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Contents

Editorial: Welcome to DRS2022 1

1 Designing with bodily materials 5

2 Ethics as creativity in design 7

3 Wellbeing, happiness, and health (SIGWELL) 9

4 Biodesign 15

5 Graphics and spirituality 18

6 Tangible and embedded objects and practices (TENT SIG & OPEN SIG) 20

7 Schön's design inquiry: Pragmatist epistemology of practice 23

8 Design methods for sensing and experience 26

9 Sound and design 28

10 Design methods and transdisciplinary practices 33

11 Healthcare experience 40

12 Embodying experiential knowledge (Experiential SIG) 43

13 Design for behaviour change: Taking the long view fast (Behaviour SIG) 46

14 Linking human and planetary health (Global Health SIG) 49

15 Rethinking design for a complex world 52

16 What Legal Design could be: Towards an expanded practice of inquiry, critique, and action 60

17 Healthcare systems 65

18 Doing and undoing post-anthropocentric design 67

19 Design innovation and strategy 70

20 Curation, museums, and exhibition design 73

21 Design process / design theory 76

22 Design strategies for resilient organisations 78

23 Culture-sensitive design 81

24 Heritage and memorialisation 84

25 Meta-design in the complexity of global challenges 86

26 Sustainable design 90

27 Retail and brand design: Service futures, innovation, and intelligence (DRSF SIG) 93

28 Futures of design education (Pluriversal Design SIG and Education SIG) 96

29 Inclusive design practice and healthy ageing (Inclusive SIG) 103

30 Understanding play: Designing for emergence 109

31 Valuing the qualitative in design and data 114

32 Exploring online collaboration 120

33 Ageing 123

34 Design dematerialisation: Opportunities through reduction 126

35 Designing neighbourhoods: From the domestic to the community 129

36 Studio matters in design education (Education SIG) 132

37 Bias in design 135

38 User-centred design 137

39 Designing new financial transactions: Theories, case studies, methods, practice, and futures 139

40 Designing public organisations 142

41 Design education 145

42 Practice research in social design as a form of inquiry 147

43 Designing dialogue: Human-AI collaboration in design processes 151

44 Perspectives on climate change 154

45 Design for policy and governance (PoGo SIG) 157

46 Pasts, presents, and possible futures of design literacies 163

47 AI and the conditions of design: Towards a new set of design ideals 166

48 Framing practices in design 169

49 Creating connections: Social research of, for, and with design 172

50 Speculative design and futuring 175

51 Designing proximities 177

52 Food + design: Transformations via transversal and transdisciplinary approaches 180

Editorial: Welcome to DRS2022

DRS2022 has been a labour of love and an article of faith. The long process of preparing for the conference started in February 2020, as the pandemic began to take hold and change our world forever. Throughout the following two and a half years we have held our breath and had many doubts. We hoped that there would be a window of time in summer 2022 where design researchers could once again reconnect in-person. But we also wanted to learn the lessons that both coronavirus and climate change have taught us. Academic conferences bring with them large environmental footprints and we must either justify this or change, with our emphasis firmly on the latter. Early in our planning, we decided to hold the conference in a hybrid format, where in-person and online participants were valued equally, and with the corresponding benefits of accessibility on the one hand, and a decreased environmental footprint on the other. Our reasoning was that if any discipline could develop a workable format for hybrid conferences, it should be design research. Our experiences with both DRS2020—intended for Brisbane but held online—and the innovative DRS Festival of Emergence—held in 2021—have allowed us to prototype new approaches and shown us the way forward. With nearly 800 participants, online and in-person, DRS2022 is the biggest and most ambitious DRS conference to date. The technical challenge of treating all participants equally has been difficult and we are not sure that we have succeeded, but we have certainly made a step in the right direction.

DRS conferences have until now been hosted by a selected University but for DRS2022 our host is the City of Bilbao, represented by the organization Bilbao Ekintza, and in partnership with the local universities, led by the University of the Basque Country UPV/EHU. Bilbao is a UNESCO City of Design and the city saw the benefit, as did the DRS, of holding a design research conference in an environment that values design in all kinds of contexts; values aligned to those of the DRS. Design research, of course, is not identical to design, and a central question in our early meetings was what impact and legacy the conference could have on Bilbao and the Basque region. Shouldn't conferences be more than just a bunch of academics flying across the world to a location where they present papers to each other, and then leaving? We talked about how we could discuss and work on local issues that affect

the Bilbao region but that also resonated globally; we talked about how to involve local professionals and organisations in design research; and we talked about how to raise awareness about the importance of design research. Both the new DRS Labs and the keynote debates engage directly with these issues. The design of this conference has been considered from many angles and in its final form we hope that we have struck a good balance.

A central focus on academic quality in design research remains, with the paper presentation once again forming the core of the conference. We started in July 2021 with a call for theme tracks, receiving 41 proposals, and selecting 31. Many were familiar subject areas, but a significant number of new subjects have emerged. It seems to us that design research is extending further outwards, bringing new perspectives to disciplines such as anthropology, politics, economics, healthcare, and others. The field continues to develop its core subject areas, with new methods, approaches, technologies, and philosophies all evident in these proceedings. Also emerging is a focus on how to deal with our uncertain futures, for example through societal transitions, transdisciplinarity, transformations, and pluriversality. The themes that have emerged for DRS2022 represent a rich snapshot of the current state of the art in world design research.

The richness of content presented another problem, however. How do we prevent so many interesting sub-disciplines from fragmenting the field of design research? There is a real danger that we end up in small, specialised communities of researchers talking to ourselves. That may be necessary and desirable in some cases, but the risk is that we lose the shape and understanding of the discipline as a whole. At this point, with the hoped-for return to (pre-Covid) 'normality' imminent we felt that something different, as a conference format, was needed. Our solution has been to extend the conference over a longer period of time and have fewer parallel tracks. Previous conferences have had up to ten parallel tracks with participants effectively experiencing very different conferences, in terms of content, depending on which stream of tracks they selected. Taking more time with fewer parallel tracks means that sessions at DRS2022 may be better attended, with more people exposed to ideas that they might not have come across with more tracks. Holding the conference over a longer period of time allows for more coherence, discussion, and learning, while also creating opportunities for the informal networking where future research partnerships and initiatives are forged.

Our call for papers resulted in 588 full paper submissions which all received at least two peer reviews (and with a large proportion receiving three peer reviews, which helped to further drive-up the quality of final papers). In total 1308 reviews were written by the international board of reviewers. All authors were able to provide feedback and rate their peer reviews. An average score of 6/10 (for both accepted and rejected papers) suggests that reviewing was acceptable, but that more work needs to

be done in nurturing the reviewer community. Following peer review, 81 papers were accepted, 236 were provisionally accepted pending revision, and 271 papers were rejected. At the conclusion of the review process, we accepted 317 papers for presentation and publication in the DRS Digital Library. This represents an acceptance rate of 54%. We think this strikes a good balance between publishing high-quality research and allowing a broad variety of contemporary issues and concerns in design research to be made available.

