planning and public space design), (ii) economic innovation, and (iii) entrepreneurship.

The Major Planning Options of the City of Lisbon encompasses all areas under the remit of the Municipality of Lisbon and presents the entire strategic vision of Lisbon. The main axes of development include specific goals and measures, including the global budget [28].

Of the five axes of development of the city, three directly address innovation and urban rehabilitation—(i) Axis A: To improve quality of life and the environment; (ii) Axis C: To strengthen the economy, notably by developing innovation networks and promoting partnerships, investment, and trade agreements; (iii) Axis D: Lisbon as a global city fostering the network of spaces for collaborative work and incubation through incentives for urban rehabilitation [30–32] (See Table 1).

The Master Plan for Lisbon (PDM/Plano Director Municipal) provides the territorial expression of the local development strategy, i.e., the major planning options for the city of Lisbon, considering national and regional programmes [30,33,34].

At the governance and strategic municipal level, sectoral areas such as the "economy, innovation, creative industries, and culture", "urban, heritage, and rehabilitation", and "urbanism" (the latter operationalised through different technical departments that include "urban planning" and "public space") share goals defined by the Major Planning Options of the City of Lisbon Axes.

3.2. Where Do the City Vision and the Local Plans Meet?

Locally diagnosing, defining a programme, and designing an intervention that responds both to global objectives for the city and a particular neighbourhood deals with a range of current issues directly linked to places and people. At this point, urban planning processes open the door to the need for public participation, especially at the local level, i.e., where the different stakeholders of the city meet the local population [30].

These places and related communities hold certain particularities that technical and deep work about those areas must deal with, notably when they hold heritage value and social frailties, as has become common in the inner fringes of European historical centres, especially if gentrification is to be contained by employing urban rehabilitation.

The Master Plan for Lisbon is the planning document that is meant to find direct threads between the strategy (at the Major Planning Options of the City of Lisbon) and the urban rehabilitation detail plans (see Figure 3).

Lisbon municipality is entirely urban land. Even the larger green areas, such as Monsanto Forest Park, are considered urban. In the 1990s, urban sprawl became a problem and the urban fabric and the built environment became subject to maintenance and reconversion where possible to avoid depopulation and decay in the centre. Most of the municipal area of Lisbon is classified as an urban rehabilitation area (see Figure 1), including most of the area that is characterised by urban occupation. In this respect, urban rehabilitation profiles follow the character of the neighbourhoods and are applicable both to highly regarded areas and less qualified places.

The municipality underwent administrative reform at the national level that merged several tiny old parishes into larger districts with more competencies. Onto this statistical web were lain urban management territorial macro units (see Figure 2), within which the historical centre unit and the eastern/oriental unit were singled out for urban regeneration, the centre for its old fabric, which is extremely difficult to adapt to modern ways of life for the public, heritage value, and topography conditions, and the eastern unit for its former industrial character mixed with pre-existing rural estates, monasteries and palaces that offer riverfront potentialities under current work.

The population differs from neighbourhood to neighbourhood, as the bivariate between the vulnerability index and the ageing index shows (see Figure 4): (1) Mouraria, Baixa, and Bairro alto are peripheral fringes, socially speaking, where an ageing population is marked by poverty, low incomes, and social exclusion in the centre [31]; (2) In Beato, the

indexes seem to be lower. However, that may result in a dilution of the population density in a larger area, where the urban settlements are post-modern and in large urban units far from the traditional fabric of the centre (except for the waterfront road).

Thus, the social innovation projects sought to mitigate this situation through the implementation of new working spaces (Creation Hubs) as social–spatial drivers of urban rehabilitation in Mouraria, Baixa, Bairro Alto, and Beato. Despite maintaining its position as one of the most populated municipalities in Portugal and the Lisbon Metropolitan Area (LMA), the preliminary Census 2021 results for Lisbon, and specifically in the districts in question shows a clear drop in population (see Figure 4), confirming prior results coming from Census 2011.

The historical centre unit bears the historical neighbourhoods acknowledged as being of historical interest: Mouraria, Baixa and Bairro Alto, each of which is the recipient of a specific urban rehabilitation detail plan and corresponding creative hub as a social innovation driver [31,32] (see Table 2). All these places are central, exceptionally well connected regarding public transportation, and very appealing regarding urban livelihood. Several archeologic layers also condition them, some going back to the Phoenicians and Romans. One can say that this is the heart of the city.

The eastern/oriental unit, marked by the harbour and railway infrastructure and industrial sites, some of them already reconverted or rehabilitated, is the oriental route, part of a nostalgic Lisbon of old ruins, and exquisite palaces. With the development of Parque das Nações into an extremely powerful metropolitan centrality, it gained a new opportunity as a mid-way point between Baixa and the former Expo'98 area (see Table 2) in the area of Beato [31].

4. Discussion

It was a crisis that influenced such a small nation globally to discover new cultures and trade routes in the early modern age. The Eurozone crisis 2008 launched Lisbon into a renewed adventure into the realm of creative industries and entrepreneurship. The bailout in 2015, and policies avoiding former austerity measures intensified public and private investment. The well-known hospitality and security offered by the country captured incredible tourism development, raising difficult issues such as, on the one hand, providing capital to invest in the city's rehabilitation, notably in heritage conservation and public space redesign and, on the other, touristification in central districts leading to loss of inhabitants (see Figure 4 and Table 2).

The review of governance and urban planning documents, crisscrossing with spatial and statistics analysis, allows us to observe that the location of creative industries is mainly connected to the historical centre and the urban rehabilitation areas, clustering with the social innovation-led new working spaces. (See Tables 1 and 3, Figure 5).

Table 3. Urban rehabilitation plans and social innovation projects promoted by the Lisbon City Council by date and New Working Spaces Type. Sources: Adapted from different official websites of the Lisbon City Council (CML) and the COST CA18214 typology.

Name	NWS Type (COST CA18214)	Main Activities Promoted by the City Council (in Partnership)	Council Participatory Budget (OP) and/or Inception Date	Macro Territorial Units	Main Urban Detail Plan/District
Start-Up Lisboa	Coworking Space	Incubator	OP 2009 2012	Historical Centre	Heritage Urban Detail Plan Baixa Pombalina, Misericórdia, Santa Maria Maior, Arroios
FabLab Lisboa [FabLab Network]	Maker Space	Fabrication Laboratory	2013	Historical Centre	Urban Rehabilitation Detail Plan Castel Hill Santa Maria Maior, São Vicente and Arroios, Effective
CIM Mouraria Creative Hub	Coworking Space, Maker Space	Creative Industries Incubator	OP 2012 2015		

Table 3. *Cont.*

Name	NWS Type (COST CA18214)	Main Activities Promoted by the City Council (in Partnership)	Council Participatory Budget (OP) and/or Inception Date	Macro Territorial Units	Main Urban Detail Plan/District
MOBA Bairro Alto Creative Hub	Maker Space	Portuguese Arts and Crafts	2019	Historical Centre	Urban Rehabilitation Detail Plan Bairro Alto e Bica, Misericórdia, Effective
Beato Creative Hub	Coworking Space and others	Company Campus (ongoing)	Since 2020	Eastern/Oriental	Rehabilitation of a former Factory Military Site, Marvila

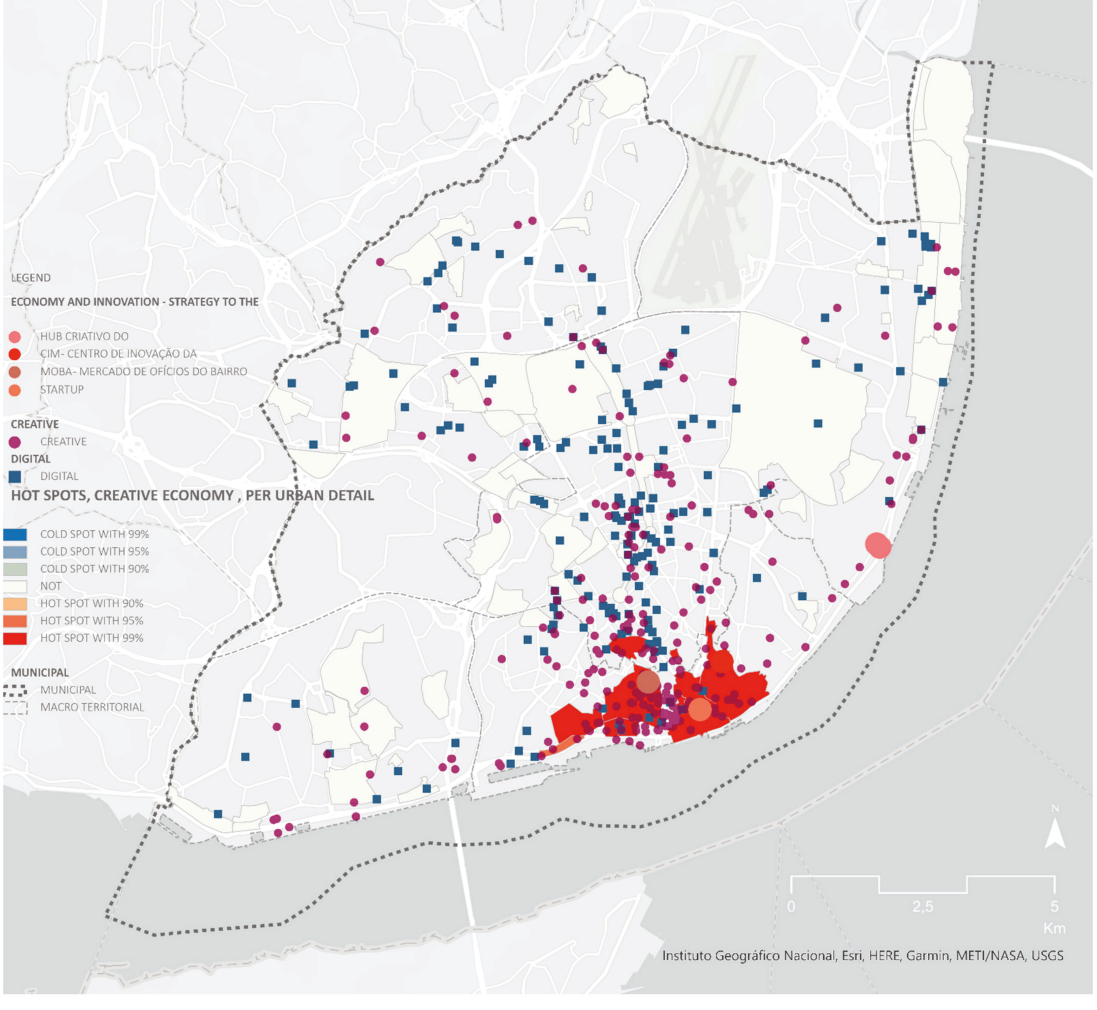

Figure 5. Hot spots analysis applied to urban detail plan polygons—impact of creative hubs and creative economy with a role in urban rehabilitation per urban detail plan in the historical centre territorial unit. Sources: Adapted from the Lisbon City Council (CML) official open-source dataset (see Back Matter). Basemap source as embedded in figure: Instituto geográfico Nacional, Esri, HERE, Garmin, METI/NASA, UGS.

However, the City of Lisbon made a considerable financial and political investment in developing an innovation and entrepreneurship ecosystem (startups, accelerators, incubators, even unicorns) that would put Lisbon on the international panorama, attracting many young entrepreneurs and creative professionals to the Web Summit since 2016.

The digital economy seems to be located in areas where offices are more significant than the smaller and more scattered "arts and crafts" creative economies in traditional neighbourhoods (See Figure 3).

Urban rehabilitation plans anchor social innovation to new working spaces settled in the available buildings, taking advantage of opportunities offered by outdated or ruined pre-existent structures and the possibility of applying funding to instruments such as the Municipal Participatory Budget (OP/Orçamento Participativo), EU funding mechanisms such as ESFR Funds Creative Europe, H2020 (now Horizon Europe) and EU Interreg, or the Social Innovation Fund [33]. The Social Innovation Fund (FIS) is managed by the Portuguese Development Bank (Banco de Fomento Português, 2020) [34,35]. The Fund aligns with the Agenda 2030 SDG-Sustainable Development Goals and falls under the umbrella of the policy mechanism Portugal Social Innovation (Portugal Inovação Social) with the support of the European Social Fund [33].

Affordable housing for younger families, green strategies, public space design (e.g., introducing soft mobility and increasing pedestrian and cycle lanes) and innovation in buildings that become landmarks allow us to pursue one of the strategic measures of the city by fostering a network of spaces for collaborative work and incubation through incentives for urban rehabilitation.

Measures are also in place to promote the concentration of cultural and creative activities in historic neighbourhoods and spaces with obsolete uses. These actions are vital for urban rehabilitation and the economic and social dynamisation of the areas of this study.

The proximity of the events, the inevitable impacts of COVID-19 and the yet to be discovered strategic reorientation by the new municipal executive team, after Local Elections in September 2021, prevent further discussion.

5. Conclusions

Coming to the end of the article, one may well formulate the question implicit in the study's design: Is urban rehabilitation a location factor of NWS and a promoter of social innovation? An unrealistic optimal answer would be positive; however, we can conclude the following:

5.1. In Lisbon

- The result lacks the timescale necessary to assess the impacts fully, and more profound research has to be conducted for that specific purpose.
- Even if the cases reported referred to places with underprivileged populations and the embitterment of the whole ecosystem, the improvements sometimes opened the door to highly exclusive real estate projects drawn by the public space quality and diversity ambience, especially in the waterfront area.
- Each intervention sets in motion complex transformations that continually fail to be tamed, at best only reoriented or adjusted, even in the absence of the instability prompted by situations such as COVID-19.

5.2. From a Broader Perspective

- Steady governance, a welfare state, social perspectives, funds, and circumstances allow us to invest in and design a particular vision of a city bound together with multilevel and cross-sectoral views.
- Mature urban planning and the design of institutional settings and state of the art technical teams and tools are essential.

Cities differ by country and political ideology and often have their own unique challenges. Hence, the case presented here is a child of its time. From a global perspective, this is a view from one particular case in Portugal.

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Data Availability Statement: Publicly available datasets were analysed in this study. These data can be found here: https://geodados-cml.hub.arcgis.com/datasets/cb737bd94c134fb68a372de22e383b7c_11/explore and https://dados.gov.pt/pt/datasets/espacos-e-bairros-criativos/, accessed on 29 September 2021) CM Lisboa 2015, Economia Digital (Digital Economy), ("Dataset of Publicity" The Strategic Actors—Creative Economy—map of Lisbon doesn't represent an exhaustive inventory. It provides data concerning several strategic actors that operate in the city and region according to clusters. Its analysis and selection were performed by Direção Municipal de Economia e Inovação according to online searches on specialised sites and it is constantly being updated and rectified."). CMLisboa 2015, Economia Criativa [Creative Economy], ("Dataset of Publicity" The Strategic Actors—Creative Economy—map of Lisbon does not represent an exhaustive inventory. It provides data concerning several strategic actors that operate in the city and region according to clusters. Its analysis and selection were performed by Direção Municipal de Economia e Inovação according to online searches on specialised sites and it is constantly being updated and rectified."). CMLisboa 2015, Freguesias (Districts) (Serviço de mapa utilizado na aplicação Freguesias de Lisboa.). CMLisboa 2021, Planeamento (Urban Planning) (Map service providing the limits of municipal urban areas and detailed plans.)

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Precaution and Innovation in the Context of Wastewater Regulation: An Examination of Financial Innovation under UWWTD Disputes in London and Milan

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Abstract: The Water Framework Directive (WFD) under the guidance of the precautionary principle sets out standards to guarantee high quality water services for European citizens. This creates pressure on European cities to update and renew their water infrastructures in accordance with EU Law at great financial cost. Cities within the Union try to bridge this financial gap with a variety of approaches. This paper presents the cases of London and Milan, both of which were subject to legal proceedings for breaching the Urban Waste Water Treatment Directive. By example of these two cases, this article details how the precautionary principle affects urban water infrastructure provision, and how the regulation of the primary risk of pollution can both trigger innovation and create secondary risks within the highly integrated urban water infrastructure sector. The London case focusses on an individual infrastructure project and shows how its financial framing has compromised the final outcome, while the Milan case presents a longer-view perspective that shows how structural changes in the urban water infrastructure sector have enabled an environment for sustainable financial innovation. The role of transparency and good local governance practices are emphasized for a successful implementation of the precautionary principle requirements in a city's water sector. Managing this process effectively can result in meaningful social innovation for urban water infrastructure provision.

Keywords: innovation; infrastructure; financializaton; precautionary principle

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1. Introduction

Many European cities are facing the challenges of having to massively overhaul their urban water infrastructures. Ageing and overburdened systems first installed in the 19th century are challenged by increasing environmental standards imposed by European regulation. Water legislation in the European Union is defined by the Water Framework Directive (WFD) and its various daughter directives. These directives form the legal frame for European, national and regional policies for water protection. The Marine Strategy Framework Directive, the Nitrates Directive and the Floods Directive further support these. Furthermore, the 'Water Industry Directives' (Urban Waste Water Treatment, Drinking Water Directive, and the Bathing Water Directive) provide complementary legislative tools for the safe management of sewage, the protection of drinking and bathing waters. These pieces of legislation form the core of water policy in the European Union and each address separate issues within the water sector. As these issues are still closely interrelated, these directives mutually impact compliance [1] (p. 5). The Urban Waste Water Treatment Directive (UWWTD) is of particular note for the purposes of this paper, as it has been utilized to legally challenge cities within the European Union that do not comply with the required standards.

These standards are closely tied to the precautionary principle. The precautionary principle is one of the core principles of the WFD and is established in article 11. The precau-

tionary principle is "a guiding principle that allows decision-makers to adopt precautionary measures even when scientific uncertainties about environmental and health impacts of new technologies or products remain" [2]. The precautionary principle itself is subject to ongoing debates: there are numerous voices that claim that the precautionary principle hinders innovation and only triggers new risks due to uncertain side effects [3]. While, it is also known from research that carefully selected environmental regulations can lead to innovation [4]. There is a discrepancy in how the precautionary principle is being put to use: there is an emphasis on making use of the principle by applying it to the factors that trigger its application, there is less guidance on how to implement precautionary measures that prevent this triggering in the first place [2]. Thus, the precautionary principle by means of the WFD enacts immense influence over the way we organize and manage our cities' water systems: it triggers punitive measures in case key factors are not met, but it does not prescribe precautionary measures that would help cities maintain good standing with those factors. There is a certain consensus that the implementation of the precautionary principle can preferably be done by means of Responsible Research and Innovation (RRI). RRI is a conceptual framework for integrative research policy, primarily at the EU level [5]. From the EU side, the principle of democratic governance is emphasized above all, namely that "societal actors work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs, and expectations of European society." [6]. Authors of RRI (e.g., [7]) at the same time emphasize aspects of responsiveness, for example, anticipation as the ability to consider alternatives and to ensure reversibility.

The ensuing situation presents cities with an enormous task: in order to avoid these legal challenges, cities have to invest immense sums beyond their financial capacity into their water infrastructure. This 'infrastructure gap' engages a variety of actors that develop different strategies for bridging it. Arguably, this raising of environmental standards under the precautionary principle might foster a particular kind of innovative milieu that strives to overcome the infrastructural challenges at hand [4]. A key area here is the question of finance and the emergence of new financial arrangements to bridge the gap. Within the literature this process is most commonly discussed in the context of the financialization of urban infrastructure, with a variety of long-term implications for urban development, politics and policy (see for example [8–11]).

Two cities that were subject to legal proceedings under the UWWTD are London in the United Kingdom and Milan in Italy. By example of these two cases, this article will detail how the precautionary principle affects urban water infrastructure provision, and how the regulation of the primary risk of pollution can both trigger innovation and create secondary risks within the highly integrated urban water infrastructure sector. This balancing of risks and innovation in a multi-risk environment is one of the key challenges for the precautionary principle in the infrastructure sector, where the regulation of one aspect might lead to the introduction of regrettable substitutions elsewhere; this is particularly significant in an environment in which the way we finance water infrastructure development is fundamentally changing (see for example [12,13]). The overall challenges of integrating water services more closely with long-term urban planning objectives has been recognized as one of the key issues for improving European water policy [1]. Koop and Leeuwen emphasize this point and helpfully provide a comprehensive perspective on the resulting needs for good water governance [14] (see Table 1). This contribution investigates by example of these two cases whether the precautionary principle by means of the UWWTD instigated social innovation in the water infrastructure development process and if so, which particular innovations we can identify.

Table 1. Good water governance. Adapted from Koop and van Leeuwen 2017 [14].

Good Water Governance
1. Develop a shared long-term vision between stakeholders. 2. Involve civil society and the commercial sector, along with stakeholders: recognizing that citizens and private businesses can individually contribute to success. 3. Manage the process and expertise: to address the complexity of the challenge, conflicting interests, and the need to remain focused on a long-term vision. 4. Stop excessive focus on technology development: recognizing that good governance is equally essential for success. 5. Make data accessible and share knowledge. 6. Carry out a thorough cost–benefit analysis and remove financial barriers: success is not dependent on simply providing more money. Limited finance can drive innovation, improve stakeholder cooperation, and help leverage new funding sources. 7. Monitor implementation: legislation and a good strategy must be supported by a demonstration that implementation and achievements progress as intended

2. Methods

This article is based on two case studies that were conducted for the RECIPES project (recipes-project.eu). The data is based on 15 interviews (can be found in Supplementary Material) with experts and practitioners in the fields of finance and water infrastructure provision, as well as on a document analysis of 224 documents issued by relevant institutions related to the two sites (see Table 2). The cases were selected for their similarities with regard to the legal issues surrounding the failure to comply with the UWWTD and their very different approaches for implementing the verdicts. The following presents an overview over key aspects of the two cases (also see Figure 1).

Table 2. Document analysis data.

Source	Number of Documents
Documents by Responsible Ministries	18
Documents from Environmental Agencies	15
Documents from the European Commission	27
Documents from Local Administrations	25
Reports issued by Local Water Service Companies	43
Reports from Regulators and Oversight Institutions	37
Reports from Investors	10
Documents from Political Organizations	9
Expert Reports	16
Press Reports	24

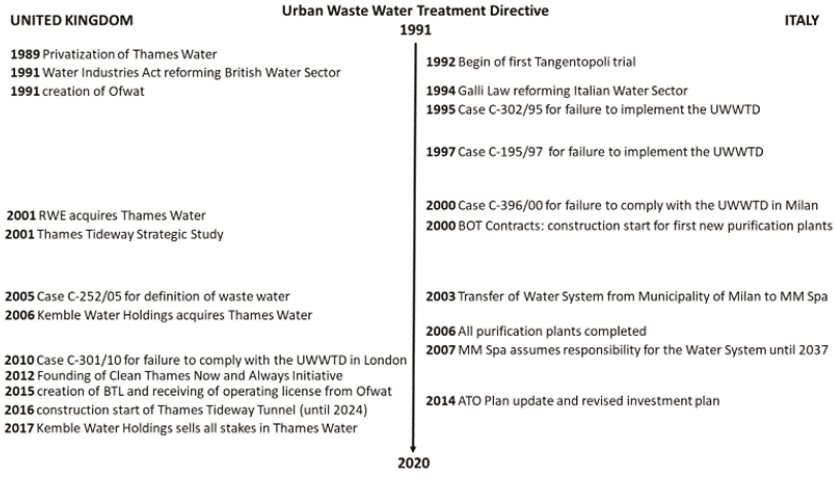

Figure 1. Timeline of the cases.

2.1. London

The 2010 legal case against the United Kingdom centered around the overflow of the sewage system into the river Thames in case of minimal rainfall [15,16]. The case argues that under the UWWTD London does not provide adequate infrastructure for the prevention of pollution. As a consequence, the city was presented with the challenge to fix the problem and present a solution that was both capable of coping with the difficult post-financial crisis funding situation as well as the long-term infrastructural challenges present in London. A strategic study was implemented by the Environmental Agency, Thames Water (TW), Department for Environment, Food and Rural Affairs (DEFRA, the responsible ministry) and the Greater London Authority to determine appropriate solutions [17]. Funding allocation for the different involved sciences was questioned later on, as the results were biased towards large-scale engineering solutions [18]. The selected solution was the adaptation of the water system to and the construction of a 25 km tunnel under the River Thames that effectively acts as a secondary sewer system that catches the overflow of the first when it becomes overburdened. Construction is ongoing and the cost is estimated at GBP 4.2 billion total. Controversies around the project relate to a lack of transparency in selection process following the strategic study, a weak tender process, a questionable financial model as well as challenges to the entire raison d'être of the project, since its services are projected to be no longer necessary (see [8,19]).

2.2. Milan

The legal case brought against Italy in 2000 for Milan's ongoing dumping of untreated waste water into the river system, handles a similar issue, however it is larger in scale. The legal case results from previous cases against Italy for the failure to implement the UWWTD into national law and points out the immense structural changes that had to be implemented in cities across Italy (see [20–22]). Milan was at the time the last major European city still dumping untreated waste water. Due to these proceedings, Milan has been the subject to an infringement procedure by the EU Commission. A reason for the EU Commission's hesitance to impose a pecuniary sanction was most likely due to the belated awarding of construction contracts to private consortia. Milan had to construct two completely new purification plants and implement major upgrades in a third between 1999 and 2006. The awarded BOT (Build–Operate–Transfer) contracts were surrounded by controversy over bribery, lack of transparency and restricted competition. These events

were still very much in line with ongoing fallout from the 1990s Tangentopoli phenomena ("Bribesville", referring to corruption in public works contracts). These scandals facilitated structural changes in the operation of Milan's water sector, particularly with the transfer of the management responsibility for the integrated water system from the Municipality to MM Spa, a multiservice company fully owned by the Municipality of Milan. Even though the way these structural changes were implemented are still not free of criticism and path dependencies resulting from the BOT contracts are still strong, today, Milan's water system has emerged from this transformation process with several technological and financial innovations, that set it apart from fixes such as those that were applied in London.

3. Results

In the following we will examine the cases in more detail and explore how their different dynamics relate to processes of financial, institutional and to a lesser extent technical innovation.

3.1. London: Financial Innovation in the Dark

To understand the financial innovation within the London case, we have to shine a light on the Thames Water's (TW) trajectory and practices in recent years. Thames Water is the key actor for the Tideway Tunnel project, they supply about 9 million customers with water and are responsible for the wastewater of about 15 million customers within South-East England [23]. TW was first privatized in 1989 and has since undergone several takeovers and restructurings. This has resulted in lower credit ratings which mostly result from overleveraging of the underlying assets to finance these takeovers [15]. TW was first listed on the London Stock Exchange but has since been unlisted and employed an increasingly byzantine off-shore structure, which in 2012 consisted of 10 corporate layers between shareholders and the licensed water company. For example, the off-shore subsidiary Thames Water Cayman Island Finance Ltd. holds over half of Thames Water's GBP 10 bn long-term debt. The ultimate owner of TW is the consortium of international investment funds Kemble Holdings Limited, who mostly refinance their investment debts by securitizing household revenue streams [24].

TW financially weak position has resulted in the fact that project delivery is being implemented by a separate entity, Bazalgette Tunnel Limited (BTL), a new special-purpose company with an off-shore holding structure similar to that of TW. The financing scheme passes a proportion of the project costs on to Thames Water's costumer bills, with an estimated GBP 25 added per annum in the mid-2020s. Martin Blaiklock, an independent infrastructure finance expert states that this scheme where customers pay both during the construction phase as well as during service delivery is contrary to common investment principles, as it transfers the project completion risk from utility company to the customer [18]. He concludes that "the incentive for contractors to achieve project completion to time and cost is now much diminished, if not eliminated. Furthermore, customers cannot manage, control or mitigate such risks" (id., p. 4).

Both TW as well as BTL are regulated by Ofwat (Office of Water Services), whose main responsibility lies in the negotiation of tariffs every 5 years based on Thames Water's business plans and Ofwat's internal Regulatory Assets Base Model (RAB). The relatively weak negotiating position of the regulator has been acknowledged and has been the subject of recent politics within the United Kingdom's political process.

The documented increasing withdrawal from oversight mechanisms as well as the relatively weak position of oversight authorities has provided an environment in which financial innovation occurs 'in the dark', and at the cost of future risks [8]. The mechanism succeeds in providing the necessary financial capital but obfuscates key categories that are necessary for cities to manage their planning risks.

3.2. Milan: Institutional Innovation and a Way Out

The history of corruption, lack of transparency, legal proceedings as well as costly BOT contracts have provided for a tough heritage for MM Spa to sort through. MM Spa itself is a joint-stock company 100% owned by the Municipality of Milan. Originally primarily an engineering company and formed in 1955 for the construction of Milan's metro system, it today covers both mobility and infrastructure engineering as well as management duties for municipal housing and other public assets. Outside these core activities MM Spa also engaged in international investments with a joint venture in Moscow with Millenium Bank, part of the Russian Railways group, which shortly thereafter went bankrupt and lost its banking license [25].

The territory and duties for operations of MM Spa is defined by the restructuring of water supply and sanitation operations in Italy through the 1994 Galli Law. According to it, responsibility for water supply and sanitation is transferred to a public authority called ATO (Ambito Territoriale Ottimale). The ATO's governing body selects the water operator and determines the organizational form for water operations. It further carries the responsibility for surveying infrastructure, developing the investment program, setting tariffs and regulating the water operator. This is done via the technical secretariat within the administrative structure of the municipality of Milan.

This sets the framework within which actors aim to provide adequate solutions despite historical baggage and pressing future challenges. Following the 2014/2015 updates to the ATO plan, MM Spa was presented with the challenge of developing an investment strategy to match the plan's requirements to maintain the current level of service as well as adapt the system to future technical and environmental challenges [26].

The key innovative moment is the bilateral development of principles for the financial strategy design and execution between MM Spa and the municipality. This is done to balance the systems long-term requirements with financial viability and current economic opportunities. Stefano Cetti, the director general of MM Spa, summarizes these as follows: "first, total IWS financial needs coverage; second, source diversification; third, risk and collateral minimization; fourth, increase in debt maturity" [27].

The first aspect refers to the principle that the total financial needs of the system up until 2037 (the end of the concession of the system to MM Spa) have to be covered, while guaranteeing coherence between old and newly employed tools, acknowledging current obligations and avoiding the insurgence of refinancing risks [27]. Source diversification refers to the fact that MM Spa aims to take advantage of favorable market conditions and be able to employ different financial instruments outside of traditional bank loans that line up with tariff and investment projections. In order to be able to do this MM Spa acquired credit ratings at the corporate level from Moody's and Standard and Poor's. As a result of this diversification, risks are spread more widely. Risk and collaterals minimization further refers to the fact that the overarching aim is self-sufficiency, thus it aims to minimize risks both to MM Spa as well as the municipality of Milan resulting from instruments that require specific collaterals. The final aspect focusses on the employ of instruments that match in duration the lifetime of the underlying assets. This effectively greatly extends the debt duration, thus heavily emphasizing long-term instruments with a duration of up to 20 years (id.).

These principles were successfully put to practice with the employment of two financial instruments: first, by issuing institutional amortizing notes for an amount EUR 100 mln, to be listed on the regulated Main Securities Market of the Irish Stock Exchange; second, the negotiation with the European Investment Bank (EIB) for a credit facility of EUR 70 million. Both of these instruments are innovative on several levels in reference to Italian water sector practices [27].

3.3. Innovation, Precaution and Shining a Light

The London case focusses on an individual infrastructure project and shows how financial innovation has shaped the case. The Milan case presents a longer-view perspective

that shows how structural changes in the infrastructure sector have enabled an environment for institutional innovation that gave rise to sustainable financial innovation. With regard to technological innovation for infrastructural solutions, the Tideway Tunnel project is filled with such innovations that make the construction of a tunnel under a river across the breadth of city possible. The project itself greatly stimulated the logistics, construction and engineering sectors across the city. Similar patterns occurred in Milan, where individual technical solutions won awards for their innovative approaches [28].

However, the cases provide two different perspectives on financial innovation in the field. The London case focusses on a specific project that employs a highly individualized financial strategy to the benefit of investors, whereas the Milan case presents a perspective that is more focused on the city's long-term needs. Both of these had to employ financial as well as institutional innovation to develop a viable model for the cities' infrastructure development. However, how we pay for infrastructure influences what is to be built, how it is going to be done and the location where it will happen. Thus, a novel financial model introduces new variables into a city's water system, potentially introducing new risks and vulnerabilities.

The innovative impetus induced by the regulatory framework triggered a cascade of innovation in the water sectors of both cities. A critique could be made of the fact that these innovations are unintended and thus unguided, often resulting in the shifting of risks from one area to the next. The vacuum of the infrastructural gap has provided an arena in which, as illustrated in the London case, financial innovation can take advantage of obfuscation strategies and profit of off an imbalance of knowledge between actors. However, the Milan case shows how even despite a difficult starting proposition, financial and institutional innovation can occur in a sustainable and impactful manner. Here in particular, potential exists to translate this occurrence of an institutional innovation into a social innovation that emphasizes transparency and the co-creation of financial strategy development for urban infrastructure provision.

Furthermore, if we understand the implementation of precautionary principle in terms of RRI, as introduced earlier, the solution found in Milan seems to be more in line with the precautionary principle than the one found in London. With respect to the criterion of democratic governance, the stakeholder-oriented, public structure of MM Spa is preferable to the non-transparent financing construct of the Tideway Tunnel. Additionally, with respect to the responsiveness criterion, the "rolling" development and funding solution in Milan seems more advantageous than the ring-fenced technology-led solution in London.

4. Discussion

London's individual infrastructure case shows how the implementation of a market-based strategy skews the selection of actors and the resulting decision-making process towards an overly economically focused solution, that fails to address some of the long-term planning and financial risks. The viability of this strategy will only become known with time, the Milan case though provides some evidence towards the risks inherent in this strategy. Milan presents the longer-term perspective and the effects of past decisions in terms of path dependencies for the adaptation of the water system to future challenges. The process that was developed was informed by the complicated history of the case and innovative in the regard that it developed a process that involved a more balanced set of opinions and outlooks during the decision-making process than the previous case.

The application of the precautionary principle through the UWWTD has significant impact on urban development, particularly due to its skewed emphasis on triggering punitive measures without providing help for implementing precautionary measures (see [2]). Its application creates space for innovation with both potential for sustainable social innovation as well as unintended shifting of risks from environmental impacts towards long-term planning risks and economic vulnerability of cities. The examination of the cases further shows how the complexity of the water sector challenges good governance practices and how external pressures such as those instigated by the directives can lead to

potentially undesirable reconfigurations. It is thus evident that the role of transparency and good local governance practices are essential for a successful implementation of precautionary measures in a city's water sector.

These findings speak directly to Koop and Van Leeuwen's key elements for good water governance ([14], see Table 1). Particularly the first element's emphasis on a shared long-term perspective (1) becomes evident and is further supported by the need for the involvement of all affected actors (2) and the acknowledgement of the complexity and long-term effects (3). As the Milan case has shown, better long-term solutions become viable when these measures are adhered to (4). In particular, the crucial role of financial innovation has been well documented in the cases (5).

As we have shown, it is not always possible to adhere to these principles, especially in a scenario where legal requirements push for immediate action on projects with significant long-term impacts. This often leads to more reactive and ad-hoc implementation of infrastructural solutions. This dynamic paired with the vested interests of certain actor groups in the water sector increases the risk of the creation of 'white elephants', that is expensive infrastructure assets that are more trouble in the long-run than they are worth in the short-term. The case of London provides a telling example of this dynamic. The case of Milan on the other hand shows how past experience and a pro-active use of the innovation aspect of the precautionary principle can foster an environment that achieves good local governance practices and transparent processes that not only help to avoid the creation of further white elephants, but facilitate the creation of a sustainable social innovation in the guise of the co-creation of financial strategy development between utility and city.

Triggering and applying the precautionary principle requires a series of science-based risk assessments [2]. How these should be commissioned and interpreted is politically and legally underdetermined. In this respect, reference can really only be made to the more developed policy advice of risk and technology impact research. Stakeholder inclusion, modeling anticipation and systemic consideration of reversibility have become standards in this field [29,30].

What remains is that the precautionary principle's impact on European cities by means of the WFD and its daughter directives is immense: while triggering the principle is relatively easy for cities, implementing the precautionary measures necessary for fulfilling its obligations is not (see [2]). The repercussions of these impacts are not yet fully explored, especially when it comes to the aspect of innovation. We here have provided some evidence towards the instigation of a social innovation in the financial frameworks of water infrastructure development in the case of Milan.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/su13169130/s1, Table S1: Documents and interviews.

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Beach Access, Property Rights, and Social-Distributive Questions: A Cross-National Legal Perspective of Fifteen Countries

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Abstract: The right to access and enjoy the coastal zone, and especially the beach, is a centuries-old legal tenet in many countries and a key part of Integrated Coastal Zone Management. However, the legal right for coastal access takes on different forms and degrees in different countries (or states). In this paper we argue that accessibility to coastal zones should be seen as a multi-faceted concept, and we distinguish among four different categories of accessibly. The first two—horizontal and vertical access—are the usual notions. We add two more: access to sea views, and access for people with disabilities. Regarding all four categories, in addition to the legal survey, we also attempt to point out some potential social justice issues. The comparative analysis focuses on national-level law and policy in fifteen advanced-economy countries. Most are also signatories to one or two international legal or policy rules about coastal management. The factual information on each country is based on country reports by top national scholars recently published in a book initiated and edited by this paper's authors. In this paper, the authors develop further systematic comparative analysis within a new theoretical framing. The findings show that to date, the international rules have had only limited on-the-ground influence. Many gaps remain, mirroring cross-national inequalities in the rights to beach access. The comparative findings point to some emerging trends—both progressive and regressive. The conclusions call for upgrading the issue of coastal access rights through further research on aspects of implementation and through cross-national exchange.

Keywords: coastal zones; beach access; distributive justice; legal aspects; Barcelona ICZM protocol; international comparative analysis

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1. Introduction

Most of us love coastal areas and want to access them freely. Today, an estimated 40% of the global population live within 100 km of the coast [1]. However, will they have access to enjoy the seashore or beaches? (In the context of this paper, we use the terms "seashore" and "beaches" interchangeably.) In many countries, the public's expectation to have the right to access the beach is embedded in ancient tradition or law. Accessibility is today also part of the broad conception of integrated coastal zone management—ICZM [2,3] (*ICZM Protocol to the Barcelona Convention* and the *Recommendation of the European Parliament and of the Council . . . Concerning the Implementation of Integrated Coastal Zone Management in Europe*). However, heightened beach access rights inevitably entail more anthropogenic disturbances to the ecosystem. With the growing threats of sea level rise, tensions between beach access rights and urban sustainability are growing [4]. In this paper, environmental sustainability will play in the background, to be addressed again when it appears in legislation or court decisions regarding beach access rights.

A daily and highly visible arena of conflict surrounding coastal areas is caused by their attributes as prime real estate locations [5]. Attempts to extend public access rights will likely encounter opposition from private real estate interests and from government

financial and political interests. As Thom [6] argued, beach access is inherently a highly contested issue. Conflicts might occur between landowners on or near the beach and public groups arguing "the beaches are ours"; between the wealthy who can purchase apartments with a sea view and those whose view is blocked; and between socio-economic groups who can pay high beach access fees, and those who cannot afford to do so [7]. The rising commodification of real property potentially exacerbates such conflicts. If one adds the special challenge of enabling beach access for people with disabilities, the potential for clashes among competing objectives becomes even higher. How should such clashes be resolved?

There are no globally consistent answers. This paper does not propose specific normative rules but, rather, presents the many different legal and regulatory approaches among a large set of countries. The readers are challenged to rethink their own countries' coastal access rights now through the prism of what could be learned from other countries—whether positively or negatively. We also try to go beyond the usual legal frameworks and highlight relevant social-distributive issues that might arise. The paper concludes with some thoughts about emerging trends towards international convergence and how these might be enhanced.

2. Research Questions and Method

This paper looks at the ways and degrees to which the right to coastal access is addressed. The overall research question is: How, or to what extent, do the laws, regulations, and policies in a selected group of countries address the public right to access in coastal areas? There are two secondary questions: What are the major differences across the countries studied? And are there any trends visible over time?

The questions were posed in relation to national-level laws and policies in 15 selected countries (Figure 1). Based on a set of shared parameters and evaluation criteria, we analyse the similarities and differences regarding coastal access rights. The analysis is applied to the legislation and "soft law" documents in each of the selected jurisdictions, and also relies on relevant academic publications. The information about each jurisdiction is based on an analytical report written by a leading academic expert (one or two per country) whom we invited to participate in an academic book *Regulating Coastal Zones: International Perspectives on Land Management Instruments*. We shall cite their individual work frequently in this paper. Our collaborators in the book project are: Anker (Denmark), Balla & Giannakourou (Greece), Carmon & Alterman (Israel), Correia & Calor (Portugal), Falco & Barbanente (Italy), Gurran (Australia), Jong & van Sandick (Netherlands), Marot (Slovenia), McElduff & Ritchie (UK), Prieur (France), Schachtner (Germany), Tarlock (USA), Ünsal (Turkey), Vallvé, Molina Alegre & Pellach (Spain), Xerri (Malta). Their contributions are cited throughout this paper. The country chapters were written according to a rigorously shared framework addressing a set of parameters drawn from the principles of ICZM [8]. Accessibility was only one among ten parameters discussed in the book.

Due to the quintessential role of beach access as an expression of the broader values underlying coastal zone management, we devote this entire paper to the topic. The paper goes beyond the information provided in the book in three ways: First, for this paper we conducted a broad survey of current international academic knowledge specifically about beach access. Second, we were able to expand and deepen the theoretical framework dedicated to analysing accessibility rights. Third, the scope of the comparative analysis of access rights presented here goes well beyond the limited space we were able to devote to it in the book ([9], pp. 408–415). For this paper, we undertook further "mining" of the factual and analytical information provided by each country-chapter authors and are thus able to present comparative analysis and evaluation well beyond what is provided in the book.

