

Review

Conceptualizing an Informational Paradigm in the Pursuit of Sustainable Cities and Communities

Ilonette Abdeh Tabar ^{1,2} and Elizelle Juaneé Cilliers ^{1,3,*}

¹ School of Built Environment, Faculty of Design Architecture and Building, University of Technology Sydney, Ultimo, NSW 2007, Australia; ilonette.abdo@yahoo.com (I.A.)

² Faculty of Architecture, Department of Architecture, Yasar University, University Road, No. 37-39, 35100 Izmir, Turkey

³ Unit for Environmental Sciences and Management, North-West University, Potchefstroom 2531, South Africa

* Corresponding author. E-mail: jua.cilliers@uts.edu.au (E.J.C.)

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ABSTRACT: This study seeks to conceptualize ‘Informational Sustainability’ by examining the dynamic relationship between Sustainable Development and the Information and Communication Technologies (ICT) Revolution through the exploration of two prominent urban theories—Lefebvre’s ‘Right to the City’ and Castells’ ‘Rise of the Network Society’—to underscore the importance of knowledge integration in the development of informed, sustainable communities. Conducting a cross-country comparison between developed and developing nations, the study underscores the critical role of informational transformation in enabling resource efficiency, knowledge sharing, innovation, and informed decision-making—key for achieving Sustainable Development Goals (SDGs), while also highlighting potential risks associated with resisting ICT adoption, including hindered growth, increased inequalities, and reduced social engagement and environmental stewardship. The core focus of this conceptual framework is to validate the precursor role of ICT in building sustainable cities and communities by identifying synergies in Sustainable Development, defining dimensions for effective ICT application within the dynamic interplay of global and local levels, and identifying implementation gaps and necessary presumptions for its effective use.

Keywords: Citizen empowerment; Information and communication technology (ICT); Information society; Right to the city; Right to information; Sustainable cities and communities (SDG 11); Sustainable information society (SIS)



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1. Introduction

The emerging information revolution and quest towards Sustainable Development are two prominent visions of the 21st century, which have gained significant attention due to the increasing influence of the ‘Network Society’ and the pressing global environmental challenges [1,2]. The recent revolution, embodied by ICT, has brought forth a myriad of transformations in urban contexts. These transformations encompass the globalization of the economy and technology, the decentralization of traditional national power structures to a dynamic interplay between global and local levels, the dematerialization of consumption patterns, and a notable shift towards information and knowledge-based services [3–6]. Together, these dynamics contribute to the intricate process of societal deindustrialization, reshaping the fabric of contemporary societies [7,8].

Adding to the growing process of urbanization, cities not only face challenges of environmental degradation and exploitation, but they also serve as melting pots of diverse ethnicities and cultures, representing the social diversity and normative heterogeneity of societies [5,9,10]. While the industrial age was characterized by discussions centered around technological determinism, standardization, and decontextualized thinking, the recent information revolution signifies a paradigm shift towards addressing the public’s yearning for recognition of their values. This transformation is exemplified by key concepts such as Sustainable Development, the global economy, the Information Society, the Right to the City, and democracy, with sustainability serving as the foundational principle guiding all development strategies [3,5,6].

Urban studies has witnessed a transition from structuralism to subjectivism, facilitating a broader comprehension of urban dynamics [7]. Likewise, Sustainable Development has expanded beyond its ecological focus to encompass economic, political, cultural, and social dimensions [3]. However, the very definition of contemporary cities is questionable, let alone

the task of integrating the diverse goals of Sustainable Development into city planning. The reduction of the concept of the “Urban Area” to a mere geographical entity, disregarding its role as a sociopolitical order and material support for the communication system it accommodates, results in the creation of meaningless space and unstructured relationships [4,10,11]. This, in turn, contributes to the collapse of the public sector due to a lack of coordination, authority, and a sense of public responsibility [2]. As a result, planning itself becomes the ultimate objective, rather than a means to achieve coherence and comprehensive sustainable management, perpetuating the fragmented nature of urban development [5]. The whirlwind of social and spatial transformation brought about by the emergence of ICT has further led to a perceived detachment of traditional urban planning from theory, rendering it obsolete, as we inhabit cities that are globally connected yet locally disconnected [3,7,9,10,12–14].

