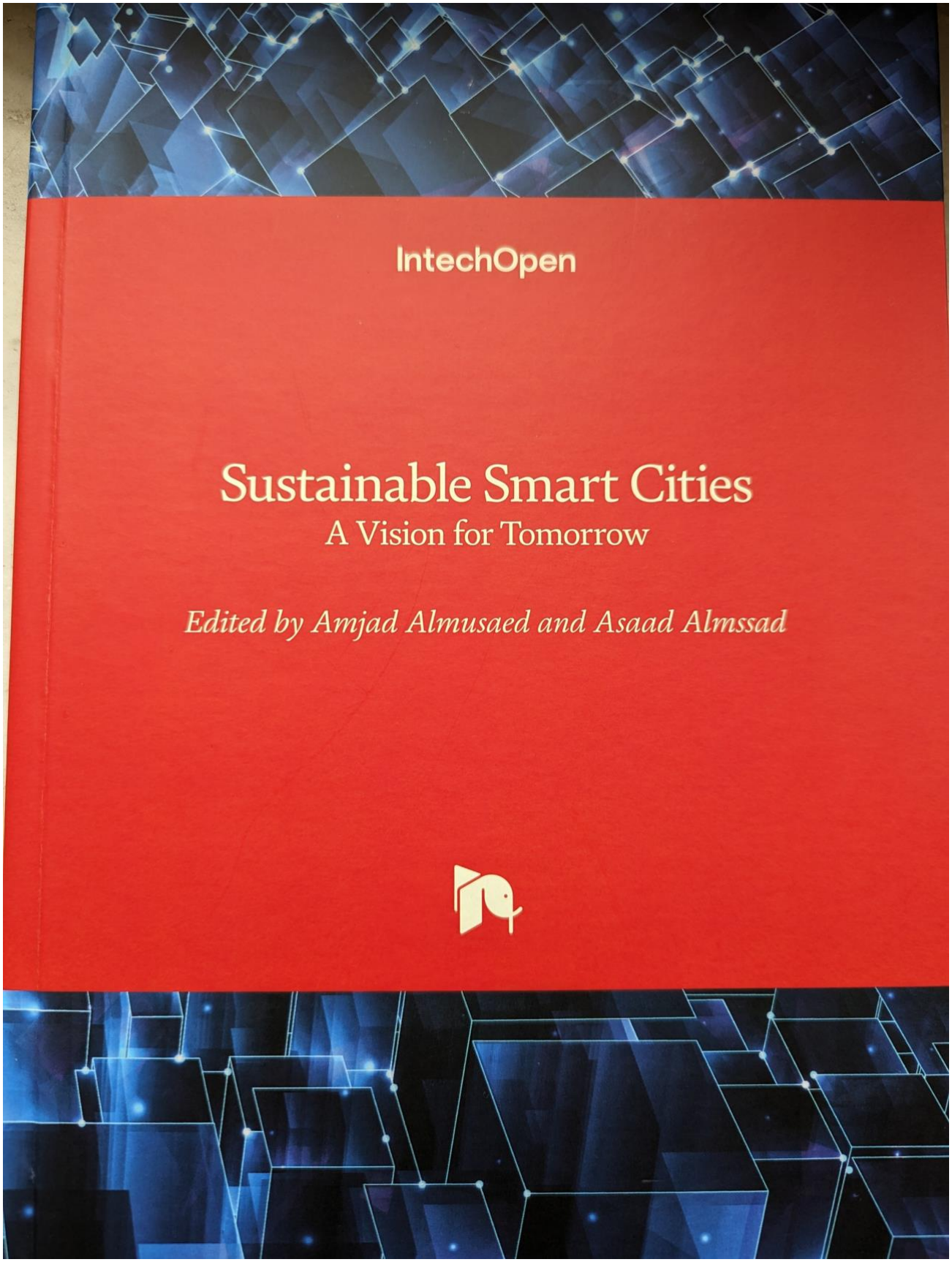
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Edited by Amjad Almusaed and Asaad Almssad

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Contributors
Doghmane Mohamed Zinelabidine, Eladj Said, Fachrul Kurniawan, Mochamad Hariadi, Supeno Mardi Susiki Nugroho, Prita Dewi Basoeki, Toshio Uchiyama, Tsukasa Hokimoto, Jong Woo Choi, Jae Eun You, Menachem Domb, Kamal Shahid, Muhammad Hassan, Sadaf Mukhtar, Ali Husnain, Chang-Wei Chai, Yu-Heng Huang, Tseng-Wei Chao, Margherita Pillan, Lasse Berntzen, Qian Meng, Adipandang Yudono, Sapto Wibowo, Christia Meidiana, Surjono Surjono, Irnia Nurika, Erryana Martati, Yan Akhbar Pamungkas, Daniel Adu, Ransford O. Darko, Boamah Kofi Baah, Agnes Abbey, Laurentiu Constantin Lipan, Sorin Dimitriu, Amjad Almusaed, Asaad Almssad

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Contents

Chapter

Embracing Human Complexity in Service Design for Inclusive and Sustainable Smart Cities

Margherita Pillan

Abstract

According to the UN Agenda 2030, the sustainable development of cities is aimed at innovation for social, environmental, and economical progress. The goal is the development of services and socio-technical systems apt to conjugate inclusivity) with economical and ambient sustainability. To produce social progress, the innovation of infrastructures and services should match the diversified needs of the contemporary multicultural environments and be designed to favor the change of behavior of citizens toward more convenient and sustainable lifestyles. The chapter discusses the importance of the active contribution of citizens to achieving the objectives of the UN Agenda 2030. It argues the opportunity to include scientific theories on human complexity in university training for sustainable service design and proposes the theories of Design for Behavior Change as a valuable conceptual tool. Finally, the chapter focuses on the general value of considering gender perspectives in the design of smart services and systems to optimize satisfaction and adherence to services.