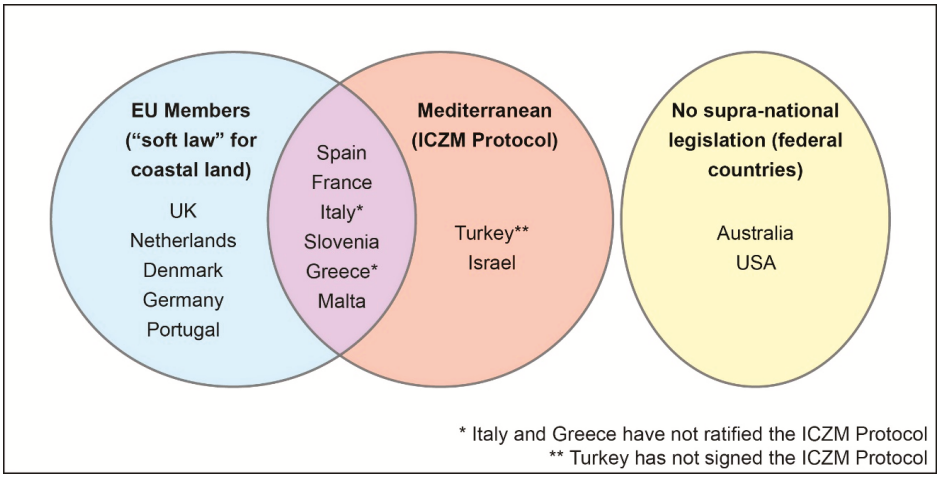

Figure 1. The sample countries and relevant supra-national law or policy.

In addition to looking at each country's individual laws and policies, we also look upwards, at international law about ICZM. This is a unique area of international legislation and supra-national "soft law" which exists only for a limited number of countries. We selected the research countries so that 13 of our 15 countries do come under international or supranational legislation or "soft law" (government policy documents). Figure 1 displays the selected countries divided into groups according to the relevance of supra-national legislation of policy.

In selecting the set of countries (or states) for the comparative analysis, we made sure there would be a sufficient common denominator to enable cross-country learning to some degree. At the same time, we wanted to represent enough diversity to reflect the legal complexity. The common denominator is that all selected countries have advanced economies and a reasonably working governance system (and most are members of the Organization for Economic Cooperation and Development—OECD. The rules of membership in the OECD are that the candidate country has a well-developed economy and a reasonably working (democratic) government. One country, Malta, is not yet an OECD member). Of the 36 OECD member countries in 2020, our set in fact represents a hefty 40%. Our study does not include developing countries.

The discussion begins with a conceptual classification of categories of accessibility. These will serve as the framework for analysing beach access rights in law and practice across the selected countries. Next, we review the academic literature, in order to place our contribution within the current state of knowledge. The paper then introduces the relevant international law about ICZM and coastal access rights. The factual (legal regulatory) information in the paper draws on the findings from the 15-country reports analysis, where we point out similarities and difference and attempt to gauge emerging trends. Throughout, we try to point out potential distributive justice issues. These are usually not spelled out in ICZM guidelines nor in national coastal laws. We end by pointing out the major challenges that still await further legal and policy research, and action.

3. Conceptual Framework: Categories of Public Accessibility and Their Inherent Conflicts

Here we present our conceptual framework, which will serve as the backbone for the comparative analysis of the selected countries.

The most basic notion of the public's right to coastal access is dictated by geography: a defined strip along the coast where public access is permitted. A related notion is whether

and how that coastal strip can be physically reached from the hinterland. To these dual categories we propose to add two more. The four categories are:

1. Horizontal (lateral) accessibility—the public right to swim, walk, hike bike, play, relax, etc., along the seashore.
2. Vertical (perpendicular) accessibility—the public right to reach the seashore from the urban or nonurban hinterland.
3. Visual accessibility—ability of the public to view the coast from within the city.
4. Accessibility for people with physical disabilities.

Importantly, the underlying definitions of the "public" differs across these categories. The first category is usually defined according to an objective geographic area (it may fluctuate with the tidal movements). In demarcating the zone in which horizontal access is a right, the "public" of users is usually general and anonymous. In the second category, vertical access, there is often some discretion about where to locate the publicly accessible routes, and, thus, location-specific and community-specific publics may have better access than others. In the case of visual access, the public served is on the move and enjoyment of the coast depends (literally) on one's point of view. The view from particular neighbourhoods (or office buildings) could be given preference. Thus, social-distributive considerations could be relevant both to vertical and visual accessibility. Finally, the public in the fourth category refers to persons or communities with specific needs, and the right of access would likely be available only in special locations rather than as a general legal rule. The public targeted here—persons with physical disabilities—is usually a small minority, often disadvantaged in political influence and socio-economic terms.

Each of these categories of accessibility is likely to encounter differing configurations of conflicts: horizontal access rights on their own are ostensibly blind to social justice considerations because they tend to apply to a predetermined geographic zone and to the generic public. At the same time, horizonal access rights might clash head-on with real-property rights and economic interests. As we move down the list, social justice concerns play a more apparent role because determining the locations that enable the right of access involves greater discretion about location and extent. Site-specific decisions taken by legislators, planning bodies, or public finance bodies are not blind to population characteristics and, thus, distributive justice questions lurk behind.

4. Contribution to Current Knowledge

This paper (and the book on which it is partially based) seeks to fill a major gap in current knowledge. We hope to contribute at three levels: first, to the best of our knowledge, this is the first systematic cross-national comparison of a large set of countries in terms of their legal and regulatory expression of beach access rights. Second, the paper encompasses all categories of beach access rights within a single conceptual framework. Third, this is the first paper to attempt to address the impact of international law and policy about coastal regulation on the national laws and policies of the signatory countries (the majority among the 15).

In scanning current literature (in the English language), we identified only one legal paper where beach access rights are compared cross-nationally: Cartlidge's [10] excellent analysis compares Australia and the USA, and also differentiates among some state jurisdictions in these federal countries. Country-specific research is more prevalent (not only in English). Much of it is cited by the authors of each country report in our book, and we will not repeat it here. Most previous literature covers only the horizontal or vertical categories of access. This is not surprising, because these categories also attract the most litigation, reflecting their direct interaction with property rights.

As we move up the categories of accessibility rights, academic literature on the legal and regulatory issues becomes more sparse. The third category—visual accessibility—is addressed in architectural and urban design literature about waterfront development, but we have not found any relevant studies about its legal and regulatory aspects. The fourth category of coastal accessibility—access for the physically disabled—draws the attention of

social, public health, and tourism studies, but very little scholarship related to planning or property rights. We shall bring forth the relevant international literature as we discuss each of the categories of accessibility.

5. International Legal Norms

Public access to beaches holds a privileged status among other topics of land-related law. In many jurisdictions around the world, the right of public access is anchored in age-old tenets—"public domain" and "the "public trust doctrine". Most dramatically—public access to coastal zones, as part of broader ICZM, has been uniquely "upgraded" to international law. We discuss these notions in greater detail.

5.1. The Public Trust Doctrine

In many jurisdictions, the legal history of public rights in coastal areas is tied to the "public trust doctrine", which relates (or some argue, should relate) to some types of natural resources [11]. Historically, this doctrine was codified by Emperor Justinian in the 6th Century Byzantine Empire based on Roman common law. The often-cited principle states:

> "By the law of nature, these things are common to mankind—the air, running water, the sea, and consequently the shores of the sea" (cited in [2], p. 3; see also [11], p. 711).

This doctrine is not exclusive to the Roman Law tradition and has been independently developed in some other parts of the world—with varying legal interpretations across jurisdictions and over time [12]. In some countries, the public trust doctrine is manifested through publicly owned land ownership along the seashore. As we shall see, this is dominant among the set of countries analysed here. In some other countries, such as the UK, Australia, and five US coastal states, where private land ownership extends into the sea, the public trust doctrine is sometimes invoked to interpret the weight to be given to beach access rights. The interpretation of the public trust doctrine tends to be in legal flux, and thus has drawn an extensive literature; see, for example, [13–16].

5.2. Public Beach Access in International Law (Mediterranean) and EU Recommendation

To what extent does international law require, or incentivize, nations to adopt rules of beach access rights? As shown in Figure 1, in our set of countries, 13 of the 15 come under the canopy of at least one of two relevant international documents. Two countries—the USA and Australia—are not legally affected by any supra-national rules for ICZM.

In 2008, an unprecedented step was taken when the notion of integrated coastal zone management was elevated to the realm of international law. The legislation, the Barcelona Convention Protocol on Integrated Coastal Zone Management for the Mediterranean (henceforth the Mediterranean ICZM Protocol [17]), applies to all countries along the Mediterranean Basin [18]. It was adopted as a unique multinational effort [5,19]. The Protocol was signed by 20 countries, plus the EU itself. It is relevant to all Mediterranean member states in our sample. Seven of our eight Mediterranean countries have signed the ICZM Protocol (Turkey has not but is eligible to do so). Five of these have already ratified the Protocol, thus rendering it part of their domestic law; Italy and Greece have not.

A few years earlier, in 2002, the European Parliament adopted an important "soft law" document—the Recommendation of the European Parliament and of the Council . . . Concerning the Implementation of Integrated Coastal Zone Management in Europe [20], applicable to all EU member states (henceforth EU ICZM Recommendation). In our study, there are five countries outside the EU: the USA, Australia, Turkey, Malta, and Israel. The two sets of rules (Mediterranean ICZM Protocol and EU ICZM Recommendation) are legally independent, and they both apply to several of our sample countries which are both Mediterranean countries and EU member states (Figure 1). Six of the Mediterranean countries are also members of the EU and thus come under both umbrellas—the ICZM Protocol and the EU ICZM Recommendation. One country—Israel—is bound only by the ICZM Protocol.

These two international law/soft law documents are unique because they apply directly to land ownership and regulation. Nations are usually reluctant to agree to international law that would intervene directly in their land issues. This sensitivity probably reflects the very local attributes of property law, its intensive socio-political repercussions, and the high economic value of real-estate. We recount elsewhere the story of how the European Parliament backed off from its initial intention to include both the sea and coastal land in a binding Directive (as any ICZM textbook would recommend). Instead, the EU had to be satisfied with a binding directive only for the sea (Directive 2014/89/EU of the European parliament and of the council of 23 July 2014 establishing a framework for maritime spatial planning [21]), and a soft-law Recommendation for coastal land ([22], pp. 5–7).

Let's look first at how the right of access to the coastal zone is address by the Mediterranean ICZM Protocol. The quote below is drawn from the "criteria for sustainable use of the coastal zone" [17]:

> " . . . providing for freedom of access by the public to the sea and along the shore" (Article 3(d)).

The wording pertains to two types of access; to the sea (which we called vertical or perpendicular accessibility) and along the shore (horizontal accessibility). The two other types of accessibility are not addressed. The Protocol is binding for the signatory countries at the international law level and for those countries that have also ratified it—also in domestic law (See Figure 1). However, international law on such topics is difficult to enforce.

The second international document is the 2002 EU ICZM Recommendation, which addresses the public right to access the coast thus:

> " . . . adequate accessible land for the public, both for recreational purposes and aesthetic reasons" (Chapter I(f)) [20]

Neither legislation stipulates any further rules or criteria of what constitutes "freedom of access" or "adequate accessible land". However, these documents were clearly intended to stimulate public awareness and discussion of how these norms should be anchored in domestic (national) legislation, statutory plans, or other policy statements.

Beyond our praise for the elevated standing of beach access rights in international law, the reports about the relevant countries indicate that, in reality, neither of these documents have had much direct legal influence. This means that there is little evidence that they have been cited and applied in national (domestic) legislation or court decisions. This holds even for those Mediterranean countries that come under both international documents and have ratified the Protocol. Furthermore, even if the relevant clauses were to be invoked before the courts, the vague wording of both statements about access would be difficult to apply in contested cases.

The focus in our comparative analysis, therefore, remains at the level of each country's internal laws and policies. The analysis will follow the conceptual framework presented above. However, in order to understand some of the legal regulatory concepts related to coastal accessibility in each selected country, we must take a short detour to discuss an underlying legal factor: is there a legally grounded "coastal public domain"?

6. Is There a Coastal Public Domain in the Research Countries?

Before presenting the comparative analysis according to each of the four categories of accessibility rights, it is important to look at whether coastal access rights can be facilitated by a pre-existing "coastal public domain". This term often refers to a legally defined, publicly owned strip (or under sovereign trust) along the coast, landwards from the territorial waters line.

Public land ownership or management is viewed by many, even today, as potentially more effective in protecting the coast from overdevelopment than land-use regulations alone. In many countries, there is some degree of public land ownership along the coast,

often based on generations-old law. Yet, this is not a global rule. In some other countries or sub-national jurisdictions, even among EU members, there is no established public domain landward from the shoreline, and private land ownership may be permitted all the way into the sea. An example is Finland—an EU and OECD member country not included in this research—private land ownership is permitted even seaward of mean low water ([23], p. 165). The widespread presence of coastal public domains distinguishes coastal zones from some other land uses with distinct public value, such as forests.

It so happens that most of the nations in our set do have some form of a legally defined coastal public domain that the public can freely access (excepting specific areas such as ports or sites with unique environmental value). However, location and scale differ significantly across our jurisdictions. Where the public domain is submerged all year-round, it may be useful for boating, fishing, etc., but not for the many beach activities on dry or part-dry beaches.

Figure 2 visually depicts our comparative analysis of the landward reach of coastal public domain in the research jurisdictions (In the seaward direction, coastal public domains usually extend to the limit of the jurisdiction's territorial waters, but this is not relevant to the current research). We place the jurisdictions along a schematic scale of coastal topography, to indicate how far their public coastal land ownership extends landwards. In the discussion of each category of accessibly, we shall see that some jurisdictions have gradually gone beyond what their current public domain allows but have had to invent creative legal arrangements to enhance their right to coastal access.

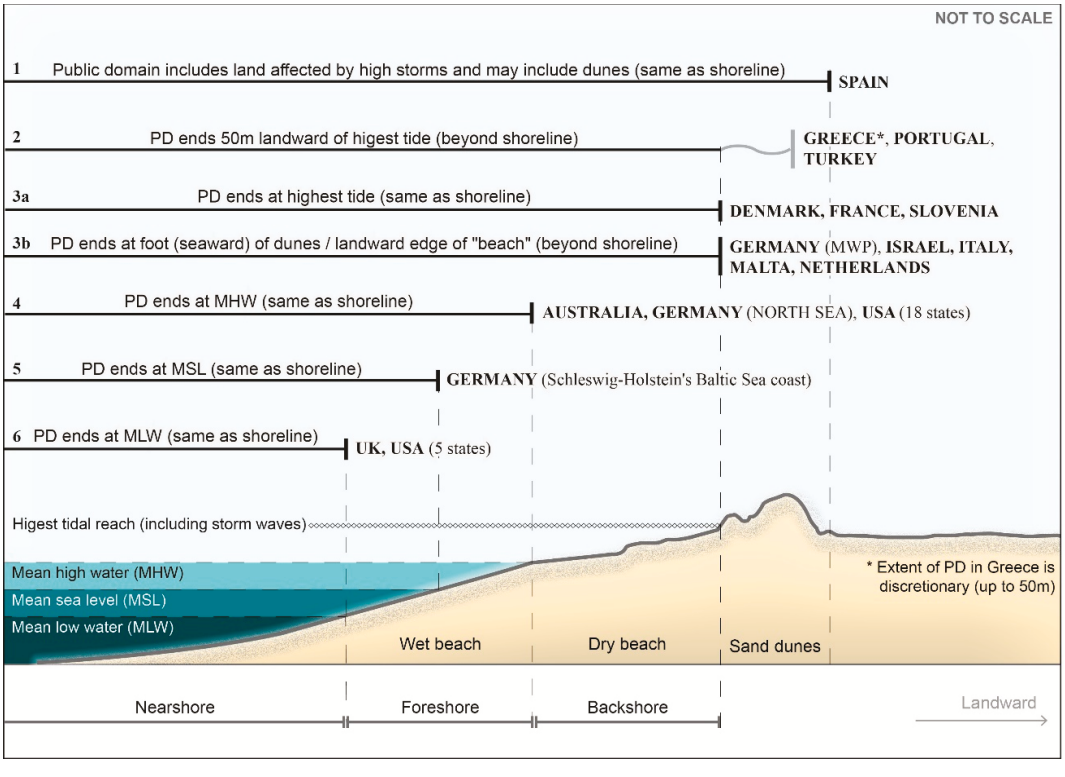

Figure 2. The landward extent of the public domain in relation to the shoreline definition: schematic comparative diagram. Illustration by Cygal Pellach.

The jurisdictions on the lower rungs of the scale (rung 6) have been historically unlucky—they inherited legal rules whereby the public domain is almost always under water. Thus, private ownership may extend well into the water, and if no other government rules are imposed, the under-water beach too would be private. These jurisdictions are the UK [24] and five among the US coastal states [25]. Figure 3 vividly portrays the attitude of an anonymous beach-front property owner who warns of criminal action against anyone who accesses the beach. The emphasis conveyed is that walking along the beach is not allowed even in shallow water, when the tides cover beach (which probably means most seasons).

In several other jurisdictions—rungs 5 and 4—the public domain is in the "wet beach" zone, which is covered and uncovered by tidal waters under normal conditions (three of the four German coastal states [26]; Australia [27]; and all other US coastal states [25]). In the remaining jurisdictions—the "lucky" ones for public access—the public coastal domain extends landwards, to the "dry beach" (which is affected only by the highest tides), up to the sand dunes or even beyond. These jurisdictions are Portugal [28]; Spain [29] Netherlands [30]; Denmark [31], Germany's state of Mecklenburg-Western Pomerania [26], France [32]; Italy [33]; Malta [34]; Greece [35]; Slovenia [36]; Turkey [37]; and Israel [38]. If we were to announce an international competition, the "winner" would be Spain: Its coastal public domain extends the furthest inland (despite some recent minor legislative changes; [29]).

Figure 3. No trespassing, private beach, sign in Washington State, USA. This Figure was selected for its visual characteristics, not the specific legal context. Coastal access law in the USA in general, and also in the State of Washington, is complex and evolves through court decisions [39,40]. The clause cited in the sign—RCW 9A:52.080 says: *Criminal trespass in the second degree. (1) A person is guilty of criminal trespass in the second degree if he or she knowingly enters or remains unlawfully in or upon premises of another under circumstances not constituting criminal trespass in the first degree. (2) Criminal trespass in the second degree is a misdemeanour*). Source: Lumpytrout on Wikimedia Commons, CC BY-SA 4.0 license. Available at: https://commons.wikimedia.org/wiki/File:No_Beach_Access_Sign.jpg. accessed 2 March 2022.

Because we are analysing a relatively large set of national and subnational jurisdictions, we are able to observe whether there are emerging trends. For example, are there jurisdictions that attempt to extend their public domain beyond what was achieved many decades or centuries ago, when population densities and real estate prices were much

lower? As may be expected, this is rare. However, we can highlight two countries that have expanded their previous public domain successfully in recent decades. These are Spain and Slovenia. In 1988, Spain extended its previously narrow public domain far landward, but this achievement came at the price of legal turbulence and intensive social conflicts that still linger on [29]. Another country, Slovenia, instituted its public domain relatively recently—after the country became an independent democracy [36]. Decision makers at the time may have known how to seize the crisis opportunity and add public domain to the drastic changes that were instituted in law and governance.

Countries where the public domain is submerged most of the year may try to harness other available legal instruments to provide horizontal and other access rights to dry beaches. There will inevitably be significant differences across countries. We, therefore, turn to analysis of the 15 countries in terms of each of the four categories of accessibility.

7. Comparative Analysis Applying the Four Categories of Coastal Access Rights

Table 1 presents a comparative summary of the four categories of accessibility. This will serve as the anchor for the discussion to follow, where each category of access rights is addressed in depth.

Table 1. The categories of accessibility: comparative findings.

Degree of Specificity of National or Subnational Legislation	The Categories of Accessibility			
	Horizontal	**Vertical**	**Visual from Hinterland**	**Access for Persons with Disabilities**
No rules	Australia (but local level is empowered) Malta (national plan with rules was cancelled) UK (but 2009 legislation for England incentivizes a contiguous path)	Australia (but local level is empowered) Netherlands Germany—Some states have "the right to roam" in open land Malta Slovenia UK USA—most states	Australia Denmark France Germany Greece Italy—national level Malta Portugal Slovenia Turkey UK USA	Australia Denmark France Germany Greece Italy—national level Malta Netherlands Portugal Slovenia Spain Turkey UK USA
General normative statement	Denmark Germany (some states also have "the right to roam" in open land) Greece Israel Netherlands Portugal Slovenia Turkey USA—varies by state; see Figure 4	Denmark—plus the general "right to roam" Israel (in national statutory plan; following court decisions) Italy (most extensive is Puglia Region) [32] Portugal Turkey USA—California, New Jersey	Italy—Puglia region Netherlands	Israel Italy—Puglia Region
Numerical standards or other concrete criteria	France (3-metre-wide easement along the outer edge of the MPD) Italy (access along beach within 5 m of shoreline) Spain (6-metre easement at outer edge of MTPD)	Greece (10 m-wide coastal access roads); ineffective Spain (Roads every 500 m, pedestrian paths every 200 m) France–paths or roads recommended every 500 m	Spain—added architecture-based rule Israel—new national statutory coastal plan requires mandates "visual impact statement"	-

MPD—maritime public domain—publicly owned land, MTPD—maritime terrestrial public domain—publicly owned land.

7.1. Horizontal Accessibility

A general national or subnational right to horizontal access along the coast is, as already noted, the basic and probably the oldest tenet of coastal zone accessibility. As

we saw, both international legal and soft-law documents refer explicitly to this right. We therefore placed horizontal access first in Table 1, which shows that, in most of our research countries, national-level laws and regulations do address such rights, but with important differences.

Because horizontal access is closely connected with public land ownership, it is usually expressed in the form of some minimal strip of contiguous publicly owned land. Where the public domain is under water or is very narrow, provision of horizontal access may require other legal and policy measures. Where such measures were not implemented when development pressures and property values were low, a "retrofit" today would be a major legal and financial challenge due to pre-existing private property rights or expectations of development. Nevertheless, as we shall see, even in some countries, we witness attempts to extend the geographic bounds of horizonal accessibility by harnessing alternative legal tools.

We first discuss those jurisdictions that do have at least some dry beach public domain, and then we look at those without a dry beach public domain. In each case, we will refer to the manner in which horizontal access rights are addressed in national legislation or regulation, as summarised in Table 1.

7.1.1. Jurisdictions with a Dry-Beach Public Domain

Several among the research countries with a dry beach public domain have elected to go beyond a general normative statement about access rights to provide geographically specific numeric standards (for better or for worse); in Italy, the law states that horizontal access should be provided within the 5 m closest to the shoreline (defined according to high tide; [33]). As Italy's public domain extends beyond the shoreline to the edge of the dry beach, this requirement both adds an additional "safeguard" for access along the beach and protects horizontal access in areas where there is no beach (e.g., cliffy shores) or where the beach is very narrow. France and Spain adopt a different approach—they provide additional public easements at the outer edge of their landward public domain. The French rule is 3 m and the Spanish 6 m. Because Spain's public domain is the most extensive, this means that, with this supplement, Spain grants the most generous horizontal access rights [29].

The public domain in Israel also extends landwards to the dry beach, but there are legal challenges in keeping commercial concessions away. The beaches in Israel are becoming very crowded due to the country's extremely high population growth rate and high population density. Over time, local governments granted various concession rights to commercial operators. Protection of the beaches from development, including access rights, has become a major rallying point for environmental NGOs. In 2004, the Coastal Protection Act was adopted as the result of concerted action by a coalition of NGOs. The new law, replacing prior reliance on national planning regulations, gave national and local government stronger implementation and enforcement instruments. They have been successful in pushing permitted commercial concessions to the back of the beach, allowing for continuous open horizontal access [38].

The story of Malta, as recounted by Xerri [34], is unique because the country only introduced a formal coastal public domain as recently as 2016. Prior claims of historic private ownership mean that much of the land within the public zone is privately owned—making Malta more comparable with jurisdictions without a dry beach public domain. The 1992 National Structure Plan had included a requirement that, in approving new development, the planning bodies would assure beach access "around the shoreline immediately adjacent to the sea or at the top of cliffs". However, this plan was later repealed by a government decision due to criticism by landowners and developers. The strip of land that should have been dedicated to the public for horizontal access has apparently been largely overtaken by private development, often illegally [34]. Malta's legislators and government bodies have tried to find alternative modes, primarily through planning and building controls. How-

ever, this has turned out to be especially difficult in Malta due to its highly conservative conception of property rights as expressed in court rulings.

7.1.2. Jurisdictions without a Dry-Beach Public Domain

There are several jurisdictions without a public domain along the dry beach. We focus here on Australia and the UK and address the special case of the USA under a separate subheading.

In Australia and the UK, horizontal access rights are not explicitly anchored in any national (or state) legislation or regulation. Nevertheless, the importance of horizonal access rights is recognised and each country has instituted some policies to overcome the absence of a historic public domain.

Although, in Australia, accessibility of any type is left to the will of the subnational levels, in practice, horizontal access is broadly (but inconsistently) enabled by the states and local governments [27]. In the UK, a 2009 law adopted in England (but not Northern Ireland) has the highly ambitious objective of creating the English Coastal Route by incentivising (and helping to finance) co-operation with leading NGOs and local governments. In the meantime, the situation on the ground still varies greatly across local jurisdictions [24,41].

7.1.3. The "Regulatory Takings" Doctrine and Its Impacts in the USA

The USA provides an especially legally "unfriendly" context for the provision of both horizontal and vertical access. Recall from Figure 2 that, in the USA, the public domain often does not extend over parts of the beach that are dry for much of the year. Public access rights are usually provided only along the submerged coastal strip (see Figure 4 and [25]). Thus, if members of the public can access the beach from some public venue, then they may be allowed to boat or swim in the water, including over privately owned land, but they will not be permitted to walk even within the water-covered part of the land. This is the situation also in the UK and Australia. However, as we have seen, these jurisdictions are incrementally providing what may be a more extensive proportion of coastal coverage of horizontal access rights than in the USA.

Where there is no general dry-beach public domain, governments may still be able to harness alternative legal or financial instruments to create a partial substitute for the public domain. Government authorities could purchase private land or undertake land expropriation (called eminent domain in the USA). Both would involve public expenditures and might instigate socio-political conflicts. Less drastic instruments could include voluntary donation of land by private or quasi-public owners; a precondition placed by planning authorities on development permission that the owner grant permission for public access of some form; a "deal" with the owner to provide public access in exchange for development rights elsewhere ("transfer of development rights"); or similar tools. However, the differences across countries in the capacity to apply such instruments depends, to some extent, on underlying legal differences in the conceptions of property rights. Here, the USA differs from most of the countries surveyed in this work.

In the USA, there is a persisting constitutional doctrine called "regulatory takings" [42]. Based on this doctrine, a landowner could, in principle, argue before the courts that a regulatory interference in property rights (in fact meaning a property's economic value) should be ruled as unconstitutional. Comparative research on regulatory takings [43] has shown that, in this respect, the US is an "outlier" among the 13 countries studied. In the present discussion, the direct comparison regarding coastal access is the UK, Germany, and Australia. There, the regulatory takings concept is either non-existent or applies under limited conditions outlined in statutory law. Furthermore, in the USA, regulatory takings law is almost entirely the product of jurisprudence, with an unprecedently large and growing body of decisions [44]. Thus, at any given point in time, government bodies often face legal uncertainty when they attempt to apply regulatory tools, such as zoning or development conditions to gain coastal access for the public—whether horizontal or vertical; see, for example, [16,45,46]. It is, thus, not surprising that, in the present comparative study, the US

falls in a category of its own, with little legal room for manoeuvre to achieve major legal transformations, even in the most basic category of beach access rights—horizontal access.

Despite these legal constraints, the establishment and operation of the California Coastal Commission shows that a concerted initiative supported by civil society can incrementally enhance beach access rights [47]. The California Coastal Act states that "development shall not interfere with the public's right of access to the sea". Even though the Act does grant property owners the right to apply for a special permit to terminate a previously existing public access right, the California Coastal Commission does not grant such permits easily [25]. The provisions of the Act cannot insulate it from challenges under the regulatory takings doctrine. A famous example is the 1987 US Supreme Court decision, *Nollan v. California Coastal Commission*, 483 U.S. 825 (1987). It demonstrates the complexity of the legal challenges concerning all of our accessibility categories. The Court ruled that a condition imposed by the California Coastal Commission on owners who requested to replace an existing house with a larger one to require dedication of a horizontal strip. To just justify using a regulatory tool rather than expropriating the strip of land along the shoreline (and paying compensation), the Commission argued that the proposed structure would "wall off the view" of the coast from the road above, and the compulsory dedication of the strip of land would mitigate that. The Court rejected this rationale and ruled an "illegal taking" of private property. This decision has generated extensive academic discussion about the relationship between land use regulation and property rights in general [48]. Nevertheless, several decades of legal experimentation and case-by-case achievements have placed California as a leader among US states in its quest to enhance public access rights along its coasts.

7.2. Summarizing Horizontal Accessibility

To sum up the horizontal access category: The countries in our set, among them many EU members, still differ greatly in the horizontal access rights they provide to the public. We did point out some instances of a positive momentum to enhance these rights in contexts where they are very limited, but such efforts do not alter the general picture. There are still major disparities in the interpretation and protection of horizontal access rights—the most basic type of coastal access rights. Citizens or visitors in our set of 15 countries will have very different experiences when they wish to access the beach, even for the purpose of simply taking a walk along the seashore.

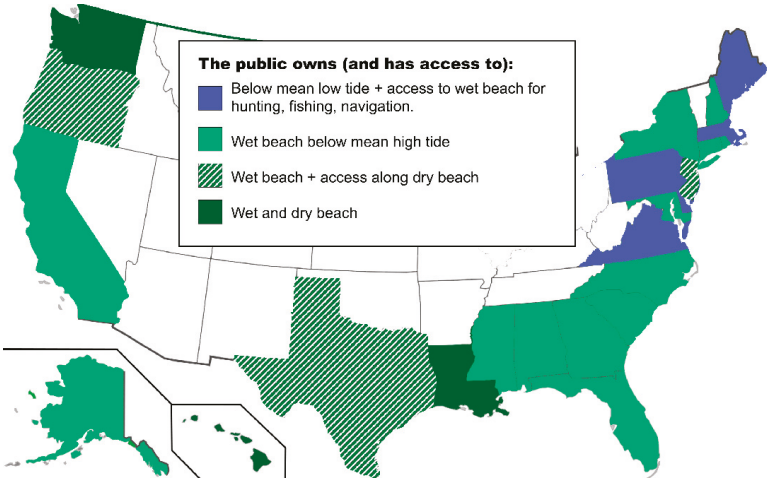

Figure 4. Public domain and coastal access among US states. (Prepared by Cygal Pellach, based on image by Rick Wilson/Surfrider Foundation, 2014.) For further details, see Tarlock 2021 [25].

8. Vertical (Perpendicular) Accessibility

In order to be able to walk along the coast, one needs to reach it from the hinterland—whether urban or nonurban. Unlike horizontal access, vertical accessibility is less geographically determined. There are often no historically preassigned vertical public rights of way. There is no shared norm about what a reasonable expression of vertical access would be and, unlike horizontal access, no internationally prevalent legacy of government responsibility.

8.1. Dilemmas Surrounding Vertical Access Rights

Many concrete questions arise regarding vertical access rights. Access from where to where? Who should be obliged to establish, finance, or maintain vertical routes? Should all access routes be located on public land, or should there be a right to pass through privately owned properties? What distinctions should be made between rural and urban areas? Should there be a norm of maximal distance between vertical access routes? In their quest to secure vertical access from within the city or region, government (or civil society) bodies are likely to encounter many conflicts between real estate considerations and beach-users' interests. These might be even more diverse and complex than maintaining horizontal access.

To these dilemmas, one should add issues of social-distributive justice. Control of vertical access could be used as a socially exclusionary mechanism, as argued and empirically supported by Ernst [7], Kim & Nicholls [49], and Kim et al. [50]. For example, high parking fees, absence of public transportation, delineation of routes that serve some communities more than others, and entry-right preference for local residents over outsiders (or the reverse)—all of these could challenge social-distributive justice in vertical coastal access. Since beach maintenance is also a public finance issue, the issue is who should bear the burden: local taxpayers? Regional or national taxpayers? Imposition of access fees (or parking fees) could help to regulate the overload, but such fees can also have a socially selective effect (see [51]).

8.2. The Social Obligation of Property and "the Right to Roam"

Vertical access can be pre-planned (or retrofitted) through government action on public land. However, such routes are not always feasible and are necessarily inflexible. What if vertical access was permitted over privately owned land, where it does not interfere severely with privacy or with production? The issue of vertical access over privately owned land highlights some of the ideological differences between conceptions of private property rights.

In most jurisdictions in our sample, the law on real-property rights broadly follows the more traditional perspective, whereby passing through property without the owner's permission is trespassing and is punishable. There are, however, several jurisdictions in our set where the ideology of property rights leans closer to the conception of "the social function of property" or "the social obligation of property" [52–54]. In those countries, vertical accessibility to the coast is part of an over-riding right that members of the general public have the right to hike across and enjoy privately owned open land, under certain limitations. This legal approach is popularly known as "the right to roam", and usually includes the beaches as open land.

Among our sample jurisdictions are several where there is a right to roam (but with detailed legal differences). These are Denmark [31], three of the four coastal German states [26] (the German state of Schleswig-Holstein recognizes the right to roam along the beach only, not to access private land vertically), Scotland, and, to a more modest degree, also England [24]. In these jurisdictions, the issue of vertical accessibility to the coast is less acute. For example, in Denmark, as explained in detail by Anker [31], the right to roam is deeply embedded in law and public expectations. One of the expressions of this right concerning coastal access is that existing footpaths leading to beaches across private uncultivated land may not be removed without special permission [31].

8.3. Vertical Access Rights in National (or State) Legislation

Apart from the jurisdictions where the law recognises the right to roam, the others might face many property rights challenges in achieving vertical accessibility. Provision of public access paths could entail issues of land expropriation ("eminent domain" in the USA). Imposition of an obligation on private property is even more challenging.

We were, thus, happily surprised that most of our set of countries do address this topic within their national-level coastal legislation or regulations (see Table 1). Denmark is notable in that its legislation goes beyond the general right to roam to embed vertical access rights in national legislation: vertical accessibility should be ensured and, if possible improved whenever new development is proposed within 3 km of the shoreline, as explained by Anker [31]. This is an exceptionally generous rule.

Here are some more examples of such wording: Portugal's Public Water Domain Definition Law says only that access to the shore would be granted to the public [28]. A somewhat more specific wording is found in Italy's Financial and Budget Law, which requires that access to the maritime public domain be guaranteed in statutory plans for that domain [33].

Although these examples of wording are rather general, embedding vertical accessibility rights in national-level legislation could, in principle, hold some legal weight when petitioners argue before the courts that vertical public access has not been adequately ensured.

Several countries have gone yet further and provide numeric standards. France's national planning law stipulates that, if there is no public path within 500 m to reach the public domain, the local government *may* create that path by imposing an easement over private property (with compensation). If needed, the local government has the powers to turn the path into a road [32]. Spain and Greece adopted numeric standards too [29,35]. Spain's legislation mandates that roads for vertical access be no more than 500 m apart and, unlike France, leaves little discretion to local government. In addition, in Spain, nonmotorised paths must be provided every 200 m.

In some jurisdictions, vertical access standards are to be implemented through demarcation of the access routes in local urban plans. An example is Greece, where, during a field research visit to the city of Kavala, we were shown the statutory plan. There, access roads or paths are delineated approximately 500 m apart [55]. However, the authors of both the Spanish and the Greek chapters report that implementation of these standards falls below expectations [29,35]. Possible reasons are lack of funds to purchase or expropriate land or insufficient political will.

One can debate how realistic numeric standards imposed by national government are, and how locally democratic they are. However, they do represent attempts to provide some concrete norms. They are also easier for public interest groups to monitor and for the courts to review. In theory, quantitative norms may help to create greater social-distributive justice because they are expected to be blind to land prices and to the economic political influence of various interest groups.

Our comparative findings about vertical access, like horizontal access, indicate a positive momentum in some countries. Notably, in recent decades, Portugal's 2005 legislation ambitiously requires that the areas where there are sandy beaches be made fully vertically accessible by 2016. We learn that some progress has indeed been made [28].

By contrast, Malta's jurisprudence is making it difficult for government authorities to progress towards vertical access rights. As noted earlier, the shoreline is already highly developed. Government has attempted to achieve incremental change to vertical access opportunities by conditioning new building permits (or retrospective legalisation permits) on provision of public access, but this has been ruled illegal by the courts. Xerri [34] reports that, in a 2015 decision, the planning tribunal, while expressing some sympathy for both horizontal and vertical public access, saw no way of imposing such a condition under the existing legal framework:

> " . . . no law can grant third parties rights on private property if not through the legal means which the legislator would have already put in place for such

> purpose. A policy certainly cannot, by itself, grant private property rights to third parties or be used to deny the development requested by an owner on his own land." (Victor Borg vs. Malta Environment and Planning Authority).

Unlike the other jurisdictions analysed here, Malta's direction may be characterised as regressive. Yet, even within this country's challenging legal and physical contexts, there is an increasing recognition of the importance of coastal access rights, especially within some local plans [34].

8.4. The Issue of Private Fencing

Where vertical access rights cross private property, one of the major issues is illegal fencing or other physical obstacles intended to deter access. Tarlock [25] reports of many court cases regarding obstacles or misleading signs placed by property owners, even in California, where, relative to other US states, beach access rights are better protected. The California Coastal Commission has the authority to impose high fines. An example is a 2021 court decision upholding a USD 4.2 million fine for fencing off a 1.5-m public easement to the beach continuously for 11 years [56].

Several countries have deemed fencing to be important enough to scale it up from the local development permission level to the national or subnational level. However, "the devil is in the details", and countries differ in what types of land uses they do permit to gate.

In Spain, Greece, Italy's Puglia region, Turkey, and Denmark (to some extent), the legislation prohibits fencing within a specified distance from the shoreline—500 m in Spain and Greece, 300 m in Puglia, 100 m in Turkey, and 3 km in Denmark [29,31,33,35,37]. In Greece, however, a presidential decree has gutted much of this rule by exempting a wide range of land uses, including tourist facilities, as explained by Balla & Giannakourou [35].

Interestingly, in France, Prieur [32] reports of the opposite approach. A 1986 amendment to the national planning law explicitly instructs local planning authorities to ensure that tourist and related commercial facilities approved near the coast do not block vertical access. One can assume that this legislation was not easy to enact because of its economic impacts on tourism projects. The conflict between tourism projects and vertical public access is a difficult one to balance, especially in countries such as Greece, where tourism is such a significant part of the economy.

Israel provides another example of fencing as a "red flag". In this high-growth country, as noted earlier, the beaches are the most popular site of recreation, and crowding visibly increases annually. Environmental activists and enforcement authorities are especially engaged in monitoring any new fencing that curtails either horizontal or vertical access. The legislation now states that local authorities are no longer authorised to permit any fences in the coastal zone, except in special circumstances and with the permission of the national coastal regulatory committee [38].

8.5. The Special Case of Gated Communities in Coastal Locations

When the practice of illegal fencing is carried out not just by individuals, but by "gated communities" along the coast, it may become an especially contested issue, with symbolic or direct implications for distributive justice. In some countries, such as the USA, gating is legal and rampant (not specifically on the coast [57]). In many other countries, it is a de facto practice, even if unregulated or illegal [58,59]. In such cases, there is a double legal conflict with public accessibility: first, is it legal to gate residential neighbourhoods? Secondly, if gating is legal, do beach access rights override gating rights?

Within our study, the USA stands out because there are many gated communities along the coasts, and conflicts often reach the courts [25,60,61]. In California, despite the Coastal Commission's successes in providing for vertical public access to privately owned beaches, gated communities are a special challenge [25]. In such cases, the blockage of public access may be more correlated with social exclusion.

Where gating is carried out by stealth, governments or the courts may find it even more difficult to enforce access rights. As noted by the Portuguese team, residents of quasi-gated communities sometimes use physical design or symbolic gating to signal "do not go through our property" [28].

In Israel, the conflict between attempts to gate communities and coastal access has reached the courts. In two media-covered court challenges the petitions were triggered by the fact that the projects blocked coastal access. The court decisions became well-known rulings against neighbourhood gating in general [38].

Enforcement of vertical access rights could be even more challenging where residential buildings or tourist facilities are entirely illegal [62]. In this paper, we cover this complex topic only in passing (for detail, see [63]). Such situations are not reserved for developing countries. Even within our sample countries—all with advanced economies—illegal construction along the coast is (or has been) especially rampant. These countries include Turkey, Italy, Malta, Greece, Slovenia, and Portugal (for Portugal, see also [64]).

8.6. Ports as a Special Issue

Ports have good reasons to be located at and near the shoreline. National or regional legislation usually exempts them from enabling public access. Their premises have been tightly sealed off, even though they occupy hefty tracts of waterfront land. Due to increasing security needs (and international insurance requirements), ports have become even more locked in (Based on interviews with several port authorities in several countries, conducted during 2015, as part of the Mare Nostrum Project, ([55], pp. 31–32)).

In recent years, citizen expectations and urban planning policies have succeeded in persuading port authorities in some cities to open up at least a small zone for public access to the waterfront. However, such retrofitting attempts are costly and are sometimes achieved through deals with private developers. Here is an example drawn from one of our research visits. Figure 5 shows the only access point to the water at the Port of Marseilles (France). The port occupies a huge tract of the city's urban coastal land but has developed one edge with a publicly accessible shopping mall. This large balcony overlooking the water's edge is the closest that the public can get to the water and the only way to reach the balcony is to pass through the mall's "golden cage" elevators or stairs (Based on an interview with the relevant officer of the Marseilles Port Authority, July 2015, and a personal visit to the Port and the shopping centre).

8.7. Summarizing Vertical Accessibility

The cross-national survey of vertical access rights exhibits a variety of approaches, similar to what we saw with horizonal access. The survey highlights some of the legal differences associated with the differing property right regimes. At the same time, one can point to a positive trend by which NGO initiatives reinforced by court decisions, coupled with the evolution of planning norms, has succeeded to some extent in overcoming entrenched conceptions of property rights.

Figure 5. The shopping centre balcony at the Marseilles Port: the only place the public can get close to the shore, but the public must first pass through the shopping mall. Photograph by Cygal Pellach (2015).

9. Visual Accessibility

Visual accessibility is our third category of accessibility. It refers to unobstructed sightlines from the urban hinterland towards the coast. Protection of sightlines means, first and foremost, prevention of architectural configurations of large and tall structures close to the coastal area which block the sea view from city locations or routes. Since view of the coast is also a prime real-estate asset, intervention to enhance visual accessibility is likely to be resisted by developers or property owners.