The nation, being too large to effectively manage daily life and too small to control global flows of wealth, power, and information [5], has raised questions about the current universal trend of Sustainable Development as a unified approach to global environmental issues [14]. Castells accurately characterizes this transformation as the emergence of localities that require the integration of various aspects (economic, technological, political, cultural, and social) within specific territories and communities [5,15]. This includes embracing local cultural diversity and advocating for the interests of citizens, thereby challenging conventional urban planning approaches [9,10,12]. In the Information Era, urban adaptation re-emerges, differing from the Industrial Revolution. Unlike the Industrial era, which aimed to assimilate sub-cultures into a unified urban culture with structured segmentation, the Information Era, driven by ICT’s communicative turn, presents an identity challenge. It underscores the necessity of embracing diversities, resulting in the creation of numerous cultural subsets and laying the foundation for a “culture of communication within an irreversibly diverse local community” [16–18].

City living, a vibrant tapestry woven with diverse threads of individuals from various backgrounds, ideologies, socio-economic, and political affiliations, inherently fosters a collective approach—whether conscious or unconscious—aimed at forging and perpetuating social relationships, thereby contributing to social capital [9,19]. These relationships can be utilized in the short or long term, impacting connections within the community such as neighborhoods, workplaces, and kinship, while also fostering environmental stewardship. Embracing diverse social norms within the collective whole builds a sense of trustworthiness and enduring obligations, subjectively felt and collectively rationalized [19]. This cultural projection within spatial formation has been a longstanding frontier in the planning profession, where planners initially served as facilitators of public views, integrating community voices into planning procedures through public participation, thereby forming the foundation for strengthening social capital. The Internet, propelled by Information and Communication Technology (ICT), emerges as a catalyst for change by facilitating planners’ engagement in addressing the public’s overall esteem needs and enabling the decoding of the encoded meaning of space as experienced and manifested in the online social structure [5,6,12,19,20]. This virtual representation of the social meaning, values, and lived experiences of the public serves as a valuable tool for planning sustainable approaches aligned with the public’s overall needs, embracing individualization while responding to the changing power dynamics that once dominated city planning [5].

Moving towards drastic changes, specifically towards achieving a sustainable future that entails significant transformations in consumption patterns, energy and transportation policies, community design, and international relations, necessitates a substantial enhancement in the intensity and quality of human communication [15]. Effective communication is crucial for initiating large-scale transformations necessary for sustainability. Acknowledging the transformative impact of Information and Communication Technology (ICT) on the mode of production, it is imperative to recognize the implications of changes in technology, communication, and information systems on reshaping social relations and spatial configurations. This recognition extends to understanding that when the form of communication undergoes significant changes, influencing the mode of production in a society, there should be a corresponding adaptation in the production of space [21]. In the contemporary pursuit of building sustainable communities, the restoration of urban culture emerges as a pivotal challenge. City and regional planning is now more crucial than ever in addressing global challenges, especially within the Information Age, where the transformative impact of Information and Communication Technology (ICT) is recognized as a significant driver for substantial social transformation, leading to the emergence of the Network Society [4]. Local and regional governments are increasingly acknowledging the necessity to navigate complex dynamics, foster connections with diverse constituencies, and engage in collaborative efforts to address the transformative impact of Information and Communication Technology (ICT) for Sustainable Development [5]. This entails active and responsible individual participation, the establishment of multisectoral partnerships, and the implementation of strategies that consider community diversity [22]. Leveraging information technology tools strategically is crucial for improving decision-making, realizing the full potential of informatization, and enhancing sustainable urban development by mitigating geographical and operational distances among stakeholders, planners, and the public [15].

The transformation in production dynamics during the Information Era, coupled with the rise of the Network Society, rejuvenates the struggle for the Right to the City in the age of ICT. This multifaceted endeavor involves technological empowerment, civic participation, and the preservation of urban identity, occurring in a crucial phase of urbanization marked by the city's increased reproduction through digital information [11]. The influence of digital information in urbanization leads to the emergence of a virtual realm of values (space of flows) alongside the tangible aspects of the real city (space of places) [4,6,9,11,12,14,20]. Leveraging social networks enables citizens to assert their Right to the City, fostering a harmonious integration of functional urban aspects with profound social meanings [5–7,10,12,19,22]. However, neglecting this potential exacerbates the division between the urban-scape and human-scape, leading to a conflict between external tasks and internal experiences [5,9,23]. The tension between the space of flows and the space of places exacerbates the separation of function and meaning, leading to a “distortion or disjunction” [21] noted by Lefebvre and acknowledged by Castells as “structural schizophrenia” [4]. This division between the real city (space of places) and the virtual city (space of flows) may result in living in parallel universes within an incompatible social hyperspace, posing a threat to crucial communication channels necessary for large-scale transformations toward more sustainable urban living [4,7,15,21]. Deliberate efforts are required to construct bridges between these spatial logics, recognizing their superimposed nature and mutually complementary relation.