Keywords: sustainability, United Nations agenda 2030, service design, design for behavior change, gender issues

1. Introduction

Smart cities are paradigms for the development of urban environments and the contemporary expression of the eternal human strive toward the perfect settlement.

In human history, the ambition of conceiving ideal urban organizations is very old, and the dreams of the perfect city always reflected the culture, values, and beliefs of the philosopher and architect generating them. The vision of future urban settlements is animated by the intention of progress, by the aspiration of achieving an ideal condition, and overcoming problems and critical situations. Each proposition for urban development reflects, in explicit or implicit ways, a system of values and priorities and a vision of the relationship between humans and the natural environment. From Plato to Leon Battista Alberti in the Italian Renaissance to Le Corbusier, the study of the paradigms proposed for the cities of the future produces a representation of the human aspiration for improvement according to the values of their time and of the struggles for the realization of visions through attempts, errors, and improvements [1].

Plato's idea of roles in society was influenced by the assumption of the natural social distinction between freemen and slaves and by the importance paid to military protection; the wish to contribute to restoring people's dignity inspired Gropius's work [2]; contemporary theories on social innovation express the convincement that people and communities are main stakeholders in the invention of solutions for sustainable and desirable development [3].

The primary purpose of smart cities is the creation of environments and socio-technical ecosystems capable of conjugating the well-being of individuals and communities with respect for the environment and wise use of resources [4]. Smart cities involve policies and deal with productivity, sustainability, and well-being [5]. They can therefore be ascribed to the realm of utopian models for urban development aimed at providing the context for an ideal and desirable future for humans.

However, several specific factors mark the novelty and peculiarity of the smart city; among others:

- the centrality of digital technologies that provide the nervous system and access/control terminals for a new generation of solutions based on information and algorithms [6–8];

- the lack of a unique model for development: the invention of smart solutions is an open opportunity for innovation and progress where private companies, policymakers, and local administrators, together with single citizens and associations, are agents and stakeholders for smart initiatives to create economic, social, and environmental value [9];

- the global and planetary dimensions of the unprecedented challenges that humanity is facing today.

Smart solutions are made possible by the availability of digital infrastructures and applications. Technologies provide the means for the automation of physical services and facilities, enable the exchange of information and control, and provide access at a distance to facilities and commodities [10]. The scenarios referred to the smart city aim at the rational use of local resources, and at the optimization of efficiency and satisfaction for main services, including mobility, transportation, health care, democratic participation, smart generation, and distribution of energy [7, 10].

Several smart city initiatives are animated by the ambition of creating progress in terms of social and environmental sustainability, but the creation of socio-technical systems based on digital technologies is not necessarily always aligned with the values of sustainable development [11].

The digital transition is associated with enormous economic interests; the creation of digital infrastructures and services has been both demand- and market-driven. The case studies on smart cities reflect different models and ambitions of urban development and include eco-city experiments, systems aimed at improving the efficiency and effectiveness of economic and productive environments, and initiatives for the creation of elitist contexts [7, 9]. Digitalization can be leveraged as a strategic opportunity for industrial and business competition. Big data, artificial intelligence, and automation can increase efficiency and promote the innovation of products, processes, and services; they also support the creation of virtuous synergies between different comparts of industry and services. On the other hand, according to the UN report on Technology and Innovation [12], creating digital facilities and systems

requires financial investments and research and technical capabilities. Countries with low capabilities of investment, poor education and research systems (notably for STEM disciplines), and scarce industrial know-how could have severe difficulties in grasping the opportunities offered by digitization. Specific support actions should therefore aim at supporting the digitalization of those nations that have the most significant difficulty in implementing the digital transition. Furthermore, the report refers that "Women are also severely underrepresented in the key area of ICTs, accounting for only 30 percent of total workers in the digital sector in the European Union. Underrepresentation occurs at all levels, but particularly in decision-making positions".

In other words, socially sustainable digitalization requires dedicated education plans, inclusive industrial growth and policies, and the capability to design for diversity.

Altogether, the experiments and the criticism that accompany them do not question the potential of ICTs in the generation of meaningful and desirable solutions for social and environmental progress, but they point out the importance of dealing with the complexity of the impacts and frictions connected to change [13].

In this context, the updating of education programs becomes an important priority to provide the young generations of designers with a suitable background and sense of critics [14–16].

Smart cities are transdisciplinary project fields, and their creation requires the convergence of different domains of knowledge; they are an ideal melting pot where human sciences, design disciplines, and formal sciences collaborate and become contaminated. Smart systems and services, in fact, involve three dimensions and architecture: the physical dimensions, the network of information, and the organization [17]. No development proposal is politically neutral: inevitably, every vision of the future arises from an interpretation of what is right and desirable for individuals, communities, and the environment. Each discipline involved in urban development should develop an ethical reflection on the consequences of project choices and on how to approach the project of the future, considering the impacts and consequences of change in a conscious and responsible way [18].

In the design of smart solutions, the design of services and interaction has the task of understanding people's needs and attitudes and inventing solutions that are meaningful, desirable, and simple. To this end, user-centered design approaches have been developed, which include multiple survey techniques on users and contexts, aimed precisely at collecting insights and identifying design opportunities [19–21].

However, in many cases, the implementation of smart socio-technical systems oriented toward sustainability requires a change of mentality and behavior on the part of people so that they can accept and adhere to new services and systems [22].

Designing smart solutions for sustainable development is not only a question of understanding and responding to people's needs but, rather, of designing to enable changes that are acceptable and beneficial for people and communities.