Design researchers must continue to strive to produce high-quality research: research that is carefully argued and evidence-based. While some conferences approach design research in more of a 'show and tell' manner, with DRS conferences we aim for research that is contextualised and argued in a way which will have a greater long-term impact. Many of the papers in this conference demonstrate these qualities. We should continue to bear in mind the distinction between design research and design itself. Design research is different from design, though it clearly depends on design and design activities for its meaning. Good design research asks well considered questions and answers them in interesting, innovative, and rigorous ways. Good design research leaves a legacy for others to build on.

One community of design researchers deserves a special mention in this respect, and that is the community of PhD researchers who now make up a substantial part of the DRS membership and design research more generally. This is a community that has grown considerably over past years, forming the next generation of design researchers. For many PhD researchers, who have become used to online conferences through the pandemic, DRS2022 is the first opportunity to participate in a conference in person and experience the benefits that can result—new ideas, new colleagues, new opportunities—that online conferences have sometimes struggled to recreate. Many older academics can trace important developments in their career to conferences. The progress of the design research PhD has been significant in recent years and is on show at DRS2022. PhD researchers are tackling contemporary subjects in new and exciting ways, in many cases surpassing previous generations with their insight.

We should also note how the DRS itself has developed in the past two years, since governance changes have allowed a more international and inclusive organization to take shape. This is also reflected in the geographical make-up in the production of the conference, with authors and reviewers participating from 64 countries; the majority are from Europe and the USA, with the top five countries being the UK (19%), the USA (12%), The Netherlands (10%), Denmark (6%) and Italy (6%). Notable countries for increased contributions are China (4%) and India (2%).

The biennial conference remains the major event for the DRS as an organisation, but we now have a healthy ecosystem of Special Interest Groups, Networks, and communities all offering events and initiatives of their own. We have a more active membership and opportunities for regular communications between members.

Supporting recent developments in the DRS has been our open access Digital Library: in place since 2020, the Library is now a central hub for disseminating design research. The Library is also a place where we can connect with and promote other design research communities. For example, the recent partnership with Nordes (Nordic Design Research), for example, has made more widely available a high-quality catalogue of design research.

We hope that DRS2022 will be a celebration of new ideas, of new connections, of increasing diversity, and of ways of doing things together that many have missed intensely. We also welcome opportunities for new, hybrid approaches to gathering. We should certainly look back and celebrate what we have achieved as a discipline but above all we should look forward to the potential that design research has in helping us to see older disciplines from new perspectives, to translate concepts and methods between fields, and to enable technologies to bring people together through new communicative formats. We hope that the ideas shared and the relationships created at DRS2022—whether in person, online, or a combination of both—will be powerful catalysts for design research's positive contributions to the future.

Acknowledgements

We have many people to thank in making DRS2022 happen. Above all, we have to thank everyone at Bilbao Ekintza, and especially Carolina Gutiérrez Gabriel, for her commitment, energy, trust, and professionalism. We have had many meetings, and grown into a highly effective team. It has been a joy to work together and with the amazing City of Bilbao. We would also like to thank the University of the Basque Country and other local universities who provided resources and allowed their staff to contribute to DRS2022.

We owe a special debt of gratitude to all the Theme Track Chairs who have put so much time and effort into producing their themes, as well as to the Reviewers who provided constructive criticism to help develop individual paper. And then, of course, we thank all the authors themselves who submitted their work for review. Some have been accepted and some rejected but we hope all have grown from the experience and will participate in future DRS conferences.

Finally, we should also thank two TU Delft Master's students: Caroline Häger wrote her thesis on the design of academic conferences in the future, which provided valuable inspiration for us as we planned DRS2022 as a hybrid event; and, Lenny Martinez Dominguez worked countless hours—right up to the last moment—to format papers for the conference proceedings.

DRS2022 Proceedings Editors:

Dan Lockton, Sara Lenzi, Paul Hekkert, Arlene Oak, Juan Sádaba, Peter Lloyd

Jun 25th, 9:00 AM

Technologies and collaborative services proximity in the smart cities: Distributed ledger as a push for new relationships

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DRS 2022
Bilbao 25th June — 3rd July

Technologies and collaborative services: Proximity in the smart cities. Distributed ledger as a push for new relationships

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Abstract: The expected demographic densification presents specific critical points where opportunities for improving citizens' lives can be identified. For this reason, projects are underway to analyze and explore the dynamics of cities to adapt to new contexts. Several European cities, including Milan, Paris, and Barcelona, are already implementing changes to encourage new types of neighborhood organizations which revolve around the concept of proximity, and primary services close to home. In this context, it seems fundamental to seek connectivity, encouraging new forms of relationships between citizens. The use of new digital tools, such as blockchain, favors new types of autonomous organizations that can manage activities on a neighborhood scale. Design should propose suitable and innovative models of application and act as a facilitator for their implementation. Through design, it is also possible to identify guidelines for the relationships in a neighborhood and to define activities and experiences with which citizens can relate.

Keywords: sustainable cities; co-design; decentralized autonomous organization; new relations

1. Introduction

The world's population is growing more and more, and in many regions, there have been excises such as wars or pandemics, there have been moments of strong economic and demographic development and growth. According to the studies of mathematician and statistician Hans Rosling (Roser, Richie, and Ortiz-Ospina, 2013), the birth rate has stabilized in the most developed countries ("Western World") where it was therefore achieved a condition of general well-being. At the same time, population growth occurs in societies that have yet to achieve such condition, such as the countries of the so-called "Third World" (Coale and Hoover, 2015).

Economic and demographic growth is associated with an ever-increasing concentration in urbanized centers. People look to the city for quick access to essential goods and services: for example, Lagos (Nigeria) is expected to grow to become the most populous city globally, with a population of about 80 million (United Nations, 2019). This example introduces a

reflection on the fact that the demographic curve cannot be similar to the economic or infrastructural one. It is precisely this separation, that will lead to an increase in the self-organization of social networks and will foster mutual contamination between informal and formal models, generating greater social awareness and the development of controlled and adaptive models (Ostanel and Fregonel, 2017).