Through an integrative study of ICT and SD, this research aims to explore the relevance of two foundational urban theories: Lefebvre's ‘Right to the City’ and Castells' concept of the Information Society (referred to as the ‘Right to Information’ in this study) in light of current paradoxical spatial realities arising from the emergence of ICT and representational platforms. This dual spatial existence is perceived as an opportunity to rectify the identified implementation gap in Sustainable Development, arising from social disparities in SD approaches. This highlights the essential synergy between ICT and SD in constructing sustainable communities, addressing spatial dualities, and utilizing representational platforms for social implication assessment to tackle disparities. To scrutinize the interdependence of SD and ICT, the study undertakes a concise comparative review of sustainable approaches in both developed and developing countries. This review aims to identify synergies in Sustainable Development, establish dimensions for effective ICT application within the dynamic interplay of global and local levels, and discern implementation gaps and necessary presumptions for its effective use. The overarching goal is to validate the precursor role of ICT in achieving inclusive Sustainable Development.

2. Methodological Approach

This study aims to conceptualize a framework in which ICT is considered a foundational element for inclusive, resilient Sustainable Development, serving as the precursor to sustainable initiatives in the wake of the information revolution. To elucidate the proposed sequential dependency framework in this study, the methodological approach, termed ‘Theoretical-Comparative Integration,’ is organized into distinct stages, following a sequential hierarchical order. The initial stage centers on defining issues and objectives related to the integration of Information and Communication Technology (ICT) for Sustainable Development (SD). This is succeeded by a theoretical examination of two prominent urban theories: Henri Lefebvre's “Right to the City” [21], identified as a solution for addressing social disparities within SD approaches, and Manuel Castells' “Rise of Network Society” [4], recognized as a promising avenue for proposing novel participatory methods towards achieving inclusive, sustainable cities and communities. These theoretical frameworks function as a structured lens for analyzing and interpreting data, emphasizing the relevance of these prominent urban theories in guiding the research to address current urban issues and understand relationships, patterns, or phenomena within the integration of SD and ICT. Furthermore, to validate this sequential dependency framework and specify integration requirements, a comparative study between developed and developing nations is undertaken. This analysis serves as a crucial step to theoretically identify dimensions for incorporating ICT in SD, elucidate necessities for its effective implementation, and ultimately substantiate the precursor role of ICT in achieving inclusive Sustainable Development. In this regard, the main questions to be answered within the research would be: How does the integration of Information and Communication Technology (ICT) and the shift toward an information-based society impact the development of sustainable communities? Additionally, what factors contribute to the successful integration of ICT and Sustainable Development (SD) in diverse contexts?

Addressing these questions is a crucial step in validating the sequential hierarchy of the study's conceptual framework. The established structure depicts Sustainable Development (SD) requiring the “Right to the City,” which, in turn, necessitates the “Right to Information.” This inquiry aims to validate the imperative role of information integration in sustainable community development. The hierarchical interdependence, symbolized by the relationship $SD < \text{Right to the City} < \text{Right to Information}$, is visually represented in the following illustration (Figure 1).