A question therefore arises: what are the skills that can strengthen the ability of designers to understand human complexity in order to design solutions that garner the support of end users?

This document contributes to answering this question by indicating two specific themes: the theories of Design for Behavior Change as a useful support to the understanding of how to cope with human reluctance for change and the importance of considering the specific gender point of view in order to design services capable of responding more effectively to people's needs.

The remainder of this document is organized as follows: a section is dedicated to illustrating the importance of the active participation of end users in the actions for achieving the objectives of the 2030 Agenda. Two sections are dedicated to the theories of design for behavior change and briefly indicate the results of their application in a university course. Finally, a fourth paragraph focuses on the importance of including the gender perspective in the preliminary research for the design of services for developing inclusive services; it also briefly reports the results of an education experiment.

2. Citizens are the main actors in sustainable development

Humanity today faces multiple challenges on which the future of human beings and the planet will depend. Climate change, dramatic social inequalities, conflicts, pollution, and scarcity of resources ask for actions and responsibility for improving human conditions and conservating natural systems for future generations. Digital technologies play a crucial role in the search for suitable solutions, but technology alone is not sufficient, and every social actor should contribute to the mitigation of the current crises [23, 24].

A meaningful example of the importance of citizens in sustainable development is the energy transition. Energy services are the focus of the seventh goal in UN Agenda 2030 and one of the arenas where smart systems must provide value for people and environments. The targets listed for this goal include the development of technological systems for the production and distribution of clean energy, the substantial increase of renewable sources in the production mix, and the improvement in energy efficiency. Digital systems play a fundamental role in the creation of smart systems that can improve the efficiency and quality of energy services [25] and are essential for managing the integration of local and centralized production. But the energy challenge is not only a matter of production and distribution systems.

The document Climate Change and Energy Renovation Wave by the European Commission for the Environment provides a map of the different opportunities for the specific and local strategies in each country in the European Green Deal: each contest asks for a specific approach to the energy transition. Citizens can be an active part by giving their contributions with behaviors and lifestyles that favor energy savings: they can build or renovate homes and workplaces following sustainability criteria so as to reduce the need for energy in thermal regulation; influence the energy policies of local administrations and the energy industries by asking for transparency on the energy sources negotiating for a fair mix; participate in the co-production of energy, exploiting local resources; contribute to culture change by their advocacy on the value of the energy transition [26].

Figure 1 maps the potential contributions of citizens to the energy transition.

Nowadays, the availability of energy supply under reasonable conditions for consumers and companies – considering quantity, quality, and costs of the services – is not guaranteed in a uniform and fair way in the various parts of the world. According to the UN Agenda, "Health, food security, gender equality, education, economic development and other sustainable development goals critically depend on access to clean, affordable and reliable energy services" [27].

The agenda points out as a primary priority the task of "ensuring universal access to affordable, reliable, and modern energy services, and of expanding infrastructure, and upgrading technology for supplying modern and sustainable energy services for all in developing countries" [28].

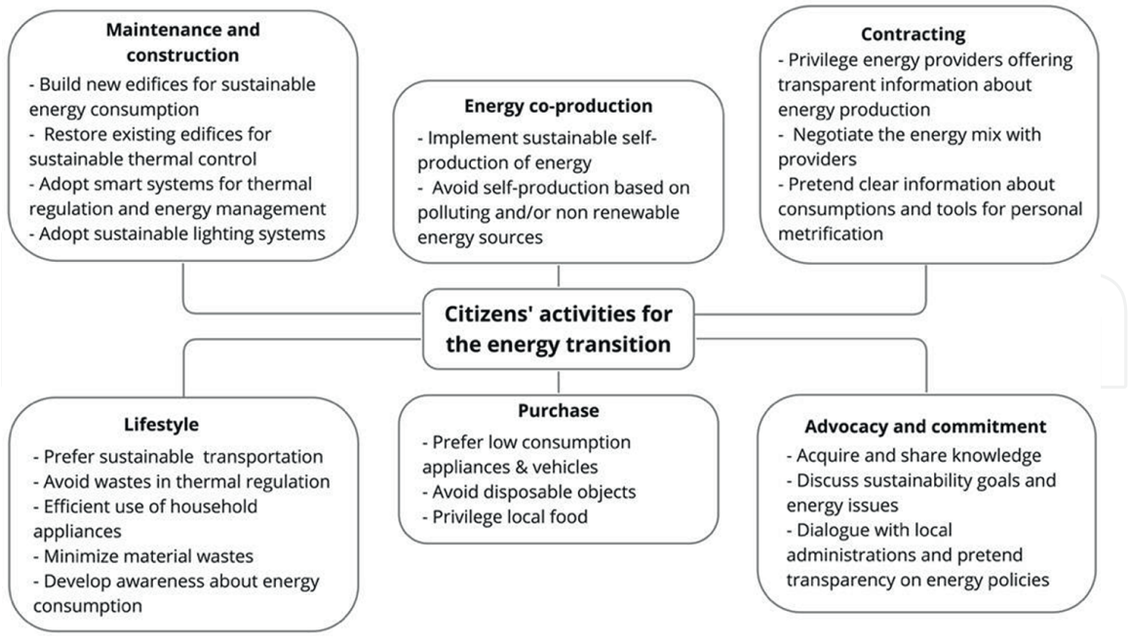

Figure 1.
How citizens can engage themselves in the energy transition.

To produce progress in terms of environmental and social sustainability, the energy transition must therefore involve people so that they collaborate in identifying and implementing the most acceptable, desirable, and effective solutions in local level contexts.