Urban planning and design policies could contribute to greater fairness in the social distribution of coastal views. Ostensibly, this topic is remote from national-level policies. Yet, embedding the public right to visual access in a national-level law or policy document could encourage local efforts to address the social-distributive aspects of visual access. In our comparative analysis, we wanted to know whether visual access is regarded as part of the public right to coastal access and how national policy addresses it. The findings, as shown in Table 1, indicate that, although this type of access right is not widely acknowledged, there are interesting exceptions. Perhaps they herald a rising legal recognition of visual access rights.

We were positively surprised that four of our jurisdictions already have explicit national or subnational provisions about protection of visual access to the coast, most introduced in recent years. These are Italy's Puglia region, the Netherlands, Spain, and Israel. In California, visual access rights have been implemented in practice in some cases and have received scholarly analysis due to a major court decision (See discussion in Section 7.1.3 about the US Supreme Court decision: Nollan v. California Coastal Commission).

Spain's 1988 Coastal Law was the pioneer among our set. The Law stipulates that buildings constructed within 500 m of the shoreline should not form "architectural screens" that block views to the sea—that is, the wider façade should be perpendicular to the shoreline (interpretation of the law [29]). As explained by Falco and Barbanente [33],

the Puglia's Regional Landscape and Territorial Plan (2015) has added a prohibition on construction within 300 m of the shoreline that would reduce coastal views. Jong & van Sandick [30] report that the Dutch General Spatial Planning Rules (2011) also require that a statutory land use plan approved at the local level should not enable construction that will obstruct the view of the horizon.

The latest to give explicit legal status to visual accessibility is Israel [38]. The national statutory plan adopted in 2020 goes beyond a general normative statement to install a new mandatory procedure. In considering the merits of any proposed project within the coastal zone, the developer should submit a "view impact statement" (our translation) to the relevant planning body. Although it is too soon to know how the courts will interpret this requirement, one can assume that it will pave a smoother road for judicial review of planning decisions, which, according to the petitioners, assign insufficient weight to the public's right to visual access. This innovation was stimulated by a court decision where a Tel Aviv NGO argued against approval of tall towers near the beach. The court ruled that the towers' heights should be reduced to minimise obstruction of the coastal views.

So, while the right to visual coastal access is less recognised in national legislation than the first and second category, there are signals of an international positive moment.

We now move to the fourth (and final) category of accessibility rights, where social aspects are at the forefront.

10. Accessibility for People with Physical Disabilities

10.1. The Ratoinale for Assigning a Special Category

The fourth category of coastal access rights is less focused on broad geographic rules serving an anonymous public and more on the special needs of individuals. Making a beach site accessible to persons with physical disabilities (PWD) usually entails some special construction works (e.g., the interventions shown in Figures 6 and 7), adding a disruption of the beach environment to some degree. In the comparative research, we wanted to know whether and how the research jurisdictions have addressed the inherent normative conflict between environmental protection and the rights of PWD.

Beach access rights for PWD are not a marginal issue. An estimated 15% of the global population has a disability of some form, many of whom are persons with physical disabilities [65]. A recent UN report reiterates the importance that national and local governments would increase their efforts to adjust public spaces and facilities to enable access by PWD [66]. There is a large body of literature on this broad topic by researchers in the medical, socio-psychological, and design fields (see, for example, [67–69]). There are even some papers about beach access for PWD written with tourism in mind [70,71]. Although many countries, including some in our sample, have general requirements about facilitating access to public spaces, these have yet to be adequately integrated into land use planning, as argued by Terashima and Clark [72].

The comparative analysis indeed shows that, in most jurisdictions, beach access rights of PWD have not yet become part of the norms governing coastal land use planning and management in general, and accessibility in particular. Before we discuss the two national exceptions, we should note that the absence of national-level legislation does not imply that good practices cannot emerge "from below", as part of the globally rising awareness of the rights of persons with disabilities. The Slovenian author, Marot [36], provides an interesting example of how NGO action has managed to convince the City of Izola to pioneer in designating one of its beaches as accessible to PWD, with commensurate design and facilities. The city also waved the entrance fee, which it was permitted to charge for "special facilities".

At the national level, the two notable exceptions are Italy's Puglia region and Israel. Puglia's Law of 2006 mandates that, when the Puglia Regional Government will prepare its Coastal Plan, the plan will ensure that local plans provide adequate access for people with disabilities [33]. This is the pioneering legislative anchoring of this right among the jurisdictions in our sample.

Figure 6. A wheelchair access ramp to the beach in Miami (Source: Dpalma01 on Wikimedia Commons, CC BY-SA 4.0 license. Available at: https://commons.wikimedia.org/wiki/File:Miami_Beach_-_Sand_Dunes_Flora_-_Beach_Access_Ramp_for_Wheelchairs_Amid_Seagrape_Bushes.jpg, accessed on 2 March 2022.

Figure 7. A wheelchair at the end of an access ramp at a North Sea beach in Germany (Source: andreas160578 on Pixabay. Available at: https://pixabay.com/photos/wheelchair-disability-spa-disabled-2082941/, accessed on 2 March 2022.

10.2. Case Study of Jurisprudence on Beach Access Rights of PWD

In Israel, the 2004 Coastal Law is silent on this issue, but the new 2020 national plan includes distinct wording. Once again, the Israeli report highlights how NGO action and court decisions can lead the way [38]. The jurisprudence on this issue provides an interesting legal manifestation of the clash between environmental protection and the rights of the disabled.

As noted in several places in the above discussion, in Israel, the role of court precedents, usually prompted by NGO actions, has played a prominent role in shaping coastal accessibility rights. In the case of PWD rights, the story is especially interesting due to a combination of circumstances.

By coincidence, two court cases regarding two adjacent cities (Tel Aviv and its neighbour Herzliya) were heard before the same district judge in 2013 and 2014. In one case, environmental NGOs petitioned against the city's intention to extend a hard-surface promenade into the beach for a relatively short length. Part of the municipality's rationale was that the surfacing would also facilitate wheelchair access. In this case, the judge ruled in favour of the city, despite the ambiguousness about whether the local plan permits the necessary public works. In her reasoning, the judge elaborated on the importance of social-distributive justice norms when considering the rights of persons with disabilities, because they are often deprived of public political influence. In the factual context of that case, she decided that the weight of these considerations over-rides environmental considerations.

However, in the second case brought before the same judge a while later, she ruled against the city, saying that, this time, environmental damage outweighs PWD accessibility rights. Indeed, in the second case, the proposed promenade was longer, but this fact does diminish the legal dilemmas that accompany such cases: how to balance two important public norms when they compete in specific, real-life situations?

With these precedential court decisions, Israeli planners and decision-makers went ahead to insert in the 2020 coastal national plan an explicit obligation to "take into account the needs of persons with disabilities". Despite its vagueness, in some cases, such wording could, in theory, tip the balance when planning authorities or the courts must weigh environmental considerations against the rights of persons with physical disabilities. The sociological insight provided by the judge in the two court cases was instructive: environmental objectives, and the broad public and NGOs that support them, usually carry much more influence on public decision-making than do the small minority of physically disabled persons. Silence on this issue at the national level would leave the rights of PWD to local decisions, where there is usually an imbalance in the degree of influence on decision-makers.

11. Conclusions

Coastal zones are widely recognised as meriting special environmental protection, special modes of management (ICZM), and even have a unique standing in international law (though relevant only to some parts of the world). One would expect that the public's right to access the beach would become the emblem of this special standing, but is it?

This paper presented a "reality check" through comparative analysis of the laws and regulations pertaining to coastal access rights in 15 advanced-economy countries. Eight of them are also members of the EU. To unpack the notion "coastal access", we propose a conceptual framework that distinguishes among four categories: horizonal, vertical, visual, and accessible for persons with disabilities. This framework enables us to present a pioneering analysis that highlights the differences in legal and policy implications associated with each category. For each national (or state) jurisdiction, we rely on an expert report that analyses the relevant legislation and regulatory planning documents at the national level to see whether and how they address coastal access rights.

The emerging picture is of a clutter of types and degree of legal protection granted to coastal access rights. Even the international legislation (Mediterranean ICZM Protocol), which, in theory, applies to eight among the research countries, is shown to have only a

marginal effect towards convergence. This is not benign diversity; it indicates that the international community—even among member of the OECD and members of the EU—is still a long way from elevating beach access rights into a consensual norm that is valid across borders.

At the same time, we do observe a trend in some countries towards enhancement of beach access rights. This momentum, however, is uneven across issues and countries. We believe that greater convergence could be promoted through cross-national learning. Our research—the first of its kind—could stimulate knowledge exchange.

Throughout this paper, we argued that the public right to access the beach (or the broader coastal zone) is not just a matter of geographic delineation of a strip of land along the beach, or demarcation of paths or roads to reach it from the hinterland. Our survey, spanning many different legal contexts, demonstrates that each of the four categories of coastal access rights invokes a somewhat different but deep-seated ideological debate about the role and limits of private property rights in the face of a consensual public good, such as beach access. The details of these conflicts are addressed differently in each country. We also highlighted that coastal accessibility is a social justice issue, with many facets.

Our comparative research, despite the large number of countries covered, is yet only a preliminary probe into the underlying implications of the different legal approaches to the right to coastal access and their outcomes in practice. There is room for much more comparative research, both legal and empirical. At the same time, one should keep in mind that coastal zones are experiencing accelerated change due to climate issues, and especially sea level rise. This implies that the rules about beach access rights are likely to require much rethinking. The need for international mutual learning will only increase.

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NEET Rural–Urban Ecosystems: The Role of Urban Social Innovation Diffusion in Supporting Sustainable Rural Pathways to Education, Employment, and Training

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Abstract: Common themes of EU social policy include: the promotion of employment; improved living and working conditions; the equal treatment of employees; adequate social protection; and capacity building of the European citizenship. However, it is often the case that rural dwellers and, more specifically, rural NEETs, experience higher levels of marginalisation than their urban counterparts. Such marginalisation is evidenced by their exclusion from decision-making, public life, community, and society. These issues are compounded by an underdeveloped rural infrastructure, problematic access to education, limited employment opportunities, and a lack of meaningful social interaction. This study, a cross-sectional analysis, assesses a number (n = 51) of social interventions under the Youth Guarantee Programme from a social innovation perspective and presents a characterisation of examples of best practice across different dimensions of social innovations. This paper presents an examination of the potential of sustainable rural–urban ecosystems that are focused on supporting the symbiotic social innovation diffusion methods which can help to establish and sustain rural–urban pathways to improved education, employment, and training.

Keywords: rural–urban ecosystems; social innovation diffusion; education; NEET; social inclusion; Youth Guarantee Programme; best practices

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1. Introduction

The European Union (EU) typically supports young people aged between 15–24 years who are not in employment, education, or training (NEETs) via policies that target the following interconnected areas at the individual member state level: employment; education; social work; and youth engagement. In the context of employment, each country must develop an aligned European employment strategy coordinated with the other member states, which should contribute to the management of common policies and the involvement of local governments, trade unions, and employers' organisations [1]. In the area of education systems, this cooperative approach between the member states is intended to contribute to the development of high-quality education recognised within and across the European community [2]. The circumstances underpinning these common themes of the EU social policy are: the promotion of employment, improved living and working conditions, the equal treatment of employees, adequate social protection, and the development of human resources [2]. The European Pillar of Social Rights Action Plan (2021) sets out guidelines for the member states relating to the need to achieve high levels of employability, skills, and strong social protection systems [3]. The Action Plan projected that, by December 2020,

16 million people would be unemployed, and youth unemployment would be at 17.8%, well above the overall population unemployment rate. Therefore, it was the goal of the Action Plan to reduce the rate of youth unemployment or NEETs from 12.6% to 9% over the lifetime of the plan. However, during the last decade, the recession exacerbated the economic disparities across Europe, with more pronounced increases in unemployment rates, especially among youths in the southern European countries, which were more severely impacted [4]. Indeed, it may be the case that differences in institutional environments may help explain cross-country youth disparities [5]. Considerable differences are evident in terms of the efficiency of the school-to-work transition system (e.g., the period between the end of compulsory schooling and full-time employment involving many actors from education systems to the institutions operating in the labour market); labour market regulations; and labour market flexibility, which may affect the length of unemployment spells and gaps in experience among youths [5–7]. Therefore, it is clear that there is a need to develop a coherent overview of this challenging environment.

Consequently, the European Commission encourages the member states, along with the provision of targeted financial support [3], to implement the newly reformulated Youth Guarantee Programme with a particular focus on the development and provision of high-quality opportunities that have the capacity to support stable labour market integration. An action plan needed to be set up to implement the reformulated Youth Guarantee Programme adapted to national, regional, and local circumstances. For ensuring continuity across the European Union as far as is possible, the European Commission's Youth Guarantee guidance document identifies the need to strengthen partnerships between Youth Guarantee providers and the relevant stakeholders at all levels of government for the duration of the work programme (2021–2027) [3]. There is also a need to adapt these action plans to suit the complexities of the regional contexts of the affected people as the geographical location of a young person's residence can be an important contributing or limiting factor. For rural areas, it is recommended that a review of the restrictions on public employment services is carried out to ensure more efficient support, institutional arrangements, and practices in various fields (social affairs; health; education; and employment) that do not meet the needs of young people and encourages young people to simply abandon their pursuit of employment [8,9].

The revised and reinforced Youth Guarantee recognises that while some NEETs may need a "less support" approach, other more vulnerable NEETs are likely to need "more intensive, longer-term, and comprehensive measures" to avoid disproportionately experiencing the negative impacts that are typical of the demographic [3]. At a European level, seven different categories of diversity-related NEETs have been identified, which allow the member states to analyse and concentrate on more precise policy-making [10]

Even though the Youth Guarantee Programme acknowledges that certain sub-categorie s of youth are more likely to fall into the NEET status and, consequently, can be at a greater risk of social exclusion, scant attention has been paid to systemic exclusion in the context of rural areas in Europe. Since 2012, Eurofound has calculated that young people living in remote areas are at one-and-a-half times greater risk of falling into the NEET status than young people living in medium-sized cities [1]. Indeed, youth NEET rates vary significantly across European countries (and sometimes also within the countries), in which personal characteristics can correspond to different NEET traits [6], compounded by rurality. Exploring this further, such categorisations are still largely based on the assessment of the individual context and not the systems that influence that context. Institutional and structural risk factors are rarely addressed within youth programmes despite local structures that support labour market entry, the field of innovation, and education systems being critical elements of urban and rural area ecosystems. Returning to the aforementioned disparity of risk versus geographic location, there are also significant variances between countries in which the percentage of NEETs in the population can vary greatly from 8% (Netherlands) to 38% (Turkey) [11].

The empirical research on this topic is extremely limited. It is clear that there is a need to understand the institutional and structural factors that underpin the challenges associated with NEETs and the increased risk that youths living in rural areas experience [12]. In the case of the Youth Guarantee Programme and the aforementioned categories, coordination is based on working in the context of multilevel governance, which focuses on combining the work of formally separate organisations to achieve a specific public policy objective [13]. This approach calls on the member states to share good practices in order to attempt to decrease the cross-country differences that are evident in countries, such as the Netherlands and Turkey. It is for this reason that the European Commission collates and disseminates good practice through public knowledge centres. These centres present opportunities to establish a variety of channels (yet unexplored) that can help us develop a deeper understanding of vulnerable youth [14]. The reports and guidelines from the knowledge centres investigated in the present study (n = 51) present an opportunity to understand the links between the revised Youth Guarantee Programme and the best practices from a range of the member states and regions across Europe that focus on supporting young people in their transition from school to work. Making this transition is difficult, and rural regions, especially Europe, are commonly regarded as places with challenges relating to regional economic growth; high migration levels; a great need for mobility; and the scarcity of available resources, such as the diversity in career and social interaction opportunities. These challenges, relevant to 83% of the EU area in 2018, are compounded by demographic fluctuation and a higher risk of poverty [11]. To evaluate and interpret the reports reviewed in this paper, the authors take a holistic approach to the review process, embracing the perspective that interventions that aim to support the youth should not only make them fit for the (labour) market, but also build their capacities to be the future drivers of change and innovation, empowering them to respond to these extant challenges [12].

2. The Role of Social Innovation in Supporting Sustainable Responses to NEET Challenges

This article aims to contribute to the future development interventions that focus on NEETs by providing a heretofore absent broader view of the reasons that influence the movement of young people into the NEET status. Understanding the lives of young people from their perspective, by embracing them as co-creators of responses to the challenges they experience, is a critical factor in effective policy-making [15]. This process is as complex as the target groups that such policies strive to serve. This paper will inform this action by exploring various best practices from Europe under the Youth Guarantee Programme, regarding their capacity to support sustainable social innovation.

Historically, the Organisation for Economic Cooperation and Development (OECD) has determined that policies for the financial redistribution in rural development are not enough to address the specific challenges of different regions and help them develop. This action must be supplemented with policies that aim to develop rural regions and make them more competitive by mobilising local assets and potential [16]. In this context, social innovation can help communities respond to local problems; sustainable effect change; and react to environmental, economic, and social challenges [17]. Kröhnert and coauthors [18] conclude that in peripheral rural areas, only those villages in which an active civil society takes the local problems into its own hands are likely to be able to adapt and adjust, stressing that negative demographic change will not cease in regions that lack innovation and whose citizens lack a collective sense [18]. At this level, the commitment and creativity of citizens, as well as their ability to develop sustainable action structures, can support the successful and sustainable development of interventions [19]. Following on from this, and concerning rural development, such acts of collaborative action in the form of social innovations are at the core of rural development and essential prerequisites for its success. Indeed, social innovation is a participative process, bringing together different actors from different backgrounds [19]. These diverse social systems are considered more innovative than uniform social systems as, in such systems, there is a greater openness and willingness to adopt new ideas [20]. Applying this perspective to social innovation suggests that

actors with entirely different backgrounds, know-how, and interests have more potential to develop a successful social innovation than actors with similar interests and know-how. The diversity of capacity in rural areas is often very limited. Therefore, it is important that participation involves the fullest range of citizenship to ensure that sustainable social innovation is possible.

According to Peter and Pollermann [21], participation seems to be related to the education level, whereby graduates, civil servants, and white-collar workers are more likely to take part in such processes than blue-collar workers and unemployed persons. As such, the social contexts most in need of social innovation may also have the greatest difficulties in motivating and mobilising the actors necessary for successful social innovation, which can also be addressed by the education system or youth work. It is clear, therefore, that education has a particular role to play in this process as those who engage with the education system, such as NEETs who re-engage, are likely to be the individuals who will have the decisive role in the occurrence or even the success of a social innovation act. Increasing this capacity, especially in rural areas, will be decisive for the future of any region as part of a systemic and/or systematic response to the challenges experienced by NEETs.

Critical aspects for the success of social innovation, especially the underlying participation process, are the opportunities or constraints beyond the responsibility of the actors involved in any participation process. Examples of such factors are the culture/means of funding; organisational structures; basic judicial conditions to which a rural development process is subjected; and the readiness of superordinate public administration groups to get involved with and support (development) processes with an uncertain outcome. Thus, one of the challenges is to alter disadvantageous determining factors to ensure potential success. One important factor to add to the likelihood of implementing social innovation is the possible barriers [22]. For example, in the case of the LEADER initiative, Dargan and Shucksmith [23] examined the use of the concept of social innovation in the context of LEADER interventions. They found that it can be challenging to promote local development in places with no history of collective action [23]. While the social innovation capacity of our communities seems to have the motivation to respond when supported, the distribution of reliable social innovative practices in rural areas is far behind their urban counterparts. This paper seeks to understand what social innovation interventions can work in such contexts through a close examination of disseminated knowledge and to encourage further discourse and action.

3. Methodology

Employing a scientific realist review methodology, this article draws on documents presented on the webpage of the European Commission Knowledge Centre public channels, linked to the Youth Guarantee Programme, which allows all member states of the EU to upload their interventions and best cases. The documents are written from the national viewpoint and show the national and collective approaches to the extra curriculum services for youths from various nations of the EU. The reports are based on rural and urban experiences. This article aims to investigate how the youth programmes address or do not address social innovation factors, which are crucial for regional or rural development. In terms of methodology, a qualitative study that employs a scientific realist review methodology has been used. This review methodology has a number of important steps. In the first instance, the authors searched the European Commission Knowledge Centre public channels for different ideas, theories, and processes that reflect best practice in supporting youth transition into the labour market. Second, the authors narrowed the focus of the review by identifying commonalties across the document repository, bringing into focus the webpage linked to the Youth Guarantee Programme and the documents associated with this. Thirdly, the process was further advanced by searching for work that presented imperial evidence for appraisal. The authors appraised the documents independently and prior to synthesis. By analysing and synthesising the intervention documents, the

authors attempted to understand the correlation between the implementation of the social interventions (under the Youth Guarantee Programme) and their impact on challenges associated with youth transition into the labour market in different European countries, thus achieving the aim of employing a scientific realist review methodology. The document repository comprises 51 documents and emerged from 27 different European countries. Slovenia has four interventions, followed by Germany, Latvia, Lithuania, Luxembourg, and Slovakia as presented in the Figure 1 below.

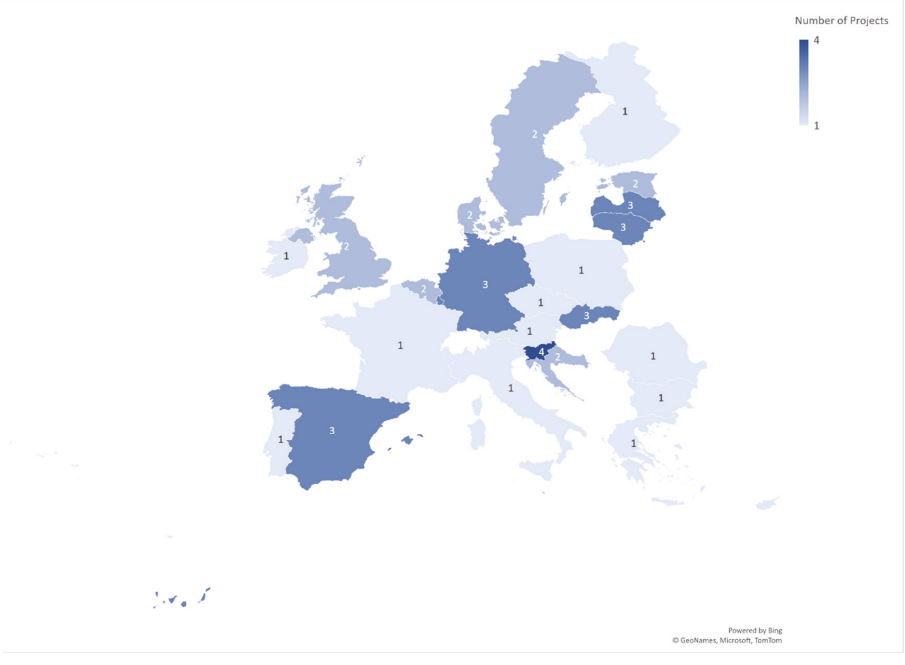

Figure 1. Geographical distribution of projects.

There are two transnational projects ("Baltic Alliance for Apprenticeships" conducted in Baltic countries and "Apprenticeship Toolbox" organised by Germany and its neighbours) in the database. The documents located in the database also provide information relating to the assigned budgets of the interventions. The budgetary support of the interventions ranges between 40,000 Euros (for the Open Youth Centre "Gates" in Lithuania, a local programme financed by the local administration) and 1 billion Euros (for the "Career entry support by mentoring" programme in Germany, a nationwide mentoring system). This budgetary distribution is noted as being skewed with 20 out of 51 projects having a budget lower than 10 million Euros and only 5 projects having a budget over 100 million Euros. The target population of all of the intervention projects is generally young citizens and NEETs. However, it should be noted that the definition of "youth" changes from one country to another. The lower age bracket is generally 15 or 16 years, and the upper bracket is 29 years, but, for some projects, this upper limit is defined as 24 years. The "MolenGeek" Tech Ecosystem project of Belgium also targets children above 11 years old.

Summarising these specific interventions, we coded these documents according to our coding scheme, informed by the five aforementioned macro variables. We developed our coding scheme to reflect the dimensions of Baptista [24] and his coauthors using a holistic approach: two coders read documents and coded according to given directives.

Coding Scheme for the Evaluation Process

Baptista et al. [24] argue that government support and recognising the potential for the scaling of social innovations should be determined using a categorisation scheme. We identified five layers on how to include social innovation in youth work, namely policy intervention; profit orientation; geographical scale; organisation direction; and social inclusion. These layers are adapted from Baptista et al. [24] for use in this study and are presented below.

4. Findings

The analysis of all 51 documents covering 28 countries from the EU gave us a deeper understanding of how the youth programmes are organised and what aspects they address. In the present study, this analysis is presented thematically. Figure 2 below graphically shows the dimensions and subdimensions which we used in our analyses.

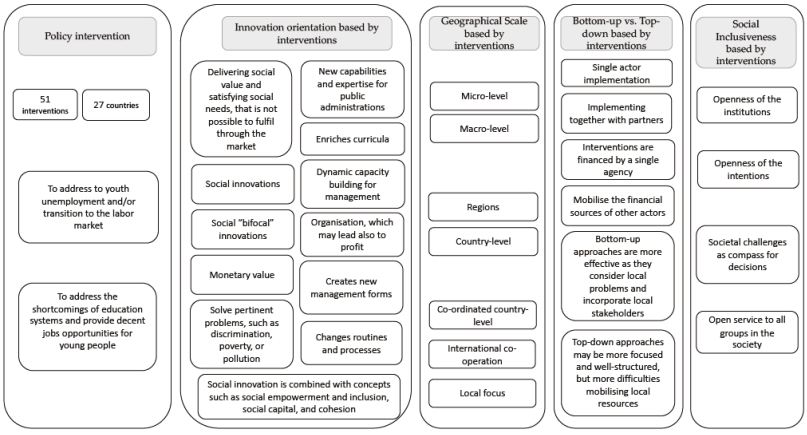

Figure 2. Dimensions of social innovations.

5. Policy Intervention: Market Failure or Profit Generation

According to Baptista et al. [24] a several social innovations address market failures, such as the problems concerning school-to-job transitions. The cases analysed in this paper have different attitudes to the policy level for youth work. Some interventions attempt to solve market failures and others aim to establish new organisations, such as public and private partnerships. Given that the Youth Guarantee Programme aims to address youth unemployment and/or a transition to the labour market, the project's primary objective is to address the shortcomings of education systems and provide decent jobs opportunities for young people. Almost every project we analysed targets the creation of jobs for youth cohorts; therefore, they can be accepted as policies that address market failures. However, some programmes support the nurturing of entrepreneurship in participating young people by channeling funds to young entrepreneurs. The "Self-employment Subsidy" project in Croatia provides subsidies to young entrepreneurs of up to 37,000 Euros, depending on the number of employees that are involved. The "Entrepreneurship Promotion Fund" in Lithuania provides microcredit of 25,000 Euros to young entrepreneurs, in addition to consultation service support. Another microcredit programme has been developed in Italy (the "SELFIEmployment" project) which channels up to 50,000 Euros to young applicants. As all these enterprises are profit-seeking, it is worth discussing to what degree these projects may be accepted as social innovations, as many of these investments are eventually turned into profit-making private institutions.

An additional point of discussion is the provision of individual incentives to the participants. Almost half of the projects we analysed channel material incentives to partic-

ipants of approximately 30 Euros per day. This small incentive contributes significantly to sustained attendance and to the success of programmes, as noted by the organisers of these activities. Other programmes support employers for each young person they employ during the program, and this is a factor that contributes to the success of projects that adopt this approach as part of their engagement strategy.

5.1. The Profit Orientation

Another dimension of categorisation relating to social innovations is the tendency to generate profit from their activities. The studied cases have, in most instances, a variety of approaches in terms of defining "profit". Some interventions only focus on "delivering social value and satisfying social needs, that is not possible to fulfil through the market" and we label these interventions as "pure social innovations". Some others are social "bifocal" innovations, which generate a positive social value and create monetary value [24] (p. 386). Social innovation is also referred to when indicating the need for the society to solve pertinent problems, such as discrimination, poverty, or pollution [25]. In these situations, the focus rests on changes in social relations, human behaviour, as well as norms and values. Social innovation is then combined with other concepts, such as social empowerment and inclusion, social capital, and cohesion. In line with the profit orientation, the social innovation approach creates new capabilities and expertise for public administrations; enriches curricula; creates new management forms; changes routines and processes; as well as encouraging dynamic capacity building for management and organisation, which may also lead to profit. However, it is also possible that this can add new services and functions to potential new jobs.

5.2. Geographical Scale

This dimension refers to the capacity of social innovation to spread geographically, in other words, scalability. Some interventions can be only arranged at the micro level, and others at the macro level. Scalability means expanding social innovation to other geographic regions and countries [26]. The cases identified in this study are generally organised at the national level, and there are a few of them based on transnational cooperation. According to our analyses, 41 out of 51 projects are conducted at the national level using national organisations. We discovered seven projects that have regional focuses, three of them are from Belgium and two are from Spain. The "Traineeship First", "MolenGeek", and "Trecone" projects in Belgium are conducted in Brussels. Spain's "Youth Guarantee Communication Plan through promoters" is a project conducting information activities in Catalonia, and "Technical round-tables for coordination of the Youth Guarantee at Municipal level in the Region of Murcia" is located in Murcia. Slovenia's "First Challenge" project focuses on eastern Slovenia and Germany's "Education & Business Cooperation" project is in Baden-Württemberg. It is evident that almost all regional-focused projects are located in countries in which the regional governments are compelling, or a federalist system exists. Only two international–transnational projects exist in the database. "Baltic Alliance for Apprenticeships" is a project targeting "raising the status and enhancing the attractiveness of VET in the Baltic states by involving national social partners and VET provider organisations in the development of effective approaches." It has been organised by the cooperation of the Latvian, Lithuanian, and Estonian ministries of education. The project has been successful in creating a dialogue between Baltic institutions. The second transnational project is "Apprenticeship Toolbox", a project which aims "to create an online database—a 'one-stop-shop'—housing reports and information on the different approaches to dual apprenticeships in the five participating countries," namely in Austria, Denmark, Germany, Switzerland, and Luxembourg. The project also aims to scale up the successful practices in these countries across Europe. These figures show that the scalability of projects is relatively weak, and many projects are conducted within the national boundaries.

5.3. Bottom-Up vs. Top-Down

This dimension focuses on the organisation of the intervention, whereby stakeholders are incorporated into the action. It also takes the sources of finance into account. Some interventions are organised and conducted by a single actor, and others incorporate other societal actors. Similarly, some interventions are financed by a single agency, and some others mobilise the financial sources of other actors [27]. This dimension is critical, as it has a demonstrable impact on the social innovation process in communities. According to Butkeviciene [28], the "bottom-up" and "down-up" approaches in social innovation seem to be more successful than "top-down" initiatives [28]. In terms of social innovation, the bottom-up approaches are more effective as they consider local problems and incorporate local stakeholders.

On the other hand, top-down approaches may be more focused and well-structured, but they will have difficulties mobilising local resources. We analysed these documents by asking two questions: which organisations are involved in the action and which institutions are financing them? Our analyses show that the state is the key actor in these projects. A total of forty-four out of fifty one projects include a state agency as the key actor. The public employment services (PES), ministries of labour or social services, ministries of education, and ministries of economics are among these state institutions. Two different factors may explain the dominant role of the state as the organiser of these activities. First of all, the Youth Guarantee Programme is an international body; it functions as a tool to be employed by government agencies. Secondly, the problem of NEETs is observed as a macro problem to be solved using macro interventions. As previously mentioned, the relatively lower number of regional projects is another indicator of this top-down approach.

Meanwhile, the role of the local governments presents a clue about the potential of local dynamics. Local governments are partners in nine projects, and they are the key actors in three. The "Trecone" project in Belgium; Spain's "Youth Guarantee Communication Plan through promoters", a project conducting information activities in Catalonia; and "Technical round-tables for coordination of the Youth Guarantee at Municipal level in the Region of Murcia" are projects coordinated by local governments. There is a conjunction between the regional focus and bottom-up approaches.

Civil society organisations (non-governmental organisations) are also active actors of these projects, and, in three of them, they acted as the main organiser. The "PULSA Employment" project in Spain is coordinated by Red Cross Spain and aims to empower youths across the country. The Open Youth Centre "Gates" in Lithuania has been operated by Actio Catholica Patria, a Lithuanian civil society organisation, and it provides services to young people visiting its centres. In other projects, civil society organisations have a supportive role. Our analyses show that the role of the private sector is also limited. Out of 51 projects, the private sector has a role in 6 projects, and it is the coordinator only in 1of them. An example of one of these projects is the "Talent Match" programme in the UK that has been organised with the support of the Big Lottery Fund and led by voluntary or community-led organisations. The involvement of the private sector has occurred via the incorporation of the umbrella organisations, such as the Chambers of Commerce and/or Industry, or they have been the beneficiaries of the project via subsidies provided for their employment. In a small number of projects, they are directly included in the decision-making process. From that perspective, we can conclude that the private sector has been observed to address the problem by providing employment. However, they are excluded from being an active actor in the decision-making process.

Similarly, the labour unions also had a limited role (5 projects), and they did not have any direct projects. A good example is the "Lifelong Career Guidance Centres—CISOK" in Croatia. The PES in Croatia operates these centres, and the labour unions are listed among the partners, without having any direct responsibility in the operation of these centres. Another example of this kind of division of labour was noted in the "Alliance for Initial and Further Training" project in Germany, in which labour unions are listed among the stakeholders without having any active role in the project.

The second sub-dimension we attempted to categorise is the financial structure of the projects. The majority of the projects were financed by the European Social Fund (ESF) programme and the Youth Employment Initiative (YEI). In contrast, the local government contributed a small portion of the budget, changing between 8% to 15%. For example, 89% of the budget for "The First Challenge" in Slovenia (20.7 million Euros); 90% of the budget for "Through Work Experience to Employment" in Slovakia (31 million Euros); and 90% of the budget for "Second Chance Vocational Education Programs" in Lithuania (32 million Euros) have been financed by these two programmes. Meanwhile, Erasmus+ also financed some of these projects; for example, "Baltic Alliance for Apprenticeships" in the Baltic states and the "Young Adults Skills Programme" in Finland are two examples of that kind of contribution. Moreover, the contribution of the Erasmus+ programme is a meagre 200,000 Euros (out of 187 million Euros). These figures show that EU finance is essential for these projects.

It was also evident that the national governments channeled significant amounts of money to deal with this problem. For example, the Federal Employment Agency of Germany finances 50% of its "Career Entry Support by Mentoring" project (1 billion Euros) and the ESF has financed the rest. The French government channeled more than 120 million Euros to its "Guarantee for Youth" project (the total budget was 229 million Euros). In a small number of projects, the national budget was the only source of finance. "The Delegation for the Employment" in Sweden (15 million Euros), "Building Bridge to Education" (21 million Euros), and "Job Bridge to Education" in Denmark (17 million Euros) are examples of projects directly financed by the national budget. The private sectors' contribution remains limited. In the case of the "Talent Match" project in the UK, the budget of 121 million Euros has been covered by the private sector. The private sector's contribution remained extremely limited in the the "MolenGeek" Tech Ecosystem in Belgium (200,000 Euros). Similarly, other stakeholders' contributions seem to be covering a minimal amount of money spent to solve this problem. Significantly, local governments, civil society organisations, labour unions, and other stakeholders have limited contributions to the projects. These figures show that the EU initiatives, the ESF, and the YEI are the most important initiators of interventions we analysed. The contribution from the national governments seems to be dependent on the fiscal capacity of the receiving countries. Germany, France, and Finland can channel a significant amount of funds, whereas the contribution of other member countries is limited. Meanwhile, it is possible to state that the private sector and other stakeholders have a very passive role in financing these projects. Considering all these facts, we can suggest that the top-down approach is the dominant method.

5.4. Social Inclusiveness

Social inclusion describes the participation of affected people in the process of intervention. In modern society, particularly disadvantaged people can enhance their opportunities, access resources, voice their needs, and gain respect for their rights through participation. According to Rogers [20], actors of successful social innovation must be from diverse social systems. In such systems, there is a greater openness and willingness to adopt new ideas [20]. Actors with quite different backgrounds, know-how, and interests have a greater potential to develop a successful social innovation than a network consisting of actors with similar experience and know-how. If an intervention explicitly states one or more vulnerable groups among its target groups, it will be considered suitable for classification as socially inclusive. The last dimension we used to categorise these documents was social inclusiveness. We defined social inclusiveness as openness, as presented in the Figure 3 below.

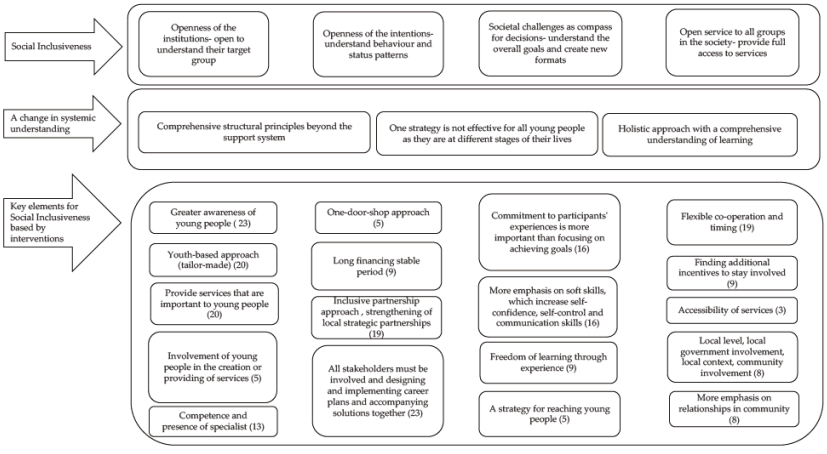

Figure 3. Dimensions of inclusiveness.

Most NEET or youth projects and programmes aim to enhance the capacities for the job market. The analysed projects themselves are non-profit organisations or projects. They operate on a social dimension (common good) to make youths or NEETs employable. Being employable does not necessarily translate to the inclusion of the person in the society, nor does it suggest that the person can contribute through innovation to the society. Isolated people (geographically, education-wise, societally, or technologically) experience difficulties on various levels and areas of life, whereas social inclusion may, through contacts and relationships, ease the difficulties with support from the society on many levels. This can enable the person to be innovative regarding the pressing topics of the society (social, ecological, and technological innovation), which may also translate in the fruitful elaboration of projects, ideas, and business (e.g., for the youth entrepreneurship programmes). The inclusion or exclusion of persons is very much affected by the density of the population; the diversity of people in the society; and the encounters with different ideas, manners, and ways of doing things. People in rural areas may be less exposed to skills, solutions, and ideas, enabling them to be innovative in their surroundings. Densely populated societies can also live in a micro-world, in which certain disadvantaged people are not exposed to opportunities for innovation (e.g., migrant children, with weaker (local) language skills) and are, therefore, socially excluded.

The subjective perception of a job is often associated with social integration, but also with life satisfaction, the access to economic resources, and mental health [28]. Social status and higher self-efficacy are especially associated with employment and career. The negative effects of being unemployed are increasing with the duration of unemployment, as well as how early in life they occur, whereas having a partner and being highly educated reduces the negative effects. While we know that our current society cannot find employment for every single member, for the sake of resilience and wellbeing, we need to address the attached meanings to employment and find adequate solutions to those needs, too. This necessity is often neglected by the education and youth programmes. Analysing these potential dimensions of social exclusion is an important topic for future research. Less educated individuals suffer more from unemployment, which accounts for the cases of youth unemployment. Programmes that positively influence the perceived social status and self-efficacy can, prevent individuals from feeling rejected by society and, thus, avoid the onset of a downward spiral ending in long-term unemployment [29]. Social innovation actors from different backgrounds, know-how, and interests are potentially more successful in social innovation than actors with similar interests, know-how, background, and talents [20].

Consequently, the diversity of actors in areas with less population diversity, such as rural areas, may decrease substantially. Therefore, we conclude:

- The integration and empowerment of youths that engage in extracurricular activities can add the necessary diversity to the mainstream educated group of people in rural areas [30,31].
- Social inclusion is affected by the manner in which institutions in charge are operating. They can create the necessary "room to manoeuvre", facilitating the emergence of social innovations [22].
- Youth work and education work can prepare young people for the engagement with social innovation.
- If social innovation actors are open to understanding their target group and engage with their communities, they must also be willing to embracing the characteristics of the people they support.
- Transparency is important as it allows new goals and outcomes to be established for the participants, which can evolve in the process and are therefore new for the institution and the participants (innovative).
- If they understand the overall goals and challenges (climate, resilience, etc.), scale up, and create new formats to maximise the local potential, this will facilitate social innovation.
- When social innovation actors provide full access to services without a restriction on gender, race, and/or geographical placement, this will open access to education and training pathways for all members of society.

The analysed projects provided a "starting package" with information about how to secure a smooth implementation, based on knowledge and experiences from the pilot phase. We assume that they were willing to understand their target group (openness of the institutions) and their decisions were guided with an inner compass of societal challenges. If the document addresses one of the vulnerable groups, we coded it as an inclusive social intervention.

According to our coding, two-thirds of projects do not have a clear definition of their target groups. These projects present their target groups as "young people", "youth", "school pupils", or people younger than 29 years old. For some other projects, target groups are VET providers or other stakeholders. Hence, it is not possible to categorise them as inclusive projects. However, some projects have clearly defined their target groups. For example, the "Production Schools" in Austria includes young people with "special education needs or disabilities"; "Project Learning for Young Adults (PLYA)" in Slovenia targets young people who are socially excluded; Sweden's "The Delegation for the Employment of Young People and Newly Arrived Migrants" aims to integrate newly arrived migrants; and "Alliance for Initial and Further Training" in Germany include migrants, young persons with disabilities, and disadvantaged young people in their target groups. Some other projects included favorable conditions for disadvantaged groups. Our analysis shows that social inclusiveness is not a common practice among the projects we analysed.