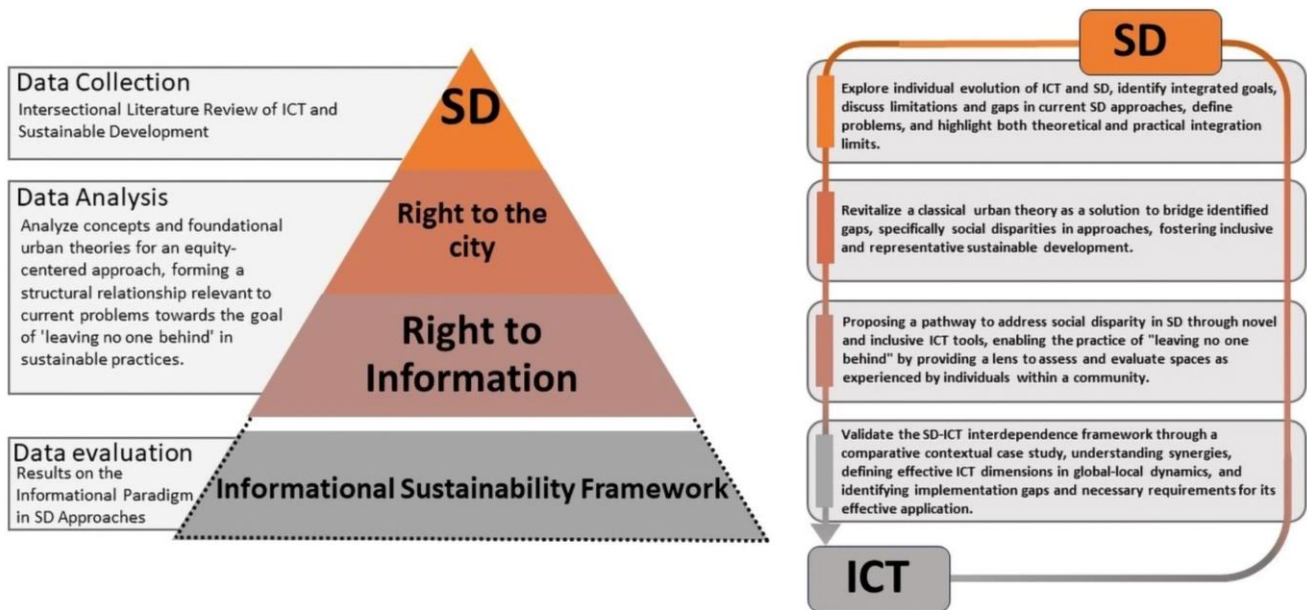


Figure 1. Visualizing Informational Sustainability: A Framework for the Hierarchical Interdependence of Sustainable Development, Right to the City, and Right to Information. Source: Authors.

The methodological approach of the study is being systematically broken down into three distinct phases, aligning with the established conceptual framework, to furnish a comprehensive understanding of the interconnections between these concepts.

2.1. Literature Review: Mapping Gaps and Framing ‘Informational Sustainability’ Framework

This section represents the top layer within the conceptual hierarchical order, with Sustainable Development (SD) as the central focus of discussion. Utilizing the data collection method, a comprehensive examination commences, involving a critical analysis of the evolutionary progression, theoretical gaps, and practical constraints within both SD and Information and Communication Technology (ICT), both individually and in their integrated form. This is achieved through an in-depth review of literature and theoretical frameworks. The primary objective is to identify shortcomings in prevailing approaches to SD, thereby contributing to a comprehensive understanding of the subject matter.

2.2. Connecting Threads: Bridging Gaps with the ‘Right to the City’

This section constitutes the intermediate layer within the sequential conceptual order, focusing on addressing identified gaps in Sustainable Development (SD) and ICT integration and outlining the necessary requirements for their mutual development through an analysis of the Right to the City concept. Reviving a foundational urban theory for contemporary challenges, the study emphasizes its role in recognizing the replication of social inequities in Sustainable Development approaches. The inquiry underscores the significance of multi-dimensional or community-defined measures, emphasizing their crucial contribution to advancing the socio-spatial agency of communities and achieving equitable urban development. The topic of ICT integration gains attention in this context as an inclusive communicative turn that enables the integration or recognition of the lacking social dimension within SD; recognizing that environmental targets call for a supportive social fabric, therefore necessitate the issues of environmental problems and social inclusion to be addressed as overlapping issues in SD and ICT.

2.3. Novel Solutions: The ‘Right to Information’ Paradigm

This section constitutes the second layer of analysis, expanding on the ‘Right to the City’ concept by integrating Castells’ contemporary urban theory, “Rise of the Network Society” [4]. The resurgence of this right is associated with escalating tensions between physical cities and social networks, emphasizing spatial exclusion. The communicative turn redefines inclusion, with ICT playing a pivotal role in bridging physical and virtual spaces and facilitating social implication assessment. The section explores the novel concept of the ‘Right to Information,’ examining how ‘Informationalization’ facilitates the practice of the “Right to the City” [21]. This nuanced perspective adds a third dimension to inclusive sustainable initiatives, offering a framework for innovative participatory methods. It positions the ‘Right to Information’ as a foundational layer in integrating ICT for Sustainable Development (SD), aiming to promote inclusive and equity-centered Sustainable Development, thereby highlighting the interdependencies between SD and ICT.