3. Change is a difficult challenge in the design of solutions for sustainable development

The example of the energy transition is emblematic of the fact that to succeed in the challenges of our time, it is necessary to integrate technological skills with the ability to involve citizens as active and fundamental actors of change. In other words, the energy transition requires the convergence and collaboration of different domains of knowledge and expertise, including human and brain sciences, providing insights into human mental models and processes and the capability to develop languages, experiences, and storytelling to favor awareness and engagement. This is necessary for most changes required by the sustainability goals. According to Linner et al. [29], the agenda goals require social research for understanding how the transformation takes place in local contexts and how it is associated with changes in sense-making and social values.

The change of mindsets and behaviors is not an easy task. The lack of knowledge, suitable means, and technical skills can hinder the active participation of citizens in change. But often, the implementation of new socio-technical systems also encounters obstacles related to the lack of understanding of the importance of the transformations required by the sustainable development goals and to scarce motivation for personal engagement. The change of mindset is not straightforward even in front to sound scientific data demonstrating evidence [30–33]. According to these authors, the reluctance toward a change of opinion is very strong in individuals, regardless of their education and cognitive capabilities. From the point of view of social and

personal stability, attachment to the personal convictions and vision of reality can be useful as it contributes to sustaining determination and perseverance even in the face of crises and difficulties.

In the implementation of systems for sustainable development, reluctance to change is a factor of complexity to cope with, also demanding specific attention and dedicated knowledge. For this purpose, the theories of Design for Behavior Change (DfBC) can offer a valuable contribution.

4. Including design for behavior change in the conceptual toolbox for the design of digital services and systems

Design for Behavior Change (DfBC) is a set of design theories based on the application of behavioral sciences and aimed at supporting the project of solutions requiring a change of attitude, behavior, or mindset in users. According to Niedderer et al. [34], "Design for behavior change is concerned with how design can shape or influence human behavior and sustainable innovation".

While it can be argued that most design work is addressed to have an impact on users, according to Lockton [35], "Systems intentionally designed to influence behavior different from that usually associated with the situation or in situations where a user would not otherwise have a strong idea of what to do (e.g., with an unfamiliar interface), represent a degree of designer intent beyond this".

It is important to point out that DfBC is not aimed at the persuasion of the users; it aims instead to understand what are the factors that prevent people from adopting a certain behavior even when it is associated with obvious individual and collective advantages. Application of DfBC could impact solutions to support health-friendly lifestyles; could empower people to reduce the use of energy and water resources, food waste, and correct waste management; could give a contribution to enabling responsibility toward the common goods and the territory; could promote the adoption of collaborative behaviors; could encourage responsible behaviors in mobility. According to Wendel [36], DfBC assumes that the human mind has limits in attention and willpower and that human activities depend on both conscious and unconscious thinking, with habits and automatism often governing our behaviors while our decision processes are influenced by the context. These assumptions are coherent with the findings of the scientists rewarded with the Nobel prize to the psychologist Daniel Kahneman and the economist Richard H. Thaler.

Figure 2 shows the main obstacles that can hinder people from changing behavior even when they understand the benefits of change.

Other authors instead frame the obstacles to behavior change in terms of physical vs. phycological capabilities, reflective vs. automatic motivation, and physical vs. social opportunities.

Withe et al. [37] produced a review on strategies for shifting consumer behaviors to be more sustainable. Their research includes several factors such as social influence, habits, sense of self, feelings, and cognitions. The authors propose drivers for positive engagement of citizens and consumers that address the importance of operating on symbolic attributes of innovative proposals. They remark the focus on broadening the sense of self associated with the adoption of sustainable lifestyles and preferences; the focus on positive emotions, empathy, and moral elevation as leverages in sustainable change.

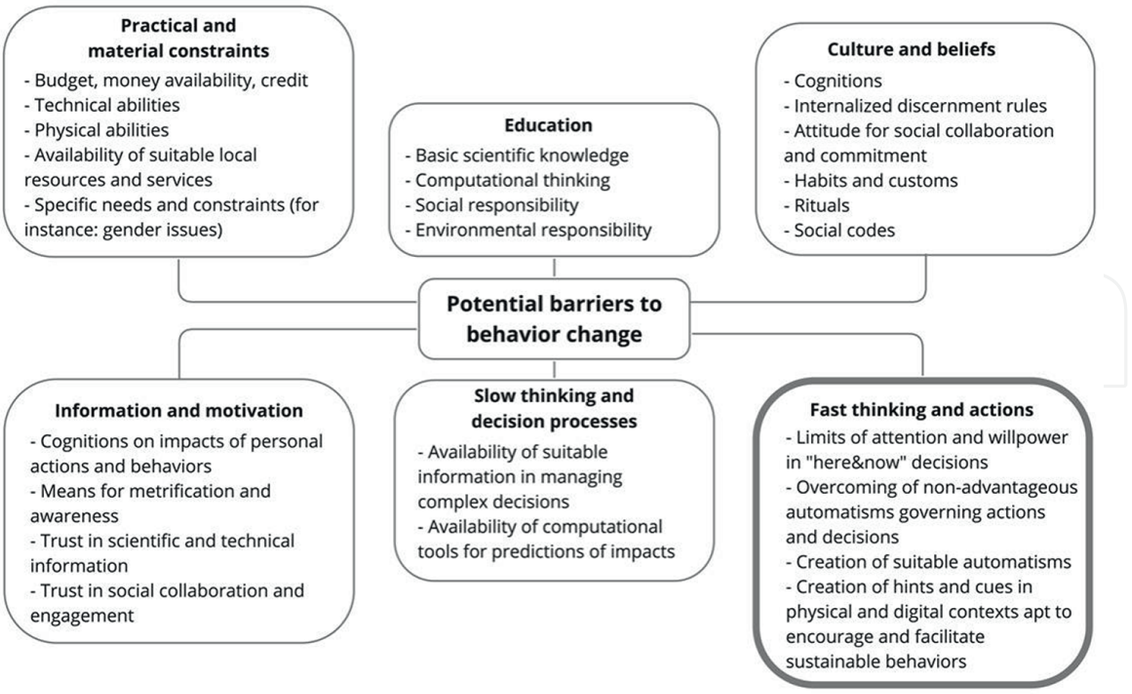

Figure 2.
The several factors that can hamper the availability of citizens for behavior change. The bold frame points the attention to the specific focus of theories for DfBC.