We indicated the numbers of interventions to visualise the scope of the proposals. Social innovation includes the development of new ideas and ways of working that offer better solutions to social problems and challenges than previous methods, leading to the more efficient functioning of society and the community. Social innovation offers solutions to social problems by developing innovative and better-functioning solutions. These can also be in the form of services. Given that our focus is on vulnerable young people, based on the descriptions of the interventions, factors can be identified that can help to reach and support the respective target group. According to our analyses (51 interventions), the involvement of young people with fewer opportunities is mentioned in the general plan in less than half of the interventions and it is less predictable through various explanations. Based on the interventions, it can be pointed out that although most of the interventions are universal and aimed at a wider target group, the description highlights the need to

approach and offer more specific approaches to vulnerable target groups and to reach them. Half interventions repeatedly point out the understanding that the target group is not heterogeneous and, for this reason, there is a need for an individual, cross-sectoral, and youth-based approach (tailor-made method).

Poland's intervention (Equal Labor Market) experience points out that individual support was needed for different age groups of the NEET target group and that one strategy is not effective for all young people as they are at different stages of their lives. The UK's intervention (Talent Match) experience revelas that the development of young people who have lived chaotic lives and experienced trauma is not linear; it is important to work with them flexibly and for as long as necessary, without postponing meetings or having setbacks. It is important to point out that in a similar case there must be no time limits, otherwise support for a young person cannot be provided. In order to ensure an individual approach, factors such as the availability of the service (e.g., electronic registration; the proximity to home; local level; a lack of preconditions for participation; and additional incentives to maintain motivation, in addition to support and ensuring mobility) are also highlighted. Denmark's intervention (Building Bridge to Education) experience describes how an individual and tailor-made approach also supports young people's motivation and increases the likelihood of sustained education or training. Holistic views and strategic partnerships are the most mentioned key factors (23 interventions). In the Latvian interventions (KNOW and DO), it was highlighted that the establishment and strengthening of local strategic partnerships was key to ensuring that the strengths of local partners were fully utilised to reach and support the target group. This also included the development of a national information strategy and a common methodology for actions targeting young people at the national level, to ensure a common and shared approach between partners.

Furthermore, some interventions raised the participation of young people in the creation of the service as an important issue, and the commitment to the experience of the participants was more important than focusing on the achievement of the goals. Secondly, a specialist working with a young person was identified as an important party, whose knowledge and competence either created or limited opportunities for young people or networking practices. In the Slovenian (Project Learning for Young Adults (PLYA)) intervention emphasised that an inclusive partnership approach was important from this perspective, in which all major stakeholders (including participants themselves, as well as parents, support services/organisations, social partners, and schools) must be involved in designing and implementing career plans and accompanying solutions together. Luxembourg's (National School for Adults (ENAD)) intervention suggested that common cooperation and mutual support among learners not only develops a positive work environment, but also enables learners to develop teamwork skills. Slovenia's (Project Learning for Young Adults (PLYA)) intervention highlighted that more emphasis needed to be placed on soft skills, which increase the learner's self-confidence, self-control, and the communication skills that benefit people throughout life, in both relationships and in the wider community. In the Lithuanian (Open Youth Center "Gates") interventions, it was pointed out that to involve and support more youth, we must be able to provide the services they consider necessary for young people, not just following the priorities formulated by policymakers. The opportunity for workers and young people to experiment with new methods, tools, activities, and services, and the freedom to learn through experience is very important. Spain (PULSA Employment) also highlighted an innovative methodological approach whereby young people's skills are assessed through informal activities outside the classroom (e.g., theater workshops, group games, and robotics).

Based on the descriptions of the interventions, it can be pointed out that although the services are aimed at everyone, there is a need for greater cooperation between different actors, in order to create more specific services based on the needs of young people. Most of the interventions are related to the European Commission's recommendation to create quick support opportunities for young people on the basis of existing systems, but, at

present, there is an opportunity to create new opportunities based on lessons already learned on the principle of social innovation. Given that social innovation represents new ideas and the way new solutions work, the interventions analysed offer better solutions to the social problems and challenges we face, making NEETs more effective for young people, society, and the community.

6. Conclusions

It is evident that tailoring social innovation activities to support the individual nature of education and training must be both the starting point and reference point for the design and implementation of learning environments. This position demands a comprehensive, holistic vision of how to support learners and it should take into account all areas and forms of learning and competencies, as well as the individual learner's personality, life-world, and biographical (learning) history. While such an approach represents a paradigm shift from an institutional perspective to a strict learner centric perspective, the authors recognise that implementing such a comprehensive reform would require a resistance to the structural principles within education systems and their relationship with the wider social innovation ecosystem. However, reconceptualisation and, perhaps, new concepts of traditional structures of education are necessary, especially at the local (rural) level, if successful innovation is to be meaningfully connected to cultural contexts and to avoid reluctance or even refusal by stakeholders. It is also the case that successful strategies for establishing social innovation in education may not be fully transferable to other contexts or regions without also considering the cultural or regional context. This is an important consideration as reconceptualisation might therefore be more effective than disruption, for realising educational change.

In summary, it can be concluded that the findings presented in the present study can act as a starting point for further and deeper research in supporting sustainable rural pathways to education, employment, and training. Mission oriented social innovations can be based on a five-dimensional representation of interventions: policy intervention; the profit orientation; bottom-up vs. top-down organisations; and the last category, social inclusiveness. Following this, at a policy level, new European and national innovation strategies are required to sustainably support interventions. This includes the increase in awareness, visibility, acceptance, and implementation of social innovation and its underlying concept to improve the quantitative and qualitative contribution to education, employment, and training. At the core of this position is an acknowledgement that by addressing the individual capacities for social innovation and increasing the framework or ecosystem capacities, the youths can have a greater impact on the rural pathways open to them. This will require a reduction on the dependency of social innovations on formal support systems and in the silo thinking of public institutions. By adopting such an approach, public policy actors within a social innovation ecosystem will have critical input in areas previously marginalised or unknown. This cross-cutting perspective and the holistic approach of solutions, with the input of these stakeholders, will provide opportunities for collaborations that are focused on joint solutions that facilitate tailored support at different stages of the social innovation process, effective scaling mechanisms, and mechanisms leading to social change.

7. Limitations

Our work has significant limitations that extend our conclusions to a larger domain of interventions. First of all, our analyses are limited by documented interventions presented with a specific standardised format, which focuses on the accomplishments of interventions. This presentation undoubtedly hinders the failures and weaknesses of interventions, which require further investigation. An in-depth focus on the projects can reveal further information to create a clearer measurement of the social innovation dimensions of interventions. Secondly, these documents do not reveal information about the social impact of these interventions. Some of these documents include a specific section to present quantitative

outcomes; however, it is not a common practice. A standardised toolbox for measuring the social impact of the programmes has not been developed yet, and it depends on the authors of the reports. In the medium term, this measurement can be included in the presentation of the results. The lack of this data prevented us from building a link between the social innovation of any intervention with its performance. Building such a link and proving it empirically would be an important contribution to the debate. To fill this gap, it is possible to select a sample of interventions and focus on this relationship. Finally, as these interventions are not developed from a social innovation perspective, our analyses became ex-post-facto and, sometimes, practically irrelevant, as many of them have already been completed. However, we believe that this article may include this perspective regarding the design and evaluation of the projects in the near future.

Independently of how radical the proposed changes are, social innovation is considered essential as an instrument and process to realise a transition towards more sustainable practices in urban/rural societies. This underlines the importance of better understanding how it works and how the process related to social innovation may be effectively supported. The role of the individual actors in the social innovation ecosystem is immense; therefore, the regions, despite whether they are rural or urban, must address this in their education programme (standard, voluntary, and extracurricular). The EU-wide policies and guarantees would make this new orientation more effective and can also emphasise a special attention to rural frameworks and ecosystems.

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Social Innovation for Sustainable Urban Developmental Transitions in Sub-Saharan Africa: Leveraging Economic Ecosystems and the Entrepreneurial State

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Abstract: This study theorizes social innovation-based transitions to sustainable urban development from the perspective of the African urban condition, highlighting that large infrastructure and service provision deficits, poverty, inequality, heavy import dependence and the prevalence of dual formal–informal sector systems are key factors to account for in a just, sustainable urban African developmental transition. It identifies an opportunity space that can be leveraged for urban and broader transitions to sustainability on the continent by leveraging "economic ecosystems" for local scale social innovation-based development interventions. It theorizes that multi-level transitions to sustainability can be engendered by adopting an entrepreneurial state led approach at local scales by using economic ecosystems as the framework to (1) stimulate social innovation-based entrepreneurship that meets local and local–regional demands through decentralized, low cost, small-scale infrastructures, technologies and services, (2) leverage social innovation-based economic ecosystems for catalyzing multi-scalar transitions to sustainability, (3) recast the role of the entrepreneurial state, specifically in relation to social innovation and sustainable urban development (SUD) in Africa and (4) bridge formal–informal sector dualism. This framing prioritizes local economic development over centralized, state-led interventions that involve grand-scale masterplans, wholly new satellite cities and bulk infrastructure deployments in conceptualizing sustainable urban development transitions in Africa.

Keywords: Sub-Saharan Africa; social innovation; sustainable urban development; economic ecosystems; transitions to sustainability; informality; green technology; fourth industrial revolution

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1. Introduction

> "The state must also *lead* the process of industrial development, by developing strategies for technological advance in priority areas. This type of State action . . . seeks to *create* and *shape* markets and systems." [1] (p. 47)

The celebrated growth of the African continent's countries over the past four decades has been accompanied and underpinned by the growth of Africa's cities [2], which are growing at the highest rates in the world [3,4]. Notwithstanding the dramatic projections of the continent's urban dwellers tripling from 548 million in 2018 to 1.5 billion in 2050—around 22% of the global urban citizenry at that time [4]—African cities remain characterized by high levels of informality, poverty, inequality, unemployment and infrastructure and service provision deficits. Rapid urbanization is unfolding in the absence of any significant industrialization [3]. The question of what urban development and industrialization trajectories may ensue on the continent and how sustainably the growing needs of the African urban citizenry will be met, is hence important for (note that this study builds on recent work—i.e., [5,6]—that set the foundation for the emphasis on social innovation articulated in this paper) (1) meeting global sustainable development goals [7,8] and (2) mitigating against the exacerbation and/or increased growth of existing socio-economic ills, such as poverty and inequality, which characterizes the urban divide in Africa [9].

African cities have become targets for multi-national corporations seeking to secure urban real estate in the "new scramble for Africa", i.e., for knowledge cities, global cities, eco-cities and smart cities [10]. Yet, in contrast to this push for grand master planning styled urban development and the establishment of wholly new green fields satellite cities [10–12], the scholarly discourse on African cities has, for the greater part of the past two decades, focused on the need to pay detailed attention to the strategies and tactics through which the "everyday" navigation of dual formal and informal systems is navigated [13–17]. More recently, in response to this emphasis on the quotidian, several scholarly contributions have argued for a re-appraisal of the role of the state, namely, that the state, through both its presence and absence, significantly shapes the development of African cities [18,19]. This tension—between bottom-up and top-down intervention priorities—in the southern urbanism literature closely mirrors similar tensions in the debates on social innovation [20].

This top-down, bottom-up tension speaks directly to what scales of intervention are required, what the target of intervention should be (i.e., who, what) and what mode (i.e., how) of intervention is required for SUD in Africa. It also raises the question of what roles —i.e., the state, private sector, civil society and academia—can play. In this respect, considering the role that social innovation can play—with the support of the aforementioned sectors and, particularly, the state [21]—in engendering sustainable urban development (SUD) in Africa is worth exploring in tandem. This is particularly the case as social innovation (taking a cue from Moulaert et. al. [22] this study adopts a broad, all-encompassing definition of social innovation of as "conscious corporations to non-profit charitable ventures" [23] (p.2)) is widely recognized as "'transformative' in relation to systemic change" as well as "'instrumental'" in responding to the need for the provision of social services [24], both of which are clearly required when contemplating transitions to SUD in African cities. Moreover, social innovation can emerge independently from the aforementioned sectors alone, from collaboration and cooperation between them [21,24] and from top-down, bottom-up and hybrid approaches that integrate both [20].

In response to this, this study explores the African urban condition to help diagnose what kind of sustainability transition is required in the African context and what role social innovation can play in catalyzing transition. It draws on a range of scholarly and policy outputs to characterize the African urban condition and its specificities, peculiarities and vulnerabilities. This enables an argument to be made for social innovation that is informed by the following three considerations: (1) the appropriate scale of intervention that is required (i.e., small to intermediate scale cities), (2) the target of intervention (i.e., the food–water–energy–transport nexus that middle class African households are heavily dependent on) and (3) the appropriate mode of intervention for African cities (i.e., in situ development in slums and informal settlements, leveraging low-tech sustainability-oriented and green offerings in combination with fourth industrial revolution offerings).

This study adopts an economic ecosystem lens because it places a specific focus on local economic development [25]. It argues that—by adopting an economic ecosystem perspective and focusing social innovation agendas on the scales, targets and mode of intervention identified in this study—transitions to SUD can be seeded, catalyzed and consolidated at local and local–regional scales, empowering local authorities and social innovation-based organizations to deliver on SUD agendas. In this framing, small to intermediate scale African cities serve as incubators of niche social innovations and catalysts for local transitions to SUD, respectively. These cities are ideal candidates for sustainability transitions that are infrastructure and technology intensive, as well as inclusive, precisely due to their more manageable developmental scales. Moreover, due to their location along corridors that typically connect larger cities to rural towns and areas, they can act as a "glue" in the rural–urban assemblage, helping overcome rural–urban divides on the continent to some extent.

With respect to broader, macro-scale transitions to sustainability, this study theorizes that by deploying the multi-level perspective on sustainability transitions (MLP) [26], small-scale, decentralized development at local and local–regional scales—driven by social

innovation—can help develop the niche innovations and economic ecosystems [25,27] that can drive broader scale transitions. In this casting, economic ecosystems established in small to intermediate sized cities—which draw on both green/sustainable solutions and fourth industrial revolution offerings to innovate context-specific offerings (i.e., products and services)—act as distributed "engines" of social innovation and local economic diversification that cumulatively drives national and regional-scale economic diversification trajectories.

This framing, in turn, helps elucidate the role of the entrepreneurial state in actualizing SUD in Africa. Namely, the role of the entrepreneurial state is to shape SUD transitions in Africa through directing, building and supporting local economic ecosystems that foster social innovation for SUD at the appropriate scales, for the targets identified and in the modes stipulated in this study. This includes managing the complexity of hybrid top-down bottom-up participation, protecting the interests of the marginal majority poor and maintaining a focus on scaling for sustainability at broader scales.

In addition to its emphasis on local economic development, this study also adopts an economic ecosystem lens because it is agnostic towards formal–informal sector dualism, i.e., both these considerations are important for actualizing local transitions to SUD in the African context. The economic ecosystem framing helps overcome formal–informal sector dualism, providing a framework for a post-dualistic conception of formal and informal sectors, one that enables a holistic, heterodox perspective that is more suited to the realities of the African urban context.

In the next section the dimensions of African urbanism are accounted for and serve as a basis upon which the scales, targets and modes of intervention are rationalized. Section 3 offers a specific definition of what a sustainable African city would ideally be characterized by and identifies the stabilization of the middle class as key to the broader transition, as well as the means through which that can be achieved, i.e., by targeting "nexus" (i.e., food–water–energy–transport) costs. Section 4 positions local economic ecosystems as vehicles through which infrastructural, technological and economic diversification can be achieved (i.e., in both formal and informal sectors, as well as local, national and regional), drawing on the multi-level perspective as a framework for transitions to sustainability. Section 5 discusses the key theoretical contributions of this study and Section 6 summarizes and concludes the study. Section 7 identifies its key limitations and suggests avenues for future (theoretical and empirical) research on this basis.

It is important to note that the vast heterogeneity of the African continent limits the validity of any developmental approach that attempts to be comprehensive. Hence, this study maintains a strict focus on the urban condition, drawing on well-established common developmental conditions and challenges in African cities, while acknowledging that accommodating territorial differences and sensitivity to context and heterogeneity is a critical and necessary consideration in formulating and implementing this approach. Moreover, while the study draws on Africa-wide data and findings for pragmatic reasons relating to data availability, the approach that is developed in this study is mainly directed at Sub-Saharan African cities.

2. African Urbanism: The Scale, Target and Mode of Intervention

The African continent's celebrated growth [2]—characterized by even growth across sectors that fueled consistent GDP growth over the past four decades—is largely underpinned by its urbanization rates [3], which are projected to soon be the highest in the world [28]. The continent exhibits the highest city growth rates in the world [4]. City growth rates hovered at around 4% for the four decades spanning from 1950 to 1990 and is projected to be at least 3% by 2035–2040 [4]. Consequently, the continent's highest performing 18 cities are likely to achieve a purchasing power of USD 1.3 trillion by 2030 [3,29]. Africa's middle class is expected to grow to 1.1 billion in 2060, up from 355 million in 2010 [3,30] and its labor force is expected to reach 1.1 billion, exceeding that of China and India [2] by 2034 [28]. Hence, Africa's cities have become targets for the global multina-

tional corporations seeking to secure and re-valorize urban real estate in the new scramble for Africa [12].

However, African cities are characterized by dual formal–informal systems spanning almost every sector and activity (i.e., trade, service provision, employment, housing, land ownership and leasing and finance). The informal sector in Africa employs 66% of Africa's non-agricultural labor force, while contributing around upwards of 35% (35% in middle income countries, 40% and higher in low-income countries) of GDP [31]. Urban slum dwellers increased from 31 % in 1995 to 62% in 2012 [32] and it can reasonably be expected that this growth has continued with rapid city growth rates. The large infrastructure and service deficits that prevail across the continent and its cities, alongside the prevalence of dual formal and informal systems, present perhaps the largest obstacle to stabilizing the African middle class and alleviating those in poverty. The prevalence of slums and informal settlements—which are characterized by piecemeal planning and uneven development—typically serves as a barrier to the provision of bulk infrastructures, such as water and sanitation, bulk energy supply, waste management and roads and transportation [3]. Demand is met through a combination of formal and informal service providers, often at higher cost to the poor, who cannot physically access formal bulk infrastructures and service provisions [3]. Moreover, Africa and its cities are heavily dependent on imports, such as goods, food and fuel, to meet local demand, rendering them vulnerable to exogenous change effects [33].

Three key additional—and peculiar—factors are critical to account for in respect of aspirations to SUD on the continent.

Scale of intervention. First, contrary to popular perceptions of urbanization on the continent, the large majority of growth has not been occurring in the large metropoles of the continent (e.g., such as Lagos and Kinshasa), but has rather been occurring in small to intermediate cities instead (i.e., 63.9%) [34]. With 54% of growth occurring in small cities (i.e., 100,000–500,000) and 9.9% in intermediate cities (i.e., 500,000–1,000,000) [34] and the majority of these cities springing up along corridors that connect larger cities, the spatial transition that African urbanization is undergoing offers up a key opportunity to leapfrog urban development by focusing efforts at smaller, more manageable scales yet still driving macro-scale transitions at the same time. This indicates that inclusive, participatory-based approaches are more achievable as well, as the scale of engagement is smaller. It also speaks to the need for stronger decentralization for local and local–regional economic diversification; decentralized infrastructures and service provisions are key to this transition. Hence, the scale of intervention can be identified as that consisting of small to intermediate cities, focusing on local and local–regional (the term "local–regional" is used in this article to differentiate between transnational regions and local regions) developmental scales.

Target of intervention. Second, the African middle class does not resemble the global middle class and is in contrast—in reality—a middle-class precariat. Whereas the global middle class is defined as people living on USD 10–100 per day, the African middle class is defined as those living on USD 2–20 per day [35]. The African middle class in 2010 constituted 34% of the total African population and around 60% of this 34% actually survived on incomes of USD 2–4 per day (i.e., the "floating middle class") [35]. Hence, the African middle class is considerably vulnerable to exogenous shocks and changes, with household budgets under severe and persistent strain, especially due to heavy dependence on imports of goods, food and energy (i.e., nexus effects; see Section 3.2). Only 4% of Africans earn above USD 10 per day and constitute only 2% of the global middle class, with 50% of Africans living under the poverty line of USD 1.25 per day [36]. Hence, the target of intervention is clear: transitioning the precarious middle class into stability and growing it, particularly by focusing on household budgets, alongside stabilizing formal and informal sector SMEs that typically provide services at the—aforementioned—scales of intervention.

Mode of intervention. Third, in contrast to the first wave of urbanization that saw urbanization accompany the industrialization (i.e., the industrial revolution from 1750 to 1950) of now developed nations, urbanization in Africa has largely been unfolding in the absence of any significant industrialization [3,15,29]. Extractive and agrarian activities largely underpin growth on the continent. Notwithstanding, significant tertiary sector growth has unfolded on the continent over the past decade, with telecommunications, finance and banking services reaching more people due to the—mainly ICT—platforms that technological advancements of the third industrial revolution have enabled [36–39]. This speaks to the need for and potential for Africa to leapfrog the type of industrialization trajectory that the cities of the developed world underwent. This is critical in respect of the need for low-carbon, sustainable growth that is just, inclusive, resource efficient and is hence suited to the pressing concerns of the 21st Century [29,30], particularly the need to meet global Sustainable Development Goals (SDGs). This in turn is a strong indication of the mode of intervention that is most appropriate for African cities, that is, in situ development that leverages the convergence of sustainability oriented and/or green solutions, as well as fourth industrial revolution offerings that are appropriate for and fit the African urban context and its needs (see Section 3.1).

In summary, this study enables us to discern (1) the scale of intervention, (2) the target of intervention and (3) the mode of intervention that ascribe a "fit-for-purpose" approach towards engendering sustainable urbanism in African cities. This in turn helps frame the role social innovation can play in generating radical, top-down, bottom-up and hybrid solutions [20] to the pressing—wicked—SUD challenges facing African cities. Moreover, it provides focus for sectoral intervention and support, particularly the role that the (entrepreneurial) state can play in supporting social innovation for local development in African cities, with a view to stimulating local economic development and broader transitions to sustainability at the same time.

3. Transitions to Sustainable Urbanism in Africa

3.1. Sustainable Urbanism in Africa: A Broad Definition

With respect to what kind of sustainable development trajectory is appropriate for African cities, it is worth tendering a comprehensive definition, based on what the key, desirable characteristics of just, sustainable African cities would be. To this end, this study conceives of sustainable African cities as being (1) resilient, adaptive and transformative (e.g., to change effects and shocks, whether emanating from the global, regional or national/local scales), (2) able to leverage intra- and cross-scale interdependencies and relationships (i.e., more internal coherence and resilience through strengthening intra-relations and leveraging cross-scale interdependencies to navigate change), (3) more equitable in respect of the urban citizenry (i.e., with respect to livability and reducing inequalities in access to infrastructure services and provisions, access and mobility), (4) resource efficient and sustainable (i.e., in order to navigate the pressures of resource scarcity and low-carbon development in the 21st Century) and (5) productive (i.e., through economic diversification that boosts economic growth and employment where it is most needed).

In short, the sustainable African city should ideally be inclusive, productive, resilient and sustainable. This speaks directly to the kind of social innovation that is required in African cities, that is, social innovation that draws on inclusive, participatory based processes bottom-up, while also integrating inputs from experts and decision-makers from the top-down (articulated as hybrid by Manzini (2013)). In this framing, game-changing social innovation can be produced through transdisciplinary, multi-sector and multi-level engagements that are primarily informed by the needs of the communities and urban citizens that these social innovations target [40]. This is particularly important where informality is concerned. As articulated by Roy [41] (p. 152), a "different set of experts" needs to generate knowledge about upgrading, namely, "the residents of informal settlements" themselves. This is because, as Roy [41] (pp. 150–152) points out, "the provision and distribution of infrastructure is not a technical issue but rather a political

process" and that the "question of who sets the upgrading agenda" is central to meeting the needs of informal settlement dwellers. In this respect, social innovation that is inclusive and focused on producing an "*enabling system*: a system of producers and services aiming to empower the social actors involved" [20] (p. 60) is required in the African urban context.

In this paper, the enabling systems are conceptualized as social innovation-based economic ecosystems for SUD (see Section 4). The next section identifies, more precisely, the "nexus" (i.e., food–water–energy–transport) that this enabling system should ideally be oriented upon in the case of African cities, particularly at the household level. Moreover, it presents a rationale for stimulating game-changing social innovation through exploiting the convergence between green technologies and fourth industrial revolution offerings for SUD in the African context.

3.2. Nexus: Enabling Just, Inclusive Sustainable Urban Transitions

What is clear, is that any successful developmental transition must both stabilize and broaden the African middle class and lift poor households out of poverty at the same time if it is to reduce inequalities (with Africa's Gini coefficient averaging 0.58, above the global average of 0.4) and the entrenched urban divide that persists in African cities [3,42]. Moreover, stabilizing the African middle class is critical to broader transition, as their precarity limits their ability to meet basic needs, service their assets effectively and make significant savings, as well as access entrepreneurial, educational and skills development opportunities [43]. It is also important because local authorities in Africa are generally unable to collect significant revenues locally and remain dependent on central authorities for funds [44] that are often limited and, in turn, subject to corruption and influence from central authorities. Growing and stabilizing the African middle class, who are mainly urban, is hence key to ensuring a macro-level developmental transition that is significantly transformative and raises African living standards to the same level as developed nations [3,35,43].

With respect to stabilizing middle class African household budgets, a key intervention point can be identified by acknowledging that between 50% and 70% of household budgets of the poor is spent on food, water, energy [45] (including transportation [46]), with food alone averaging above 50%. This is commonly referred to in development literature as the "nexus" [47] and, while it mainly pertains to poor African households, it is also significant for the African middle class, who in reality are precarious and earn significantly less than the global middle class (as discussed earlier in Section 2). This is especially the case as the—already high—dependence on imports in the food and energy sectors is projected to increase for most African countries [33]. These nexus effects are critical to account for at the household level, as they are combinatorial and can therefore result in double and triple squeeze effects between food, water, energy and transport costs on households [3].

Nexus impacts, hence, serve as key destabilizing factors for households and any intervention at the household level must necessarily address them. They can plunge households into near-poverty and poverty conditions from month to month. They hamper the ability of households to save, service their assets, engage in entrepreneurial activities in the formal and informal sectors, access basic services and engage in skills development and education for self-advancement. Moreover, this has upstream impacts on local governments, who are unable to collect revenues effectively enough to sustain local government funded programs of action, as previously discussed. Hence, nexus impacts at the household level/scale have significant knock-on effects on local authorities and are key to actualizing broader scale (i.e., city, national and regional) transitions to sustainability.

In acknowledgement of this reality and drawing on the scholarly discourse that emphasizes the importance of working with the everyday realities of African urbanism (especially informality), African urban theorists and practitioners alike have argued for in situ development approaches to take precedence in slums and informal settlements [3,15,48]. In situ development typically seeks to co-construct and implement small-scale, decentralized solutions, drawing on local and indigenous knowledge (e.g., constructing water reserves) or

convenient (low cost, easy to maintain) technologies and systems that can be implemented from household to neighborhood scales [3]. Critically, in situ development ensures that infrastructures and service provisions become available to slum and informal settlement dwellers quicker than bulk infrastructures. Indeed, this coheres with Swilling [40], who rationalizes game-changing local-level in situ interventions and solutions as critical for African urban and multi-scalar sustainability transitions on the continent.

The role of social innovation in actualizing this in situ developmental vision in African cities warrants further discussion, particularly as it is focused on leveraging "new ways of thinking and acting" [21] (p. 2) on the grand developmental challenges of our era—which are complex and integrated [49]—with the specific aim of meeting social needs and goals. Moreover, the discourse around social innovation has risen in significance, as information and communications technology (ICT) offerings have grown and matured [21], enabling social innovation efforts to significantly extend their reach and impact. Critically, social innovation is widely viewed as key for actualizing collective visions of sustainability in local economic development ([20,50–52] in [21]). Social innovation also draws on and combines with both financial and technological innovations in producing and reproducing its offerings, for example, leveraging technological innovations in microfinancing to meet social needs through sustainable technology and infrastructure provisions and services [21,53] (p. 45). Social innovation can emerge from any sector alone—such as civil society, the state and the private sector—but also from the combined efforts of sectors. Likewise, social innovation can also emerge from transdisciplinary cooperation and collaboration [21].

Similarly, in the African context, Swilling [40] (p. 1) argues for "game-changers" in sustainable urban development that follow from precisely the modes of engagement through which social innovation is generated, i.e., that new, innovative systems and solutions emerge from cross-sector, transdisciplinary and multi-level interactions that are primarily informed by the context of implementation (i.e., the communities themselves). Collectivity (typically through participation) and relationality (i.e., cross-scale, cross-sector and multi-level) typically play a key role in unlocking solutions that are fit for context and give voice and primacy to the citizenry. That is, by generating cross-pollination of ideas about how to develop solutions that may range, for example, from innovations in financing to technological and systems innovation, to innovations that leverage local and indigenous knowledge(s) [23].

In their review of 29 cases of social innovation across nine domains, Angelidou and Psaltoglou [21] emphasize the importance of ICTs—i.e., digital social innovation (DSI)—in the recent rise of the prominence of social innovation. Taking their cue, this study argues that the potential for boosting social innovation through new technologies and systems solutions in SUD in Africa is even higher when considering the convergence between green technologies and fourth industrial revolution offerings. Note that the emphasis here is not necessarily on primary innovation in these areas, but rather generating systems solutions that are appropriate for context by recombining, "in a creative way, already existing products, services, places, knowledge skills and traditions" [20] (p. 61), an approach that is core to social innovation.

Many green technology offerings and systems solutions are particularly suited to the African context. They are predominantly decentralized and/or semi-decentralized and can operate independently or supplemental to bulk infrastructures. They are also scale-able and for example can be scaled up to neighborhood scales and higher (e.g., micro-grids). Green technology offerings and solutions are also customizable to local contexts, as they can be taken up in different systems configurations. This allows absorption considerations to be made, taking local specificities and contextual factors into account, as well as the specific needs of communities. Moreover, they are, in most cases, easy to install, service and maintain and low-skills levels are required, creating opportunities for low-skilled and semi-skilled workers (especially the youth) to be trained and absorbed into employment. There are also many low-cost options available, a key factor in ensuring absorption in this context.

Green technologies and solutions that have potential for absorption in the African urban context at the household and neighborhood/district scales are shown in Figure 1. At city scales, green activities, such as agro-industrial symbiosis, waste recycling, waste to gas/energy plants and public transit systems, have significant potential for uptake and indeed have been taken up in some major cities. For example, Addis Ababa has implemented a waste-to-energy plant that will process 80% of the city's waste while supplying 30% of the city's electricity needs [54]. It also boasts its own light rail system since 2015, which can carry 15,000 passengers in each direction [55]. Lagos City in Nigeria boasts both a light rail and bus rapid transit system and so does the City of Johannesburg in South Africa. Kenya has one of the most dynamic solar power markets in Africa, having adopted solar power in the 1980s, producing thousands of solar technicians since then [3].

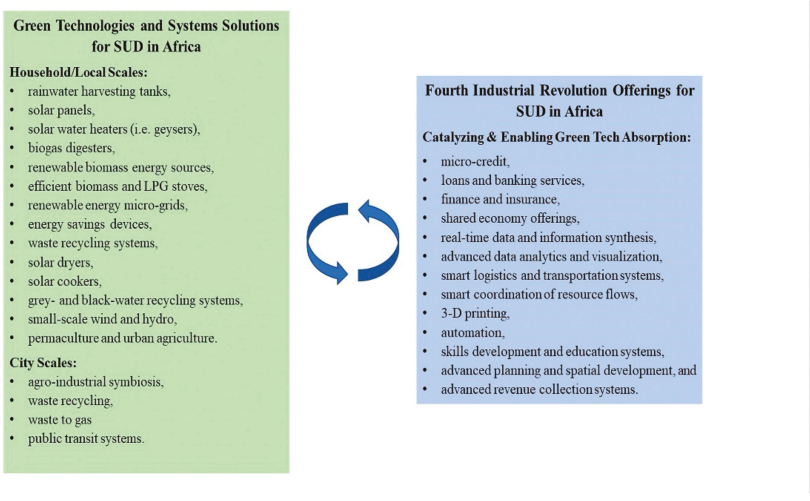

Figure 1. An inexhaustive account of green technology and fourth industrial revolution offerings that may be combined for SUD in Africa.

Additionally, fourth industrial revolution offerings, shown in Figure 1, can serve as significant catalysts and facilitators of the absorption potential of these green technology offerings and systems solutions by (1) helping develop the skills base that is required for roll-out and implementation, (2) assisting with data-driven systems optimization and customization of solutions, (3) optimizing resource efficiencies, while improving resilience to potential shocks, (4) contributing to local production and (5) providing innovative, new non-predatory micro-credit, financial and banking services and savings schemes that low-income households can access.

Countries like Kenya, where mobile phone enabled money transfer and microfinancing services are offered by M-Pesa, are actively engaged in absorption of blockchain technologies [56]. Blockchain and the ubiquity of mobile phones and telecommunications are already at the heart of many innovative offerings that are transforming both urban and rural citizenries' abilities to access previously inaccessible services on the continent, for example, in the agricultural sector, which is dominated by small farmers [57]. One new blockchain initiative seeks to provide loans to 50,000 smallholder farmers in Africa, to the value of USD 10 million. This project is a collaboration between Block Commodities, an African blockchain based commodities trader, Wala, a financial services platform powered by Blockchain, Dala, which provides crypto-tokens that supports instant, borderless micropayments at no cost and FinComEco, which assists farmers in gaining wider market access for their crops [58]. In Ghana, BenBen [59] provides a trust-based, Blockchain enabled platform for land tenure and property that "aggregates both formal and informal public

transaction data", integrating diverse property market data sources to provide verified and rated land data for use by differing market actors.

The potential convergence between green technologies and fourth industrial revolution offerings hosts considerable promise for development and economic diversification on the continent, but whether development will prove to be inclusive and equitable depends in large part on how these solutions are customized to African urban contexts. This is in turn dependent on who participates in the processes that conceptualize and implement that customization. To cater for the vast array of stakeholders and interest groups who will be affected by any deployment of smart solutions in African cities, this customization requires a more inclusive, participatory approach towards local implementation of sustainability agendas. In this respect, social innovation is oriented on precisely those considerations that are key for realizing SUD in African cities. Social innovation can broadly be described as constituted of two key discursive streams: "the first one (is) predominantly concerned with the role of social innovation in local development, building on the role of citizens and their communities in neighborhoods, cities and regions and the second one (is) concerned with socio-technical transitions, focusing on the process and involved actors in social innovation in addressing social challenges . . . " [21] (p. 5). This simultaneous focus on socio-technical transition and inclusive local development is precisely what is required in the African urban context, particularly in Sub-Saharan Africa. The next section mobilizes this assertion by drawing on a theory of transitions to sustainability (i.e., the multi-level perspective, or MLP) [26] and economic ecosystems theory [25] to contextualize and characterize the role that an entrepreneurial state led approach can play in local SUD in African cities. It also discusses the value that this perspective brings for African states and city governments, in particular, in respect of the role that they can play in facilitating economic ecosystems that drive broader transitions to sustainability while boosting economic diversification—i.e., through a technology and infrastructure led transition—at the same time.

4. An Economic Ecosystems-Based Framework for Transitions to SUD in Africa

In respect of transitions, this study draws on multi-level perspective on transitions theory (MLP), as a basis for developing this framing, as it specifically focuses on socio-technical transitions to sustainability, which are clearly of great relevance in the African context given its high infrastructure deficits and stark urban divide. It is important to acknowledge, however, that the MLP has largely been developed in and for developed world contexts and may not adequately address the contextual specificities of developing world contexts.

The multi-level perspective on transitions to sustainability (MLP) conceptualizes transitions as socio-technical systems (STSs) (see Figure 2 below), where transitions are multi-level in respect of micro (i.e., niche), meso (i.e., regime) and macro (i.e., landscape) levels [26,60,61]. At the meso-level, regimes comprise a whole system and its normative features, that is, policy, regulatory, institutional, societal, structural, processual, economic, social, physical (i.e., infrastructural and technological), cultural, environmental and so forth. This constitutes a socio-technical system that is recognizable and which is dynamically evolving. At the macro-scale, landscapes refer to the greater context (and scales) in which regimes reside (e.g., regional, global). Landscapes exert exogenous landscape pressures on regimes that force regimes to adapt, primarily because regimes have little or no direct control over landscape pressures. Landscape pressures act as forcing factors that drive change in regimes. This change is facilitated by the ability of the regime to reconfigure its internal structures, processes, functions and identity (i.e., its adaptive capacity), as well as by the absorption and amplification of niches that occur at the micro-level (i.e., its transformability) [62]. As landscape pressures exert pressures on a regime, this creates opportunities for niches to accumulate, gain momentum and penetrate at the regime level spurring transition to new modes of operation at the regime level.

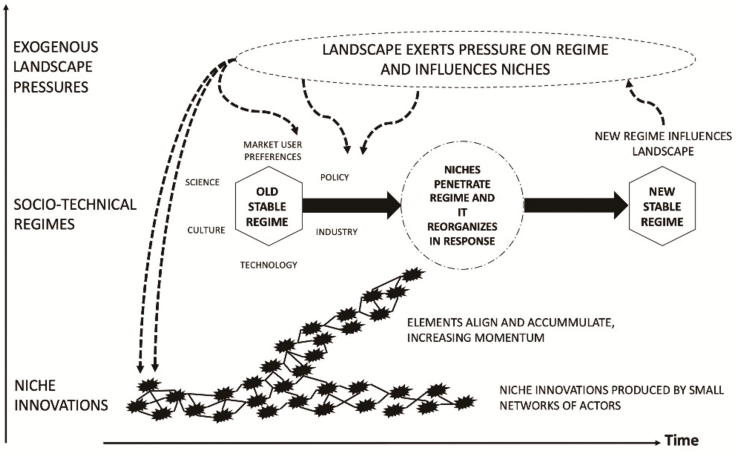

Figure 2. Illustration of the multi-level perspective on transitions. Adapted from [60] (p. 1263).

Niches are typically innovative on a range of different levels [62]; they can be discursive and policy oriented, technology and/or systems solutions oriented, or they may involve the establishment of strategic intermediaries that bridge activities that would otherwise be conducted in silos (e.g., urban coalitions, laboratories, management agencies). They are key to bringing about transformative change or transition at the regime level. This study theorizes that niche activities, as conceptualized in the MLP, can be further elaborated in the African context by embracing the notion of local and local–regional scale economic ecosystems, an old conceptual framing [27] that has enjoyed a recent revival [25].

Economic ecosystems theory has its roots in Malcolm Marshall's 1920 eighth edition of *Principles of Economics* [27], where he argues for an approach towards economics that acknowledges two key insights. First, the use of the mechanistic metaphor accommodates complexity to a lesser degree than the biological metaphor in appreciating the adaptive evolution of economic systems. Second, localization of economic activity has profound commensurate benefits, particularly for knowledge co-creation and transfer, innovation and normalizing participation in trade and entrepreneurship at local levels. These insights have recently been mobilized by Auerswald and Dani [25] to formulate a comprehensive theoretical framework of economic ecosystems.

In this respect, Auerswald and Dani define an economic ecosystem as "(a) dynamically stable network of interconnected firms and institutions within a bounded geographical space" [25] (p. 362). In their framing, economic activities and innovations are geographically localized and characterized by innovation in ecosystems. They are densely interconnected and characterized by "speciation" (p. 374) between firms. The speciation of each firm is characterized by its "production algorithm" (p. 368), which serves as its differentiator in the broader "fitness landscape" (p. 369). Interconnectedness drives "biparental reproduction" (p. 366) as the progenitor of chance mutation in this fitness landscape, enabling Schumpeterian innovation and entrepreneurship to harness relationships to improve fitness. Firms proceed along the fitness landscape by leveraging their learning curves to proceed through learning and adaptation, adapting to changes as they occur and charting a way forward based on the new position achieved along the fitness landscape. This mirrors how complex systems maintain stability far away from equilibrium by harnessing feedbacks to "self-correct" to maintain stability through an "adaptive walk" (p. 369) of sorts. In this sense, the firm's resilience is enhanced by its ability to adapt as well as the "DNA" (p. 368) that underpins its production algorithm, which provides it with the fallback mechanisms to adapt and self-organize [25].

Adopting a Schumpeterian perspective characterized by creative disruption—where innovation results from "a constant process of differentiation among firms, based on their

abilities to innovate because of different internal routines and competencies" [1] (p. 41)—this study theorizes that the potential for creative destruction (or disruption) at the regime level can best be achieved through catalyzing and organizing niche activities that produce social innovations in economic ecosystems at local and local–regional scales in African cities. That is, social innovation-based niches that respond to local demands (e.g., for goods, services, food, infrastructures and technology solutions, as well as skills development, financing, micro-credit) in service of sustainability transitions at local scales.

In this respect, an economic ecosystem perspective enables several key advances to be made that enable niche-level activities in the MLP to be organized for greater impact. First, it enables a heterodox economics perspective to be actualized. This is particularly suited to the African urban context as the prevalence of dual formal–informal systems negates the direct adoption of neoclassical economic models of development. Second, and related to the former, it enables a systems perspective, in which the false dichotomy between formal and informal systems can be transcended [6], enabling an inclusive, "organizing from the street" [63] perspective to be leveraged in service of in situ development in slums, informal settlements and informal trade, service provision, employment, production and the like. Third, an economic ecosystem perspective enables a unit of analysis and scale of implementation that is focused at the local and local–regional scales (this coheres with Mazzucato's [1] (p. 43) perspective, whose focus is on the "network", stating that, "from the meso perspective the network is the unit of analysis (not the firm). The network consists of customers, subcontractors, infrastructure, suppliers, competencies or functions and the links or relationships between them"), which is precisely where the need for infrastructure and technology provisions, service provisions, goods, skills development, reduced export dependence, cash flow and employment arises in African cities.

Hence, an economic ecosystem perspective brings a particular set of advantages when navigating urban development in African cities. Importantly, by leveraging a systems and heterodox economics perspective that is rooted in biological metaphor(s), it enables an understanding of what creates and drives adaptive and transformative capacity in local systems, i.e., what yields fitness and enables navigation of fitness trajectories on the fitness landscape. In this perspective, the economic ecosystem as a process becomes the unit of analysis in multi-level transition and not the production algorithm of firms, or their "DNA". This enables a multi-scalar perspective on the accumulation of niches that penetrate at the regime level to be actualized. Individual firms' fitness is predicated on their individual "DNA" (which is the unit of analysis at the firm level) and capacity for self-organizing in relation to other firms, as well as in response to exogenous and endogenous changes (e.g., in demand) in the environment. Local–regional economic ecosystems are constituted by the networked assemblage of firms that is organized into ecosystems and where self-organization and adaptive capacity yields fitness at the (economic) ecosystem scale. This in turn can catalyze niche penetration at the regime scale. In this casting, economic ecosystem fitness is not so much a product of *accumulation* of niches [26,61] as much as it is a product of networking, organization, adaptation and consolidation, i.e., *organization and institutionalization* of niches. Social innovation-based economic ecosystems hence become the enabling systems [1] that are directed by the entrepreneurial state (see Section 5.2).