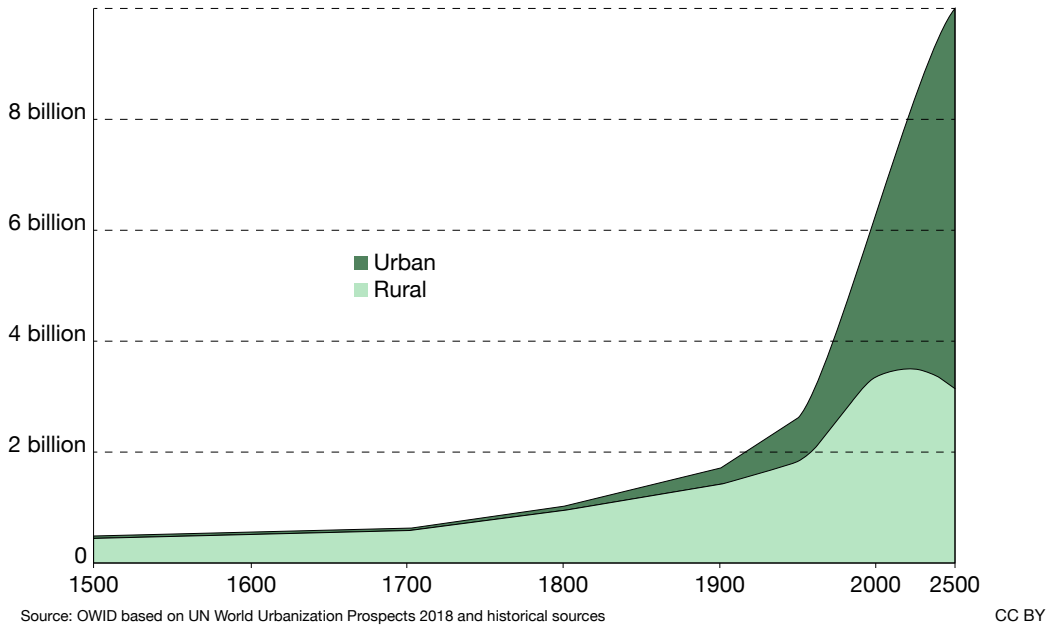

Figure 1. Urban and rural population projected to 2050. Projections are based on the UN World Urbanization Prospects and its median fertility scenario.

The Light Recicla project [1] is a significant example for understanding the possibilities that emerge from an informal system that has a more horizontal structure, in which the behavior of each citizen strongly influences the internal dynamics of the community. The project aims to create relational services in which participants are actively and collaboratively involved in interpersonal relationships (Cipolla, Melo, and Manzini, 2013).

The project is interesting for the activation of relations between citizens and the response that this has generated: vertical collaborations between service providers and consumers, necessary for the co-production of the service, and horizontal collaborations between the service users themselves, born spontaneously. The latter denotes the user's willingness to participate in the improvement of the city community and act as a starting point for the development of digital peer-to-peer (P2P) systems, which regulate relations within intelligent cities.

Therefore, some fundamental aspects of the informal economy are solidarity and the sharing of one's goods with the surrounding community. These models are strongly linked to the circular economy. A form of citizen self-sufficiency is favored to eliminate the massive transport flows resulting from large-scale distribution: it follows that self-sufficiency and

self-production are recognized and pursued values (Brown, McGranahan, and Dodman, 2014).

The role of design can be central in regulating new relationships: the social dynamics typical of an informal community must be understood, accepted, and structured into models that govern a system that is not centralized, but controlled, and that facilitate alternative ways of using community services, emphasizing the benefits of sharing goods; finally, design, as a regulator of knowledge and relationships, helps to make the technological system transparent, technologies are a fundamental aid to improve the use of services, therefore it is fundamental to work on the interaction and relationship between user and technology, so that all actors can understand and subsequently develop trust in its application and use. The activity of design is precisely that of establishing the ways and processes of interaction/integration, or in other words, the possible configurations that the two systems assume by interacting and integrating.

1.1 Methodology

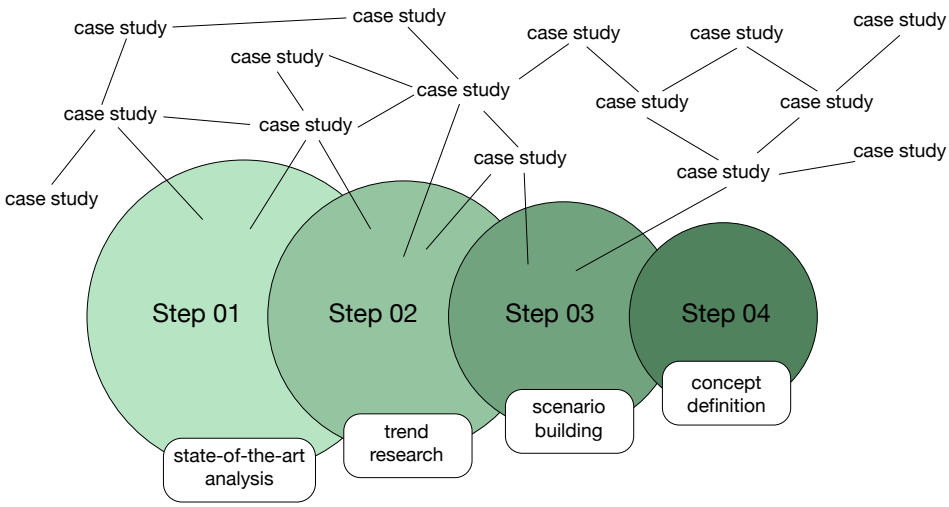

Figure 2. The diagram shows the phases of the methodology.

The methodology used provides 4 main phases for the development of a research aimed at defining a theoretical framework that can suggest relationships and social modalities to live in new urban centers; the phases of the design process, in which different tools on the basis of the objectives of the single step were used, to understand not only the phenomenon itself but also the conditions in the context, proceed in the following order:

1. Multidisciplinary analysis of the state-of-the-art based on the comparison with many variables from whose critical selection the elements for the next step are drawn. The interpretative framework that derives from this determines the subsequent areas of analysis of the research: for this activity, we chose to use the analysis of case studies,

which allows us to collect data from different perspectives - and for periods of time of indefinite duration. The objective is also the construction of a grid of parameters characterizing collaborative communities, analyzed both in their current state and in their main evolutionary lines.

Case study research traditionally answers two general questions:

a. What happened? (description of the phenomenon)

b. How did it happen? (how the phenomenon came about)

2. The second phase involves the research and mapping of current and future trends, through significant keywords on several levels, whose hierarchy allows to structure the scenario. In this phase we proceed with the analysis of social and relational trends, innovations linked to digitalization and opportunities of a multidisciplinary nature that can activate social innovation processes.
3. The scenario of the context is characterized by the research elements put into system in a targeted manner, from which emerges strongly the definition of a network of possible relationships between contexts, people and technologies. This network combines elements already experimented in the selected case studies and connected in a new way, with a high perspective of feasibility.
4. The fourth and last phase is based on the new synthesis of the emerged parameters, supporting the subsequent definition of the theoretical framework and the simulations of its developments. The framework modeling is supported by scientific literature and desk research, which will be followed by subsequent research for the verification of the limits and opportunities that will result, for subsequent applications.