Michie et al. present a systematic review on the effectiveness of different techniques for behavior change in health care [38]. Despite the available data documenting the effectiveness of the techniques evaluated by the authors, the paper points out the opportunities and needs for systematic and comparative studies on the topic that, with the support of data collection and analysis, could provide new paradigms for research in health care.

Altogether, academic literature on DfBC shows its potential as a conceptual aid in the design of services requiring change of behavior and/or mindset in final users and stakeholders.

The DfBC theories can be useful in the design of digital solutions for sustainability? To answer this question, during the academic year 2021-2022, an educational experiment was conducted with the students of the MsC in Digital and Interaction Design at the Design School of Politecnico di Milano within the course of UX Design. The course aims at teaching how to design digital services and applications, and it includes preliminary research on contexts, stakeholders, and users to collect insight and design opportunities. The class counted approximately 60 students from 14 different countries, working in 9 teams. Students attended lectures on the sustainability goals of the 2030 agenda; the lessons on theories and case studies on DfBC introduced students to the difficulties of inducing a change in behavior and provided the conceptual tools to frame the bottlenecks that can prevent it.

Although initially, a few students declared difficulties in understanding the theories of the DfBC, during the course, the teams progressively recognized its value. Behavioral and cognitive sciences provide new models to describe the understanding of the complexity of the information processing and decision-making processes that govern human behavior; the acknowledgment of this knowledge and its implications may require a change of mindset in designers that is not easy to accept at first.

The teams were free to look for design opportunities, scouting for innovative forms to produce digital or digital/physical services; they were asked to conduct preliminary research, devise concepts, and prototype the applications for final assessment with stakeholders and users. The concepts proposed by the students included a service to reduce food waste and a system to encourage the consumption of seasonal food, applications to counter impulsive purchases in the field of clothing, a physical/digital system for education in the conscious use of mobile phones for children, a service for reducing the use of disposable items in the hotel sector, an application for self-control and awareness in interpersonal communication on digital channels.

The results of the course showed that the theories of the DfBC can offer a contribution to university education for the digital services project capable of making students expand their user-centered culture and develop a complexity-aware attitude. According to the students, the discussion on the DfBC theories also stimulated their thinking about the ethical issues in the design of digital services.

5. Exploiting human diversity in the design for sustainable development

The scientific knowledge that describes the general human reluctance toward change can be valuable for the design of effective systems involving people in changes for sustainability.

This topic is twined with another one that should be considered fundamental in university-level training education for the inclusive design of smart services and systems, i.e., the attention to human diversity.

The issue of human diversity has been vastly explored in research and theories of service and interaction design: as stated by D. Evans [39], in service and interaction design, it is important to start from the assumption "that one size doesn't fit all" and that innovation asks for the capability of coping with human differences. Designers can refer to literature from different disciplines investigating human diversity to extract knowledge to design for inclusivity. Examples of this are the research on human disposition and the impacts of age on the relationship with technologies [40, 41]. On the other hand, interaction and service design rely on multiple methodologies for the human-centered design that have been developed for research on users and contexts. Over the last half-century, the methodologies for user-centered design kept on evolving, together with the conception of the role of the final user in the design process: from being the recipient of the project to being a stakeholder in the invention and implementation of services. In a recent paper, Auernhammer et al. [42] reported research outcomes on the evolution of Human Centred Design over the last half-century. The document also presents a map visualizing the various approaches adopted in investigating user needs for the different design purposes and branches: from Ergonomics to the studies on human-computer interaction and design for all. The document enlists the fields of application for the studies on users, ranging from interaction design to universal design and design for inclusion. It also traces the main steps of the evolution: from ergonomics to participatory design and the growing importance of psychological theories.

Despite the wide deployment of methods and approaches for research in users, research in this sector has paid little attention to the specific needs and viewpoints of women. For example, Beebeejaun [43] remarks that gender issues are yet scarcely considered in the academic literature, despite the fact that they should be a pivotal focus in considering social diversity.

Gender equality is the focus of the fifth goal on the UN Agenda, and this specific focus is important and a priority not only for women but for all social communities since, as clearly indicated in the UN Agenda, "Women are not only the hardest hit by this pandemic, they are also the backbone of recovery in communities. Putting women and girls at the center of economies will fundamentally drive better and more sustainable development outcomes for all, support more rapid recovery, and place the world back on the footing to achieve the Sustainability Development goals" [44, 45].

The tasks in the fifth goal focus on the mitigation of gender-based violence, the need for dedicated social protection and economic stimuli, and the importance of inclusion of women and girls in planning and decision-making. Asteria [46] points out that "Smart cities must develop gender sensitivity and awareness about the needs of women by using inclusion mechanisms."

Furthermore, the goal points out the importance of adopting gender perspectives in data and coordination mechanisms that are crucial for the future of smart cities. Special attention should be paid, in fact, to bias in AI algorithms due to uneven availability of data or to gender blindness in data gathering. Bias in data gathering and processing impacts not only women but also on fairness and the capability to manage diversity in the whole society [47, 48].