Moreover, embracing an economic ecosystem perspective enables a valuable multi-scalar perspective to be actualized on the (object of and) unit of analysis. This extends down to the individual firm's "DNA" (i.e., the firm as a single system understood through a biological metaphor where its essential traits are encoded throughout the system and informs its form, as well as function), to the local "ecosystem" level (i.e., a networked, self-organized and adaptive system) and all the way up to the large scale enterprises that come to dominate regime level normativity (networked, ubiquitous, normative, i.e., *institutional)*. In other words, an economic ecosystem framing enables a multi-scalar perspective to be envisaged on the question of transitions to SUD, one which extends from local to the broader national and regional scale transitions (see Section 5.2).

5. Discussion: Enabling the Entrepreneurial State

5.1. Economic Ecosystems and Multi-Scalar Transitions to Sustainability

In theorizing the broader scales of transitions that can be underpinned by seeding and catalyzing local urban economic ecosystems on the continent, several levels of broader scale transition can be envisaged. First, building on the growth of local economic ecosystems in cities, niche development and evolution can be catalyzed through organization, increasing the potential for niches to penetrate at the regime level and bring about national scale transitions. Second, when considering that the majority growth is occurring in small to intermediate scale cities and that these cities typically occur along corridors that link larger cities, that considerable potential for strengthening rural–urban linkages and catalyzing national scale transitions can be harnessed. Third, extending this rationale, this study also speculatively theorizes that—because some of these urban corridors typically span across national boundaries (e.g., the Greater Ibadan, Accra, Lagos corridor in West Africa)—that transnational regional scale transitions can also be catalyzed to some extent in these regions. In these respects, local economic ecosystems can potentially play a key role in multi-level and multi-scalar transitions to sustainability, while boosting economic growth and diversification at the same time.

At each scale, different governance considerations may need to be made. For example, at the firm scale, it is the "DNA" and production algorithm of the firm that is important. At the local economic ecosystem scale the networked interaction of linked niche activities is important to organize, catalyze, support and shape/direct. At greater scales—particularly national scales—the institutions that govern how clusters of local economic ecosystems and their interconnectedness with other clusters in other cities across county/provincial and national boundaries become important.

At national scales, cities are key drivers of growth, innovation, economic diversification, skills development and socio-cultural change. Cities, hence, impact national policies and planning for transition as a result of their primacy in generating new and diverse offerings and ways of doing, particularly with respect to social innovation that responds to global and local sustainability challenges facing them [21]. In turn, at transnational regional scales, cities can engender networked cross-scale responses that coordinate key functions of cities, even adapting them to absorb impacts and alleviate regional scale damage (e.g., in the case of disasters). Hence, cities are also of key importance to regional governance bodies that oversee key policy and planning decisions, which accommodate the role of cities in regional development.

5.2. Entrepreneurial State for SUD in Africa

The entrepreneurial state is a term that has been popularized by Mariana Mazzucato [1], who refutes the discursive notion that innovation-led growth is purely an outcome of "'market-driven' mechanisms (p. 1), empirically emphasizing the large role that public investment programs plays in underwriting and absorbing the risk of early state innovation that underpins growth instead. Importantly, Mazzucato argues that the role of the entrepreneurial state "does not necessarily have to take place at a national level (although it can)" (p. 80). Hence, in the casting adopted in this study, the role of the state—whether at national, city or local scales/levels of governance—is to engage in shaping, catalyzing and supporting local economic ecosystems that foster sustainable local and local–regional diversification and growth. Additionally, she specifically argues for "pushing" (i.e., versus nudging) (p. 121) to catalyze green industrial transitions through building "green innovation ecosystem(s)" that are symbiotic and not parasitic (p. 176), where the flow and diffusion of knowledge and ideas serves as a basis for innovation (p. 43).

This study embraces the entrepreneurial state as playing a key role at local scales by shaping and facilitating organization of economic ecosystems and establishing the institutions for cooperation, adaptive capacity, competitiveness and sustainability of economic ecosystems. Enhancing niche-driven economic ecosystem fitness is the priority in this framing. In turn, local scale economic ecosystems drive broader urban transitions and the

role of the state is to direct and shape them (as well as clusters of economic ecosystems that may emerge). This perspective coheres with that of Lee et al. [64] in rationalizing how to respond to the fourth industrial revolution.

Moreover, the entrepreneurial state has a strong role to play in supporting social innovation for SUD through shaping the objectives and providing support to the hybrid processes (i.e., top-down and bottom-up) [20] that underpin social innovation. These hybrid processes typically entail bottom-up direct social innovation initiatives drawing on support from interventions by "institutions, civic organizations or companies (top-down)" (p. 63), where progress can be incremental. Critically, the entrepreneurial state has a critical role to play in managing the complexity of scaling social innovation processes that reside in economic ecosystems. As Manzini [20] puts it, "(t)he hybrid nature of these social innovation processes becomes increasingly evident as the scale of change to be achieved increases" (p. 63) and that "as highly dynamic processes" they "go far beyond" traditional views on participatory design, "becoming complex, interconnected and often contradictory processes" (p. 65). This points to the need for the entrepreneurial state to play a coordinating role as a strategic intermediary or supporting strategic intermediaries that help bring greater coordination and direction to social innovation in economic ecosystems, particularly with respect to hybrid social innovation. In addition, the entrepreneurial state has a role to play in grappling with the complexity of these "complex, interconnected and often contradictory processes" [20] (p. 65) by providing direction, helping mitigate risk and uncertainty and supporting local authorities to be able to deliver effectively on social innovation in respect of the required scale, target and mode of intervention. The entrepreneurial state also has a role to play in supporting the more *radical* "creative and proactive activities" [20] (p. 65) underpinning social innovation and participatory design, as it entails experimentation and, hence, navigating higher levels of risk that wholly independent and/or private sector organizations may be less likely to undertake (indeed, this is the role that the entrepreneurial state has historically undertaken through public venture capital [1] (p. 68)). Hence, in sum, it can be argued that the entrepreneurial state has a key role to play in (1) incremental and radical, as well as (2) top-down, bottom-up and hybrid social innovation activities [20] (p. 57).

The role of the entrepreneurial state in the African context is about more than simply shaping markets and providing directionality to them that responds better to local needs. The entrepreneurial state also has a key role to play in mitigating against both private sector and NGO led sustainable innovation activities in Africa, where public participation is teleological, that is, where communities are skillfully guided towards preconceived solutions that "usurp community autonomy" [23] (p. 3), underpinned by how tacit power dynamics play out. In this respect, it is not merely inclusion that the entrepreneurial state needs to be focused on, it also needs to overcome the formal–informal sector dualism that governs both state and private sector led approaches in Africa (see next section). Moreover, private sector and civil society led social innovation tends to emphasize "finding and scaling" solutions and offerings, where indigenous communities can be "overpowered by outside ideas and processes" [23] (p. 3). In this study, the proposition differs in that scaling transitions to SUD is the objective and not scaling social innovations themselves, precisely because the focus is on economic ecosystems.

5.3. Economic Ecosystems for Overcoming Formal–Informal "Sector" Dualism

Critically, embracing an economic ecosystem perspective advances the framing on transitions provided in the multi-level perspective on transitions framework to address the formal–informal system dualism that presents in African contexts. Indeed, the MLP framework is largely formulated on the basis of developed European and North American economies, where informality does not present in the way that it does in the Global South. In the framing provided in this study the concept of economic ecosystems becomes useful, as it enables a perspective that incorporates both formal and informal systems in a

post-dualistic conception, hence supplementing the MLP framework, rendering it more appropriate and "fit-for-purpose" in the African context.

This is particularly the case because transcending classical and neoclassical economic dualisms between formal and informal "sectors" requires adopting a systems perspective and embracing a holistic heterodox perspective. In this respect, Roy [41] (p. 148) asserts that urban informality is not as much a sector as it is a "series of transactions that connects different economies and spaces to one another" and a "mode" representing "an organizing logic, a system of norms that governs the process of urban transformation itself". Hence, an economic ecosystem perspective that adopts a holistic systems perspective on formal and informal sectors and enables a post-dualistic conception is needed; one that is sensitive to the fluidity, overlap and porosity between them, as well as their fundamental inseparability [6]. In turn, this post-dualistic conception of formal and informal sector activities enables an entrepreneurial state led approach that is focused on local economic development—i.e., by adopting an economic ecosystem perspective—and remains agnostic with respect to whether economic activities are formal or informal. Instead, its focus is on organizing and institutionalizing economic ecosystems so that social innovation for SUD is prioritized rather than a particular "sector" and its activities.

5.4. Towards Inclusive Fourth Industrial Revolution Cum Green Technology Growth Trajectories

The question of SUD transitions—and ICT-enabled social innovation—cannot escape the realities that the new, globalized, data-driven, fourth industrial revolution-enabled economy has introduced. The dangers of the new "surveillance capitalism" [65], characterized by oligarchic big technology companies whose machine learning (ML) algorithm driven business models are predicated on trawling and collating large swathes of data (i.e., physical, digital and biological), must, in some respects, be catered for in any developmental strategy that seeks to engage with the fourth industrial revolution. This is not only because this has introduced acute power asymmetries between big technology companies and the consumers and users of their platforms, but because of the monopolization and deep inequalities that have accompanied it. This inequality manifests particularly in steep wage inequalities in big technology companies, such as Apple [1] (p. 185), as well as in the "the distribution of returns" [1] (p. 181). As Mazzucato [1] (p. 192) puts it, lamenting where "corporate success result(s) in regional economic misery", "(t)he big question for us here is: will the New Economy Business Model transform itself so as to distribute the benefits of the IT revolution?"

In conceptualizing what it means to build "green innovation ecosystems" [1] (p. 176) that are "symbiotic" [1] (p. 179), this study has proposed social innovation-based economic ecosystems as the enabling platforms for transitions to SUD and local economic diversification. In this respect, a deeper question can be asked, namely, what foundations support "'fairer' and more 'inclusive'" [1] (p. 181) growth? That is, not in respect of wage inequality, but in respect of monopolization by platform-based technology companies that become heavily dominant due to the ubiquity and heavy dominance and control of markets and services that corralling vast data sets affords them. It is conceivable that social innovation-based economic ecosystems for SUD may find themselves controlled and heavily dependent on larger platform operators that essentially render them bit players in the fourth industrial revolution economy. To this end, deeper, more fundamental considerations have to be made with respect to the underlying platform choices that underpin the emergence of the fourth industrial revolution in economies and societies in cities on the continent.

Vergne [66] makes an insightful and thorough analysis of the platforms underpinning the new data-driven economy and highlights two key differences that are of relevance in this respect. Namely, that the big-tech giants that have monopolized the surveillance economy are underpinned by ML algorithms that essentially centralize decision-making and communications, even though their delivery models may be distributed (e.g., Amazon and Uber). In this respect, centralization of power is essentially derived from the control

of the algorithms that learn from data and are used to predict and control—to some extent—absorption of goods, services and commodities. Machine learning algorithms are centrally controlled and, hence, can—at the turn of a switch—be changed, impacting whole ecosystems of activities that are embedded in and rely upon that algorithmic reality.

In contrast, Blockchain, as a platform, is mediated by peer-to-peer consent by organizational members—through voting rights—over how that algorithmic reality is established. Blockchain essentially acts as a digital ledger that is decentralized and distributed where authenticated transaction data are securely stored [66] (p. 9). The chains represent a chronological history of transactions that cannot be unilaterally or centrally altered but requires that transactions are queued until consensus is obtained, whereafter the chain is grouped and recorded as a block. Blockchain essentially decentralizes communications creating a shared understanding of transactions whereby new members can quickly orient themselves and perform organizational tasks with contact with just a few organizational members. There is no need to interact with a centralized "command and control", so to speak, to become familiar with the institutions, or to make decisions. Hence, decision-making is distributed.

In sum, whereas ML platforms are centralized and distributed, Blockchain is decentralized and distributed. Citing Vukolić [67], Vergne argues that there are inherent advantages in decentralized platforms such as Blockchain, namely, that they (1) are able to broker trust, a currency that ML platforms are increasingly and noticeably lacking in and (2) are inherently predisposed towards reduced scalability, which mitigates against the formation of monopolies, as "services and applications have to be shifted away from the main chain" [66] and are shed from it. In this respect, Blockchain is inherently anti-monopolistic, mitigating against the "data gravity" ([68] in [66] (p. 3)) that underpins the ML-based platforms upon which big technology platforms are based.

Citing Boudreau [69], Vergne argues that the platforms of the future will be those without "central 'owners'" [66] (p. 15), capitalizing on decentralized trust where platform rules cannot be changed unilaterally by centralized command and control hierarchies. This presents a fundamentally different route, through which Africa and the Global South can engage with the new economy, i.e., where developing nations struggle to compete with the big technology giants that centralize decision-making through ML. It sets the scene for decentralized and distributed organizations to emerge as local providers of goods and services, where the platforms that fundamentally underpin how growth unfolds yields scalability without oligarchic dominance and peer representation that mitigates against runaway monopolization. Notably, this does not negate against existing "centralized, for-profit, non-neutral ML" platforms being "retrofitted with Blockchain to scale up outside of their initial market" [66] (p. 16), opening up room for offerings such as M-Pesa to retrofit [66] (p. 16) with Blockchain, as mentioned earlier. Rather, the key assertion is that more assiduous deliberation over what fundamental platform choices underpin economic ecosystems as enabling systems will likely impact the form of economies that emerge in absorbing fourth industrial revolution offerings.

6. Conclusions

In this study, the African urban context informs the theorizing by drawing on the literature on southern urbanism, particularly that relating to African cities. In theorizing, three key literature streams are further mobilized and integrated, namely, (1) social innovation and SUD, (2) economic ecosystems theory and (3) transitions to sustainability. In doing so, this study argues that small to intermediate African cities can facilitate broader transitions to sustainability through driving social innovation-based economic diversification at both local and macro-scales. Moreover, this study argues that this can be achieved by targeting the nexus costs of precarious African middle-class households by combining (1) green/sustainable technologies, infrastructures and service provisions and (2) fourth industrial revolution offerings to meet local development needs in African cities. Social innovation-based activities are critical to actualizing this vision. Harnessing

these activities into self-organizing economic ecosystems is key to generating broader scale transitions, as well as engendering multi-scale resilience at the same time. Hence, local economic ecosystem development is key to sustainability transitions in Africa and particularly in Sub-Saharan Africa. This, in essence, makes the argument for niche innovation activities—particularly social innovation—to be organized better (i.e., into local economic ecosystems). In this perspective, the state's involvement is rendered more effective, that is, in supporting the development of local and local–regional economic ecosystem creation and growth through social innovation that is sensitive to context, rather than the state engaging solely in centralized, large-scale strategic planning and/or research and development for innovation.

With respect to the entrepreneurial state, Mazzucato [1] (p. 27) presents "a case for a targeted, proactive *entrepreneurial* state, one able to take risks and create a highly networked system of actors that harness the best of the private sector for the national good over a medium- to long-term time horizon", with "the State acting as lead investor and catalyst which sparks the network to act and spread knowledge." Drawing on this understanding, this study argues for an interpretation of what the role of the entrepreneurial state should be in relation to the challenge of SUD in African cities, integrating the aforementioned literature streams to conceptualize transitions to sustainability. In theorizing from the perspective of African cities and by integrating these literature streams accordingly, the role of the entrepreneurial state in relation to social innovation in SUD is made clearer. Specifically, an emphasis on local economic development and diversification in African cities that draws on social innovation—which can be enhanced through an entrepreneurial state-led approach that adopts an economic ecosystem lens—to meet societal needs is required.

Lastly, this study also argues for deeper considerations regarding the underlying platforms on which these social innovation-based economic ecosystems and their products and services are to be made. Specifically, the entrepreneurial state should lead the way in shaping which foundational platforms become dominant, with a view to ensuring more equitable, diverse and inclusive growth and fostering trust-based symbiotic relationships within economic ecosystems. This consideration is critical for promoting diversification and mitigating against monopolization and control by private sector actors in transitions to SUD.

7. Limitations and Future Research

Three key limitations, that lie beyond the scope of this paper, present opportunities for further research on the key propositions of this paper.

First, one of the key limitations of this paper is that it does not explicitly deal with the question of what kind of governance may be required to actualize SUD and broader transitions to sustainability at the same time. What is clear is that multi-level governance that is "fit for purpose" [42] is required in order to act as a "glue" (i.e., coordinating framework) between national and local African governments, as well as between different sectors of society. Urban decision-making requires marrying national level decision-making (typically at a larger scale) with local context and their specific characteristics, constraints and opportunities. Multi-level governance can serve as a glue between different activities and development programs that act across scales and impact upon cities. It can also act as a capacity booster by drawing on leadership, management and technical skills and capacities from the different sectors that are distributed across different levels of governance and within cities. Critically, it can draw on a multi-scale understanding of what yields creative and adaptive capacity to govern multi-scale systems in service of broader transition objectives. Hence, further research into how the framing proposed in this paper can be actualized through multi-level governance is required, as without that understanding the role of the entrepreneurial state as proposed in this paper may not be realized.

Second, this paper also did not reflect in-depth on case studies of social innovation policies and activities in African cities that support SUD. It is conceivable, however, that even a non-comprehensive examination of these case studies might provide valuable insight

into the value of the framing proposed in this paper and may enhance the robustness of that framing. More specifically, more in-depth studies of social innovation policies and activities in African cities would (1) shift the perspective from a continental appraisal to a more local analysis, (2) thereby also enabling a cross-case analyses that could in turn improve the robustness of the overall framing. Hence, this presents a second avenue for future research and the prospect of developing a set of propositions to enhance social innovation for SUD in Africa, which lies beyond the scope of this study.

Third, in generalizing the African urban condition, there is a need to qualify that the approach proffered in this study—i.e., social innovation-based economic ecosystems—is not intended as a blueprint. It is important to acknowledge the vast heterogeneity of territorial conditions across the continent as this limits any attempt at comprehensiveness from an interpretive model. The territory, in this study, is the city and the study makes an in-depth analysis of what the appropriate scale of intervention is in this respect, particularly in the Sub-Saharan African context, highlighting that small to intermediate scale cities are the opportunity space for intervention. Moreover, the approach deliberately does not specify implementation priorities at the planning level but rather stipulates an inclusive approach and implementation modality that is sensitive to local context precisely to accommodate the aforementioned heterogeneity.

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Economic Development, Informal Land-Use Practices and Institutional Change in Dongguan, China

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Abstract: This paper is engaged with the critical perspective that highlights the role of the state in the production of urban informality by examining the dynamics of informal land-use practices in Dongguan, China since 1978. Based on in-depth interviews and archival analysis, the relationship between informal land development, the state, and land institution change has been revealed. Our findings show that informal land development is practiced by village collectives from below in Dongguan as a response to the absence and limitation of the national land law. The local government handles the informality in a pragmatic way that serves the goal of economic development in different historical conditions by actions of encouraging, tolerating, and authorizing, suggesting that the definition of informality is not a neutral classification. It is argued that while informality represents people's creativity in dealing with practical problems, when and to what extent it can be tolerated, formalized, and absorbed depends on the intention of the state in a specific historical context.

Keywords: informal land-use practice; institutional innovation; urban informality; state governance; the PRD

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1. Introduction

Urbanization in China has progressed rapidly since the reform and opening up in 1978, with the proportion of the urban population growing by 60.60% and the urban built-up area increasing by 58,455.66 km^2 in 2019 [1]. A large amount of land resources was developed for the sake of industrialization and urban construction, resulting in a dramatic change of land-use structure over the country [2]. At the local level, the city government fanatically developed land as a tool for promoting urban expansion and economic growth and as a source of local financial revenue [3]. This land-led development constitutes a key facet of China's urban and economic growth in the post-reform era [4,5]. However, rarely known is the informal land-use practice behind the dramatic urban transformation, which was pervasive in China and mostly occurred in urban fringe areas at the township level [6]. A high proportion of rural land conversion for industrial and housing uses has occurred through informal channels [7]. According to the statistics of the Ministry of Land and Resources of China (MLRC) in 2014, there were 56,926 cases of unapproved land use, involving 348.82 km^2 of land area [8]. In Guangdong Province, which was a demonstration zone for institutional experimentation in China [9], there were 7129 cases of unapproved land use, involving 20.55 km2 of land area, including 2.92 km2 of arable land in 2014. These data suggest that China's rapid urbanization cannot be fully understood without considering informality in land development.

Informal land-use practices in China have drawn increasing attention from both the public and academics [10,11]. This term generally refers to urban development on land without land-use permission or planning approval from the state or development that does

not comply with land-use planning and development regulations [12]. Informal land use can be understood as the spontaneous response of society to the absence or imperfection of land institutions. It is a pragmatic practice from below, involving the circumvention of and incomplete complying with formal land institutions based on practical needs [13], such as the behavior "hitting an edge ball".

Academic interest in informal land-use practices in China has mainly focused on the formal-informal dualism perspective [14,15]. Studies also examine the actors of urban development and economic growth, such as local villages, village collectives, and small enterprises, and how their interests and survival needs lead them to break land laws [12,16,17]. Little research has been concerned with the role of the state in the dynamics of informal land-use practices and their effect on the formal land system [2,18]. Following the literature of urban informality [19,20], this paper investigates forms and dynamics of informal land-use practices on the part of the local state in the Chinese context with a case study of Changan Town in Dongguan City in the Pearl River Delta (PRD). It examines why and how informal land development is practiced by the local state at the township level in different historical circumstances since 1978 and how it brings about changes to the formal land institution. The paper furthers the conceptualization of informality as forms of governance by investigating how the government navigates the relationship between informal land development and formal land system to achieve the goal of economic development in different institutional contexts. From this investigation, we detect the possibility of informality as the seed of institutional innovation. Our main argument is that informality is both a violation and a seed-of-change of formal institutions.

This research contributes to the existing literature by examining how the relationship between the Chinese state and informal land practices has evolved since the reforms of 1978, and with more recent decentralization [2,20]. Urban development and informal land practices in China have occurred in the context of political and economic transition, characterized by numerous simultaneous processes, including decentralization, marketization, and globalization, which have significantly changed the relationship between the state and city governments [21]. Moreover, because the state is an actor, this study has incorporated related literature regarding state development to understand the regulation of informal land practices in the Chinese milieu. This approach has permitted a critical understanding of informal land practices at the grassroots level by considering informality as a device that reveals the nature of the state [22].

The rest of this paper proceeds as follows. The second section discusses existing literature on urban informality and the theory of institutional change and elaborates on the article's analytical framework. The third section introduces a case study on the relationship between the state and informal land practices in Changan Town of Dongguan City in PRD, China. The final section discusses the results and their policy implications.

2. Literature Review: Urban Informality and Institutional Change

2.1. Urban Informality: A Mode of State Governance

Urban informality is a pervasive phenomenon in the global South, which has attracted attention from economic, sociological, and urban studies since the early 1970s [23,24]. Research on urban informality has evolved over more than four decades, from investigating a single discipline or territory into a comprehensive, transnational, and comparative topic. Three types of theoretical perspectives have generally guided informality research. First, the early dualist perspective viewed informality as sets of traditional and undeveloped socio-economic activities, which are divorced from formal economic sectors in developing countries [11,23]. This view emphasized a precise distinction between formal and informal sectors. The informal sector was generally associated with marginalization and poverty but not regarded as illegal; instead, it represented the survival strategies of the grassroots amid difficult living conditions, which were outside state regulations. Therefore, identifying how to reduce informal activities through the accelerated development of formal economies was viewed as a significant concern.

Second, the New-Marxism theoretical perspective criticized dualism, arguing against the dichotomy between the formal and informal sectors [25,26]. This perspective considered the informal and formal sectors as closely connected, with the informal economy remaining a segment of modern economic systems.

Third, the neo-liberal perspective developed in the context of the acceleration of economic globalization and the prevalence of neo-liberal policies. This theoretical perspective views informality as the grassroots' spontaneous response to the state's overregulation; the excessive regulation of economic activities by the state causes the formation of the informal economy. Informality was the real reflection of the market, rather than the consequence of unemployment [27]. The economic development gap between developing countries and developed countries persists due to the developing countries' lack of formal property rights systems. As a result, the informal economy fails to be transformed into a conventional formal market [28]. However, the three perspectives generally treat the state as a background factor and, therefore, cannot fully explain informality.

Although the study of informality began with a focus on the informal sector in the 1970s, it has been extended to include informal spaces such as informal settlements, informal housing, and informal land use. There are no closed linkages between informal sectors and informal spaces [29–32]. There is still no defined concept for informality; the sole consensus is that lack of regulation leads to the formation of informality [14]. Based on these three theoretical perspectives, some research on informality has emphasized the role of the state in recent years. The appearance of the criticism governance perspective at the beginning of the 21st century introduced a novel and more profound understanding of informality [24]. Roy and AISayyad provided a comprehensive discussion of the relationship between the state's power and informal practices, introducing the concept of urban informality. There are three primary academic contributions of the criticism governance perspective [33].

First, advancing beyond the dualism perspective, the criticism governance perspective posits that formality and informality are not a simple binary opposition of legality and illegality, regulated and unregulated, or either in or out of control [14]. Rather, informality is the process of deregulation of the state. Formality and informality are not only contradictory, they are also connected with each other and one can become the other, moving the boundary between them, becoming a continuum. Informality lies within the scope of the state, rather than outside of it, and is a deregulated system rather than an unregulated one [19]. For instance, Dicken (2005) argues that Rio's favelas, far from being marginal spaces in the city, are central to the logic of urbanism and law [34].

Second, urban informality is a mode of governance. Urban informality is a flexible strategy of the state under different political, social, and economic circumstances. Urban informality can be viewed as the space practice of the state under the interaction of all actors in urban development and economic growth, such as the central state, local states, enterprises, village collectives, and villagers, rather than a simple economic sector or geographical space [20]. The production of space within a state's territory is embedded in its sovereignty [35–37], because the state has the power to determine what is informal and what is not, and the state can determine which forms of informality will thrive or fail [22]. In the case of Turkey, political authorities reconstituted the informal-formal spatial divide to support their own land claims [38].

Third, the epistemology of urban informality has shifted from bottom-up to top-down. The state contributes significantly to urban informality. As the informal is defined as the socio-economic activities that occur outside of and separately from the formal economic system, informality is typically observed in urban "grey spaces" and "shadow cities" [39]. Informality is usually regarded as the space practice of the grassroots; it is bottom-up and can be understood as a static object of study. Moreover, formality can be understood and considered a lie, or a temporary status; it is an ambivalent and uncertain system [22]. In other words, informality exists in the core power of the state, and it is the government that sets the conditions of the possibility of informality. In contrast to the idea that informality

is caused by the lack of state regulation, Roy contends that informality is generated by the state itself [40]. The state's selective enforcement of regulation, the suspension of relevant laws, and the partial authorization of informality, indicate a "calculated" informality, or a "system of deregulation" that is, in essence, a "mode of regulation." Recent studies have revealed the failure of the state to end social practices such as informal housing and street vending [41–43].

2.2. Institutional Change: From Informal Institution to Formal Institution

Over the last three decades, with the development of economic globalization, the social sciences have embraced new institutionalism by recognizing the centrality of institutional frameworks, when dealing with social and economic phenomena [44–47]. Institutions are one of the primary factors of production, which contribute significantly to the economic growth and reshape the capitalist milieu; institutional change is considered the fundamental source of economic growth and urban development [48].

This study utilized institutional theory to study formality and informality. According to Douglass North, institutions "are the rules of the game in a society, or more formally, are the humanly devised constraints that shape human interaction" [48]. There are two kinds of institutions: formal and informal. Formal institutions are governed by rules codified by laws, regulations, administrative orders, and administrative statutes. Informal institutions are defined as organizations that are motivated by deeply embedded values, norms, customs, and traditions [49]. Both formal and informal institutions can enable and constrain human behavior [50]. Informal institutions may also exert considerable influence on formal institutions. In fact, throughout human history, many formal institutions were established upon the foundation of informal institutions, which modified, supplemented, or extended to become the formal institution [51]. The study of the global South has discovered that informal practices not only supplement and rectify the defects of formal institutions but also become the foundation of state reform and institutional innovation [52].

Institutional change can involve the substitution of a less effective arrangement in socio-economic activities, which is an ongoing evolution from institutional imbalance toward innovation, and ultimately, the realization of institutional equilibrium. Institutional change essentially involves the transfer and redistribution of power and interests. In general, informal institutions are transformed into formal institutions. The state and local governments, as the primary founders of institutions, typically make institutional arrangements to serve the space production within their territory, based on the characteristics of institutional implementation, such as the changes within socio-economic structures and the goals of urban development [18].

While the social sciences have given greater attention to formal institutions, the study of informal institutions is by no means a new research agenda [53]. Informal institutions are equally as important as formal ones for understanding the world. How do informal institutions emerge, spread, change, and become formalized? In recent years, some research on institutional change theory has moved beyond institutional forms and has again, interjected institutional function into the discussion [54]. The functionalist approach holds that informal institutions emerge to perform essential functions, such as providing efficient solutions to problems of information or collective action [50]. For example, Helmke and Levitsky argued that informal rules may be created when formal institutions are incomplete and cannot cover certain contingencies [49]. Similarly, Tsai found that local actors devise informal coping strategies to evade the restrictions of formal institutions [55].

However, in the scholarly debates concerning informality, the term "informal" is not linked to institutions in North's work or interactions among actors. In general, the field of urban studies has not applied the institutional perspective to the impact of urban development institutional change theory [48]. Nevertheless, drawing on Roy's urban informality and North's institutional change theory, Altrock proposed the concept of conceded informality [19]. He analyzed the connection between the two theories, which include interactions between state and local governments, enterprises, villagers, and

village collectives. Not only are formal and informal institutions constructed, but also the formal and informal urban development statuses are formed in the socio-economic system. The state is viewed as the central actor, that determines the status of institutions and urban informality.

In summary, land is not only the spatial carrier of urban development but also an important tool for attracting investment. In the context of global environmental change, rapid urbanization, and sustainable development, land use has been a great concern among Chinese academics [2,42]. The reform of land systems is the most important institutional change in China since 1978, and it has had a far-reaching influence on urban development. The PRD was a typical peri-urbanization area under the bottom-up urbanization mode [16], and there have been significant informal land practices at the grassroots level in the PRD since the market-oriented institutional changes of 1978.

This process, however, has differed significantly from the conventional understanding of informal land-use practices, as a negative consequence of state-led land expropriation [6]. This research contributes to the understanding of informality as a production of the state by investigating the regulation of informal land practices in China since 1978. By exploring the state's motivations behind regulatory practices in different historical circumstances, this present study argues that the definition of informality is not a neutral classification, but rather, one made and remade by the state to satisfy its political purposes. The state is viewed as an actor and is understood to have disclosed the relationship between the regulation of informal land practices and the political purposes of the state.

Although it has been proven that the state and the land institutions are contributing more significantly to urban development and economic growth, there exists a close relationship between informal land-use practices and land institution innovation, especially in regard to the acts of the state from the perspective of criticism governance. Three questions remain unanswered. First, how did informal land practices in the PRD emerge, spread, and persist? Second, how did the state and local governments deal with large-scale informal land-use practices in different historical circumstances? Third, how did informal land institutions become authorized by the state and come to represent land institution innovation? The case study answers these questions.

3. Materials and Methods

3.1. Study Case

Changan Town is located on the south of Dongguan City, Guangdong, China, which is in the Shenzhen-Guangzhou Economic Corridor. It is known as the "world factory zone" (see Figure 1). There are 13 villages or communities under the jurisdiction of Changan Town, which covers an area of 81.5 km^2. The level of socio-economic development has increased rapidly since 1978, with a population size of 674,000 and 76.03 billion yuan GDP, Changan was ranked as the seventh most important industrial town of 1000 in China in 2019. However, there are pervasive informal land-use practices in Changan for numerous reasons. First, the specific administrative structure in Dongguan has four levels: city, town, village, and group. Second, the center of economic growth is at the grassroots level, especially at the levels of the town, village, and group. Third, there is a cultural tradition of significant autonomy in the villages in Guangdong; villages and the village collectives determine their affairs independently, including decisions regarding land utilization, building plans, infrastructure development, and their execution. Finally, the rapid economic growth in Changan has been supported by the sufficient supply of rural land; villagers collectives own the property rights over rural land by law, which they mobilized to attract industrial investment to increase the villagers collectives' income in pragmatic ways that circumvented the formal land system. For these reasons, Changan Town in Dongguan City was selected for the case study, as it can illuminate the relationship between the state and informal land-use practices and institutional innovation at the grassroots level in China.

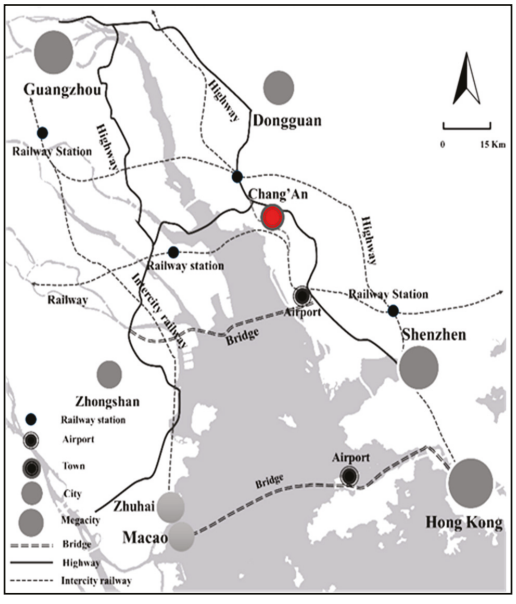

Figure 1. The location of Chang' An Town in the PRD.

3.2. Study Method

The case study focuses on three dimensions. The first dimension is the informal land, which is the core factor of production. The second dimension consists of the formal and informal land-use institutions of the state, local governments, and the grassroots level, which is the second factor of production. These two dimensions contributed significantly to the urban development and economic growth in Changan. The third dimension is the creator of the land institutions, and the primary actors in economic growth, such as the state, local governments, enterprises, villagers, and village collectives (see Table 1).

Table 1. The interactors of land institutional change.

Interactor	Main Subjects
State	The central government and the Ministry of Land and Resources
Local state	Guangdong provincial government, Dongguan government, Changan Town government, and the planning, land, and three old transformation governments at all levels
Enterprises	Foreign-invested enterprises and private enterprises (like the "three-plus-one" enterprises (enterprises that process raw materials on clients' demands, assemble parts for the clients and process according to the clients' samples or engage in compensation) and the mold factories)
Villagers and village collectives	Villagers and village (community) collectives

This study employed qualitative research methods, such as in-depth interviews and document analysis, to analyze the root cause and forms of informal land-use practices and their relationship with the state in Changan Town during different socio-economic and historical circumstances since 1978. First, in-depth interviews were conducted with local villagers, village cadres, and entrepreneurs, investigating how they developed informal land practices and coping strategies for managing regulations by the state and local gov-

ernments. The interviews were conducted with villagers and village cadres from Xiaobian, Jinxia, and Yongtou; the managers and workers in enterprises funded by investors from Hong Kong and Taiwan were also interviewed. In addition, in-depth interviews were conducted with local officers from the urban planning and management office, the land resource management office, and the "three old (old towns, old villages, and old factories) redevelopment" office in Changan Town, investigating the roles and attitudes of the townships and city governments regarding informal land-use practices. The interviews were conducted on 10 October, 2015 and throughout February 2016. A total of 23 persons were interviewed, conversing with some individuals multiple times, culminating in more than 33 appointments, that ranged from 0.5 to 3 h, each. The entire process was recorded with the consent of the interviewees.

Secondly, document analysis methods were employed; archives, newspapers, official statistics, historical documents, and public statements of senior officials from Beijing were analyzed in order to explore the forms of informal land-use practices and the goals and dynamic mechanisms of the changes to land institutions in different historical circumstances. The documents included *The Annals of Changan Town, Ten Preferential Treatments for Foreign Investors in Setting up Factories in Dongguan County*, *Measures of Guangdong Province for the Administration of the Transfer of the Right to Use the Collective Land for Construction Purposes*, *Some Opinions of Guangdong Province on Implementing the Three Old Transformation to Promote the Intensive Land Use*, *Specific Rules for the Enforcement of the Three Old Transformation in Dongguan City*, and the documentary, *Changan's Development in Past Thirty Years*. Land-use data and information were also obtained.

As discussed in the empirical section of the study, the root causes and methods of informal land-use practices during different historical circumstances were explored, including the state's motivations, macro-backgrounds, features of urban development, economic growth, and the regulatory practices concerning formal land institutions in different historical circumstances. These causes and methods can be understood by disclosing the relationship between the informal land-use practice and the political purposes of the state.

4. Informal Land-Use Practices, Economic Growth and State Governance in the Changan Town Since 1978

4.1. Deregulation and Active Support for Informal Land-Use Practices in the Early Days of the Transformation (1978–1986)

Gaps in land institutions led to the emergence of informal land-use practices in Changan in the context of deregulation, decentralization, and globalization in China. The state actively supported informal land-use practices in the early days of the reform and opening in China, with the institutional transformation from the planned economy to a market-oriented economy. The Chinese central government delegated powers to Guangdong Province, as a pilot area for the reform, to experiment with market-oriented economic institutions, to support economic growth in the PRD. Meanwhile, the government of Guangdong Province delegated powers to city, county, and town governments, to ultimately extend the grassroots level. Additionally, there was a great disparity in economic development between the PRD and Hong Kong, as Guangdong, in particular, was one of the poorest regions in China, before 1978. Under the pressure of the international industry, the institutional balance was shifting from Hong Kong to the PRD, paralleling the global development of an international division of labor. Under these circumstances, the PRD gradually received more overseas investments from Hong Kong and Taiwan, which was initiated in the early 1980s. A consensus to promote economic development in the PRD was reached among four stakeholders: the state, local governments, investors, villagers, and village collectives.

Although China did not have market-oriented land institutions before 1978, all government levels actively supported institutional experimentation for economic growth. Growth in Changan, which was mainly driven by investments from Hong Kong, increased under a special economic model called "the three-processing and one compensation" economy. Specifically, the Hong Kong investors supplied raw materials, machinery, equipment, and

product samples, while the local villagers and village collectives supplied the land and labor. The manufactured products were sold overseas, and the Hong Kong investors paid remuneration for the land and labor to the villagers and village collectives. As the villagers received more compensation through this model, they continued to supply land and labor, and additional rural collective land was converted into industrial land. This process promoted rural industrialization in Changan.

To further promote economic growth in the PRD, informal land-use practices were actively supported by states at all levels, as formal land institutions were insufficient. For example, the secretary of the Guangdong Provincial Party Committee, Ren Zhongyi, gave a public speech in 1980, actively supporting the exploration of informal practices; the speech emphasized that extant institutions should be flexible, or be replaced with new ones, if found lacking in contributions to economic growth [56]. After "the three-processing and one compensation" economic model progressed, the Guangdong Province government enacted *The Interim Provisions on Strengthening the Management of the Foreign Processing and Assembling Businesses* in 1983 to provide institutional support for foreign investment. Dongguan County government issued *Ten Preferential Treatments for Foreign Investors in Setting up Factories in Dongguan County* in 1984. Term one provided that foreign investors who established factories in Dongguan would be offered land at a preferential price, that was lower than in the Shenzhen special economic zone; investors interested in building villas in Dongguan could also benefit from the preferential land price. Moreover, the Dongguan local government developed a strategy for rural industrialization after the county was upgraded to a county-level city in 1985. All of these institutions promoted the growth of informal land-use practices because formal market-oriented land institutions in China were insufficiently appealing to investors.

Another reason for the emergence of the informal land-use practices in Changan was a persistent misunderstanding of the land institutions by the villagers and village collectives. China's constitution of 1954 stipulated that villagers and village collectives were the joint owners of the rural collective lands, which ensured their high degree of autonomy over that land. Market-oriented land institutions were lacking in the early days of the reforms, and access to industrial land was usually acquired free of charge through administrative allocation. The state enacted the Household Contract Responsibility System and subcontracted the collective land to households in 1980, which led to the mistaken belief that rural collectives were privately owned. Information gleaned from village interviews in January 2016, revealed that the villagers believed they possessed ownership rights that would allow them to change the function of the rural land. Furthermore, along with the collectives, the villagers believed there was more to gain by converting rural land to industrial land under the "three-processing and one compensation" economic model. For instance, local villagers were typically appointed as factory directors or workers, allowing them to earn greater remuneration from the land. Under these conditions, landowners typically actively supported the informal land-use practices.

The number of "three-processing and one compensation" factories continued to grow from the early days of reform in Changan, increasing to 45 by 1986. The village collectives could acquire more processing fees and remuneration from these factories than from agriculture, which they either redistributed to the villagers or used to build roads or more factories. As rural land became the key factor in attracting additional investment, informal land-use practices, mainly changing agricultural land to industrial land, continued to increase, driven by the economic interests of villagers and village collectives. Initially, existing structures, such as ancestral halls, dining halls, and conference halls, were used for factories in Changan. Later, agricultural land was taken too, decreasing the overall area by 794.47 km^2 by 1985.

In an interview with the secretary of Xiaobian village in Changan in December 2015, a research interviewer learned there were two primary types of informal land-use institutions involving the grassroots and investors from Hong Kong during the early days of reform in Changan. The first type was land leases. In order to reduce the cost and lower the risk

of investment, investors usually leased the village's factories when they founded their enterprises in Changan. The second type of informal land-use was land transfers. The "three-processing and one compensation" enterprises usually intended to expand their production scales after generating initial profits, but the crude factories provided by the villagers in Changan failed to meet their production needs. In such cases, the poor villagers sold the rural collective land to the Hong Kong investors, signing informal land transfer agreements, enabling the investors to design and build more advanced factories. In an effort to promote economic growth, the village collectives and the township governments typically supported these informal institutions.