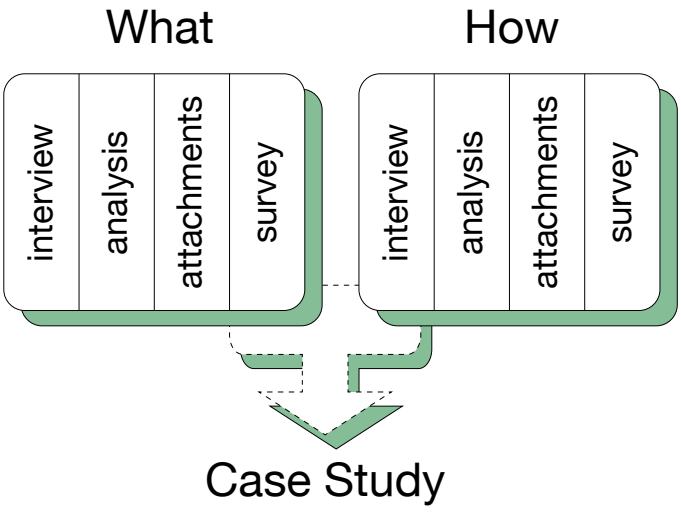

Figure 3. Sources, data, information to build the case study

The paper aims to reflect on the possibilities emerging from the continuous evolution of smart cities in the Western world, looking at some trends that are thought to emerge in the near future to build democratic, inclusive, and collaborative systems.

The first section is devoted to an overview of the concept of smart cities and to the explanation of the case study of the municipality of Paris; it also introduces the blockchain technology, its underlying logic and structure, and its opportunities for social and environmental applications within the context of interest. In the second section, a theoretical design model based on this technology for a food services company will be presented, which is part of a broader system on an urban scale. In this scenario, the network of distributed nodes and connections gives the possibility to create direct relationships between company and citizens, aimed at the social and environmental improvement of the system itself.

2. Smart cities: New types of relationships

Starting with the concepts of collaborative services and the relationships that manage informal spaces, we consider the European situation: the urban densification mentioned above will imply the need to research and devise new architectural and social models that will base their principles on horizontality and the democratization of relationships (Chabaud, Pratlong, and Moreno, 2019).

Public authorities are committed to draw up plans to give citizens easy and rapid access to essential services, such as health, education, mobility, green spaces, work, and leisure, by encouraging the development of neighbourhood commercial activities, creating cultural spaces, boosting health care, and multiplying the functions of buildings. The temporal aspect is of fundamental importance: the current concept of the city is going to be redesigned facing a new spatial and functional organization of cities, and a chrono-urbanism that makes it possible to envisage new ways of regulating adaptable cities. The temporal approach also implies a flexible morphology, multi-service buildings, the invention of an adaptable urban design, the development of a new kind of ergonomics, an information and signaling system that can be adapted according to the different times and ages of public space. This also requires new professionals and new technical tools to manage an "augmented city" (Gwiazdzinski, 2014).

The leading promoters of this vision are the municipalities of Paris, Barcelona, Copenhagen, and Milan: in this contribution, Paris has been taken into consideration, in which the concept of the fifteen minutes city is becoming an experimental model, and a partially lived reality, indicating how design can play a preponderant role for a new urban concept.

In this macro-scenario, to describe the widespread condition of constant mobility and change in relationships, identities, and the global economy of contemporary society, sociologist and philosopher Zygmunt Bauman (2000) coined the concept of “liquid modernity". In the liquid-modern society, happiness does not consist in owning or having things, but in using and co-consuming them and, thus, in "detaching" from them again (Jacobsen, 2019). This

fluidity in consumption is linked to fluidity in relationships and is a founding concept for the "city of augmented proximity" [2], a P2P system in which each user contributes to city activities on several levels, from organization to the use of specific goods and services.

This concept lies at the heart of collaborative services, and it is being developed not only in mature countries but, in different forms, in developing nations; it has a common trait of breaking away from the concept of individualism that was proposed until a few years ago and of rediscovering collaboration as a positive element for help and savings (Manzini, 2010). A ten-year study carried out on urban collaborative networks has shown that they produce strong social values and achieve results with practical implications. Light Communities are characterized by openness, reversibility, negotiability, oriented towards a result, and activated by a planning coalition (Manzini, 2015), working as functioning prototypes for social innovation.

2.1 Services in proximity to own home: The case of Paris

The French capital is the leading promoter of a model for the city of the future, 'la Ville du quart d'heure' (Moreno et al., 2021). This concept reveals new opportunities for the creation and feasibility of digitally enhanced services to counter the disintegration of the social fabric. A more liveable city, tailor-made for its citizens, which lays the foundations for a profound paradigm shift in city mobility: reduction or removal of car lanes, with a consequent increase in spaces reserved for pedestrians and bicycles, public spaces, and incentives for the creation and development of neighbourhood shops, spaces for shows and cultural activities even in large peripheral squares, city kiosks with municipal employees offering community cohesion services.

The project is based on the principle of "chrono-urbanism" which underlines the importance of urban rhythms to understand the quality of life: space is only relevant when coupled with the temporal dimension (Mulíˇcek, Osman and Seidenglanz, 2014). It enables increased proximity and social interaction (Manzini, 2019) originated by the dimension of 'density' and digitization.

Improving the citizen’s quality of life leads to a focus on four significant converging aspects:

- Promoting social inclusion for better social cohesion and combating exclusion.
- Reinventing urban infrastructure to adapt to the changing lifestyles of the 21st century.
- Implement the digital infrastructure.
- Consider the main urban environmental issues.

Digitization is effective in achieving the proximity necessary to apply the model within the city and in identifying what services are essential, how to distribute them, what data to collect to have viable maps, etc.: services such as e-commerce, cashless transactions, virtual communications and interactions are implemented and promoted. Different technologies

have been identified as potential means to achieve sustainability and urban resilience. The infrastructures enabled by Web 3.0 prove themselves useful in minimizing security problems (Moreno et al., 2021) and they open new possibilities for improving city life at different levels.

The growing population density in urban centres influences the configuration of the distributed services' city, leading to the establishment of distributed frameworks in adjacent microsystems. The main actors of these systems fall into different groups, with different roles and objectives, but in synergy with each other: the municipality is the body that coordinates the functioning of the system, but it is not the guarantor, as it merely manages the structure in a transparent manner, to make the offer accessible to all; then there are the companies, i.e., the providers of community services and assets practical to city life; also, the citizens who can decide whether to be an active member of the organization (or of the project), or whether to use it passively.

In such a context, a substantial degree of connectivity between citizens is necessary, as they are elements that must converse and relate in social forms that are also defined by the means that can be used in these forms of conversation (Manzini, 2010).

Digital technologies follow what has just been said: in fact, digital interconnection is a powerful means of enabling exchanges with anyone within the system, governed by a characteristic democratic horizontality, favoring the creation of direct relationships; a model in which each user is both client and server for the community to which he or she belongs.

In this direction, the adoption of Information and Communication Technology (ICT) applications for the development of innovative, sustainable, and smart cities represents a new model of municipal cooperation between government and society, capable of actively involving people in the dynamics of city life: a study conducted showed that, if an ICT-based service is qualitatively appreciable and innovative and ensures people's privacy, it is going to be accepted and used (Manzini, 2019).