The adoption of a gender perspective is valuable also in the design or optimization of services and systems dedicated to all citizens regardless of gender, such, for example, in the case of mobility and transport services. The studies on this topic that consider a gender perspective show the specific needs, priorities, and requirements of women. According to Chang [49], the perception of spaces, including affordances and risks, is gender-dependent. The World Development Report 2012 [50] reports specific women's needs related to their activities, their role in their families, and activities as caregivers. Women have specific needs regarding the time schedule, the physical and ergonomic characteristics of the vehicles, and the personal safety of vehicles and stations. In several countries, women have limited access to transportation due to their limited economic power and technical skills and reduced access to ownership of transportation means. Limited access to transportation and mobility has an impact on opportunities for education, work, health care, culture, and leisure. Some countries, such as Sweden and Germany, have developed gender-oriented services and initiatives to mitigate the gap in opportunities for women and facilitate the adhesion to sustainable services [51, 52].

The digression on the issue of mobility and transport is just one of the examples that can be cited to illustrate how considering the point of view of women on a specific service or system leads to the understanding of specific factors that can jeopardize access and acceptability for a large part of the population. The same reasoning could be extended to sectors such as smart working systems, medical care, and others.

In the academic year 2020-2021, during the period of social restrictions due to the pandemic due to Covid-19, an educational experiment was conducted to investigate the potential of adopting a gender point of view within the process. Design for digital services and systems. The experiment was conducted with the students of the MSc in Digital and Interaction Design at the School of Design of the Politecnico di Milano and involved about 60 students who conducted preliminary research and development of innovative digital service concepts. The course was conducted with the participation of the Consulta Femminile Interassociativa di Milano (Consfim, https://www.consultafemminilemi.com) and the local club Soroptimist International Milano alla Scala. Among other activities, these female associations are promoting the debate on smart cities with a gender-focused approach aimed at orienting the

local administration toward inclusive policies for development. Similarly as in the education experiment on DfBC reported in the first part of this document, students were asked to generate concepts of digital services with a double-diamond design approach, freely scouting for design opportunities through research on users and context. However, in this course, students were asked to investigate the specific point of view of women and collect specific design hints related to the diversity of gender. The students expressed great appreciation for this experience, and several reported that the analysis of the perspective of gender enabled a deeper and more articulated understanding of needs and opportunities to create value for the users. The concepts developed by the teams included mobility and transportation (focus on access to sharing-service, safety in public transportation and urban mobility, last-mile mobility), social life for elderly people, mental health, family activities for children's care and education, and the exploitation and care of public spaces. The female association that patronized the experiment expressed high appreciation for the outcomes of preliminary research and concept development; they consider the contents as valuable to inspire and orient the dialog with the local public administration for gender-sensible development policies. Further information can be found in a dedicated paper [53].

6. Conclusions

According to the idea of a smart city, urban centers are conceived as dynamic entities capable of fast evolutions and adaptation far beyond the constraints of physical structures that define the city layout and material configuration. Implementing the new socio-technical systems should give solutions for the challenges of our time if they are framed in the sustainable development goals of the UN Agenda 2030. The digital infrastructures can provide data enabling efficient use of resources and services by offering the means for understanding and answering the diversified needs of citizens. The conjugation of the principles of environmental and social sustainability with the development models of smart cities is fertile. It can offer significant opportunities for innovation and progress to benefit people and the environment. As clearly indicated by the UN documents, the exploitation of this potential asks for large and diversified involvement and engagement of citizens.

This document reports research aimed at developing education at the university level for designing interactive solutions and digital services coherent with the principles of social and environmental sustainability. The research starts from the assumption that the capability to deal with the complexity of social systems and cope with human diversity is a requirement for the design of inclusive and desirable development.

The first section of the document presents the research background; it points out the importance of confronting the innovation paradigms of smart cities with the development goals of the UN Agenda 2030 and of updating the contents for design education considering the outcomes of behavioral sciences that can be useful in the project of inclusive solutions.

Section two refers to the energy transition program as a case study showing the diversified modality in which the citizens can contribute to the implementation of the goals for sustainable development. The third part reports literature references about the complexity of producing changes in behaviors and mindsets.

The deployment of the main theories on design for behavior change is the main content of section four. This knowledge enriches the theoretical and methodological

competencies for designing effective services and physical-digital systems; it provides suitable content for university design education, as demonstrated by a teaching experience performed at the Design School of Politecnico di Milano, also reported in the chapter.

The fifth and last part of the document focuses on gender issues and on the importance of considering women's perspectives in the design of inclusive and effective socio-technical systems. Gender equality is a primary requirement for democracy, and it is a specific goal of the UN Agenda. The chapter points out the value of considering gender issues in the development of general-purpose services, and it reports the case study of transportation as a meaningful example. Academic literature shows that gender-oriented studies are currently very scarce; to ensure inclusive development, it is, therefore, necessary to develop dedicated research. The document reports the results of an educational experiment for service design with a gender perspective, which demonstrate the effectiveness of this theme in university education.

To summarize, this chapter is an act of advocacy for the inclusion of two topics in design education. Cognitive psychology and behavioral sciences provide helpful knowledge for education on inclusive design. The focus on the gender perspective is also presented as a valuable source of inspiration in the development of innovative socio-technical systems. Both topics are complex and require investigations and discussions, but experiments demonstrated their suitability for university education and the cultural growth of young designers.

Future developments of the research will focus on both, with a special focus on how to create motivation and engagement for sustainability.

The document "New threats to human security in the Anthropocene" [54] points out the importance of working for improving the availability of solidarity, agency, and engagement. These goals ask for multidisciplinary research and experimentation and more dialog between the social stakeholders of development.