4.2. Re-Regulation and Toleration of Informal Land-Use Practices (1986–2005)

With the rapid rural industrialization in the PRD, a large amount of agricultural land was informally leased and transferred to foreign investors, then converted into industrial lands. This informal agriculture land conversion was extensive and disorderly, causing two major problems: the loss of arable land and land-based social unrest [6,7]. Although the grassroots accrued some gains from the industrialization of rural areas, they lost their farmland. The per capita farmland in China began decreasing annually, gaining the state's attention, which made the protection of farmland part of its national strategy [2]. The state issued the National Land Management Law in 1986 to regulate land use, to maintain national food security and social stability. However, informal land-use practices continued to increase in Changan after 1986 for four reasons.

First, the villagers misunderstood the nature of formal land institutions. For instance, Article 2 of the National Land Management Law stipulated that no unit or individual could legally appropriate, sell, lease, or transfer rural land. Article 39 of the law required that construction on rural land by township and village enterprises be approved by a local government above the county level and that the scale of rural construction projects should be rigorously controlled. The law was formally implemented on 1 January, 1987. In addition, to adapt to economic development, the state revised the constitution in 1988, separating land ownership and land-use rights, regulating land-use rights transactions. Although the rural land was owned by villagers and village collectives in China according to the constitution, they had no right to transfer or change the nature of rural land [12]. If the villages wanted to repurpose rural land into industrial land, the requirement stipulated the land must first be designated as urban land, owned by the state. This meant that the development rights for rural land still belonged to the state and its agents, the city governments. Although rural land use was rigorously regulated by the National Land Management Law, the villages and village collectives in Changan only had a tenuous understanding of the laws. In their opinions, they held ownership of the rural land and could transfer or use it in any way under the constitution and the Household Responsibility System.

Second, there were conflicts between the rigorous land management law and the land-use demands of villagers. Foreign direct investment (FDI) in Dongguan increased rapidly in the 1990s, fuelling rural economic growth in Changan. Given the favorable economic development opportunities, the village and village collectives endeavored to transition additional rural land into industrial land. Informal land use, especially the unauthorized conversion of cultivated lands for non-agricultural uses, is a persistent feature of the reform era in China [7]. According to the formal land institutions, the amount of rural land that could be designated as industrial land was limited and the duration of the approval process was lengthy, it would lead to the villagers lose their land-use rights. A village cadre stated that the grassroots typically used any informal means to reclassify rural land as industrial land as quickly as possible under such conditions. Factories were built across the PRD, and rapid urbanization occurred such that "every village has spark, and every household was smoking" [56].

Third, the informal land-use practices were driven by the economic interests of village collectives. Land rental by the grassroots increased rapidly in Dongguan in the 1990s. The village collectives borrowed loans from banks to build factories and then rented

or transferred them to investors, generating significant returns for the grassroots. To encourage the expansion of the rental economy, the Dongguan City government issued *The Provisions on the Management of Rural Collective Assets in Gongguan* in 1997, and *The Measures for the Administration of House Leasing in Dongguan* in 1998. The grassroots rented their rural land or factories to investors because it generated more income than farming. In Dongguan, 70% of the village collective's income had originated from rural land or factories since the 1990s. Additionally, the grassroots earned income from "the three-processing and one compensation" factories. The proportions varied from a few to a dozen percent of the profit, and this income increased from CN 4.55¥ million in 1986 to CN 1.7¥ billion in 2002. The income was invested in building factories, constructing roads and public facilities, and funding sanitation, public security, endowment insurance, and bonuses for villagers. Rent became a stable source of income for villagers and provided maintenance funds for local public facilities.

Fourth, informal land-use practices were tolerated and given tacit approval by local governments. China began building the socialist market economic system in 1992 and reformed the tax redistribution system between the central and local government in 1994. With the decentralization of the state, those reforms increased the enthusiasm of local governments for economic growth. In this context, the government of Dongguan City projected an economic development strategy called "the second industrial revolution" in 1994 to promote rapid urban development. The Dongguan City government adopted a tolerant attitude towards informal land-use practices. According to a public statement by a spokesman of the land and resources bureau of Dongguan, the city government neither supported, encouraged, nor interfered with informal land-use practices. In fact, both the city and town level governments permitted informal land-use practices, especially the transfer of rural land prior to gaining formal approval. This led to the increased use of informal land-use practices in Changan.

In the meantime, there were two methods of informal land use adopted in Changan to cope with the re-regulation by the state. First, enterprises usually registered with the village collective and applied for land-use certificates in the name of the village collective, bypassing formal land regulations. With the rapid growth of the enterprises in Changan, the state began to monitor land use. As the transfer of rural land was strictly limited by the National Land Management Law, it became difficult for the village-township enterprises to obtain land-use rights. However, in an effort to attract more investments, the rural collectives actively helped the enterprises obtain land-use rights. A common informal practice evolved where the village collective registered the enterprise, secured the certificate of land-use rights, and then transferred the certificate to the enterprise in exchange for a "transfer fee". Because formal land institutions hindered economic development, a consensus developed among the actors in favor of this informal land-use practice.

In addition, village collectives managed rural land through the rural land stock cooperative system, which was an informal land institution innovation. The village land stock cooperative system, which evolved within the PRD in the early 1990s, successfully circumvented the National Land Management Law. On the premise of following the rule of rural land collective ownership, the rural collectives divided the collective land property rights into shares held by the villagers and initiated joint-stock companies for land management, including the development of industrial zones, attracting FDI, and informally leasing, or transferring the rural land. Seven different modes of developing rural collective land into industrial zones are utilized in Changan, with 56 industrial zones, 1162 enterprises, and 19, 657 mu rural collectives are utilized in total in 2002 (see Table 2). However, this informal land-use practice has not yet been accepted by the state, and the land-use rights in these industrial zones have not been approved by local governments. Compared to direct land transactions between the villages and enterprises prior to the issuance of the National Land Management Law, this collective action effectively reduced or avoided the risk of rural land transfer. Economic growth in Changan was rapid under this type of informal land institution. The flexible strategy of land use in Changan successfully

circumvented the state's formal land management system and served the interests of the local government, enterprises, village collectives, and villagers.

Table 2. The mode and number of industrial zones in Changan from 1980 to 2002.

Development Subject and Mode	Number	Number of Enterprises	Area (mu)
Town level	3	44	3860
Village level	25	372	8069
Cooperation between village level and foreign investors	2	14	1680
Cooperation between village level and group level	10	339	2970
Cooperation between village level and private	3	70	598
Group level	10	281	2100
Cooperation between group level and private	3	42	380
Total	56	1162	19,657

Source: The Annals of Changan Town.

4.3. Institutional Innovation and the Elimination of Informal Land-Use Practices Since 2005

Informal land-use practices have gradually become an obstacle to urban transformation and the upgrading of industries in the PRD. With globalization and the state's deregulation since the 1980s, the city-region has become the primary spatial unit participating in global competition [57]. Despite experiencing rapid economic growth after the reform and opening of China, the PRD has been faced with a series of developmental problems, such as low-end industrial structures, low land productivity, shortages of land for construction, and a large amount of informal land use. In addition, the institutional advantage the PRD once enjoyed has been lost and the region's development model has become unsustainable, placing the PRD at a disadvantage in regional and global competition. Moreover, China's central government announced its "scientific development" views and called for comprehensive, harmonious, and sustainable development in 2003, to promote city-regional transformation and productive efficiency. At the local government level, in order to return the PRD to regional competitiveness, the Guangdong Province government issued *The Outline of the Plan for the Reform and Development of the Pearl River Delta*. Along with the "dual track transformation", and the "empty the cage for new birds" development strategies in 2008, this plan was designed to foster industrial upgrades through the replacement of low-end and high-pollution manufacturing in the PRD with the addition of high-value industries.

However, formal land institutions have made it challenging to adapt to the new needs of the urban development in the PRD. Construction projects, 87.7% of which were located on rural collective land, had developed in 42.1 km^2 of Changan in 2005, accounting for 43% of the town's overall land. Informal industrial land, which was primarily developed without approval, accounted for 47.03% of the total industrial land area. In addition, rapid industrialization brought a large number of immigrants, many of whom rented housing from local villagers. Additionally, the development led to the emergence of informal residential land use in Changan. Nevertheless, the restrictions of the National Land Management Law on rural collective land transactions were still the primary reason for the emergence of informal land use in Changan. The law prevented urban transformation and the upgrading of industries in the PRD, generating an urgent need for innovation in land institutions.

Land institutional innovation was led by the Guangdong Province government. In an effort to promote industrial upgrades and urban development in PRD, the government of Guangdong Province applied for central government authorization of a land institution and issued *The Measures for the Administration of Circulation of the Collective Construction Land Use Right* in 2005. The basis of this measure was the deregulation of transactions involving rural collective construction land, allowing the land to be rented and transferred at the same price as urban land. As De Soto observes, the reason for the disparity in economic development between developed and developing countries is that the former have clear

formal property rights, while the latter, do not [22]. The innovation by the Guangdong Province government transformed rural collective construction land, especially some of the informal land, into assets. The rural collective construction land and part of informal land at the grassroots level in Changan was intended to be formally authorized by the state to allow this transfer of land within the formal land market. This was the first time that an informal land-use practice at the grassroots level became a foundation of institutional innovation.

Informality is the primary characteristic of the land institution modifications in the PRD. As Roy notes, urban informality is a mode of governance, and it is the production of the state within its territory [22]. The state promotes institutional innovation or issues new formal institutions by flexing its power to define and redefine formality and informality, advancing urban development, and serving political interests. Furthermore, the government of Guangdong Province announced the acceleration of regional development and industrial advancements in 2008. After the introduction of *The Measures for the Administration of Circulation of the Collective Construction Land Use Right*, the Guangdong provincial government continued to apply for central government approval of land institution innovations. It issued *Some Opinions on Implementing the 'Three Old' Transformation to Promote Economical and Intensive Land Use* in 2009, and its experimental stage lasted from 2009 to 2012. The policy stipulated that if informal land use occurred before the enforcement of the National Land Management Law commenced on January 1, 1987, villagers could apply for formal land-use rights certificates and registration, as state-owned construction land. If the informal land use occurred between January 1, 1987 and June 30, 2007, the villagers could pay a small penalty according to the National Land Management Law and then apply for a land-use rights certificate and registration as state-owned construction land. The "three old" redevelopment policy permitted villagers who desired to transfer their rural collective land to negotiate directly with developers without first reclassifying the land as state-owned construction land. The "three old" redevelopment policy availed more rural land to the market, including some informal lands that became assets for the holders. Moreover, the local city government encouraged the "three old" transformation project by returning land transfer payments to enterprises and village collectives to accelerate urban redevelopment and industrial advancement.

Led by the Guangdong provincial government, the "three old" redevelopment policy has been widely implemented in Dongguan, but as a local agent of the state, the Dongguan City government also exhibited the substantive characteristics of urban informality in the "three old" redevelopment project. For instance, one of the "three old" projects in Xiaobian village, Changan is named Ding Feng community redevelopment. The Xiaobian village collective applied for the "three old" redevelopment policy, and the city government encouraged the developers and social capital to participate in the "three old" redevelopment project during the experimental stage. The village collective directly negotiated the transfer of old informal industrial land to a developer, which formalized what had been an informal use of the rural collective land supply. Both the village collective and the developer benefitted from economic gains, and the developer had 30% of the land transfer payment returned from the Dongguan City government for participating in the "three old" redevelopment project.

While this policy effectively promoted urban development and economic growth in Dongguan, new problems did arise. The Dongguan City government lost significant revenue due to its debasement to a passive and marginalized role. In this context, the government issued *The Operation Guidelines for the Cooperative Enforcement* of the *'Three Old' Transformation between the Collective Economic Organization and the Enterprises* in 2015, which banned direct negotiation of the transfer of rural land between village collectives and developers. Instead, land transfers were required to be conducted under the supervision of the city and township governments. The introduction of this policy meant that the rural collective land transfers between village collectives and developers became informal again, which was a reiteration of the urban informality led by the Dongguan City government as

promoting land institutional change (see Table 3). The policy served the interests of the city government and would be continually adjusted on that basis.

Table 3. The change of informal land practice in Changan since 1978.

	Stage of Lack of Formal Land Institution (1978 to 1986)	**Stage of Getting around the Formal Land Institution (1986 to 2005)**	**State of Land Institution Innovation Led by Local State (from 2005 till Now)**
Main Contradiction	Contradiction among the state and local state, the rural grassroots and land institution	Contradiction between economic development and formal land institution	Contradiction between informal land-use practice and local state
Agent of informal land-use practice	The state and local state and the rural grassroots	Local state and rural grassroots	Rural grassroots
Form of manifestation of informal land-use practice	Changing the property of land use, leasing, and transferring the land	Changing the property of land use, leasing (half-legalized), and transferring the land	Changing the property of land use (partially legalized), leasing (legalized), and transferring the land (legalized)
Informal land-use institution	Informal land transfer agreement (oral)	Rural land joint-stock cooperative institution	
Agent of institution innovation		Villagers and rural collective	Guangdong provincial government
Form land institution	The Constitution in 1954 and the Household Contract Responsibility Institution	Land management law	Measures for the circulation of collective construction land and the "three old" transformation policy

To summarize, the spatial effect of the "three old" redevelopment policy on Changan was primarily the promotion of urban redevelopment and industrial upgrading, allowing informal land to enter the formal land market. The plan included 187 redevelopment projects covering an area of 8.29 km^2, and involving the industrial zones of 13 villages. Changan had completed eight "three old" redevelopment projects by 2015, covering a 0.34 km^2 area in which 80% of the previously industrial locations were informal land uses.

5. Discussion: Informality as Driver and Foundation of Institutional Innovation

5.1. The Land Institutional Change Led by Informal Land-Use Practices

Informal land-use practices at the grassroots level force the promulgation and enforcement of formal land institutions. At the beginning of the reform and opening, FDI drove rapid industrialization of rural areas in the PRD, and numerous acres of agricultural land were converted into non-agricultural land and used in a disordered and extensive manner. In this context, the state introduced the National Land Management Law in 1986, to regulate land use. The state allowed the transfer of the rural collective land-use rights, provided that changes to the nature of the land were approved by the local government and moved the development rights of rural collective land into the hands of the state's agent, the governments above the county level. In addition, the state revised the constitution in 1988, separating land ownership and land-use rights, allowing the latter to be transferred in accordance with the law. While this was the first time the central government enacted market-oriented land institution reform, informal land leases and transfers had been initiated earlier at Changan in the PRD. The rapid growth of informal land led to the significant loss of agricultural lands beginning in the 1990s [6], capturing the attention of the state, which issued *the Regulations on the Protection of Basic Farmland* in 1998. This was the most rigorous farmland protection institution in the world, and it was formally implemented on 1 January, 1999. Before the enforcement of the land institution, the villagers in Changan accelerated the process of reclassifying agricultural land as non-agricultural land to capture economic benefits, leading to the loss of 6.90 km^2 of arable land in Changan in 1998.

5.2. Some Informal Land-Use Practices Were Accepted by the Local Government

Government responses to informal land-use practices in the PRD since the reform and opening have varied, in stages, between support, encouragement, toleration, acquiescence, elimination, and finally formalization. During this process, the state evolved from having no national land institution to enforcing one to allowing institutional innovation by local governments (see Figure 2). The National Land Management Law introduced in 1986 prevented any unit or individual from appropriating, selling, leasing, or transferring rural land.

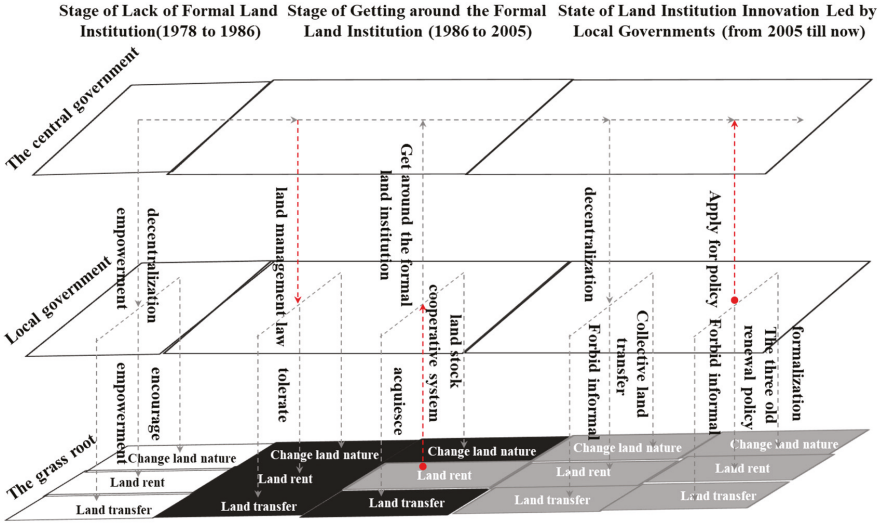

Figure 2. The process of formalization of informal land practice.

The conflicts between the rigorous national formal land institution and the land-use demands of villagers in the PRD escalated in the 1990s. In response, the rural collectives divided the collective land property right into shares held by the villagers and established land stock cooperation institutions for land management, including leases of industrial lands to investors. However, land leases contained a semi-legal status under the joint-stock cooperative institution emerging in the PRD in the 1990s, which effectively circumvented the National Land Management Law, thus promoting rapid industrialization in Changan.

Because informal land-use practices made a significant contribution to the economic development in the PRD, the Guangdong Province government initiated *The Measures for the Transfer of Rural Collective Construction Land* in 2005. In order to further advance industrial upgrading and economic development in the PRD, the Guangdong Province government initiated the "three old" redevelopment policy after it was approved by the state in 2009. Informal land-use practices in the PRD were objectively accepted by both the policies, thus allowing the formalization of informal land use, which had existed for a significant period of time.

5.3. The Agent of the Institution Innovation Changed from the Rural Grassroots to the Local Government at Higher Levels

The rural land stock cooperative institution developed in the PRD in the 1990s was a typical example of the collective behavior of villagers, which was spontaneously initiated by the grassroots from the bottom up and driven by economic interests. It was an informal land institution outside the state, that ensured a steady supply of land for economic development in the PRD. On this basis, Changan developed a flourishing rental economy,

thereby facilitating rapid urban development for nearly two decades, until the global financial crisis occurred in 2008 [58].

Guangdong Province began its urban development transformation and industrial upgrading strategy in 2008. However, due to strict regulations on the transfer of the rural collective land, the land supply for promoting the developmental strategy was woefully inadequate. There was a high proportion of construction land in the PRD, with the proportion of construction land in Dongguan reaching nearly 55%. On the one hand, the local government could not supply much more construction land for industrial upgrading. On the other hand, it is difficult to reclassify land that has been converted into non-agricultural land back to agricultural land. In order to address the shortage of construction land for the industrial upgrades and urban developmental transformation, the government must improve the benefit of low-output construction land and realize industrial improvements on existing informal industrial land. In this context, the Guangdong provincial government requested approval from the state for the "three old" redevelopment policy. As a land institution innovation, it facilitated the transfer of rural collective land, formalizing what had been informal land. The informal land practices and institutions that began at the grassroots level three decades ago have gradually become an institutional innovation, initially led by the Guangdong Province government and endorsed by the state.

6. Conclusions

This study used the case of Changan to examine the evolution of informal land-use practices. Informality in the PRD was a response to state choices in China after the reform of 1978. This paper analyzed the roots, main contradictions, and methods of the informal use practice, especially the relationship between this practice and the state, from a historical and critical governance perspective.

Informal land-use practices have experienced a range of governmental responses including encouragement, toleration, acquiescence, elimination, and finally formalization. The informality and formality of space production in Dongguan can almost be presented as a cycle that starts from an informal practice of bottom-up space production, with the empowerment of local institutions. The next step is a formal, top-down, centralized intervention, which leads to a loss of the local institutions' key role. This new situation of formality once more induces informal practices linked to the local reality, closing one cycle and probably starting another one. During this process, the state evolved from having no national land institution to enforcing one to allow institutional innovation by local governments. The land institution evolution in the PRD has been characterized by urban informality and consistent with the interests of the state. The informal land-use practices in the PRD can be regarded as the foundation of land institution innovation, which was ultimately authorized by the state.

China has gradually experienced the transformation from a planned economy to a socialist market economy since 1978. The PRD has contributed as an experimental zone for institutional innovation during this process. The state participated significantly in the process of change utilizing informal land institutions and formal institutional innovation, a classic example of reform and opening in the PRD. Roy contends that urban informality is a mode of governance and the state's production of space in its territory [24]. The state utilized its power to drive the institutional change and enact new policies to regulate the actors in urban development. Informal land-use practices are essentially the behavior of the state and its agents, which have determined the fate of the informal land-use practices through formal institutions. The new formal institutions redefine the formal and informal approaches, serving the strategies of urban development, and the needs of the state and its agents. Informal land-use practices and institutions always preceded formal land institutions in a process of continuous feedback, that promoted change in land institutions within the PRD, after the reform and opening in China.

Future studies should approach informal land-use practices and institutions rationally and objectively at the grassroots level, evaluating their impact on urban development,

although some informal land-use practices have created missed opportunities. In particular, research should focus on the formalization of informality under innovation in land institutions, and the government should make a special policy for territorial lifecycle management (TLM). In Chinese governance, imperial power has not traditionally permeated the grassroots, yet, more institutional innovation is needed from the grassroots. When formal institutions are developed, earlier informal institutions may absolve, but new informality will be created. Urban development requires this sort of bottom-up institutional innovation from the grassroots.

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Assessing the Contributions of Urban Light Rail Transit to the Sustainable Development of Addis Ababa

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Abstract: Many of the existing urban transport infrastructures in developing African cities are challenged by the mobility demands of their ever-increasing population and increased vehicle capacity. To address these transportation challenges, the Federal government of Ethiopia through the Ethiopian Railway Corporation (ERC) constructed and operates the Addis Ababa light rail transit (AA-LRT). Currently, many other African cities are following in action. This study aims to assess the contributions to sustainable development derived from the services of urban light rail in Addis Ababa. Cross-sectional quantitative research by means of a structured questionnaire survey considering key variables of social, economic, and environmental transport sustainability dimensions was conducted in Addis Ababa. Dimension-wise, the collected data was then analysed in order to measure the contributions made by AA-LRT and to identify the relations amongst each considered variable and each sustainability dimension. The findings of the study indicate a high level of perceived contributions of the economic sustainability dimension as compared to social and environmental sustainability. The study suggests an improved consideration of the environmental and social dimension for a holistic approach to transport sustainability of the city.

Keywords: sustainability; railway transport; sustainable development; urban rail; Addis Ababa light rail transit; transport infrastructure; sustainable urban transport

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1. Introduction

Addis Ababa city, similar to many of Africa's rapidly growing metropolises is challenged by the need for modern urban mobility systems to answer calls of an inefficient public transport service. A great percentage of the current transport system in many of these cities is almost automobile dominated [1], with the old fleet being unsustainable due to excessive air and noise pollution, high cost, congestion, and safety problems, among others. The desire to overcome these difficulties is therefore making economies advocate for increased effectual and sustainable solutions [2]. Since urban light railway infrastructure serves as a mainstay of urban mobility in conurbations [3–5], due to its benefits such as mass transit capacity, comfortability, fast speed, safety reliability, better environmental congestion and, mitigation impacts, Addis Ababa responded by implementing an urban LRT through the city and its suburbs.

Light Rail Transit (LRT) establishments are massively known to progress "sustainable urban mobility policies" in and around many municipalities due to their ability in changing urban surroundings together with conditions that are necessary in relation to terms of planning for their effective integration [6]. It is also notable that in discussing issues of the modern economy, a transport factor must be involved due to its influences in uplifting the social, environmental, and economic status [7]. By promoting the development of industries and quick accessibility, which improves the standards of living, urban rail transit positions itself as great leverage towards urban economy.

This paper presents an assessment of the contributions of LRT to the sustainability of Addis Ababa in terms of development (in the perspective of sustainable transportation development). Many recent studies have been conducted to analyze the contribution of LRT to the sustainable development of several cities across the world but in consideration of Ethiopia, limited work to this effect has been conducted. LRT infrastructure delivery with minimal sustainability assessment can lead to objectionable socio-economic and environmental effects for the stakeholders [8]. Although the state of knowledge has substantially improved in recent years as a result of these studies, many questions still remain open, and new evidence is clearly needed [9], especially in Africa. The question that arises is: how has LRT contributed to the sustainability of Addis Ababa?

A study by [10] concludes that the emergence of light rail as a new mobility system is not just a matter of creating capacity and reducing travel time but has many other rationalities attached. The authors therefore believe that one of these rationalities is the desire to achieve sustainable development. While some new LTR projects in middle income developing cities, may have limited economic and practical value [11], and some RLT project plans have been shelved mainly for financing reasons [12], many RLT operations have been a success, achieved intended objectives, and contributed to sustainability of their localities [13]. Additionally, when you consider cities that are moving towards the adoption of LRT, enough sustainability assessment has not been executed on the extensive LRT infrastructure projects. This may lead to hardships that increase costs and cause negative socio-economic and environmental consequences to the light-rail provider and the community [8].

In line with the above perspective and using formulated variables that are principal in transport sustainability, the research aims to utilize the survey method to collect perception-based responses amongst Addis Ababa residents on the contributions of AA-LRT to the sustainable development of Addis Ababa. Results from the collected data analysis will therefore be key in addressing the study question by indicating to what extent AA-RLT has contributed to sustainable development of Addis Ababa in the realm of the three dimensions; economic, social, and environmental sustainability dimensions, as coined by the Brundtland report [14,15]. The analysis will also try to understand the relationship among variables in each dimension.

The paper is structured in the following format. Section 2 provides a brief description of Addis Ababa city, its Light Rail Transit (AA-LRT), and sustainability approach. Then, Section 3 reviews published available literature on light rail transit and sustainability. Section 4 details materials and methods of the study, which includes the study duration and collection of both qualitative and quantitative data, particularly from a survey conducted among the residents of Addis together with data collected from ERC and other organizations. Section 5 provides the results from data analysis while Section 6 reports discussions of the results and deduced conclusions of the study, points out the limitations of the study and proposes directions for future research.

2. Background

Addis Ababa, which houses close to 25% of the city dwellers, is the capital city of Ethiopia, the largest metropolis in the country, and among Africa's fastest-rising cities. It is the growth engine for Ethiopia and a major pillar in the country's vision to become a middle-income, carbon-neutral, and resilient economy by 2025 [16]. Addis Ababa light rail transit (AA-RLT) is the first light rail and rapid transit in eastern and sub-Saharan Africa. It was put into operation in 2015 by Ethiopia Railways Cooperation (ERC) which is Mandated to advance railway infrastructure and deliver commuter and cargo rail transportation services in Ethiopia [17]. It is an electrified light rail transit with 41 stations and a total length of 34.25 km of rail lines. As indicated in Figure 1 below, it has two lines, one running north-south from Menelik Square to Kality (16.9 km) serving 23 stations and the other running east-west from Ayat to Tor Hailoch 17.35 (km) with the two lines sharing a 2.7 km section of the track in the city center serving 16 stations. On both lines of the

LRT, trains cannot travel beyond 80 km/h, putting their normal operational speed at 65km/h with a maximum network designed hourly flow of 15,000 passengers per hour per direction (PPHPD) [8]. Intended to mitigate and control the increasing traffic jam in Addis Ababa, whose populace has now exceeded 5 million occupants, the light rail was built by China Railway Engineering Corporation at a hooping sum close to US$475m, and 85% of the project was financed by loans advanced from export-import (EXIM) Bank of China (https://www.railwaygazette.com/addis-ababa-light-rail-opens/41388.article (accessed on 22 January 2020).

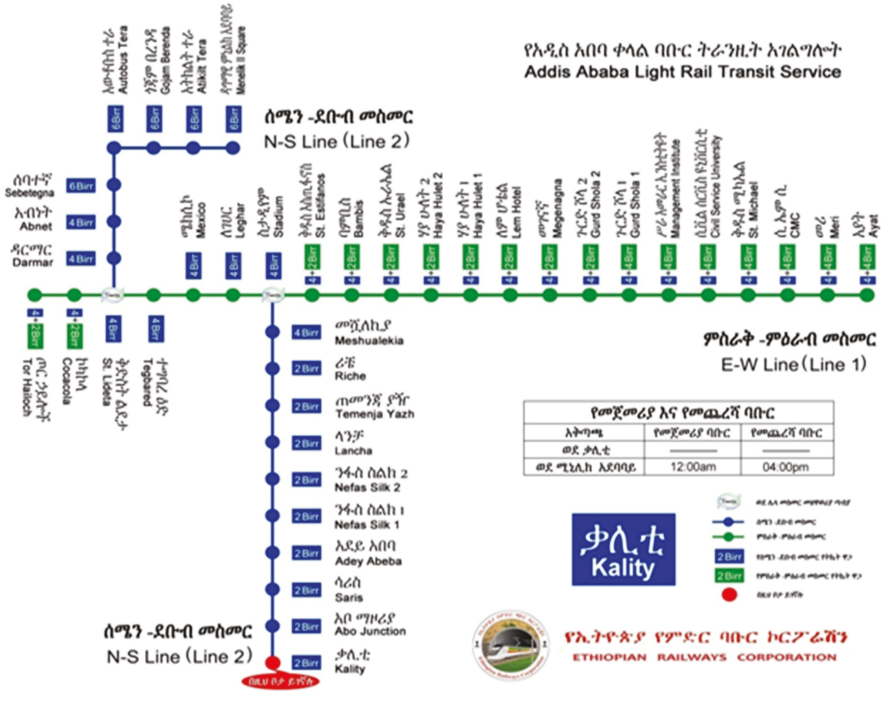


Figure 1. Operational stations along the AA-RLT route map. (Source http://www.aalrt.gov.et/maps.php (accessed on 29 December 2019); Photo taken by author inside the AA-LRT train).

3. Literature Review

The European Conference of Ministers of Transport defines light rail as a rail-borne form of transport that can be developed in stages ranging from the modern tram to a rapid transport system operating on its own right of way, be it underground, at ground level, or elevated [18]. Ideally, light rail is a form of railway urban transportation system, that is not a heavy traditional form of railways. The adoption of light rail in Africa is gaining momentum, as can be seen in Table 1 below.

Table 1. Light rail projects in Africa (Source: https://en.wikipedia.org/wiki/Urban_rail_transit_in_Africa (accessed on 29 December 2019).

Urban Railway Transit in Africa		
Suburban rail	Operation	Nairobi rail service, Botswana Railways (BR Express), Dar el salaam commuter rail, Metrorail western cape, Metrorail eastern cape, Metrorail Gauteng, Metrorail KwaZulu-Natal, Al Bidaoui, Gautrain, Petit train de banlieue
	Under construction	Train express regional
Rapid transit	Operation	Algiers metro, Cairo metro.
	Under construction	Abidjan metro, Lagos rail mass transit
Light rail	Operation	Addis Ababa light rail, Abuja light rail, Métro léger de Tunis, Sidi bel Abbés tramway, Trams in Alexandria, Casablanca tramway, Oran tramway, Algiers tramway, Constantine tramway, Ouargla tramway, Sétif tramway, Rabat-salé tramway
	Proposed	Nairobi light rail, Greater Kampala light rail

The comparison of the basic characteristic of light rail as compared to the traditional rail can be seen in Table 2 below.

Table 2. A comparison of basic characteristics of light and heavy rail.

Characteristics	Light Rail	Heavy Rail
Population of the city	100,000–1 million	>500,000
Type of line	Mainly separated from road traffic on street level	Completely separated from road traffic
Medium distance between stops (m)	250–1200	1000–5000
Engineering	Light	Medium to heavy
Maximal gradients (%)	8–10	3
Minimal Radius (M)	15–25	200
Carriage weight (t)	<20	40–50
Maximal frequency (trains/hr)	40–60	24–40
Transport capacity (Passengers/hr)	8000–15,000	30,000–60,000
Average speed (Km/hr)	10–40	40–80

Source: adopted from [18].

There is a growing body of literature related to the contributions derived from and the diverse effects of LRT projects in developing cities. Other studies have focused on the societal and commercial consequences of urban rail and light rail transit (LRT) as their main subjects of investigation. Even in the face of biting economic hardships, several developing economies in Sub-Saharan Africa and South Asia have joined the trend and are earmarking railway infrastructure projects in their strategic development plans for the next 10 to 30 years [19]. Railway infrastructure ventures are a paramount gesture and indicate one of man's greatest innovations towards the achievement of Sustainable Development Goals. Africa's commitment towards the development of RLT services is presented in Table 3 below.

Table 3. Light Rail projects by region and implementation status.

Under Construction and Commissioning												
		Track Length (km)				Min Estimated Project Cost (bn $)				Cost in Km in m$ in		
Region	**No of Projects**	**Total**	**% of World**	**Low/Middle Income Countries**	**% of World**	**Total**	**% of World**	**Low/Middle Income Countries**	**% of World**	**No of Projects**	**Total**	**Low/Middle Income Countries**
Africa	15	313	23%	313	22.6%	10.1	16%	10.1	15.6%	8	70.6	70.6
Asia	36	506	37%	380	27.4%	18.5	29%	12.3	19.0%	16	69.7	73.5
Australasia	3	31	2%	0	0.0%	2.4	4%	0.0	0.0%	3	75.5	N/A
Europe	31	240	17%	0	0.0%	8.1	13%	0.0	0.0%	29	33.9	N/A
North America	22	265	19%	23	1.6%	25.2	39%	1.4	2.2%	21	99.7	63.9
South America	3	30	2%	30	2.1%	0.5	1%	0.5	0.8%	3	18.5	18.5
World (constr.)	**110**	**1386**	**100%**	**745**	**53.8%**	**64.8**	**100%**	**24.4**	**37.7%**	**80**	**67.4**	N/A
China	16			286	21%			11.4		8		88.8
India	0			0	0%			0		0		N/A

Source: Adopted from [20].

Sustainable Development (SD), as explained in the United Nations World Commission on Environment and Development acknowledging the 1987 Brundtland Commission report: "is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [8,21–25]. According to [26], sustainability is synonymous with sustainable development. This implies that sustainability and sustainable development [27] are used interchangeably, as is the case in this paper. Elkington (1997) synthesized these dimensions as the Triple-P or the Triple Bottom Line. The United Nations 2005 World Summit Outcome Document refers to the "interdependent and mutually reinforcing pillars" of sustainable development as economic development, social development, and environmental protection [28]. Sustainable development is mostly interpreted and understood in the context of the triple bottom line approach as indicated in Figure 2 below. The SD theory, made popular through practice, is inseparable from relevant policies implementation [29] and may involve the assessment of stakeholder perceptions.

Figure 2. Percentages of CO_2 release in the transport sector. Source: International transport forum, Transport greenhouse gas emission 2010, [28].

The need for sustainability has emerged in this context [30] and the concept of sustainability, popularized in recent years, is unquestionably increasingly perceived as a necessary tool for understanding the social, economic, and environmental consequences linked to projects and project management [31].

However, some researchers approach sustainability differently and consider it to be composed of several other dimensions [26] with other dimensions or principles considered such as risk reduction, stakeholder, and accountability [32].

Environmental sustainability impacts to transport are geared towards attaining a reduction in local atmospheric pollution, global warming, negative impact on plants and animals, the impact of solid waste disposal on the environment, etc. [8]. Socially, sustainable urban transportation is concerned with delivering satisfactory access to transport with the objective of curtailing social exclusion, and progresses an individual's quality of life [8,33]. The social aspects can encompass corporate governance, human capital development, human rights, labor practices, relation with employees, and working conditions, safety, engagement of stakeholders, and decent work. The economic aspect involves return on investment, business agility, risk reduction, risk reduction, cost management, honest price, and service, project reporting, and investment evaluation. It has been clearly documented that in the contemporary economy, transport is pivotal due to its effects on social, and economic development [34].

This implies, therefore, that a properly functioning, and modern transport system leads to sustainable development as all other sectors such as power, industry, health, and

construction at one-point need to depend on transport for their delivery. In fact, the greatest priority of sustainable transport is to ensure effective and efficient mobility of goods and people, while at the same time contributing to the realization of economic, social, and environmental sustainability dimensions as shown in Figure 2. The International Union of Railways (UIC) declaration and indicators of sustainable mobility and transport provide the areas in which railways are contributing to sustainability. Spill-over sustainability contributions are not mentioned.

Railways certainly have a crucial role in a sustainable, safer, and greener evolution of the transport system [34–36]. Light rails can play a significant role to reduce the environmental impact of any city through providing efficient and effective transport with low environmental consequences, which in the end helps to fashion a more sustainable approach to transport.

Railways as the backbone of sustainable transport make strong connections to a number of the SDGs and supporting targets, notably; energy efficiency (Goal 7), resilient infrastructure (Goal 9) and access to sustainable transport (Goal 11) [37], resilience to climate-related hazards (Goal 13), and promote environmentally sound technologies and multi-stakeholder partnerships (Goal 17) [38].

According to the international transport forum, Transport greenhouse gas emission 2010, within the transport sector, energy consumption and therefore CO_2 emissions are dominated by road, followed by aviation and shipping. Rail accounts for 2% of CO_2 emissions within the transport sector as indicated in Figure 3 below. This, therefore, implies that railways are the good performers towards environmental sustainability in the transport sector.

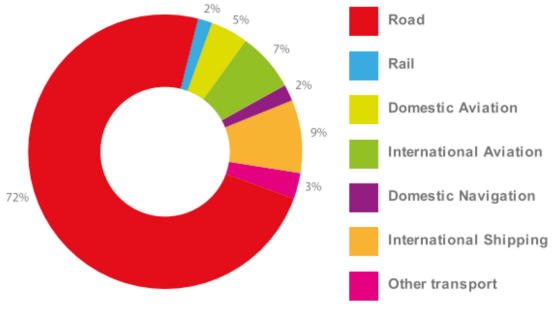


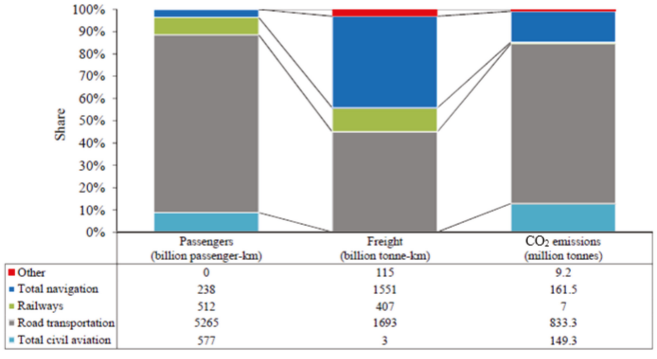
Figure 3. Percentages of CO_2 release in the transport sector. Source: International transport forum, Transport greenhouse gas emission 2010, [28].

Transport carbon dioxide emissions 2008.

This claim is further verified by data collected from 28 EU nations and was published in 2014, The collected data as indicated in Figure 4 below projects railway transport as the best performer contributing, only 7 million tonnes of CO_2 emissions with road transport leading at 833.3 million tonnes.

In discussing the findings of their study, [40] suggest that the construction of Urban Rail Transit has played an important role in realizing great-leap-forward development of economy and improving the urban economic structure and has become the source impetus for fueling urban economic growth. They further describe in detail three effects as (1) it leads the transformation of economic development way, (2) construction provides broad development space for environmental protection industry, and (3) construction improves the city's soft power. The need now is to quantify some of these effects that this paper intends to perform as well. Alade et al. [8] asserts that excluding the economic profits, the environmental and social development benefits are also derived from rail system ventures. The authors of this paper, therefore, believe that apart from the targets of railways that

include: climate protection, energy efficiency, exhaust emissions, noise, and vibrations [41], railways have much to offer in support of sustainable development.



	Passengers (billion passenger-km)	Freight (billion tonne-km)	CO_2 emissions (million tonnes)
Other	0	115	9.2
Total navigation	238	1551	161.5
Railways	512	407	7
Road transportation	5265	1693	833.3
Total civil aviation	577	3	149.3

Figure 4. Comparison of transport performance by mode and respective CO_2 emissions in EU-28 countries (EC, 2014). Source: [39].

4. Materials and Methods

Methods

Research methods are the techniques that involve the use of developed research instruments and/or tools that researchers use while carrying out the study to gain feedback from respondents [42]. This study has been conducted based on extensive collection of data, adopting [43] a quantitative methods pproach to assess the contributions of light rail in the sustainable development of Addis Ababa city below (See Figure 5 below).

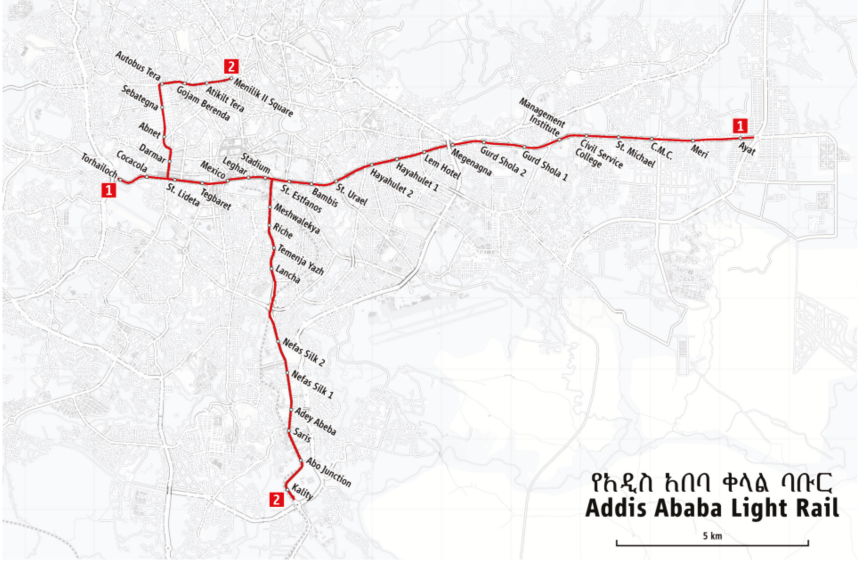


Figure 5. Location map of Addis Ababa RLT (Source [44]).

Recent research works of this nature, although in a different field, had been conducted before following a quantitative approach by [15], which validates that using a quantitative approach in this study will increase the seriousness of understanding sustainability contributions of light rails. The topic of the study suggests that it follows a case study approach,

which is an appropriate research strategy for complex phenomena that cannot be studied outside their context and for in-depth investigation [45].

The variables/aspects of the study were developed and customized basing on the sustainability model developed by [46] and was provided to the researchers upon request. During the research period, several data collection methods where used to complement the process, and these included document analysis and interviews. Quantitative data collection was mainly done by the use of a survey questionnaire. The survey utilized a Likert scale consisting of five aspects in each one of the sustainability dimensions on a 5-point Likert scale ranging [15] from 1 (strongly agree) to 5 (strongly disagree). In this same approach, the two components of the sustainability definition were also ranged, and perceived importance was analyzed. A direct formulation of the contribution of AA-LRT in forms of respective dimensions was also ranged on the same scale and studied.