By means of formative and decentralized tools, the relationships created with the transformations of citizen systems can be implemented, enhancing the exchanges of 'value' (monetary or intellectual or expressing a right, etc.) that need reliable and secure platforms of interaction. The Internet of Value (IoV), in this sense, is the most significant means to achieve better proximity between government and citizens (Almirall et al., 2016). The IoV is based on a web 3.0 structure, which allows for digitizing assets and their digitized value, and exchanging them securely, and so, for leveraging the Blockchain ecosystem (Truong et al., 2018).

2.2 New social relations: blockchain as a guarantor

To enable a city structure of such complexity, blockchain technology and digital networks enhanced by it represent potential tools. It is not very easy to define the blockchain in a few words without mentioning the technical details and risking trivializing its scope. For this discussion, it is sufficient to define it as a public and decentralized register of transactions in

which each node is created from previous nodes in a way that makes it difficult to manipulate data and insert untrue information.

It is a 'public' register because anyone can participate in the network; it is 'decentralized' because there is no central control system, but the network itself and the protocols that govern it allow it to function (Attico, 2018).

Thus, the innovation of the blockchain lies in enabling transactions of value without involving intermediaries and creating networks of neutral, accessible, and guaranteed markets. Furthermore, this is the logic that must and can govern the new relationships. The foundations of the blockchain are constituted by a smart contract, similar to a written contract signed between two or more parties, which defines terms and clauses that the computer will autonomously apply, monitoring the data and information that are written in the register.

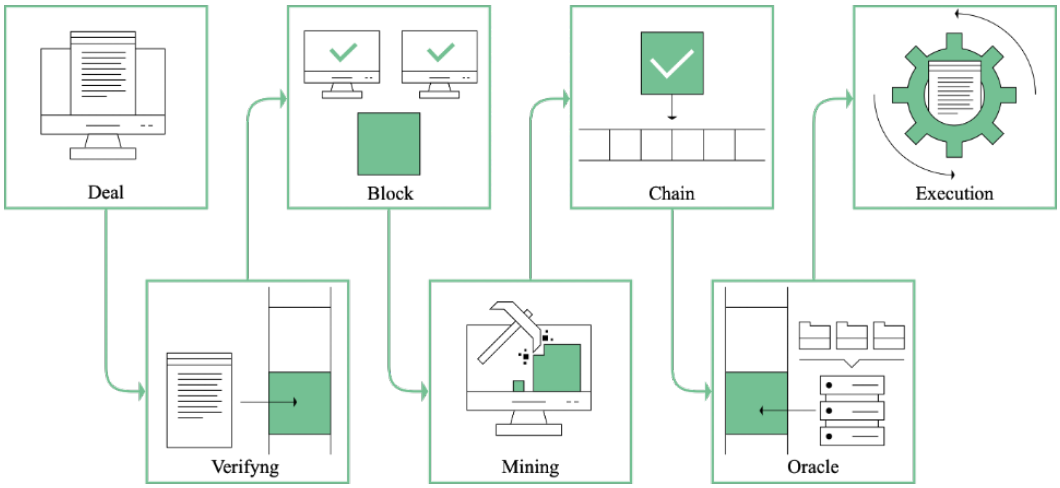

Figure 4. Author's revision of the diagram on how the blockchain works. Credit: Il Sole 24 Ore, Dario Aquaro, Smart contracts: what are (and how to do) clauses on blockchain work, 2019. For more information, see the website: https://www.ilsole24ore.com/art/smart-contract-cosa-sono-e-come-funzionano-clausole-blockchain-ACsDo2P?refresh_ce=1

Initially developed for application in the financial, agri-food, and logistics market sectors (with both successes and failures), blockchain is now used in a variety of areas, for example, to regulate energy exchanges or to enable communication between IoT products and millions of companies and user groups to continue to expand and refine the technology's features on a daily basis. One example of this rapid evolution is the Ethereum ecosystem: the aim is to use the blockchain to create a single global computing platform capable of running smart contracts. In addition to Ethereum, and similar platforms, great successes (think of Carrefour and Walmart) in the field apply the blockchain to the supply chain, allowing immutable and secure traceability of products.

Several public bodies are also starting to combine legislative efforts with research activities and projects to understand how to employ blockchain in the public sector. One case is Zug, a Swiss municipality of 30,000 inhabitants, which has launched a project to record citizens' identities to improve communication between the institution and them in anticipation of

more co-participative services for defining shared strategies. Using the Ethereum platform, 200 citizens had been able to vote remotely on several local issues.

As mentioned above, the blockchain system is the tool that makes possible a complex digital universe that also includes the IoV: again, what is interesting here is the logic underlying the functioning of the system, i.e., the fact that between the nodes of the 'chain' there can be a secure exchange of anything of value. In order to validate changes that have been made in the register, in the absence of a central body, nodes must reach a consensus.

Thanks to the proof-of-stake method [3], the larger the amount of digital currency held by each user, the greater the likelihood that the system will not be hacked.

Within an organization, the right to vote of a user is represented by the possession of so-called governance tokens [4]. The total supply of governance tokens issued can be understood as fragmentation of shares in 'corporate life' in which it does not matter how much an individual holds, but the mere fact of owning it gives everyone equal rights (Razzaq et al., 2019).

2.3 Corporate life and Internet community systems: e-governance

The societal life configured in this new scenario, and managed thanks to the blockchain, therefore, includes groups of people and organizations, which make decisions mediated by computer codes and programs, that form the foundations of Decentralised Autonomous Organisations (DAOs). These organizations have the capacity to function autonomously, without the need for a central authority to act as guarantor. The rules and transaction logs of a DAO are stored transparently on the blockchain; they are generally formed through proposals and decided by the individuals' votes. If a proposal is voted on by a majority it can be implemented (Sims, 2019).

DAOs imply the concept of e-governance, capable of generating a high level of citizen involvement. It makes possible to manage public spaces and services efficiently and to include people in small-and medium-scale decision-making processes actively. (Oliveira, Oliver, and Ramalhinho, 2019)

Decentralizing these processes implies the distribution of decision-making power, a strategy that has been adopted by implementing the Multi-Agent Systems (MAS) paradigm (Coelho et al., 2017); they allow consensus to be reached between multiple devices through negotiation protocols. The new decentralized systems are crucial for low-cost, trust-based governance: Neo [5] is a successful example of the association between digital assets and democracy; it uses a blocked-purpose protocol, implementing a consensus system based on MAS. Nodes cannot generate blocks in a new branch, avoiding the creation of forks (Elrom, 2019).

It is difficult to think that a tool as technical as the blockchain can be considered the regulator of citizen relations. In order to understand the system, it is necessary not to think that technology determines the situations around us, but that they can be made possible through its applications (Manzini, 2015). The design comes into play in this context by managing the

system's complexity, not in technological terms, but in "human" terms, ensuring that interaction with the register is intuitive and functional, simplifying the interface so that the information required for a given operation is accessible. By making the smart contract easier to understand, it is possible to establish which activities are profitable for the individual or the company and improve its usability and logic.

The role of design is also to study adequate communication that can convey to the user the tangible values that a connected and collaborative system presents; it also should act as sensemaking agent, highlighting the meaning of such innovation, and creating consensus around its application.