As the importance of inclusion grows in the context of sustainable cities and communities, attention is drawn to the paradox that equal treatment can lead to unequal outcomes, resulting in unintended disparities or inequalities. This study questions the prevailing holistic unified approach to achieving inclusive Sustainable Development (SD) in the current communicative era. The research advocates for a shift from a strictly global perspective on Sustainable Development Goals (SDGs) to a more localized approach, emphasizing a global framework that facilitates the implementation of locally tailored goals. To scrutinize the universal approach of Sustainable Development (SD), the study incorporates a comparative review of ICT integration in sustainable practices across developed and developing countries in the results section, revealing disparities and parallels. This analysis is aimed at validating the conceptual framework, constituting the data evaluation phase. Drawing from articles and digital archival research, the study delves into the nuanced complexities of ICT integration in diverse contexts, shedding light on the intricacies that contribute to the disparities observed. The aim is to understand synergies in Sustainable Development, defining dimensions for effective ICT application within the dynamic interplay of global and local levels, and identifying implementation gaps and necessary presumptions for its effective use. By recognizing ICT as a pivotal point of reference and a foundational element—a cradle for approaching inclusive Sustainable Development in urban planning—this study emphasizes its transformative capacity, validating its precedence in pursuing an inclusive and representative approach to Sustainable Development. The research underscores the profound significance of ICT, the Right to the City, and the Right to Information in the construction of sustainable societies. The methodological approach in structuring the stages of this study is aligned with the conceptual framework rather than adhering to traditional data collection, data analysis, and data evaluation divisions. This intentional alignment reflects the study's primary aim of validating a conceptual framework, where the data evaluation is considered a conclusive outcome, intricately woven within the hierarchical order established by the conceptual framework, rather than being treated as a separate stage within the methodological approach.

3. Conceptualizing Informational Sustainability: SD < Right to the City < Right to Information

3.1. Literature Review: Mapping Gaps and Framing 'Informational Sustainability' Framework

At the turn of the decade, two significant late 20th-century mega-trends, Sustainable Development and the Information Society, have gained prominence, particularly in advanced nations [15]. Originally, Sustainable Development emerged as an environmental concern for “intergenerational solidarity” [2], aiming to ensure an equitable quality of life for both present and future generations [24]. Later, it was leveraged through strategic commercial marketing for green-trending technological ad-hoc wired to conventional approaches. This phenomenon, termed ‘false sustainability’ by Pallasmaa [25], involves economically benefiting from greenwashing unsustainable approaches by labeling them as green, since what is considered economically advantageous is often filtered through the lens of ecological sustainability [2,6]. Consequently, sustainability has evolved into a branding method, promoting investments in consumerism. Yet, the realization of the social dimensions of Sustainable Development is a recent concern, grown by the awareness that current approaches in sustainability tend to create a conservative community, while excluding the community in the first place [26–30]. The key challenge in Sustainable Development (SD) is finding a balance among its components [31]. Despite advancements in researching technical aspects of sustainable applications, there's been a disproportionate focus on economic [25] and environmental aspects [32] over the social dimension [26,33–35]. The advancement in understanding the role of social attributes in environmental applications is notable [26–28,30], yet the development of sustainable communities rooted in the integration of social theories into practical applications remains insufficiently explored. This gap may be attributed to the inherent challenge of relying on incalculable values dictated by the normative nature of social indicators, complicating their implication and assessment [36–38]. This limitation results in prevalent environmental solutions favoring a universal approach, lacking nuanced socially informed interpretations in their configuration [26]. On the other hand, as the evolution of ICT progressed, with informational augmentation becoming the dominant function in the globalized information-intensive economy, the communicative turn also initiated changes fostering the grassroots of democracy, promoting social emancipation, and empowering communities [4–6,11,14,39–41]. Its integration into environmental concerns has not gone unnoticed, given its capability to generate reliable and indisputable information for monitoring practices through its information storage capacity, resulting in significant improvements in environmental governance [13,17,40,42].

Sustainable Development has broadened its scope to incorporate social aspects into its comprehensive vision for the future [15,17]. Simultaneously, ICT's role in environmental governance has evolved, extending beyond assessing environmental conditions to include social factors [40,41]. This transition is crucial in our contemporary ‘hybrid society’ and prompts a reevaluation of the role of knowledge and information in addressing complex environmental and social

challenges [4,16,40,43]. The impacts of both forces, ICT and SD, have become evident on the economy, ecology, and society, yet their intersection remains relatively unexplored, with information technology developers focusing more on sustainability—encompassing ecological, cultural, and social aspects—than environmental actors emphasizing the significance of integrating information technologies to advance Sustainable Development Goals [3,9,15,42,43].