The collected data was used to examine how the LRT contributes to transport sustainability through linking the respondents' feedback to pre-determined variables. Other data sources utilized included Ethiopia population census data, government statistical reports, journal papers, and other publications. A total of 393 respondents, mainly passengers found at railway stations and inside trains during transit and staff of ERC, residents found on bus and taxi stages, and Addis Ababa university students and staff participated in this study. A draft questionnaire was shared with one professor and two doctors (Ph.D.), all of who are teaching staff at the African railway center of excellence, Addis Ababa University, and their insights that guided in the development of a final questionnaire, which was administered to respondents both physically in hard copies and through an online survey using Google forms. A section of Addis Ababa university students who use the AA-RLT daily was part of the respondents and these could either pick the questionnaire and return it filled within a week or had to fill it at the university at their convenience. The questionnaire was constructed based on the three pillars of sustainability with respective constructs.

Convenience and purposive sampling were used on transport passengers in Addis Ababa including some RLT experts who work with the ERC. Data collected from the respondents was analyzed using IBM SPSS 25 statistical analysis software to generate descriptive, inferential, and multivariate statistical outputs that are presented in the tables and figures in this study.

The validity and reliability of the tools used in this study were ensured through the following ways; first quantitatively, the questionnaire was tested for validity using Cronbach's Alpha measure of the scale of reliability as well as giving it to university staff for corrections. Reliability of 0.85 (Cronbach's alpha) value was esteemed as acceptable. This was calculated on all survey items for this study. Qualitatively, by asking consent from the respondents for data provision, this ensured that the provided data had an acceptable degree of accuracy and acceptable.

Some of the demographic information that was collected and examined during the study include; location of the respondent in Addis Ababa (residence), gender, duration of stay in Addis Ababa, transport medium used in Addis Ababa, and category of service provision/employment. The location of respondents was scattered amongst Addis Ababa communities revealing no important pattern. The table below summarizes necessary demographic characteristics of the study.

From Table 4, as shown below, regarding descriptive statistics, it can be seen that a bigger percentage of the respondents were male (56.50%) compared to female (43.50%). The split between the transport medium used while in Addis Ababa reveals that the biggest percentage of respondents at 49.60% were AA-RLT users, while those who use private means were the lowest at 7.90%. It can be deduced that the results of the study are reliable as the biggest percentage of respondents really use the LRT most often. In addition, most of the respondents had lived in Addis Ababa for more than 5 years, implying that they are aware of happenings around Ethiopia's main city.

Table 4. Demographic characteristics of the respondents.

Variable	Category	Frequency	Percentage
Gender	Male	222	56.50
	Female	171	43.50
	Total	393	100.0
Duration of stay in Addis Ababa	1–5 years	78	20.10
	6–10 years	68	17.30
	11–15 years	76	19.30
	16–20 years	72	18.30
	21–25 years	98	24.90
	Total	393	100.0
Location in Addis Ababa:			
Transport medium used while in Addis Ababa	Bus	98	24.9
	Light rail transit	195	49.60
	Taxi	69	17.60
	Private means	31	7.90
	Total	393	100.0
Category of current service provision/employment	Government worker	80	20.40
	Non-government worker	72	18.30
	Self-employed	86	21.90
	Student	155	39.40
	Total	393	100.0
	Total	393	100.0

5. Data Analysis and Results

The results and analysis of the study have shown that the economic sustainability dimension is perceived to be addressed more than the social and environmental sustainability dimension. Many research studies have found out that the aspects of economic sustainability are considered more since many investors focus on regaining their capital investments and profits at the expense of other sustainability dimensions. This is again evidenced in the findings and analysis of this study. Some of the aspects considered in this are positively related in that when one aspect is being addressed, another aspect is being addressed in the same way and vice versa. In fact, it should be noted that sustainability is wide, and striking a balance amongst all the three dimensions cannot be easily achieved, but is a necessity for achieving the intended sustainability goals. The closeness in some of the aspects within the same dimension gives hope in improving sustainability.

5.1. Economic Sustainability

Five constructs of transportation economic sustainability were adopted for the study and included in the questionnaire to the respondents. These constructs included AA-LRT, which provides fair traveling prices compared to other modes of transport in the city (aspect 1); AA-LRT, which offers an honest transport service compared to road transport means (aspect 2); the introduction of AA-LRT, which led to decreased traffic congestion and delays in Addis Ababa (aspect 3); AA-LRT, which releases periodical project reports (profit) to the public and relevant authorities (aspect 4); and AA-LRT, which has direct (financial) benefits to the residents and authorities of Addis Ababa (aspect 5).

From the data collected from respondents about the perceived importance of the economic sustainability dimension, the first level of strongly agree had a percentage weighted average of 43.36%, which is followed by an agree level with 29.2%, then followed by the neutral level on 15.6%. The disagree and strongly disagree levels become last on an average percentage of 8.56% and 2.74%. The above average percentages of the levels indicate that many respondents accept the fact that AA-LRT is performing well via the economic sustainability aspects presented in the study.

Considering the individual aspects of economic sustainability dimension, in Figure 6 below, the aspect of introduction of AA-LRT led to decreased traffic congestion and delays in Addis Ababa had the largest percentage (49.9%) in level 1, implying that the surveyed city dwellers appreciate the reduced traffic congestion in the city due to the introduction of the light rail. Again, considering level 2, the aspect of AA-LRT releasing periodical project reports (profit) to the public and relevant authorities and having the largest percentage (34.4%), implies that respondents agree that the light rail performance reports are transmitted to relevant authorities. In the neutrality group, that is level 3, the aspect of AA-LRT has direct (financial) benefits to residents and authorities of Addis Ababa city, which had the highest percentage (17.3%) among selected aspects. The evaluated respondent's neutrality may be attributed to the fact that some of them use several means of transport.

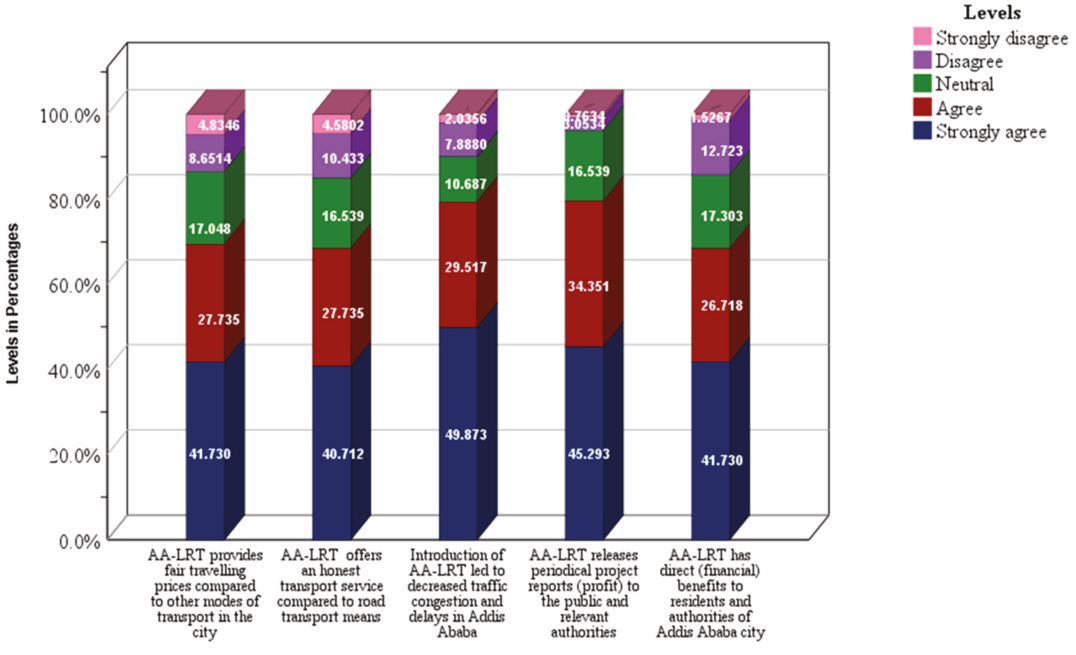


Figure 6. Category of the perceived importance of economic sustainability aspects.

It is surprising to note that the same aspect has the highest percentage (12.7%) for level 4 of disagree. The fact that light rail developments have financial benefits either directly or indirectly may not be visible to everyone and perhaps, this may be the reason why a big cluster of the respondents do not seem to realize the direct financial benefits from the AA-LRT. In level 5 of strongly disagree, the aspect of AA-LRT provides fair traveling prices compared to other modes of transport in the city, and has the highest percentage (4.8%) across evaluated respondents. This aspect considers the prices of AA-LRT in relation to other available transport means in the city. The price provided by the light rail services is uniform, whereby travelers who get off from a near station are made to pay the same money as those going to a far station, implying that short- and far-distance travelers are charged the same. This is not the case with other means, presenting a situation of fairness for short-distance travelers. The findings from the economic sustainability analysis help reinforce economic theories [8] which propose computing transport services prices based on competition methods. Providing user affordable charges increases the perception of economic sustainability from users. They also present fresh perspective on variables within the economic [4] aspects of transport sustainable development.

A Pearson product-moment correlation was also conducted to examine the degree of relationships between the above selected aspects of the economic sustainability dimension. AA-LRT provides fair traveling prices compared to other modes of transport in the city and was more strongly positively related, as AA-LRT offers an honest transport service compared to road transport means, r (391) = 0.558, ($p < 0.001$). AA-LRT also releases periodical project reports (profit) to the public and relevant authorities, which was the least strongly positively related r (391) = 0.208, ($p < 0.001$). A complete list of examined correlations is presented in Table 5 below.

Table 5. Pearson's moment-product correlation between economic sustainability aspects.

Correlation for AA-LRT Provides Fair Travelling Prices Compared to Other Modes of Transport in the City (N = 393) (Amongst Economic Sustainability Aspects)				
	AA-LRT Offers an Honest Transport Service Compared to Road Transport Means	The Introduction of AA-LRT Led to Decreased Traffic Congestion and Delays in Addis Ababa	AA-LRT Releases Periodical Project Reports (Profit) to the Public and Relevant Authorities	AA-LRT Has Direct (Financial) Benefits to Residents and Authorities of Addis Ababa City
AA-LRT provides fair travelling prices compared to other modes of transport in the city	0.558 **	0.250 **	0.208 **	0.297 **
AA-LRT offers an honest transport service compared to road transport means	1	0.394 **	0.245 **	0.341 **
The introduction of AA-LRT led to decreased traffic congestion and delays in Addis Ababa		1	0.281 **	0.546 **
AA-LRT releases periodical project reports (profit) to the public and relevant authorities			1	0.367 **

Note. ** Correlation is significant at the 0.01 level, Sig. (2-tailed).

The correlation relationship, which is positive and significant, particularly indicates that as one aspect is perceived to be addressed better, so is the other aspect also addressed better, rather in the same way. For example, the better AA-LRT provides fair travelling prices compared to other modes of transport in the city, the more it will release periodical project reports (profit) to the public and relevant authorities.

5.2. Environmental Sustainability

The five transportation environmental sustainability aspects considered are: the establishment of the AA-LRT, which led to decreased transport air pollution levels in Addis Ababa; AALRT, which led to energy saving through the use of little energy for great haul, experiencing a great positive change in the air quality due to the lowered level of exhaust emission due to AA LRT service; AA-LRT, which led to a reduction in transport noise and vibrations in the Addis Ababa; and AA-LRT management, which always gives out environmental laws and regulations and publishes environmental reports.

Based on the data collected from respondents about the perceived importance of the environmental sustainability dimension aspects, the first level of strongly agree (level 1) had a percentage weighted average of 41.96%. It was then closely followed by agree (level 2) with a percentage average of 32.34%. The average percentage of the neutral level (level 3) is 15.16%. The average percentage of those who disagree (level 4) is 7.5 and strongly disagree (level 5) comes last with an average percentage of 3.02%. These average percentages of each level indicate that many respondents who participated in this study

believe that AA-LRT does well in fulfilling the considered aspects of the environmental sustainability dimension.

Considering each of the aspects of environmental sustainability dimension, as illustrated in Figure 7 below, the aspect of the establishment of the AA-LRT, which led to decreased transport air pollution levels in Addis Ababa had the highest percentage (48.3%) in the level 1 category. This aspect considers the pollution levels from motor vehicle movement within the city but most especially in the areas where the light rails pass, also considered that respondents felt a sense of freshness in the air quality due to the introduction of AA-LRT. In the second position for the highest percentage of level two category is the aspect of AA-LRT management, which always gives out environmental laws and regulations and publishes environmental reports, at (39.4%). With the clear regulations in form of signposts and stickers commonly found on railway stations and inside the train, respondents feel it is agreeable to note that environmental rules and regulations are well communicated. In the third category of neutral (level 3) respondents about aspects, AALRT led to energy saving through the use of little energy for great haul aspect, which has the highest percentage (20.9%). Most likely, in this category, many respondents find it difficult to relate the consumption of electricity by trains and compare this with fuel (diesel) consumption. Level 4 has the aspect of AA-LRT, which has led to a reduction in transport noise and vibrations in the Addis Ababa, with the highest percentage (11.5%). The findings from environmental sustainability analysis supports theories of sustainability that attempt to prioritize and integrate [47] environmental concerns, perceptions, and problems into sustainable development.

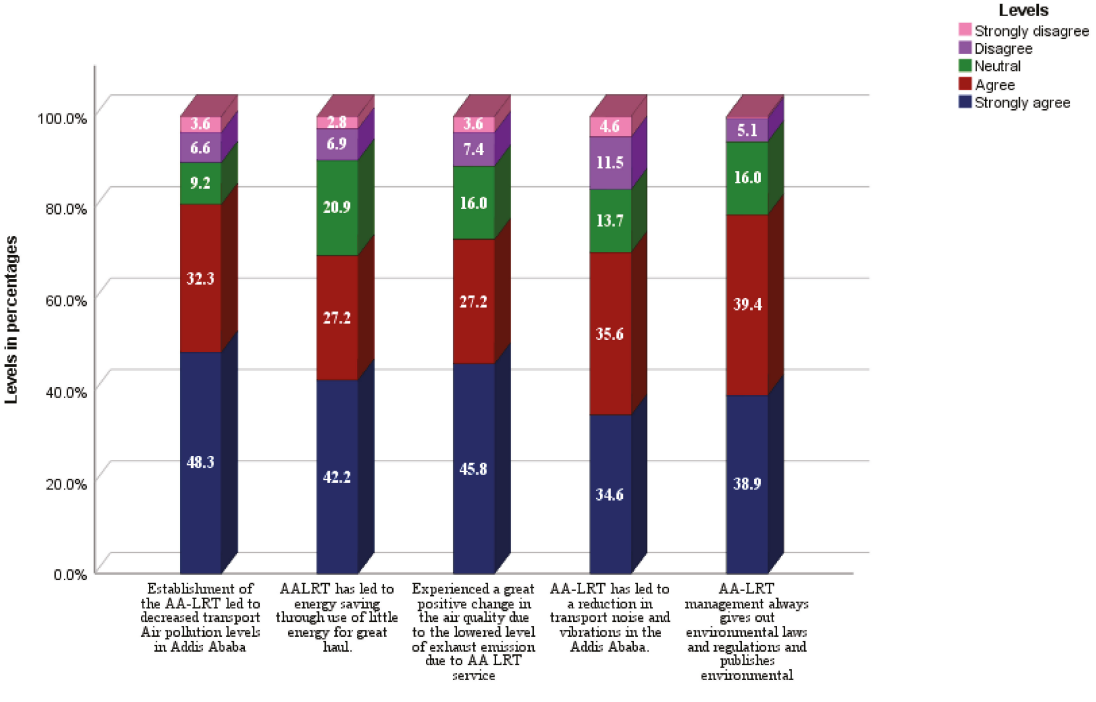


Figure 7. Category of perceived importance of environmental sustainability aspects.

Coincidentally, the same aspect has the highest percentage (4.6%) amongst the level 5 subdivision. In the analysis of the last two levels mentioned above, many respondents have a negative belief about a reduction in noise and vibration due to the introduction and

operation of the train in the city. This is evident to the extent that even during the survey, great noise would be heard whenever the train was passing by.

Pearson correlation conducted between the considered aspects of environmental sustainability dimension to measure the strength and direction of relationship amongst the aspects, which revealed a very strong positive significant relationship, r (391) = 0.874, ($p < 0.001$). This was in consideration of the aspect, establishment of the AA-LRT, which led to decreased transport Air pollution levels in Addis Ababa in relation to the aspect, experienced a great positive change in the air quality due to the lowered level of exhaust emission due to AA LRT service. This is illustrated in Table 6 below.

Table 6. Pearson's moment-product correlation between environmental sustainability aspects.

Correlation for Establishment of the AA-LRT Led to Decreased Transport Air Pollution Levels in Addis Ababa (N = 393) (Amongst Environmental Aspects)				
	AALRT Has Led to Energy Saving through Use of Little Energy for Great Haul	Experienced a Great Positive Change in the Air Quality Due to the Lowered Level of Exhaust Emission Due to AA LRT Service	AA-LRT Has Led to a Reduction in Transport Noise and Vibrations in Addis Ababa	AA-LRT Management Always Gives out Environmental Laws and Regulations and Publishes Environmental Reports
The establishment of the AA-LRT led to decreased transport Air pollution levels in Addis Ababa	0.507 **	0.874 **	0.771 **	0.569 **
AALRT has led to energy saving through the use of little energy for great haul.	1	0.475 **	0.440 **	0.377 **
Experienced a great positive change in the air quality due to the lowered level of exhaust emission due to AA LRT service		1	0.805 **	0.590 **
AA-LRT has led to a reduction in transport noise and vibrations in the Addis Ababa.			1	0.645 **

Note. ** Correlation is significant at the 0.01 level, Sig. (2-tailed).

5.3. Social Sustainability

The assessment of transportation social sustainability was composed of five variables, namely: AA-LRT, which is a safe and health-wise mode of transport compared to other transport modes in Addis Ababa; AA-LRT, which offers assistance to passengers with particular mobility needs such as the disabled to use the train; AA-LRT which offers equal opportunities and diversity to all residents of Addis Ababa; AA-LRT, which offers a reliable and convenient transport mode for business activities in the city; and AA-LRT, which offers decent work and labor practices for the whole population.

Considering the attained feedback from the survey questionnaire put across to respondents about the perceived importance of the social sustainability dimension aspects, as shown in Figure 8 below, the first level of strongly agree (level 1), with a percentage weighted average of 37.34%. This was then followed by agree (level 2) with a percentage average of 29.26%. The neutral level (level 3) had an average percentage of 21.6%. Disagree (level 4) achieved a percentage average of 7.16% with the strongly disagree (level 5) category in the last position with an average percentage of 4.52%. The averages of the percentages for each level indicate that many respondents who participated in this study believe that AA-LRT improves the social status of the city dwellers.

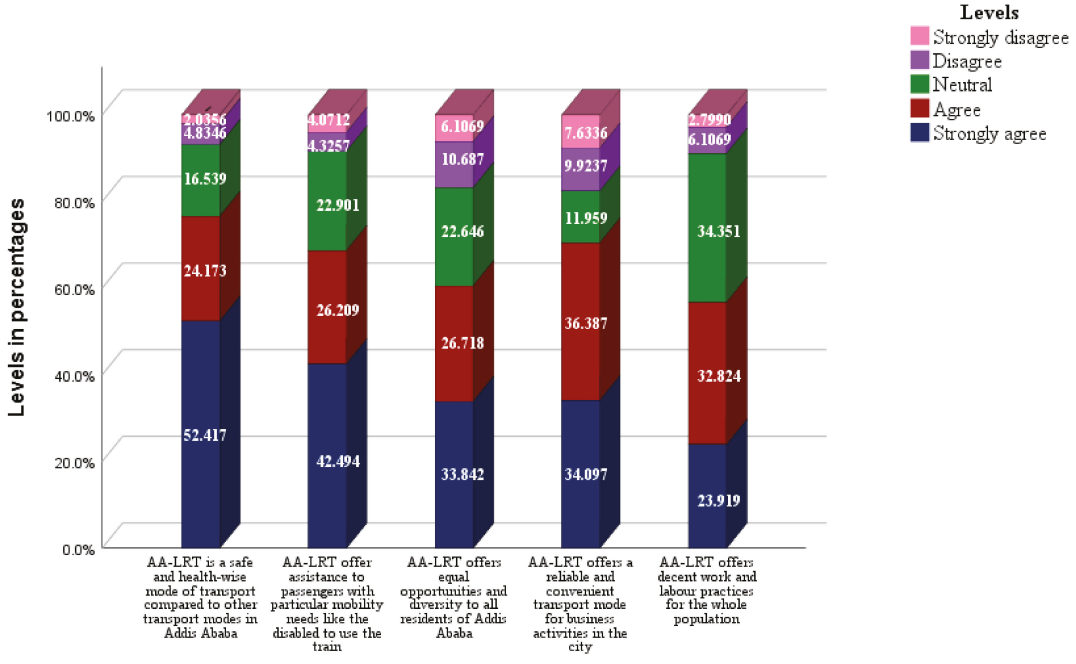


Figure 8. Category of perceived importance of social sustainability aspects.

On the performance of individual aspects, as can be seen in Figure 8 above, the aspect of AA-LRT is a safe and health-wise mode of transport compared to other transport modes in Addis Ababa, achieving the highest percentage (52.42%) across the survey responses in the social sustainability dimension for level 1. Even though passengers flood the trains to the extent that others move while standing, respondents have an admirable sense of safety when they use the train. This can be attributed to the fact that fewer accidents have occurred during the operational period of the train since its introduction compared to motor vehicles. The aspect of AA-LRT offers a reliable and convenient transport mode for business activities in the city achieved the highest percentage (36.4%) for level 2. It is well known that the movements of the train are on a timetable with its dedicated route that offers minimal interruption in train movement. This means that business movements can be scheduled well and on time, thus leading to many respondents agreeing that business activities, especially movements, are well supported by the train. The aspect of AA-LRT that offers decent work and labor practices for the whole population has the highest percentage (34.45%) amongst level 3 items. Many respondents came through with a neutrality stand on this category, most likely due to the fact that many are not employed by the rail company, so it is hard for them to analyze this properly. Considering level 4 items, a great percentage (10.7%) responded to the aspect of AA-LRT offering equal opportunities and diversity to all residents of Addis Ababa. This level of disagreement is surprising and may be based on how easy one can get employed with the LRT operations organization. The highest percentage (7.6%) was dedicated to the aspect of AA-LRT offering a reliable and convenient transport mode for business activities in the city. While the same aspect scored high in level 2, it coincidently scores high again in level 5. Some of those who conduct business want to catch the available means of transport instantly and the fact that the train may not be available all the time may hinder their business dealings. The results of the analysis point to a more holistic, integrated, and strategic approach towards social sustainability [48], performance, and a requirement to improve social variables, which are known to be weak in many sustainability studies.

Pearson's correlation was conducted between the aspects of social sustainability dimension as well, as presented in Table 7 below. The results show that there exists a strong positive significant relationship, r (391) = 0.423, ($p < 0.001$) of AA-LRT is a safe and health-wise mode of transport compared to other transport modes in Addis Ababa in relation to AA-LRT, which offers assistance to passengers with particular mobility need such as the disabled to use the train. As one of the aspects is better addressed, so is the other aspect addressed as well.

Table 7. Pearson's moment-product correlation between social sustainability aspects.

Correlation for Establishment of the AA-LRT Led to Decreased Transport Air Pollution Levels in Addis Ababa (N = 393) (Amongst Social Aspects)				
	AA-LRT Offer Assistance to Passengers with Particular Mobility Needs Like the Disabled to Use the Train	AA-LRT Offers Equal Opportunities and Diversity to All Residents of Addis Ababa	AA-LRT Offers a Reliable and Convenient Transport Mode for Business Activities in the City	AA-LRT Offers Decent Work and Labour Practices for the Whole Population
AA-LRT is a safe and health-wise mode of transport compared to other transport modes in Addis Ababa	0.423 **	0.396 **	0.337 **	0.255 **
AA-LRT offer assistance to passengers with particular mobility needs like the disabled to use the train	1	0.498 **	0.315 **	0.314 **
AA-LRT offers equal opportunities and diversity to all residents of Addis Ababa		1	0.419 **	0.302 **
AA-LRT offers a reliable and convenient transport mode for business activities in the city			1	0.238 **

Note. ** Correlation is significant at the 0.01 level, Sig. (2-tailed).

5.4. Sustainability Definition and Dimensions

The widely considered definition of sustainability, as coined by the Brundtland report, was related to the operations of AA-LRT and aspects developed from the definition, as seen in Figure 9 below. The sustainability definition comprises of two major development components: 1. meeting the needs of the present and; 2. prospects within an ability of future generations to meet their own needs [8,21–23,49–54]. In addition to that, an independent framing was done to seek to know how the respondents perceived the contributions of the AA-LRT on each of the individual dimensions that majorly constitute sustainability without breaking these dimensions into aspects as before. The service level results from the respondents are illustrated in Figure 9 below.

From the sustainability definition, respondents were asked about their views regarding levels on whether AA-LRT meets the current transport needs of Addis Ababa city and the second aspect was if AA-LRT will allow the future to meet their needs. The other three items are contributions of the light rail to the individual sustainability dimensions framed as below. AA-LRT contributes more to the economic development of Addis Ababa city, AA-LRT contributes more to the environmental development of Addis Ababa city and, AA-LRT contributes more to the social development of Addis Ababa city.

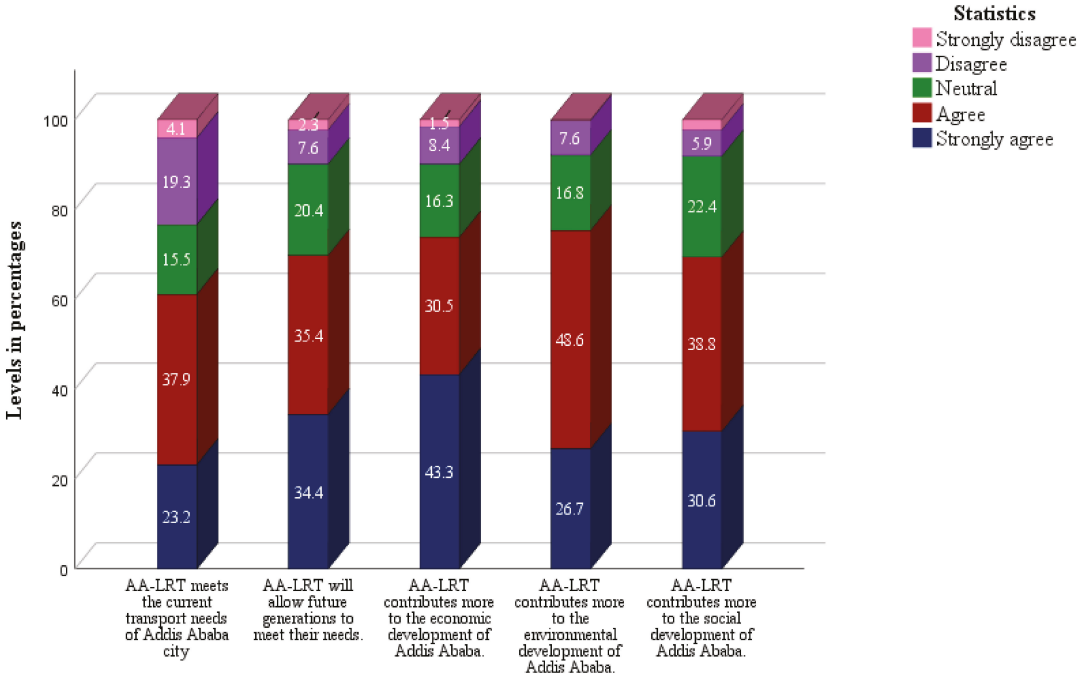


Figure 9. Breakdown on sustainability definition and individual dimensions.

On the first two aspects that are framed from the sustainability definition, level 2 got the highest average percentage (36.65%). Level 1 becomes second on average percentage (28.8%), level 3 average percentage (17.95) became third with the level 4 average percentage (13.45%), and level 5 average percentage (3.2%) in the fourth and fifth position, respectively.

From the affirmation of respondents in the breakdown below, 23.2% strongly agree (level 1) that AA-LRT meets the current transport needs of Addis Ababa city while allowing future generations to meet their transport needs is at 34.4%. The difference in perceived affirmation can be seen. This clearly shows the transport challenges in Addis Ababa city are enormous and difficulties are still existent, hence transport needs satisfaction is lower. However, all hope is not lost, as many people believe it will enable future generations to meet their needs.

Level 2 perceived importance records many respondents agreeing that AA-LRT meets the transport needs of Addis Ababa city at 37.9% while enabling future generations to meet their transport needs is at 35.4%. These two levels almost strike a balance in agreement. The combined agreement cohort at 61.1% for meeting current needs and 69.8% for meeting future needs show that there is an approach in balance towards fulfilling the components of the sustainability definition. The combined disagreement cohort is at 26.9% for disagree (level 4) and 6.4% (level 5) for strongly disagree. This clearly shows that respondents appreciate the contributions being made by AA-LRT in achieving transport sustainability of Addis Ababa.

On individual sustainability dimension aspects analysis, 43.3% perceive that AA-LRT contributes more to economic sustainability, 26.7% to environmental sustainability, and 30.6% to social sustainability, all of which follow under level 1. However, when levels 1 and 2 are combined, economic sustainability stands at 73.8%, environmental sustainability achieves 75.3%, and social sustainability at 69.4%. This is a manifestation that many respondents perceive that the economic dimension gets more while the social dimension is less valued. The results echo the literature finding of [40], which suggests that light

rail operations help in promoting the economic development of urban areas. Railways are widely known for their promotion of environmental cleanness by emitting less carbon gaseous products into the environment. It is no doubt that many respondents perceive the environmental dimension for performing well, although not much as the economic dimension. This coincides with the literature finding [28], which concludes that rails perform better environmentally compared to other transport means.

The social sustainability dimension as noted is the least considered dimension of sustainability and is perceived as less important [24,25,55], which corresponds to many prior sustainability studies.

A Pearson correlation conducted between the aspects of the sustainability definition show that there is exists a strong positive significant relationship, r (391) = 0.500, ($p < 0.001$) of AA-LRT meeting the current transport needs of Addis Ababa city in relation to AA-LRT, which will allow the future generations to meet their needs. The results indicate a pure split half balance in addressing these two components of the sustainability definition. Another correlation between the individual dimensions, economic, and environmental was also examined and the results showed a strong positive correlation, r (391) = 0.403, ($p < 0.001$) for environmental sustainability and, r (391) = 0.485, ($p < 0.001$) for social sustainability in relation to economic sustainability. These results also may suggest that environmental and social sustainability are perceived and addressed as almost the same.

6. Conclusions

In this paper, we have explored the contributions to the sustainable development of Addis Ababa city brought by the implementation of AA-LRT, which is regarded as one of the avenues of a sustainable urban transport system. We have also examined the perceived importance of the widely accepted sustainability definition components and AA-LRT contribution to separate sustainability dimensions. Through this empirical study, it has been found that AA-LRT has significant direct contributions to the sustainable development of Addis Ababa. By formulating new variables within sustainable transportation and investigating sustainable development based on transport facility user perceptions, the results supplement the available body of knowledge. The findings reveal the perceptions of residents, the first of its kind under this arrangement in Addis Ababa, and can therefore be used as a basis for future planning and RLT developments.

Again, from the analysis of collected data, the findings of the study correlate with prior studies that discovered that economic sustainability is the most well-addressed sustainability dimension [26]. Again, economic sustainability is performing better than social and environmental sustainability dimensions. These last two are almost addressed in the same way.

While the economic sustainability dimension has been found to perform better, thereby positioning AA-LRT to contribute more towards the economic transport sustainability of Addis Ababa, it should not be forgotten that these are weighted perceptions of the respondents. The results of the study therefore do not represent an objective measure of AA-LRT's contributions to sustainable development of Addis Ababa. A logical follow up study is thus deemed necessary through future research to establish objective measures of the considered variables either dimension wise or individually. This will help quantity parameters such as the actual air pollution or noise and vibration reduction levels, the exact reduction in traffic congestion and delays. A further expert evaluation can be done to see how well such findings align with the perceptions. User perceptions are subject to change and this is inevitable due to continued development and population increase over time in such cities. It is therefore suggested that future researchers dive deeper and look into the longitudinal measurements of change in perceptions over time or evaluation of perceptions vs. actual change in relation to the subject matter. The outcomes of these studies will promote the attainment of transport sustainability together with sustainable development.

The findings of the research have numerous important implications to ERC and other urban light rail investment projects in developing cities.

First, they may guide in informing ERC where it should direct more efforts towards ensuring the sustainability of the AA-RLT in order to ensure a balanced action towards addressing all the three dimensions of sustainability. The study findings will provide additional knowledge to city administrators in developing policies, which can lead to transport sustainability. It may also serve as a reference for future academics, becoming pivotal in the field of sustainable development and RLT areas. These may pick on the study area and discover more research gaps. The findings of this study may also be useful to other developing cities across Africa and Asia that wish to invest in RLT. By looking at these perceptions and knowing how users interpret or assess the services in terms of contributing to sustainable development, they can form a basis to align their operations in a way that they can contribute more to sustainable development in their localities. If LRT projects are looking at improving their public image in regard to sustainability, then these user perceptions are an important starting point for such evaluations.

Due to the varying levels of development, user perception, and people behaviors, the study is generally limited to Ethiopia and Addis Ababa in particular. Among the drawbacks that limited this study was the outset of COVID-19, which cut short the survey time and the number of respondents. A total of 393 respondents were examined in this study, which may be acceptable for academic purposes. However, Addis Ababa city is big with a large population, and AA-LRT passes through different places. The number of respondents can be made larger to include more stakeholders such as city planners, political leaders, city administrators, sustainability development think tanks around the city and more government agencies to ascertain if their sentiments correlate with the findings. Additionally, using questionnaires in research may result into bias especially due to the way the questions are designed, and this can be helped by using a large sample. Another limitation of this research emanates from the study approach and the conceptualization of sustainability and sustainable development. A triple bottom line approach was considered and transport sustainability variables formulated based on the TBL. However, the assessment of sustainability is wide with a collection of many sustainability principles such as considerations by life-cycle orientations, increasing complexity, and long-term/short-term orientations

Light rail operations are relatively new in Africa, the initial capital investment is heavy in terms of financing organizations and governments as well. Such high capital projects need to be well studied to ascertain the sustainability of these establishments. The considered transport sustainability aspects in this study are not the only that can be formulated for study consideration in the sustainability arena.

The narrative that urban rail transportation is always sustainable should not easily be accepted without evidence from research findings. Since railway sustainability is a wide area and LRT is at its infant stage in Africa, prospects for future studies are enormous for example; more sustainability variables under each dimension can be formulated for future case studies basing on the framework of this research, for proposed or under construction LRT projects (see Table 1), how to ensure sustainability of the proposed projects such as the Greater Kampala Light Rail would be a virgin area for researchers in this area, a study on how to ensure sustainability within each project life cycle stage can be conducted, and case studies of project management and project sustainability of RLT in different locations will help in contributing to shrinking the knowledge gap on the two items. Such studies will only serve to buttress the study findings and generate more unknown information if carried out.

Conclusively, the introduction and operation of AA-LRT clearly supports the transport sustainability of Addis Ababa city. The AA-LRT project, being the first of its kind in Ethiopia, has greatly improved transport accessibility and has put Addis Ababa city at the forefront of transport sustainability amongst developing cities across sub-Saharan Africa.

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The Governance Challenge within Socio-Technical Transition Processes: Public Bicycles and Smartphone-Based Bicycles in Guangzhou, China

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Abstract: In urban China, utilitarian cycling plays a significant role in achieving sustainable mobility. Within this context, different kinds of sharing-bicycle programs equipped with new technologies/devices emerge and extend. By comparing two generations of them in Guangzhou (China), this paper explores how new technologies impact existing modes of mobility governance. First, the technical innovations, e.g., app-based bicycle locks and micro-GPS equipment, contribute to liberating emerging private companies from existing governmental regulations based on land control. Second, the adoption of these innovations not only contributes to the accumulation of cultural and symbolic capitals based on a fashionable lifestyle but also links bicycles to personal point-to-point travel data that could be translated to economic capital. Third, the discrepancy between the dispositions of the government and private companies regarding the innovations opens an opportunity for the quick extension of sharing bicycles, which brings both positive and negative consequences on citizens' daily travel and life. The absence of other civic actors in the decision-making process accelerates the negative consequences caused by the profit-driven fast extension of sharing bicycles and the governmental top-down governing logic. These findings provide academia with implications for understanding the impact of innovations on achieving sustainable mobility.

Keywords: socio-technical transition; governance challenge; public bicycles; smartphone-based sharing-bicycles

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1. Introduction

Coming into the 21st century, the transportation sector in cities all over the world is challenged by congestion, air pollution, fossil fuel depletion, road safety risks, and other relevant problems [1]. In China, especially in large cities like Beijing, Shanghai, and Guangzhou, these mobility-relevant problems are even more serious compared with those in western countries. Against this background, the issue of how to promote and govern a transition toward sustainable urban mobility/transportation, i.e., a fundamental transformation towards a more sustainable and "green" urban transportation system, has received increasing attention both in the policy arena [2] and in social-science research [3,4].

In this context, it is not surprising that the managers of Chinese cities, as a once "Cycling Kingdom", re-discover the potential function and benefits of urban cycling in dealing with the transportation and environmental problems they are facing. That is the reason the central government and its officials constantly showed their pro-cycling attitude and plans through a series of formal and informal documents [5]. In the meantime, a series of technological innovations around bikes and relevant infrastructures were also implemented within the pro-cycling area to bring bicycles back to the city [6]. Among them, the series of innovations that enable the business of two kinds of rental (or say, "sharing") bicycles—"public bicycles" and "Smartphone-Based Sharing Bicycles" (SBSBs, hereafter) showed their importance as the business grew rapidly in China in the past several years.

The former refers to the kind of rental bicycles with docks and/or stations, which are provided and operated by certain private or state-owned companies. SBSBs are different as they do not have fixed stations/docks and can be unlocked/locked and charged through certain mobile phone applications. For public bicycles, by the end of 2016, more than 400 cities and counties in China had been equipped with public bicycle systems, which have provided 750 million trips to users across the country [7]. By 2020, SBSBs have been put into operation in more than 360 cities across the country, with 19.45 million vehicles invested, and the average daily order volume of sharing bicycles exceeds 45.7 million [8].

The emergence and quick extension of the new modes of daily cycling quickly attracted academic attention. Scholars have conducted a series of studies on changes in various dimensions brought by public bicycles and SBSBs. For instance, their impacts on local citizens' mobility pattern and experience [9,10], the symbolic and cultural meaning of the new and active traffic mode and its social influences [11–13], the effective methods to improve the efficiency and sustainability of certain programs [14–16], etc. Among all the changes brought by the new mobility, however, those that occurred in local mobility governance have not achieved enough academic attention. Moreover, as pointed by Lin and Spinney [17,18], some of the only exceptions basically regard the new mobility, and new technologies that make it a reality, as the result of governance, rather than the influencing factors. To fill this gap, the aim of this article is to explore how new technologies in the field of daily mobility/transportation impact existing modes of governance. More specifically, our research question is how the adoption of new technologies in the cycling field challenges the existing local mobility governance mode in urban China. Through a case study on the transition process from public bicycles to SBSBs in Guangzhou, China, we analyze the new technology as an influential element, rather than the static outcome, within the process of governance and explore the changes brought by it.

The article is structured as follows: We start by summarising the conceptual framework for this research—socio-technical transition and the field approach—based on a brief review of the research conducted on public bicycles and sharing bicycles governance. Then, we present the data collection and methods of analysis in the following section. Section 4 shows our main findings. We conclude with a discussion of the relevance of our findings in relation to the literature on technological innovation governance and urban cycling development.

2. Literature Review

2.1. Socio-Technical Transitions and the Relevant Governance

A socio-technical transition is a set of processes that lead to a fundamental shift in the socio-technical system [1]. Specifically speaking, sectors such as energy supply, water supply, and transportation can be conceptualized as socio-technical systems [19–21]. Such systems include certain necessary elements, like involved actors (individuals and organized ones), institutions and material artifacts, and the knowledge of [22,23]. These elements rely on and interact with each other [24] and also jointly provide specific services/functions for society. Therefore, it is necessary to explore the change, including innovations, within the system as a whole and dynamic process [25], which calls for a relational and interactive study approach regarding technological innovation and the relevant governance transformation.

Socio-technical transitions differ from simple technological changes by not only including technological changes but also including the changes that emerged in actors' practices and institutional structures [4]. Therefore, this analytical approach treats existing sectors as complex and adaptive societal systems in which changes occur and evolve, and the changes themselves are dynamic and ongoing processes. Thus, the governance of the changes is also a reflexive, evolutionary, and ongoing process in which different involved actors interact (in different forms) with each other [26]. Over the past decades, there has been a burgeoning literature unpacking technological innovation systems and the transition of them [27–29]. One of the key concerns within this area is the changes brought by the

emergence of certain technologies, especially the institutional and organizational ones [30]. In general, the isolated approach, like the omnipotence of market failures, is replaced by a more relative approach such as system failures [31].

To reach this kind of relative and systemic understanding of technological transition and governance, there is a pressing need to deeply explore the socio-political changes brought by the innovation and implication of certain technology around any public issue [32], especially how these technical changes challenge the existing governance system and logic and the relevant consequences. At a more conceptual level, it refers to the issue of power and politics in transformation and transition processes, which, however, has been relatively neglected by the existing literature in this area [23]. Therefore, detailed and in-depth research guided by a relative and dynamic facet concerned approach on how institutional structures are changed through the strategic interplay of different types of actors regarding the innovation and implementation of a certain technology is needed in this research area [33]. That is what the field approach can contribute to.