One of the expected goals of ICT services, which emerges from the research, is to provide relevant information for citizens, but few applications are truly focused on User Experience (UX); there is a need to develop new structures that provide easy access convenience, trust, and transparency (Oliveira, Oliver, and Ramalhinho, 2019).

3. The proposed model: Blockchain for social life in food and supply services

The DAOs social organization models favor the establishment of direct relationships (without intermediaries) and user-managed structures based on the consent and participation of all the actors. They form the basis of the study carried out to model the first draft for a system of services that can be used in the proximity of one's home. In particular, the focus has been put on food services, as the agri-food sector is a proven area for blockchain application, especially in terms of tracking the product chain. A further motivation is the need to innovate the sector in order to reduce the enormous environmental impact it causes.

The aim of reducing emissions from the food industries (Newton, Dancer and House, 2020) and limiting large-scale distribution transportation (Thakrar et al., 2020) has led to the creation of a city’s system that enables goods self-production through the implementation of urban gardens and indoor cultivation. This solution seeks to fit proactively into the context of collaborative services, involving the citizen, creating constructive relationships aimed at achieving a condition of shared well-being, and acting as a functioning prototype for social innovation.

In this context, the role of design is structured on several layers, having to deal with a multifaceted complexity: on one side, as previously mentioned, it should create simple interfaces that enable the intuitiveness and the functionality of the digital platforms that constitute the system. Therefore, its role is to design adequate communication infrastructures fruitful to demonstrate the values of the collaborative system, acting as a sensemaker. On the other side, in developing a theoretical model, its role consists also in the promotion of new relationships between the different actors, trying to behave as a catalyst and a facilitator for these innovative interactions: the dialogue between the stakeholders and the designers is functional to create consensus around the projects and the models, and so, to pursue

equitable and sustainable development objectives. In this scenario, three types of actors can be distinguished (Yang, 2018): the designer, i.e., who has design abilities and, in a co-design perspective, contributes to the construction of the service/product; the user, i.e., who does not have design abilities but through active participation acquires a relevant degree of experience to develop critical thinking; finally, the fan, who has neither design abilities nor user experience but shows interest in the project.

The hypothesized service can be divided into three stages: cultivation (or production), in which part of the fresh food is processed directly on-site using special facilities and sustainable machinery; consumption of these products, or others selected from a controlled supply chain; and finally, conservation or sale of the goods' surplus, that is not consumed, and which can be purchased in sales outlets located within the multifunctional space, which extends itself into the urban space as in the 'Ville du quart d'heure', and in which all the three phases take place. To use the services, an app is exploited, which provides information about the products, allows ordering of meals or shopping, and enables the purchase directly from the store. The app also collects a large amount of data, which are uploaded into the digital registers.

Within the system, the operators and the service providers should also monitor the different infrastructures and manage the updates. Through these automated or manual operations, data are read and enter the blockchain to be validated as a block (e.g., a certain period of data collection until the moment of writing into the chain can be established; the more data written for a transaction, the greater the validity of the block). Based on the reading of the data, which certifies compliance with the terms of the smart contracts established within the system, the different actors may receive a variable number of tokens. The latters are achieved through actions useful for the system and the community, and they represent the power exercisable by each actor in decision-making processes affecting the whole collectivity: participation is proportionally rewarded through their allocation. So, the digital system regulates the relationships established through the services, coordinating the functions of each actor, and guaranteeing the security of transactions.

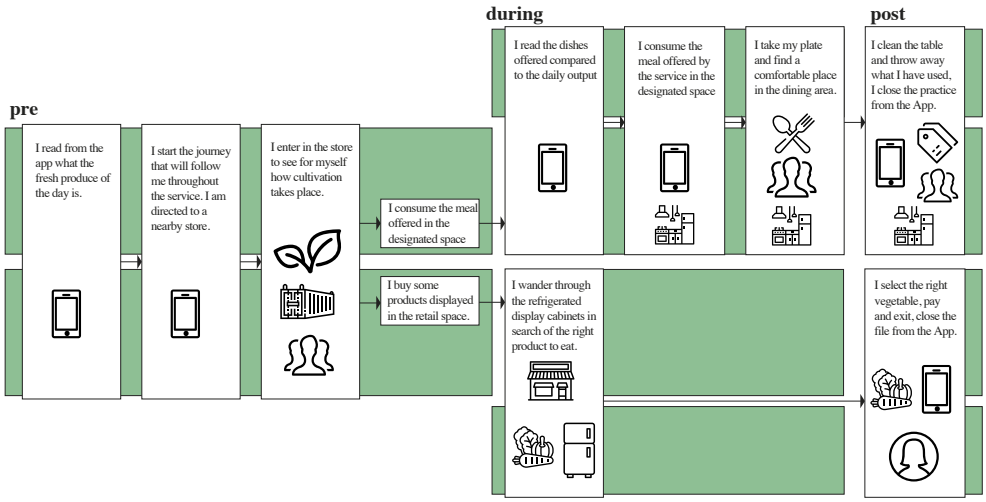

Figure 5. Customer Journey of the user.

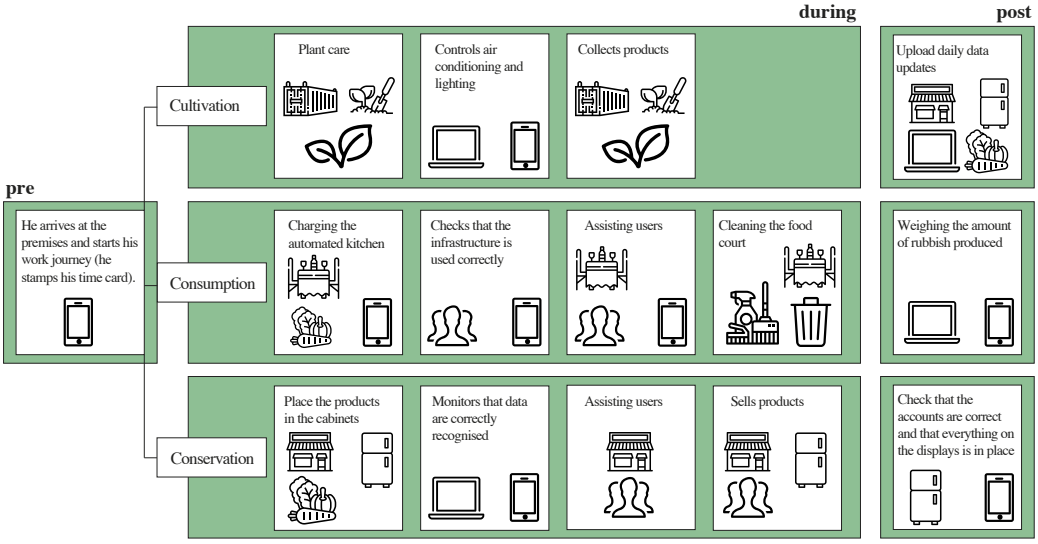

Figure 6. Customer Journey of the service operator.