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Author details

Margherita Pillan
Dipartimento del Design, Politecnico di Milano, Milano, Italia

*Address all correspondence to: margherita.pillan@polimi.it

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References

[1] Angelidou M. Smart cities: A conjuncture of four forces. Cities. 2015. ISSN 0264-2751;**47**:95-106. DOI: 10.1016/j.cities.2015.05.004

[2] Gropius W. Letter to Thomas Maldonado. Ulm, Zetschrift der Hochschule für Gestlatung. N.10-11, 1964 in Fiedler J Bauhaus 2006 Tandem Verlag GmbH. Giabudo/Könemann Editor

[3] Manzini E. Design, When Everybody Designs. An Introduction to Design for Social Innovation. Cambridge, Massachusetts: The MIT Press; 2015

[4] Yigitcanlar T, Md K, Buys L, Ioppolo G, Sabatini-Marques J, Moreira da Costa E, et al. Understanding 'smart cities': Intertwining development drivers with desired outcomes in a multidimensional framework. Cities. 2018, ISSN 0264-2751;**81**:1-16. DOI: 10.1016/j.cities.2018.04.003

[5] Mora L, Deakin M. Chapter 1 - Moving beyond the Smart City Utopia. Untangling Smart Cities. Elsevier; 2019. pp. 1-17, ISBN 9780128154779. DOI: 10.1016/B978-0-12-815477-9.00001-3

[6] Yigitcanlar T, Kankanamge N, Vella K. How Are SmartCity Concepts and Technologies Perceived and Utilized? A Systematic Geo-Twitter Analysis of Smart Cities in Australia. Journal of Urban Technology; 2020;**28**(1-2):135-154. DOI: 10.1080/10630732.2020.1753483

[7] Arroub A, Zahi B, Sabir E, Sadik M. A literature review on smart cities: Paradigms, opportunities and open problems. Proc. International Conference on Wireless Networks and Mobile Communications (WINCOM); 2016. p. 180-186. DOI: 10.1109/WINCOM.2016. 7777211

[8] Camero A, Alba E. Smart City and information technology: A review. Cities. 2019, ISSN 0264-2751;**93**:84-94. DOI: 10.1016/j.cities.2019.04.014

[9] Trindade EP, Hinnig MPF, da Costa EM, et al. Sustainable development of smart cities: A systematic review of the literature. Journal of Open Innovation. 2017;**3**:11. DOI: 10.1186/s40852-017-0063-2

[10] Lee J, Babcock J, Pham TS, Kang M. Smart city as a social transition towards inclusive development through technology: A tale of four smart cities. Internationl Journal of Urban Sciences. 2020. p. 1-27. DOI: 10.1080/12265934.2022.2074076

[11] Ahvenniemi H, Huovila A, Pinto-Seppä I, Airaksinen M. What are the differences between sustainable and smart cities? Cities. 2017 ISSN 0264-2751;**60**(Part A):234-245. DOI: 10.1016/j.cities.2016.09.009

[12] United Nation Conference on Trade and Development. Technology and Innovation Report 2018. Switzerland: United Nations Publication; 2018 UNCTAD/TIR/2018. ISBN 978-92-1-112925-0 e-ISBN 978-92-1-363310-6

[13] Mazza P. Education & Smart Cities: The role of the goals of agenda 2030 for sustainable development of smart cities. International Journal of Innovative Studies in Sociology and Humanities. Open Access. 2021;**6**(2):24-31. DOI: 10.20431/2456-4931.0602003

[14] Alcantud-Díaz M. Research, Teaching and Actions in Higher Education on the UN Sustainable Development Goals. Cambridge, UK: Cambridge Scholar Publishing; 2021

[15] Fia M, Ghasemzadeh K, Paletta A. How Higher Education Institutions Walk Their Talk on the 2030 Agenda: A Systematic Literature Review. High Educ Policy; Journal of Higher Education Policy. Springer. 2022. DOI: 10.1057/s41307-022-00277-x

[16] Zaleniene I, Pereira P. Higher education for sustainability: A global perspective. Journal of Geography and Sustainability. Vol. 2. p 99-1062021. DOI: 10.1016/j.geosus.2021.05.001

[17] Pavlovic M, Bier H, Pillan M. Ambient UX for cyber-physical spaces. Actuated and performative architecture emerging forms of human-machine interaction. SPOOL. 2020;**7**(8):27-36. DOI: 10.7480/spool.2020.3

[18] Helbing D, Fanitabasi F, Giannotti F, et al. Ethics of smart cities: Towards value-sensitive design and Co-Evolving City life. Sustainability. 2021;**13**(20):1-25. DOI: 10.3390/su132011162

[19] Benion D. Designing User Experience. London, England: Pearson Education Limited; 2019

[20] Stickdorn M, Schneider J. This Is Service Design Thinking. Amsterdam, The Nederlands: John Wiley & Sons; 2011

[21] Cooper A, Reimann R. About Face 2.0: The Essentials of Interaction Design. Amsterdam, The Nederlands: John Wiley & Sons; 2003 ISBN 0764526413

[22] Radziejowska A, Sobotka B. Analysis of the social aspect of smart cities development for the example of smart sustainable buildings. Energies. 2021;**14**:4330. DOI: 10.3390/en14144330

[23] Cathelat B et al. Smart - Cities Shaping the Society of 2030. United Nations Educational, Scientific and Cultural Organization (UNESCO); 2019

[24] Thinyane M. Engaging Citizens for Sustainable Development. Macau, China: A Data Perspective. Unu-cs; 2018