2.2. The Field Approach and the Changes within a Field

Although there are many variations/sub-approaches within the field approach, the basic idea is that "to think in terms of field is to think relationally" [34]. According to Bourdieu, the concept of a "field" refers to "a patterned system of objective forces (much in the manner of a magnetic field), a relational configuration endowed with a specific gravity which it imposes on all the objects and agents which enter it" [35]. The whole social world is treated as a space within which various actors occupy different (structured) positions according to the volume and form of the valued resources—namely, the capital—they hold [36]. The relations between different actors within a field and how the actors modify/conserve their positions are the foci of the analyses. Besides "field", there are another two concepts highlighting the key concern of the approach: the first one is capital, which refers to the resources that are valuable and at stake in a specific field, and it is the medium through which positions are attained and struggles are organized. Another one is habitus. It refers to the strategy-generating principles that translate the structured/objective field relations into perceptions and actions, which enable the actors to orient their actions to various situations [37].

Change and conflicts—including other relevant aspects such as struggles and resistance—are key concerns in Bourdieu's analysis. The key concern is what and how changes are produced and re-produced within networked relations. According to Krause [38], there are three basic analytical dimensions: variation in field autonomy, variations of field autonomy, and variation in the field structure. The key point is that a field can be vulnerable to actors and elements from other fields. The ways that any given field is linked to other fields are the key concern of exploration [39]. Among various relational factors, the impact of technologies and devices on relational fields attracts more academic attention. For instance, the new data-based technology and journalism [40], the innovation of restaurant and gastronomy [41], and so on. The key point is to put technologies/innovations from other fields as an analytical object and to explore how they bring changes to the members within a certain field. In other words, to treat the impact of the "new" technologies on certain social and political relations based on the unequal distribution of resources. Therefore, the field approach enjoys the ability to simultaneously depict the relations between different involved actors around a certain issue, which contributes to our understanding of the changes that occurred in the urban cycling field in China.

2.3. Public Bicycles, Smartphone-Based Sharing-Bicycles and the Governance of Them in China

"Public bicycles" refer to the kind of rental bicycles with docks and/or stations, which are provided and operated by certain private or state-owned companies. It has grown rapidly in China since the Hangzhou government (Zhejiang Province) introduced them from European cities (The first public bicycle program in China emerged in Beijing in 2006. It was jointly operated by seven companies, but it failed quickly and made little

impact. For more details, please refer to the webpage of "Public Bicycle in Beijing" http://bjggzxc.jtw.beijing.gov.cn/Home_index_1_1.html, accessed on 3 August 2021), especially Paris. "Smartphone-Based Sharing-Bicycles" are different from public bicycles in that they do not have bicycle stations and can be unlocked/locked and charged through a mobile phone app (Table 1). This kind of "sharing bicycles" emerged in China in late 2015, and, as mentioned above, rapidly grew in many large Chinese cities in the past five years.

Table 1. Comparisons between public bicycles and Smartphone-Based Sharing-Bicycles [1].

	Public Bicycles	Smartphone-Based Sharing-Bicycles
Subjects of operation	Mainly state-owned companies or governmentally funded firms.	Private companies, especially Internet companies.
Users' qualification	Having an urban public transport card and/or paying a deposit [200–300 yuan].	Having a smartphone with the corresponding app installed, turning on GPS function, and paying a deposit [99–299 yuan]. Some SBSBs do not require a deposit.
Price	Step charging, generally free for the first hour.	Step charging, generally 1 to 1.5 yuan for the first 15 to 30 min [or, 2 to 3 yuan for the first one hour]
How to get a bike	Going to fixed locations to rent bikes from stations.	Searching for nearby bicycles through the installed app, then going to the nearest one and renting the bike through the app.
How to return the bike	Putting the bike back to a station with free parking space.	In principle, any public area.
Payment method	Through the urban public transport card [or pay in cash in some cases].	Through the app installed on the smartphone.

[1] The source: the authors' experience and observation during the fieldwork, and the "Bicycle Data" collected by Institute for Transportation and Development Policy, refer to http://www.itdp-china.org/bikesharing/index/?lang=1, accessed 4 August 2021. The table is made by the authors.

The rapid development of public bicycles and SBSBs provides new flexible and "green" choices for urban residents' daily travel [42]. They, however, also bring about certain negative consequences, like the occupation of public spaces, the road-safety risks, and so on [18], which call for the necessary governance of them [10]. Therefore, the emergence and transition of public bicycles and SBSBs is a representative case of how certain technological innovations (and the implementation of them) challenge the existing governance logic and system around a public issue [11], and how the manager—the government—reacts to the change and challenge [43].

Although the number of studies in this field is growing rapidly, the research focusing on local mobility governance calls for more academic attention [15]. For now, existing studies in this direction generally focused on the decision-making and implementation processes of relevant local policies [44], the "failure of the market" regarding the SBSBs issue [45], and some other specific issues (like relevant legal matters and the division of responsibilities) of public bicycles and SBSBs [46]. These studies are insightful in exploring the failures/success of cycling governance. They, however, basically treat the new bicycles and the new system as the outcome of governance [17], as static elements outside the change process. According to the field approach mentioned above, however, the new kinds of bicycles, and the information and communications technology (ICT) technologies/devices installed on them [9], are in fact a kind of influential factor. Along with their emergence and extension, the social relations between existing actors within the cycling field in a city will change accordingly. In this article, we aim to help fill this knowledge gap with a study of the transition from public bicycles to SBSBs in Guangzhou, China.

3. Methodology

Guangzhou is the capital and the largest city in Guangdong Province in south-eastern China. At the moment, it is the third-largest Chinese city, behind Beijing and Shanghai, and it holds sub-provincial administrative status [47]. In 2015, the residential population within Guangzhou's administrative area was more than 13.5 million [48]. The role of urban cycling

in Guangzhou's transportation system has experienced great change over the last three to four decades. Urban cycling in this city experienced a "promotion-reduction-repromotion" process [49]. Both public bicycles and SMSBs emerged and developed in the "repromotion" phase, which started in the first decade in the new century.

In this research, we adopted a qualitative case study approach to address the research questions because of its advantage in analyzing meanings, ideas, and changes over a relatively long period [50]. The data used in this paper stem from both documents and interviewees. In the first phase, we collected the existing documents and conducted a qualitative textual analysis [51]. The collected documents fit within five categories: the documents issued by the central government; the documents issued by the local government; the documents issued by the Guangdong Provincial Government and some national documents focusing on the regional development of the Pearl River Delta, where Guangzhou is located; and the documents issued or collected by pro-cycling NGOs (or semi-organized groups) in Guangzhou. In total, 61 relevant documents were collected for analysis. The analysis process consists of three rounds of text analysis focusing on three analytical categories: (1) Timeline: we coded all the information related to time (dates) in all documents to form a timeline framework; (2) Actors and Actions Categories: we distinguish three categories of involved actors: the government (central-regional-local), the market subjects [state-owned/private] and social actors (organized/unorganized) and sort out the actions of each type of subject according to the timeline; (3) Relations and Interactions Categories: we pick out the actions regarding more than one category of actors and preliminarily describe the relationship between different subjects.

Based on the qualitative text analysis, we further conducted semi-structured interviews and group discussions to obtain fruitful and in-depth data. From October 2016 to April 2017, we talked to more than 60 respondents through semi-structured interviews and focus group discussions. As the focus of this research is on governance changes, we conducted open-ended interviews guided by three basic questions/themes: (1) What has been different since public bicycles occurred? (2) What is the difference between public bicycles and SBSBs? (3) What has been different since SBSBs occur and extend? For different interviewees, the operationalization of the "what" in three questions is different but basically consists of four dimensions: daily mobility pattern and experience, the relationship and interaction among various actors (especially with the government), business model, and profit (mainly for managers of the cycling companies), attitude towards public bicycles and SBSBs. These questions and dimensions, however, are mainly a basic and open-ended guide for the interviewers' reference, and our basic logic is to follow the narrative logic of the respondents (In fact, compared with the passive title of "respondent"/"interviewee", we prefer to use the active title of "narrator" to refer to these information providers. However, in order not to confuse readers, we still use this title for the time being). According to the representativeness and effectiveness of the answers and eliminating duplicate information, we selected 25 interviewees as key ones. Table 2 shows the details of the key respondents.

Table 2. List of Key Respondents.

Code	Identity	Meeting Date
GZ_01	The leader of a pro-cycling NGO (BIKE-GZ) in Guangzhou	15 October 2015 3 February 2016 19 April 2016 26 March 2017
GZ_02	A member of BIKE-GZ in Guangzhou	25 April 2016
GZ_03	The leader of a cycling advocacy group in Guangzhou	2 February 2016 25 April 2016
GZ_04	The manager of a public bicycle enterprise in Guangzhou	23 November 2015 25 April 2015
GZ_05	The manager of a state-owned public bicycle enterprise in Guangzhou	20 April 2016
GZ_06	An engineer from Guangzhou Urban Planning & Design Survey Research Institute and Transport Planning & Design Studio	20 April 2016
GZ_07	A professor of urban planning and member of the Guangzhou government's think tank	28 November 2015
GZ_08	An academic researcher on urban cycling and public bicycle programs in China	26 November 2015
GZ_09	An administrative staff member from Guangzhou Modern BRT and Sustainable Transport Institute	20 April 2016 27 April 2016
GZ_10	A traffic policeman in Guangzhou	2 April 2016
GZ_11	The owner of a local bicycle shop	16 July 2015 [1]
GZ_12	A bicycle seller and daily cyclist	2 February 2016 2 April 2016
GZ_13	A CPPCC member from Guangdong Province	20 April 2016
GZ_14	A bicycle repair man and member of a voluntary bicycle service group	2 February 2016
GZ_15	A junior civil servant in Guangzhou's transport department	25 April 2016
GZ_16	A manager of Guangzhou City Investment Property Management Co., Ltd.	March 2016 [2]
GZ_17	A cyclist who knows a lot about the Flower City Square case	25 April 2016
GZ_18	An urban transport expert in a governmental research institute	5 February 2016
GZ_19	A local resident and cyclist	2 March 2016
GZ_20	A local resident, daily cyclist, and local bicycle shop owner	2 March 2016
GZ_21	A local bicycle commuter	15 April 2016
GZ_22	A local daily cyclist and member of the Guangzhou Youth Volunteer Association Bicycle Service Corps	16 April 2016
GZ_23	The president of one of the largest public bicycle suppliers in China	19 November 2016
GZ_24	A media personage, cyclist, and blogger on WeChat	19 November 2016
GZ_25	A senior planner/official in a central research institute in China	19 November 2016

[1] This interview was conducted by a friend of the authors in Guangzhou using the topic questions she was given. [2] This interview was conducted by a member of a cycling advocacy organization in Guangzhou.

4. Process-Tracing: Empirical Findings

4.1. The Emergence and Evolution of Public Bicycle Programmes in Guangzhou

Public bicycle programs have grown rapidly in China since the Hangzhou government (Zhejiang Province) introduced them from European cities. The public bicycle program in Hangzhou is operated by a state-owned enterprise. It received governmental investment and subsidies for both its initial construction and daily operation. It performs well, with more than 84,100 bicycles each being used for five trips per day [52].

This program has received both national and international acclaim. It is considered to be a successful case of new invitations for both sustainable transport and city branding by the government, the media, and the public. This is the fundamental reason that many cities' governments, especially those cities that enjoy similar political and economic status to Hangzhou, quickly acted to promote similar programs in their own cities. Some of them followed Hangzhou and funded state-owned companies to invest and operate the public bicycle program. Others gave policy support and/or financial support to private companies to allow them into the area. This is how market forces, especially private companies, can enter the field. Guangzhou is an interesting case for analyzing this issue, as it has various categories of public bicycle programs invested in and operated by different organizations.

The Guangzhou government's public bicycle program emerged in 2010. To prepare for the 16th Asian Games, which were held in Guangzhou in November 2010, the Guangzhou government invested in a bus rapid transit (BRT) lane. A public bicycle program also received investment from the government as supporting facilities along the BRT lane. This program mirrored Hangzhou's, and a state-owned company (Guangzhou Public Bicycle Operation Management Company, Guangzhou, China. For more details, please refer to http://www.gsxt.gov.cn/%7BDDBF08E7B59EA93546A9CFE497422B79966BA8DBF00DD83B8CA7F51AE7DF41AEC835E003B49F5CC04D1F830EC-AB684397F82857E376550297473067F2693599353235323599353209 0E18232432350E33340F080F18231E191E25899E2DD4BD85DD6F1CC9A076104231F7CCF7E0DD5F9C008D4EB3DAA96F545354535453-1628053297986%7D, accessed 4 August 2021) was founded as a subsidiary corporation of the Guangzhou Transport Station Construction Management Centre, which was directly controlled by the Guangzhou Transportation Commission.

On 22 June 2016, 2000 bicycles in 18 stations along the BRT lane began to operate, later expanding to approximately 5000 bicycles in more than 100 stations [53]. The fee structure is as follows: 1 h of bicycle use is free for all users; 1 to 2 h costs RMB1 (approximately USD 0.15); 2 to 3 h costs RMB2; over 3 h costs RMB3 per hour; and the maximum cost per 24 h is RMB30 (For more information, please refer to http://baike.baidu.com/view/3799544.htm, accessed 4 August 2021). Local residents can borrow bicycles using their bus or metro cards after registering and paying the deposit (RMB 300). All the bicycles, stations, and relevant facilities are funded by the government and operated by the state-owned company, which relies on a governmental subsidy for daily operation. As the main color of these bicycles is orange, the public refers to it as the "orange program" to distinguish it from other public bicycle programs. This name is also used to define this governmental program in the following analysis.

In addition to the orange program, two public bicycle programs emerged in Guangzhou in 2009 and 2010—the yellow and red programs. The yellow program was invested in and operated by a private company, the Rising Sun Company, which came into existence in 2009 and was the first public bicycle company in Guangzhou. At that time, Guangzhou Metro Group Company Limited (Guangzhou, China) planned to provide public bicycles along some metro lines, especially in some metro stations, so it outsourced the project to the Rising Sun Company. Metro Group conducted the initial investment and construction. The Rising Sun Company (Guangzhou, China) was primarily responsible for daily operation and following investments. In 2009, 2000 yellow public bicycles in 29 stations started to operate, later increasing to 4800 bicycles and 50 stations [53].

The yellow bicycles are manual rentals rather than based on smart technical cards. Thus, the fee structure is similar to that of the orange program. However, the Rising Sun Company failed and left the public bicycle market in late 2013 and 2014. Its stations and bicycles were acquired by another private company, ToRide (Guangzhou, China), which provides green public bicycles. Therefore, the yellow bicycle program changed to the green program, consisting of over 2300 bicycles and 60 stations (GZ_04, 23 November 2015). The reasons for the Rising Sun Company's failure are explored in the next section.

The red program differs from the orange and the yellow-green programs, as it only operates in the Guangzhou Higher Education Mega Centre for university students and staff members rather than in central urban areas as the others do. It was totally invested in and operated by the Guangzhou University City Card Company Limited (Guangzhou, China) with no financial support from the government. In September 2010, 1000 red bicycles and 23 stations started to operate. The students and staff members of the universities and institutions in this area could then start using the red bicycles with their university cards. The fee structure of the red program is similar to those above. The red program, however, failed after 3 to 4 years of activity. By late 2014 and 2015, most of the red bicycles and their stations were abandoned, and in late 2015, they were replaced by the orange program, which has massively expanded all over the city since late 2015. The following

section focuses on exploring the extension of the orange program and the failure of both the yellow-green and red programs.

4.2. The "Death" of Private Market Forces and the Extension of the State-Owned Programme

From 2010 to 2015, four companies operated three public bicycle programs. One of them (the orange one) was governmentally founded and the other three (yellow-green and red ones) did not receive any financial support from the government. These companies are referred to as the first round of market force attempts. It was the first time that private market forces dealt with the utilitarian urban cycling issue in a way other than selling and repairing bicycles. They demonstrated the potential of market forces in providing and operating basic infrastructures, which is traditionally the government's responsibility. These market forces and their attempts, however, failed after several years of activity. The yellow program failed first, quitting the market in late 2013 and 2014. The green program, which replaced the yellow program, started to close its stations in central urban areas and shifted its focus to non-utilitarian cycling in non-urban areas in 2015 (Figures 1 and 2). The red program also failed and stopped operating in late 2014 and 2015.

The low-profit margin was the direct reason. In general, public bicycle companies that receive no financial support from the government can earn income from three main sources, as stated by the manager of the ToRide Company:

"The first is rental income—the income from renting bicycles and the loan interest of the deposit; the second is the revenue from advertising—in stations or on bicycles; and the third is the income from some services we provide in our stations, like selling newspapers, snacks and so on" (GZ_04, 23 November 2015).

The stair-step fee structure and the short-distance nature of urban cycling led to very low bicycle hire profits. For instance, in 2013, one of the public bicycle programs enjoyed more than 25,000 rides per day, but more than 90% were for free (The source of this information is a news report on an online news website *New Economy*, http://www.xinjingji.net/shangye/2374, accessed 2 May 2017. The link, however, is inaccessible in 2021. In order to ensure the authenticity of the information, we confirmed it to a respondent [GZ-04] who used to be the manager of one of the public bicycle enterprises in Guangzhou). They only earned approximately RMB100,000 from rentals, which is far short of the financial demand for daily operation and maintenance. Therefore, these companies had to develop other income resources and faced many problems in interacting with the government.

Figure 1. An Abandoned Public Bicycle Station in Guangzhou (this picture was taken by the first author on 31 January 2016).

Figure 2. Abandoned Public Bicycles in Guangzhou (this picture was taken by the first author on 31 January 2016).

The first problem was various strict regulations and policies regarding the building and operating of stations. All these programs depended on the amount and locations of stations that are the nodes for renting and returning bicycles. Most potential income innovations were also based on the stations. Some companies wanted to conduct other business operations to increase their incomes, such as selling food, operating with banks to provide financial services, and receiving deliveries for local residents (GZ_04, 23 November 2015). However, they suffered many regulatory constraints in making such implementations. For instance, the manager of the yellow program once wanted to conduct retail business in their stations, and outlined the barriers to doing so in an interview with the media:

"It is very difficult. If we want to do it, we need to register in the business sector, but there are many problems. For instance, just the required information of house [address] numbers stumped me. The stations are on the roadside; they have no house numbers. But [the government] does not care—if you do not have one, you cannot apply for the license" [54].

The problems exceed the licensing issue. For example, if the stations wanted to expand or even maintain their business, they required basic resources, such as power and water. Companies faced different situations in different districts.

"To some extent, our destiny depends on the local government's attitude and actions. You know, these things are not big issues that have clear and strict rules, but in general, we face a relatively strict regulation from the government" (GZ_04, April 2015).

The above quote is also related to the second problem that the companies faced, even the government-funded one (the orange program)—strict governmental regulation of these companies' profitability means. This problem is rooted in the governmental orientation of the public nature of public bicycle programs, regardless of who the provider is. The government imposed strict regulations on the orange program's fee structure and advertising and basically forbade any other business service to guarantee the public nature of this program and "serve the public" (GZ_23, 19 November 2016). Therefore, as a market program, the orange program experienced heavy losses. The only reason that this program can keep operating is that the government funds it with approximately RMB20 million in subsidies per year (Xu, Wei, Luo, and Deng, 2015). However, the orange program still has financial difficulties (according to "inside information", from 2010 to 2013, the orange program met a loss of about 80 million RMB (GZ_04, 23 November 2015)) in daily operation and must rely on bank loans.

The other programs had to follow the operational pattern of the orange program to serve the public if they wanted to secure governmental approval. This means they had to use similar fee structures and limited business sources, but with no governmental financial support. Therefore, it is understandable that these companies quickly concluded that they were unable to maintain daily operations. According to the rough estimate of a company manager, from 2009 (2010) to 2013, the yellow-green program lost approximately RMB30 million, and the red program lost a similar amount (GZ_04, 23 November 2015).

What made things worse for the programs with no governmental funding was that in June 2015, the government decided to extend the orange program from BRT line areas to other urban areas, including those covered by the green and red programs (at that time, the red program was nearly abandoned by the operating company). In the governmental budget adjustment in 2015, RMB120 million in financial aid was allocated to the Public Bicycle Project Promotion Fund. The goal of this fund is to provide 30,000 orange public bicycles in the urban area of Guangzhou, and the long-term vision is to provide 100,000 bicycles with further governmental financial support in the urban area to solve the "last mile" travel problem of the public (Xu et al., 2015). After that, the green program left the urban area and moved its focus to leisure cycling in non-urban areas, and the red bicycles were totally replaced by the orange program. Although the orange program has expanded rapidly, it relies on governmental investment and subsidies for both the initial construction and daily operation rather than achieving profits through market measures. To some extent, it is more of a government-affiliated agency than a market force.

Therefore, by the end of 2015, it seems that the market forces in the area of the public bicycle all failed and quit. Their failure indicates that market forces cannot work well in the utilitarian urban cycling field, which confirms governmental officials' claims that this field pertains to a public issue that "relies on the government" [55]. Things, however, do not end here. In the same year that the red program died, and the green program quit, another round of market force attempts with a new generation of public bicycles emerged in major cities in China, including Guangzhou.

4.3. A New Round of Market Forces Based on Technological Innovation and the "Death" of the State-Owned Programme

Starting in late 2015, along with the decrease of private providers in public bicycle programs in Guangzhou and across mainland China, a new round of market attempts in the utilitarian urban cycling field with a new generation of public bicycles occurred in some major Chinese cities. This new round is referred to as the second round of market force attempts. The major difference between the new programs and the old ones is that the new ones do not have bicycle stations, which were necessary for the latter (Figure 3). By adopting new information and Internet technology, users can unlock new public bicycles with their smartphones (There are various ways to lock and unlock new public bicycles with users' smartphones. For instance, some bicycles have QR codes. When users scan a code with a certain app, the bicycle is unlocked. In another category of bicycles, each has a unique number on it. A user can type this number into the app to have the secret key for the coded lock of this bicycle sent to the phone). That is why they are named "Smartphone-Based Sharing-Bicycles" to differentiate them from the first generation of public bicycles.

Therefore, the companies that operate SBSBs programs did not need to build stations and docks, but they did have to launch (helter-skelter) bicycles with GPS modules and information technical units in certain cities on roadsides and in public parking spaces. Then residents could use these bicycles by themselves. Users must install an app on their smartphones and deposit some money (usually approximately RMB300). They can then view all of the locations of available bicycles on the app and go to the nearest one. When the user finishes riding, he/she can leave the bicycle in any public area and lock it. The cost is automatically deducted from the money that the user pre-paid on his/her account linked to the app, and the bicycle is available for other users.

Figure 3. SBSBs in Guangzhou (this picture was taken by the first author on 11 February 2017).

As SBSBs do not depend on stations and docks, it enjoys several advantages for attracting investments and expanding. The most obvious one is that the cost of investing and operating greatly decreases, making the rate of return for this business higher than that of the first generation of private providers. More importantly, the companies that operate the new programs are subject to fewer administrative constraints. For these companies, the need to interact with the government is greatly reduced. Traditional governmental station-based constraints, such as land permission, water and electricity management, and advertising management, lost their foundation. Companies enjoy more freedom to operate their businesses.

In fact, if treated as a business model of bicycle rental, SBSBs are similar to public bicycles, not a business with huge profit margins. The price of SBSBs is a little higher compared with public bicycles. They also adopt a step-by-step charging model, and in general, the users need to pay 1 to 1.5 RMB for the first 15 to 30 minutes ride, and 2 to 3 RMB for one hour's ride. This business needs to bear the production cost (about 300 to 1000 RMB for each bike)and operation cost (1000 RMB a year for each bike) of bicycles [56]. As there are some other sources of profit like the interest income from the deposit and advertising revenue, almost all the SBSBs companies cannot make ends meet. That is why almost all the SBSBs companies have been losing money all year round [57]. Nevertheless, what is different between public bicycles and SBSBs is that the latter is linked to and based on smartphones, which could collect personal and travel data. Moreover, as SBSBs are not station-based, the location of the bikes and citizens' travel by them are not fixed as the public bicycles. The "freedom" of the companies makes it possible to collect the "last kilometer" travel data, in other words, citizens' point-to-point travel data, which is regarded by Internet companies as of great commercial value [7]. As such, this business has attracted the attention of investors and grown quickly. In just 1 year, this business has attracted billions in investment and has emerged in several major cities in China (Tables 3 and 4).

Table 3. Four Major Chinese Cities' SBSBs Programmes [1].

	Beijing	Shanghai	Guangzhou	Shenzhen
(2016) April–July		Mobike		
August	Mobike			
September				
October	ofo Bike	ofo Bike Small Ming Bike	Mobike Small Ming Bike	Mobike
November	Yi-Dai-Bu Bike		ofo Bike	ofo Bike Small Ming Bike Blue GOGO Bike
December		Youbike	Blue GOGO Bike;	

[1] The source: the authors' experience and observation during the fieldwork, and a public media report on Qdaily (http://www.qdaily.com/articles/35340.html) when the authors accessed it on 18 February 2017. It, however, was unaccusable in 2021. To ensure the authenticity of the information, we confirmed it to two respondents [GZ-03 and GZ-12] who are familiar with what happened that time. The table is made by the authors.

Table 4. Financing Rounds of Representative Chinese SBSBs Companies [1].

Company	Financing Rounds	Release Time	Financing Amount
ofo Bike	C2	10 October 2016	USD130 million
	C1	26 September 2016	
	B	2 September 2016	Tens of millions of USD
	A+	2 August 2016	RMB10 million
	A	1 February 2016	RMB15 million
	Pre-A	22 December 2015	RMB9 million
	Angel round	17 March 2015	Millions of RMB
Mobike	C+	13 October 2016	Over USD100 million
	C	30 September 2016	USD100 million
	B+	-	Tens of millions of USD
	B	19 August 2016	Tens of millions of USD
	A	30 October 2015	Millions of USD
Small Ming Bike	A	8 October 2016	RMB100 million
	Angel round	27 September 2016	Tens of millions of RMB
Youbike	Angel round	23 September 2016	Tens of millions of RMB

[1] The source: the information in this table is adopted from the on-line public report by Jinlicaijing on TMPOST, https://www.tmtpost.com/2538652.html, accessed on 4 August 2021. The table is made by the authours.

In September 2016, a company called Mobike entered Guangzhou after several months of operating in Shanghai and Beijing. Hundreds of bicycles were brought into the urban area of Guangzhou [53]. After the first round of launches, the company conducted several rounds of additions; by January 2017, there were nearly 90,000 Mobike bicycles in Guangzhou [58]. Following Mobike (Guangzhou, China), several other similar companies also emerged in Guangzhou, such as ofo Bike (Guangzhou, China), Small Ming Bike (Guangzhou, China), and bluegogo (Guangzhou, China). Each of them has launched or plans to launch thousands of public bicycles in the urban area of Guangzhou. The new generation of public bicycles is becoming a hot topic in Guangzhou's socio-political agenda.

For now (January 2019), these SBSBs companies are private and receive no financial support from the government. They have introduced new features compared to their failed predecessors. First, these companies expand on the meaning of bicycles and urban cycling in their advertisements. In contrast to the previous companies, which focused on describing bicycles as an environmentally friendly traffic mode, the new companies spend a great deal of effort connecting bicycles and cycling to broader meanings, such as "a modern lifestyle", "sharing economy" and "freedom" (For instance, please refer

to some published interviews with the managers/founders of these companies: https://www.xuexila.com/jieri/qingnianjie/3254806.html, accessed on 4 August 2021 (Mobike), http://mt.sohu.com/20161212/n475646158.shtml, accessed on 4 August 2021 (ofo Bike) and http://tech.163.com/16/1214/07/C87RTK0V00097U7R.html, accessed on 4 August 2021 (bluegogo)). All these companies have announced that they are representing and popularising a fashionable and technical lifestyle rather than just renting bicycles. A sense of fashion is one of the most important elements in the design of bicycles (For instance, please refer to the advertisements posted on the websites of Mobike (http://www.mobike.com/global/, accessed on 20 February 2017) and ofo (http://www.ofo.so/#/, accessed on 4 August 2021)). These companies want the public to know that riding their bicycles is chic and part of a fashionable lifestyle. This is in sharp contrast to the previous meanings, which only emphasized the efficiency and low cost of cycling. This kind of pro-cycling culture construction based on a fashionable lifestyle is similar to what Spinney and Lin explored in the production and economization of cycling culture in Taiwan [13] and also echoed with the cultural meaning added by ICT technologies to "green" transportation [11,12].

Secondly, the SBSBs companies enjoy closer relationships and frequent interactions with the public and civic cycling activists. As these companies have no stations or docks, there is a huge risk that the bicycles may be parked illegally, deliberately damaged, or even stolen. Therefore, these companies develop some kind of communication mechanism based on certain reward measures with the public. For instance, Mobike developed a hunter system by which users can report other users' illegal parking or destructive behavior. In so doing, the reporter is rewarded with credit points and the reported user loses his/her credit points. This user watch system helps companies enforce their rules, save maintenance costs, and increase their profits.

These companies also have close relationships with civic activists. Some managers were in fact pro-cycling civic activists before starting their businesses. For instance, the Guangzhou branch heads of Mobike, bluegogo, and ofo Bike are all personal friends of the leader of a cycling advocacy NGO in Guangzhou. After starting their businesses, they frequently interacted with this NGO and other relevant civic actors. These managers and their staff members attend the workshops and conferences organized by cycling activists, join online discussion groups of civic actors, and provide data to researchers. Civic actors also help these companies by discussing relevant issues online and offline, testing bicycles, providing suggestions, and publishing on their personal websites.

Thirdly, compared with the public bicycle companies, the SBSBs enjoy a different kind of relationship with the government. Unlike the first generation, which was either a regulatory object or semi-branch of the government, the newcomers are trying to be equal partners with the government in dealing with the cycling issue. This change and its potential occurred for two main reasons. Due to the disappearance of stations and docks, these companies suffer fewer administrative and regulative constraints. However, by getting investments from financial markets, they have many more economic resources than the previous generation, which is why they can support themselves on pure market measures rather than relying on governmental subsidies.

As time goes on, however, the SBSBs companies have started to face similar governmental regulations as the first-generation companies did. For instance, in August 2017, Guangzhou Municipal Transportation Commission informed all SBSBs companies in Guangzhou that they were not allowed to launch new bicycles in the city as there have been "too many" sharing bicycles in Guangzhou (For details, refer to http://news.sina.com.cn/o/2017-08-03/doc-ifyitayr8906690.shtml, accessed 30 October 2017). However, compared with their "dead" predecessors, the SBSB companies seem to enjoy more freedom and power to bargain with the local government. For instance, although the launching of new bicycles is forbidden in principle, there are still new sharing bicycles emerging in Guangzhou (For instance, refer to http://tech.163.com/17/1114/17/D37ITUPL00097U7R.html, accessed 16 November 2017). These companies also learned from the failure of the previous generation that they need governmental support, especially from local governments, to

exist and grow. Therefore, at the beginning stage, they focused on the crowded and central areas of Guangzhou, where the government-funded public bicycle programs were relatively absent. By doing this, they avoided direct competition with the government-funded programs. They also tried to convince some local governments that supporting their businesses contributed to promoting urban cycling, consistent with the spirit of the central and provincial governments, without increasing public expenditure. They received some responses. For instance, in December 2016, Haizhu District's government announced it would cooperate with ofo Bike by lining up 1200 parking spaces for new public bicycles in its district [59].

Although the SBSB companies avoided direct competition with the state-owned public bicycle program, the fast extension of them still quickly brought the latter a huge shock. More and more users of the state-owned public bicycle program moved to SBSBs, which made the operating costs and account deficit increase. The state-owned operating firm tried several reform measures in 2017, like updating the facilities, and adjusting the prices and charging methods, etc. However, they produced very little effect. Eventually, this state-owned public bicycle program announced they would be stopping operations on the 15 October 2018, as "The (smartphone-based) sharing-bicycles in our city (Guangzhou) has better met the needs of citizens for their short distance travel" (For more details, refer to https://www.sohu.com/a/259656743_119778, accessed 4 August 2021).

5. Discussion

5.1. The "Liberation" and Governance Challenge Brought by the Innovation

Inter-field relations are a vital analytical dimension of the field approach [35,37]. However, how the development of the Internet and the technological innovations based on it have changed and created tension in the cycling field has hardly been investigated. This is an interesting and important dimension as during the transition process the relationship between various actors is also changed. Regarding the public sharing bicycles in Guangzhou, the governmental regulations and policies are guiding by two principles—land (and relevant infrastructures) control as the core of the governing logic, and the low-profit (semi-public-transit) mode positioning. This kind of governing logic directly leads to the lack of profitability of this business and transit it into a kind of public welfare that relied on public finance. Therefore, the failure of the market forces in this field is foreseeable.

Nevertheless, certain technological innovations in the Internet business field, such as the smartphone-based electronic lock, GPS, and electronic payment methods, liberate private companies in this field from the above governing logic (Figure 4). The SBSBs companies no longer need to apply to the government for land to construct settled stations and infrastructures. Instead, they use existing dispersive public parking spaces. Hence, the set of regulations/policies based on land control are not suitable for the SBSBs. The adopted innovations not only give the companies more freedom in their operations but also linked them to a wider economic capital market by giving financial investors more confidence in their expected economic and mobile data profits. With the support of the financial market, SBSBs companies have since become active semi-independent actors with increasing influence in the field.

These innovations and the new kind of business around them, however, may also have negative influences on the development of urban cycling. For instance, due to the profit-seeking nature of market forces, the absence of supervision, whether from the government or the public, naturally leads to cutthroat market competition among the involved companies [57]. Many problems in the business have emerged, such as the decline in bicycle quality for cost reduction [56], the excess launching of bicycles, and the lack of bicycle maintenance [18]. In addition, the excessive concern for the public bicycle business and the financial game around it also covers some other important issues related to a bicycle-friendly city [9], such as the lack of cycle tracks and parking spaces in

certain areas [16], road-use regulations and awareness of traffic education for cyclists and motorists.

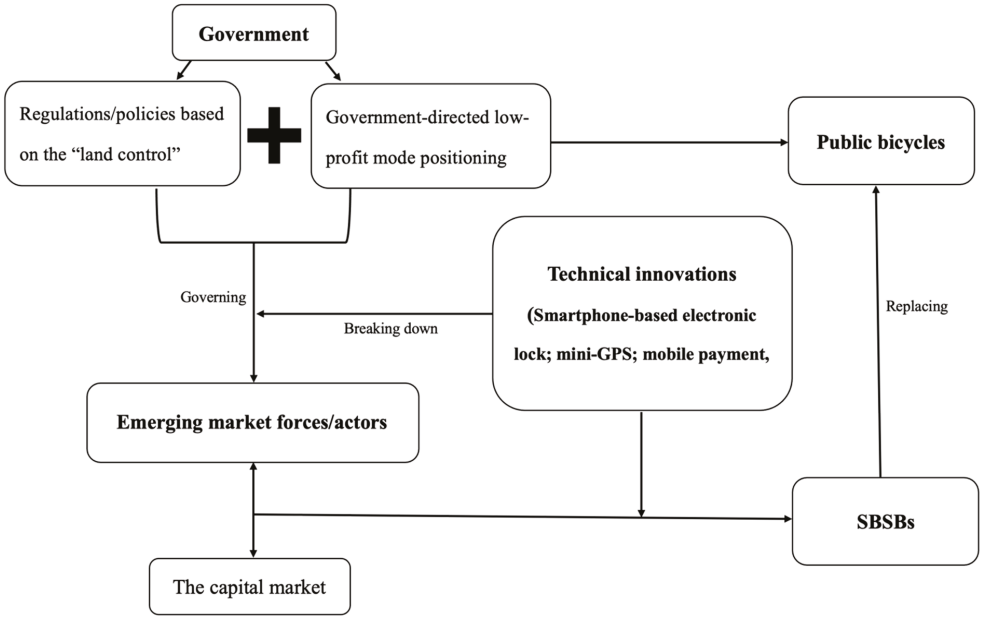

Figure 4. The basic framework of the relation between technical innovations and the governance challenge in the public-bicycle field.

5.2. Capitals and Strategic Actions (Positions and Dispositions)

The rapid development of the Internet economy in China, especially the smartphone-based economy, provides the soil for growth and a certain learning template for market forces in the cycling field. The success of business in smartphone-based shopping, meal ordering, and taxi booking services in recent years in China has given both entrepreneurs and investors the confidence to step into the cycling field. This tendency is combined with the foundation and market shortage for the utilitarian cycling business within the legacies of the previous periods. This is the basis for the quick growth of the engaging market forces in Guangzhou.

When directly engaging in the urban cycling field, market forces can cause changes in urban cycling and the relationships between different relevant actors regarding the cycling issue using their capital. In the Guangzhou case, the first-generation companies had relatively limited economic resources and relied largely on governmental regulations and policies. The new generation companies have benefitted from technological innovations and the development of the Internet economy, enabling them to get large investments from financial markets. To some extent, the first-generation companies can be considered as "dancers in shackles" (GZ_05, April 2015) as they were strictly governed and constrained by the government regarding their establishment, daily operations, and profit patterns. The SBSBs companies are gaining increasing independence, are less subject to government constraints, and are capable of conducting relatively independent actions with the huge economic resources they hold. This gives them the potential to become a new category of dominant actors in the future. Thus, shifting from dominated actors to active semi-independent actors is the foundation for engaging market forces to work as institutional entrepreneurs and bring real changes to the field. They also have more potential to run the urban cycling field than civic actors, the public, or the government.

What kind of changes can the engaging market forces cause and how do they encourage others to accept these changes? The power of engaging market forces mainly comes from the economic resources they can accumulate and distribute, especially to address the above-mentioned shortage in the urban cycling system during the Cycling Reduction period. Therefore, providing bicycles with very low rent and investing in certain cycling infrastructures are the basic starting points of engaging market forces regardless of generation. From this point of view, the engaging market forces challenge the traditional dominant position of the government in Guangzhou, as providing economic resources on cycling issues was an important part of the foundation of the government's central and dominant position in the field. The first generation was an initial attempt, as the government strictly constrained its economic resources and methods of accumulating and distributing them. The new generation has found a way to connect with a wider financial market and is less constrained by regulations. Thus, it can invest much more money in providing huge numbers of low-rent bicycles, hiring celebrities for their advertisements, and organizing various events and public activities.

Through these endeavors, engaging private companies enhance influence in the cycling field while weakening the dominant governmental position. The media, the civic cycling activists, and the public all receive certain influences, directly or indirectly, on the understanding and vision of urban cycling in this city. To some extent, besides providing material bicycles and influences, the engaging market forces also fight for power to shape the social and cultural image of cycling in society, which was once reserved for the government. This explains the co-opting of cycling advocates into these companies, as the symbolic resources, social relationships, and public influences of the civic activists contributed to the promotion of these companies' vested interests and instrumental views of cycling.

5.3. Discrepancies within the Field

Compared to the emerging and dominated marginal actors, the existing and dominant central actor (the government) is more passive and insensitive to the potential influences brought by changes in relevant fields. This can be partially explained by its intention to maintain the current power structure and overall situation in the field. In contrast to the path-dependence literature [60,61], similar to historical sociology, which has indicated the self-reinforcing and reactive sequences in certain periods [62] this study highlights the tensions between the passive and insensitive dispositions of the government and non-governmental actors' active and sensitive dispositions through their interactions. It also adds the significance of other relevant fields (e.g., technology) and actors (e.g., private companies) to explain the changes in the cycling field. Finally, the discrepancies between dispositions are not a result of the actors' agency alone but are rooted in and shaped by pre-existing circumstances and relational power structures.

In the initial phase, similar to the first generation of market attempts in Guangzhou, market forces maintain a good relationship and even collaborate with the government as a result of their relatively dominated and marginal position. Along with the extension of both market forces and civic actors, the basic divide between them will markedly widen. Their economic capital gives private companies the potential to achieve a semi-independent and even dominant position in the cycling field. They can even enjoy more power in influencing the government than civic cycling activists. The negative consequences of the expansion of private companies also attract some civic actors' worries, vigilance, and criticism. Thus, the government and civic actors are anticipated to react to the constantly expanding changes and tensions caused by market forces.

6. Conclusions

The issue of governing transformations within the socio-technical transition process has attracted quite a lot of scholars' attentions [27,29,63]. Regarding the daily mobility field, which is also a socio-technical system [1], how new technologies in the field of daily

mobility/transportation impact existing modes of governance calls for more academic attention. Through a case study, this article explored how the adoption of new ICT-based technologies in the cycling field challenges the existing local mobility governance mode in urban China. By abandoning the need for fixed infrastructures and adding the capability to collect point-to-point travel data, the adopted technological innovations challenged the core of the governance system built for an existing transport mode and opening a governance gap. In this case, the time-lag between a new urban innovation and the corresponding governance [17,64] is the result of the collapse of the original governance logic caused by the new technologies.

This kind of influence, however, is not linear or direct but is working out through a dynamic and interactive process. The relations, actions, and interactions between involved actors within the field, especially the government and market forces, are affected by the technological innovations and in return affect the socio-technical transition process. Within the singular Chinese political and urban context, the implantation of technological innovations contributes to liberating involved private companies from various and strict governmental regulations, which improved investors' confidence in these companies. Based on this huge source of accumulated economic capital, the market forces managed to navigate a transition from "dominant actors" to "active semi-independent actors" in the cycling field. Consequently, the second generation of private companies—SBSBs companies—enjoyed fewer government regulations and even more economic resources in advancing the business model by not only providing bicycles and exerting political influence but also by reshaping the social and cultural meaning of cycling through advertising and reports. Activities that once were government responsibilities were now conducted by private companies, which challenged the government's dominant position in the hierarchical power structure of utilitarian cycling.

The findings of this article highlight the importance of analyzing the social and political attributes of new technologies/devices/innovations in the daily mobility field [12,65]. When travel patterns change, the existing governance faces a challenge and needs to be adjusted or rebuilt accordingly. The key point is to adopt a relational analytical approach and treat the new technology as an element with social impact, rather than only the outcome of certain changes. These findings provide the academia and the managers with implications for understanding the impact of innovations on achieving sustainable mobility. Besides studying cycling, this article can also contribute some insights to other relevant areas like online car-hailing governance, smart transportation development, and new energy vehicle governance. As this study mainly focused on the changing process from public bicycles to SBSBs, it certainly has the limitation that we do not track what has happened to SBSBs after they replaced the former. The story does not end here, there are continuous new changes emerging in this field, like enterprise competition and elimination, new governmental management measures, different SBSBs development patterns in various cities, etc. Besides, due to the data limitation and limited scope of discussion, this article is not connected to some other related daily travel modes, like private bicycles and e-scooters/motorbikes. They, together with sharing bicycles, constitute the transitions of urban daily mobility. All the issues can be the concern of future research.

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