The United Nations (UN) initially enacted the Millennium Development Goals (MDGs) in 2000 to target socio-economic development challenges primarily in developing countries [44]. As the MDGs' target year neared, it became evident that progress had been made, yet substantial disparities persisted, highlighting the need for a more comprehensive approach to address the interconnected nature of global development challenges [17]. This resulted in the adoption of the 2030 Agenda for Sustainable Development in 2015, comprising 17 goals that encompass a broader scope, addressing social, economic, and environmental dimensions to tackle global challenges such as environmental sustainability, inequality, climate change, peace, and justice in both developed and developing countries [45]. Critics voice concerns about the accountability of the SDGs, highlighting conflicts between economic development and environmental preservation, along with perceived issues of outdatedness [46]. Political shifts over time have profoundly reshaped the sustainability concept, and the confluence of these changes with economic transformations has paved the way for a digital transformation, fundamentally reshaping our perception of equity. This is particularly relevant given the diverse nature of urban structures and the evolving dynamics of traditional gender identities. These considerations cast doubt on how the SDGs intend to achieve inclusive and equitable treatment and transform our lives without adequately addressing the realities of our transformed world [46–48].

The SDGs aim to transcend the “developing” versus “developed” dichotomy through a comprehensive approach but face challenges as a one-size-fits-all model may lead to unequal treatment, neglecting societal differences [46–48]. Scholars and policymakers stress the impracticality of centralization in development and advocate for localized governance tailored to unique societal dynamics to enhance transparency, accountability, and ensure inclusive distribution of resources and services [48]. Historically, development dynamics for categorizing countries' development levels considered various factors.

1. Vertical Inequalities; Disparities in well-being among income groups, classified by the World Bank as low-middle income (LMI), upper-middle income (UMI), and high income.
2. Horizontal Inequalities; Social discrimination based on group characteristics like gender, race, ethnicity, disability, or legal and migration status.
3. Intersecting Inequalities; A combination of both vertical and horizontal inequalities that escalate various social, economic, and demographic disparities, compounding each other, creating barriers to development and resulting in persistent inequalities among various societal groups.
4. Spatial Inequalities; Variations in development linked to location-specific traits, such as remoteness, high population density, or inadequate municipal infrastructure. These disparities signify territorial exclusion and frequently align with the aforementioned intersecting inequalities. Such communities are often overlooked in national statistical systems, comprising socially deprived individuals in impoverished areas, including slums and informal settlements, persistently marginalized [47–49].

In developing nations with low income, high urbanization, and population growth, limited resources hinder urban integration, sustainable production, and climate protections, leading to persistent inequalities. Weak community organization in marginal areas exacerbates vulnerability to poverty and environmental challenges [48–50], while centralized power obstructs social equity efforts. Despite recognizing the importance of empowering local communities, developing countries often prioritize centralization, impeding effective localization of Sustainable Development Goals (SDGs) [9,47,48,50]. Critics argue that the SDGs, designed with a focus on high-income nations, neglect diverse governance systems in developing countries [47,49] and overlook contextual disparities in less developed regions [46–48,51]. The urban challenges in developing nations, characterized by a preference for material goods and traditional production methods, impede environmental sustainability [1,52]. This discussion introduces a fifth factor influencing development patterns and disparities across diverse contexts:

5. Technological readiness; This term denotes a country's reliance on an informational mode of production across various aspects of urban life, including the economy, environmental governance, and social services [6]. It entails a country's level of adopting an informational mode of production, providing the basis for localizing Sustainable Development Goals through investments in social capital [47–49].

The United Nations Broadband Commission for Sustainable Development has emphasized the pivotal role of Information and Communication Technologies (ICT) in promoting Sustainable Development, citing ICT as a catalyst

that can accelerate progress toward the SDGs and create knowledge societies [17]. Although the SDGs indirectly reference ICT's role in development, explicit references are notably absent within the SDGs themselves [53] (Table 1). The integration issue in achieving the Sustainable Development Goals (SDGs) is not only related to the incorporation of ICT but also stems from inherent challenges within the SDGs themselves. The extensive scope of global social, environmental, and economic objectives in the SDGs creates complexity, with critics noting the difficulty in achieving all targets due to their interdependencies, leading to potential trade-offs and unintended consequences [52,54].