The structure of the relationships, transcribed within the smart contract, should follow the forthcoming modality: "IF a condition occurs, THEN the computer imposes its conditions.", which can regulate relations between companies and between citizens.

The model is divided into several digital microsystems, simplifying, and facilitating the management and control of the distributed register structure. The instituted microsystems can communicate with each other through a structure containing all the data collected.

The blockchain allows new relationships and interactions among the main actors of the system: the municipality, the businesses, and the citizens. The first one has the role of system's regulator, and it must define the terms of the smart contracts in direct dialogue with the

other entities involved; companies establish and take part in a network in which they can carry out direct and transparent operations, and the most respectful of the smart contract values obtain more tokens and have certain assets to use, as well as greater scope for decision-making. Finally, citizens are free to participate actively or passively in the system: the former are defined as operators, the latter as users. Operators are employed by the service providers, while users are those who make use of the offer.

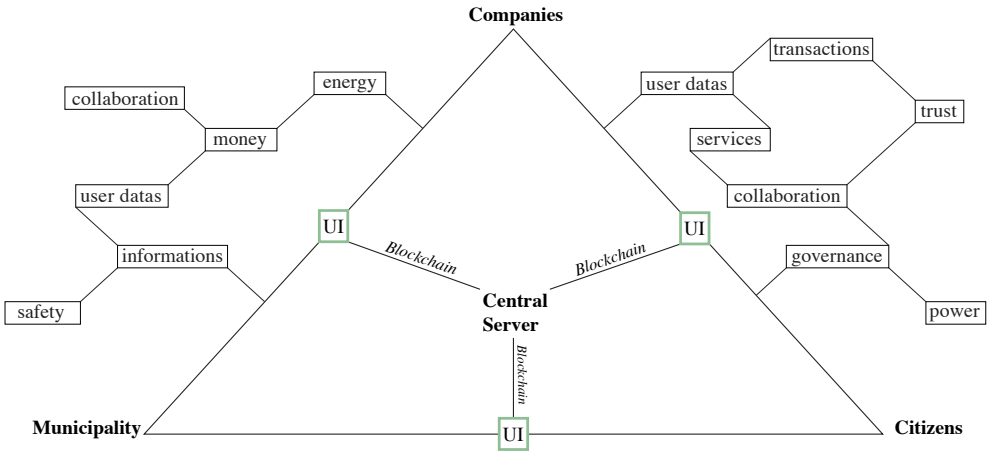

Figure 7. Relationships between the main actors and what is exchanged in the transactions between them.

In this context, the role of strategic design is decisive in orienting the interactions and social networks created. Designers deal with user's studies, defining the most suitable methodologies to develop the interface of the service, paying attention to the accessibility of the offer and to the characteristics of the spaces, products, and services, customized according to the different needs. Through the city design approach, we critically analyze several concepts with which the practice is most usually associated: formality, competence, coordination, and intentionality (Tonkiss, 2013).

The design systemic vision is fundamental to develop the digital system, its construction, and implementation, which must be aimed at accessibility of the urban system.

Finally, collaboration between designers and the company is vital to construct the offer: they can recognize which social and environmental values are the most suitable for a given type of service and how the company can best benefit from the terms and clauses indicated in the company smart contract.

4. Conclusion

The culture of design and its variety of approaches denote the predisposition of this discipline to manage complexity, succeeding in simplifying it and making it interpretable by different people.

In this case, the design object was the urban system, the relationships between the different players in the system, and the role that digital innovation can have in modifying the current paradigms.

The research focuses on the investigation of new technologies and the most suitable design processes to manage their use; the definition of a future scenario in which these models can be applied is proposed. The aim is to show the contribution of design through an example applied to food service.

As already mentioned, relationships are central in city life. The proposed scenario aims to establish a system whose values are recognized and respected by everyone. This social model aims at shifting the paradigms of relations between people: free and direct exchanges, mutual trust, the importance of the common good; these values are fostered by the new city dynamics. People experience their city differently; it is possible to talk about communities on the move, i.e., social networks in which they establish a close relationship within the places they live. They attribute meanings and values to their neighbourhood, giving it a precise identity. The proposed model fosters dynamics of open collaboration in which the common goal is to live in healthy cities.

The transition scenario presented envisages a timeframe for establishing the technologies under consideration and an alternative behavioral, social, and value model to the traditional one.

When dealing with complex issues and fields of public and private influence, the transition from a theoretical model to an actual application requires greater awareness by all the actors involved: stimulating critical thinking, in order to inform people of new and potential transformations, is, therefore, another fundamental aim of the research, which certainly leaves several open questions, among which the most interesting is the need to further investigate how the discipline of design, its approaches and methodologies can contribute to the acceptance, dissemination, application, and correct use of new technologies, to transform the paradigms in force.

5. Notes

1. Light Recicla is a 2011 sustainability project implemented in Rio de Janeiro whereby recyclable materials can be exchanged for discounts on the electricity bill. Retrieved from http://www.recicloteca.org.br/coleta-seletiva/light-recicla-reciclaveis-ponto-de-coleta-reducao-na-conta-de-luz/
2. "City of increased proximity" is a different way to express the concept of the "Ville du quart d'heure." Retrieved from https://ilgiornaledellarchitettura.com/ (Inquiries section, Prof. Maurizio Carta).
3. Method - an algorithm - for obtaining cryptocurrency and validating registry blocks. Proof of Stake is a remunerative method concerning the number of

tokens owned (participation in the blockchain). The PoS blocks are minted at the time the transaction takes place. Retrieved from https://www.bitdegree.org/

4. A token consists of digital information uniquely associated with only one specific user of the system and representing some form of right; the token can also be associated with rights other than those guaranteed by shares and bonds, such as access to the developed service (Spark and Fisher, 2016).
5. Neo is an open-source, community-driven blockchain platform. Retrieved from https://coinrivet.com/it/delegated-byzantine-fault-tolerance-dbft-explained/

6. References

Attico, N. (2018). *Blockchain. Guida all'Ecosistema. Tecnologia, Business, Società. [Blockchain. Guide to the Ecosystem. Technology, Business, Society].* Guerini Next.

Bauman, Z. (2000). *Liquid Modernity*. Wiley.

Brown, D., McGranahan, G., and Dodman, D. (2014). Urban Informality and Building a More Inclusive, Resilient and Green Economy. *IIED Working Paper*, 4-44.

Chabaud D., Pratlong F., Carlos Moreno C. (2019). Regional Innovation Ecosystems: Issues for (from) Smart Cities. *Proceedings of R&D Management Conference 2019: The Innovation Challenge: Bridging Research, Industry & Society*. L'École Polytechnique, Paris. June, 17-21, 2019.

Cipolla, C., Melo, P. and Manzini, E. (2015). Collaborative Services in Informal Settlements: Social Innovation in a Pacified Favela in Rio de Janeiro. *New Frontiers in Social Innovation Research (eds. Nicholls, A., Simon, J. and Gabriel, M.)*. 128–42. London, Palgrave Macmillan. https://doi.org/10.1057/9781137506801_7.