[25] United Nations General Assembly. Resolution Adopted by the General Assembly on 25 September 2015. Distr.: General; 2015

[26] Wahlund M, Palm J. The role of energy democracy and energy citizenship for participatory energy transitions: A comprehensive review. Energy Research & Social Science. 2022, ISSN 2214-6296;**87**:1-19. DOI: 10.1016/j.erss.2021.102482

[27] UN Sustainable development goals, Goal 7. https://www.un.org/sustainabledevelopment/energy/

[28] UN Sustainable development goals, Goal 7. Ensure Access to Affordable, Reliable, Sustainable and Modern Energy for All. https://unstats.un.org/sdgs/report/2017/goal-07/

[29] Linnér BO, Wibek V. Sustainability Transformation – Agents and Drives across Societies. Earth System Governance. Sweden: Cambridge University Press; 2019

[30] Gesiarz F, Cahill D. Sharot T evidence accumulation is biased by motivation: A computational account. PLoS Computational Biology. 2019;**15**(6):e1007089. DOI: 10.1371/journal.pcbi.1007089

[31] Kappes A, Harvey LAH, et al. Confirmation bias in the utilization of others' opinion strength. Nature Neuroscience. 2020;**23**:130-137. DOI: 10.1038/s41593-019-0549-2

[32] Sharot T, Sunstein CR. How people decide what they want to know. Nature Human Behaviour. 2020;**4**:1-6. DOI: 10.1038/s41562-019-0793-1

[33] West R, Michie SA. Brief introduction to the COM-B model of behavior and the PRIME theory of motivation. Qeios Journal2020. p. 1-6. DOI: 10.32388/WW04E6.2

[34] Niedderer K et al. Design for Behaviour Change as a Driver for Sustainable Innovation: Challenges and Opportunities for Implementation in the Private and Public Sectors. International Journal of Design. 2016;**10**(2):67-85

[35] Lockton D, Harrison DJ, Stanton NA. The design with intent method: A design tool for influencing user behaviour. Applied Ergonomics. 2010;**41**(3):382-393. DOI: 10.1016/j.apergo.2009.09.001

[36] Wendel S. Designing for Behavior Change. US: O'Reilly Media Inc; 2013 ISBN: 9781449367626

[37] White K, Habib R, Hardisty DJ. How to SHIFT consumer behaviors to be more sustainable: A literature review and guiding framework. Journal of Marketing. 2019;**83**(3):22-49. DOI: 10.1177/0022242919825649

[38] Atkins L, Michie S. Designing interventions to change eating behaviours. Proceedings of the Nutrition Society. 2015;**74**(2):164-170. DOI: 10.1017/S0029665115000075

[39] Evans D. Bottlenecks: Aligning UX Design with User Psychology. New York, US: Apress; 2017. DOI: 10.1007/978-1-4842-2580-6 ISBN: 978-1-4842-2579-0

[40] McCrae RR, Costa RR Jr. A five-factor theory of personality. Handbook of personality. Theory and Research. 1999;**2**:139-143. Guilford

[41] Fleming A, Mason C, Paxton G. Discourses of technology, ageing and participation. Palgrave Communication. 2018;**4**:54. DOI: 10.1057/s41599-018-0107-7

[42] Auernhammer J, Zallio M, Domingo L, Leifer LJ. Facets of human-centered design: The evolution of designing by, with, and for Peoplo. Preprint. 2022 https://www.researchgate.net/publication/355796639

[43] Beebeejaun Y. Gender, urban space, and the right to everyday life. Journal of Urban Affairs. 2017;**39**:3. DOI: 10.1080/07352166.2016.1255526

[44] https://www.un.org/sustainabledevelopment/gender-equality/

[45] Global Gender Gap Report. World Economic Forum. Geneva, Switzerland: Published World Economic Forum, Cologny; 2020;**2019**. ISBN-13: 978-2-940631-03-2

[46] Asteria D, Jap JJK, Utari D. A gender-responsive approach: Social innovation for the sustainable Smart City in Indonesia and beyond. Journal of International Women's Studies. 2017;**21**(6):193-207. Available from: https://vc.bridgew.edu/jiws/vol21/iss6/12

[47] Nadeem A, Abedin B, Marjanovic O. Gender bias in AI: A review of contributing factors and mitigating strategies. ACIS 2020 Proceedings. 2020;**27**:259-270. Available from: https://aisel.aisnet.org/acis2020/27

[48] Leavy S. Gender bias in artificial intelligence: The need for diversity and gender theory in machine learning. Proceedings of theIEEE/ACM 1st International Workshop on Gender Equality in Software Engineering, Gothentburg Sweden. New York, US: Conference Publishing Services; 2018. p. 14-16. ISBN: 978-1-4503-5738-8

[49] Chang J, Choi J, An H, Chung H. Gendering the smart city: A case study of Sejong City, Korea. Cities. 2022, ISSN 0264-2751;**120**:1-11. DOI: 10.1016/j.cities.2021.103422

[50] World Bank. World Development Report 2012: Gender Equality and Development. 2012 https://openknowledge.worldbank.org/handle/10986/4391

[51] https://womenmobilize.org/

[52] Swedish Government Official Reports. Gender Equality in Public Services. A Book of Ideas for Managers and Strategists from the Swedish Gender. Sweden: Mainstreaming Support Committee; 2007

[53] Pillan M, Marzola M. Experimenting the Role of UX Design in the Definition of Gender-Sensitive Service Design Policies. Bilbao: DRS2022; 2022. DOI: 10.21606/drs.2022.495

[54] United Nations Development Programme. New Threats to Human Security in the Anthropocene Demanding Greater Solidarity. New York, USA: Published by the United Nations Dev Progr; 2022

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