Coale, A.J. and Hoover, E.M. (2015). *Population Growth and Economic Development*. Princeton University Press.

Coelho, V. N., Cohen, M. W., Coelho, I. M., Liu, N., and Guimarães, F. G. (2017). Multi-Agent Systems Applied for Energy Systems Integration: State-of-the-Art Applications and Trends in Microgrids. *Applied Energy, 187*, 820–832. https://doi.org/10.1016/j.apenergy.2016.10.056.

Diallo, N. et al. (2018). EGov-DAO: A Better Government Using Blockchain Based Decentralized Autonomous Organization'. *Proceedings of the 2018 International Conference on EDemocracy & EGovernment (ICEDEG)*. Ambato, Ecuador. April, 4-7, 2018. https://doi.org/10.1109/ICEDEG.2018.8372356.

Elrom, E. (2019). NEO Blockchain and Smart Contracts'. *The Blockchain Developer (eds. Elrom, E.)*. 257–98. Berkeley, Apress. https://doi.org/10.1007/978-1-4842-4847-8_7.

Esteve, A., Wareham, J., Ratti, C., Conesa, P., Bria, F., Gaviria, A., and Edmondson, A. (2016). Smart Cities at the Crossroads: New Tensions in City Transformation. *California Management Review, 59(1),* 141–52. https://doi.org/10.1177/0008125616683949.

Gwiazdzinski, L. (2014) Adaptable cities and chrono-urbanism. *Adaptable cities and chrono-urbanism*. Sweden, May, 2014. ⟨halshs-00995870⟩

Jacobsen, M. H. (2019). Liquid-Modern Emotions: Exploring Zygmunt Bauman's Contribution to the Sociology of Emotions. *Emotions and Society 1 (1)*, 99–116. https://doi.org/10.1332/263168919X15580836411878.

Manzini, E. (2010). Small, Local, Open and Connected. *Journal of Design Strategies, 4(1)*, 14–18.

Manzini, E. and Coad, R. 2015. *Design, When Everybody Designs: An Introduction to Design for Social Innovation. Design Thinking, Design Theory*. MIT Press.

Manzini, E. (2019). Città collaborative. Comunità di luogo e rigenerazione urban [Collaborative cities. Spatial communities and urban rigeneration]. *Nuove Geografie - Design civico e innovazione sociale. cambiaMENTI* [*New Geography – Civic Design and social innovation. Changes*]. March, 19, 2019.

Moreno, C., Allam, Z., Chabaud, D., Gall, C., and Pratlong, F. (2021). Introducing the "15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities. *Smart Cities 4(1),* 93–111. https://doi.org/10.3390/smartcities4010006.

Mulíček, O., Osman, R. and Seidenglanz, D. (2015). Urban Rhythms: A Chronotopic Approach to Urban Timespace. *Time & Society 24(3)*, 304–25. https://doi.org/10.1177/0961463X14535905.

Newton, P., Dancer, A. and House, V. (2019). The Difficulties of Developing Local Food Systems: Perspectives of Farmers and Other Key Stakeholders in Boulder County, Colorado. *Food Studies: An Interdisciplinary Journal 9(4)*, 1–20. https://doi.org/10.18848/2160-1933/CGP/v09i04/1-20.

Oliveira, T. A., Oliver, M. and Ramalhinho, H. (2020). Challenges for Connecting Citizens and Smart Cities: ICT, E-Governance and Blockchain. *Sustainability 12(7)*, 2926-2947. https://doi.org/10.3390/su12072926.

Ostanel, E. and Fregolent, L. (2017). Città informale VS città progettata #2 Intervista a Laura Fregolent [Informal city VS designed city #2 Interview with Laura Fregolent]. *Tracce Urbane: Rivista Italiana Transdisciplinare di Studi Urbani [Urban Traces: Trandisciplinary Italian Journal of Urban Studies]*, *1*. https://doi.org/10.13133/2532-6562_1.4.

Portale, V. (2019). Le applicazioni della Blokchain: i cinque settori più promettenti [Blockchain applications: the five most promising sectors]. Observatory for Digital Innovation. [Accessed 30 May, 2021]

https://blog.osservatori.net/it_it/applicazioni-blockchain

Razzaq, A., Murad, M., Talib, R., Dawood, A., Hanif, D., Afzal, S., and Razeen, M. (2019). Use of Blockchain in Governance: A Systematic Literature Review. *International Journal of Advanced Computer Science and Applications, 10(5)*, 685-691. https://doi.org/10.14569/IJACSA.2019.0100585.

Roser M., Ritchie H., and Ortiz-Ospina E. (2013). World Population Growth. [Accessed 30 May, 2021].

https://ourworldindata.org/world-population-growth

Sadhukhan, J., Dugmore, T. I. J., Matharu, A., Martinez-Hernandez, E., Aburto, J., Pattanathu, K. S. M. R., and Lynch, J. (2020). Perspectives on "Game Changer" Global Challenges for Sustainable 21st Century: Plant-Based Diet, Unavoidable Food Waste Biorefining, and Circular Economy. *Sustainability 12 (5)*, 1976-1993. https://doi.org/10.3390/su12051976.

Sims, A. (2019). Blockchain and Decentralised Autonomous Organisations (DAOs): The Evolution of Companies? *28 New Zealand Universities Law review,* 423-458. https://doi.org/10.2139/ssrn.3524674.

Sparke, P. and Fisher, F. (2016). *The Routledge Companion to Design Studies. Routledge Art History and Visual Studies Companions*. Taylor & Francis.

Thakrar, S. K., Balasubramanian, S., Adams, P. J., Azevedo, I. M. L., Muller, N. Z., Pandis, S. N., Polasky, S. (2020). Reducing Mortality from Air Pollution in the United States by Targeting Specific Emission Sources. *Environmental Science & Technology Letters 7(9)*, 639–645. https://doi.org/10.1021/acs.estlett.0c00424.

Tonkiss, F. (2013). *Cities by design: The social life of urban form*. Polity Press.

Truong, N. B., Um T. B., Zhou, B., and Lee, G. M. (2018). Strengthening the Blockchain-Based Internet of Value with Trust. *Proceedings of 2018 IEEE International Conference on Communications (ICC)*. Kansas City, Kansas, May, 20-24, 2018. https://doi.org/10.1109/ICC.2018.8423014.

United Nations, Department of Economic and Social Affairs, and Population Division. (2019*). World Population Prospects Highlights, 2019.*

Veillon, E. (2020). Carlos Moreno: La proximité peut Radicalement Changer le Visage d'une Métropole [Carlos Moreno: Proximity can Radically Change the Face of a Metropolis]. Le Temps. [Accessed 30 May, 2021]

Yang, M., Jiang, P. Socialized and self-organized collaborative designer community-resilience modeling and assessment. *Res Eng Design* **31,** 3–24 (2020). https://doi.org/10.1007/s00163-019-00325-5

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