Table 1. Comparing United Nations and International Telecommunication Union approaches to ICT in achieving SDGs, based on information from [55,56].

SDGs	UN's ICT Approach for SDGs	ITU's ICT Approach to SDGs
SDG1 No poverty		Support financial inclusion through mobile banking, digital payments, and access to financial services for the unbanked
SDG2 Zero hunger		Enhance agricultural productivity, provide real-time market information to farmers, and improve food distribution systems
SDG3 Good health and well-being	Improve healthcare access and delivery, particularly in remote areas through Telemedicine and health information systems	Improve healthcare access and outcomes through Telemedicine, health monitoring apps, and electronic health records
SDG4 Quality education	Improve access to education and enhance the quality of learning through online courses, digital resources, and e-learning platforms	Enhancing education access via e-Learning, online resources, and educational apps
SDG5 Gender equality	Empower women and girls by providing access to information, education, and economic opportunities	Facilitate gender-related data collection, online empowerment programs, and digital literacy initiatives
SDG6 Clean water and sanitation		Facilitating water quality monitoring, efficient resource management, and enhanced safe drinking water access
SDG7 Affordable and clean energy	Optimize energy distribution and consumption through smart grids and monitoring systems	Promoting clean, affordable energy with smart grids and renewable technologies
SDG8 Decent work and economic growth		Generating employment opportunities and fueling economic growth through ICT-driven enterprises, digital entrepreneurship, and e-commerce
SDG9 Industry, innovation, and infrastructure	Building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation	Cultivating an entrepreneurial culture through innovation and infrastructure development
SDG10 Reduced inequality		Provide access to information and resources for marginalized communities and promote social inclusion
SDG11 Sustainable cities and communities	Enhance urban planning, reduce resource consumption, and improve the overall quality of life in cities	Foster social participation through online platforms, citizen engagement apps, and smart city solutions
SDG12 Responsible consumption and production		Enhancing supply chain transparency, minimizing waste, and advocating for sustainable consumption patterns
SDG13 Climate action	Assisting in monitoring and mitigating the effects of climate change through the collection, analysis, and modeling of data	Backing climate modeling, real-time data analysis, and greenhouse gas emissions tracking to enhance effective climate action
SDG14 Life below water		Facilitating the monitoring and protection of marine ecosystems via underwater sensors, satellite imagery, and data analytics
SDG15 Life on land		Assisting in wildlife conservation, forest management, and sustainable land use planning
SDG16 Peace, justice, and strong institutions	Promote transparency, accountability, and access to justice through e-governance and digital platforms	Improving transparency, access to legal information, and e-governance to foster robust and accountable institutions
SDG17 Partnerships for the goals	Fostering global collaboration and partnerships to achieve SDGs through data sharing, communication, and coordination	Enabling global cooperation, data sharing, and collaboration to collectively achieve all SDGs

For instance, focusing on the research topic, the development of ICT can *positively* impact economic development, productivity, entrepreneurial opportunities, and safer working conditions (SDG 1, SDG 2, and SDG 8) [52]. Automation of services (SDG 9) like health and education (SDG 3 and SDG 4) and efficient information technology management in environmental monitoring and governance (SDG 6, SDG 13, SDG 14, and SDG 15) also contribute [9,41,48,50,57]. Investment in ICT for knowledge cities and informed communities promotes citizen inclusion, equity-centered decision-making (SDG 5, SDG 10, and SDG 11), and enhances infrastructure for sustainable lifestyles (SDG 7 and SDG 12)

[1,3,12,19,23,57,58]. However, these benefits are often skewed toward developed nations, *negatively* impacting the local economies of developing countries (SDG 1, SDG 2) due to reliance on expensive imported electronic devices, leading to increased informational exclusion (SDG 10) and the rise of cheap labor in IT equipment production (SDG 8) [52,54].

Despite some researchers labeling the potential for change brought by ICT as an impractical utopia, it is undeniable that the future development trajectory leans unmistakably towards Informationalization. Neglecting this transformative power not only risks missing out on its potential benefits but also exposes societies to the risk of falling behind the ongoing digital renaissance [1,4,16,46,50]. It is crucial to note that the negative effects of ICT on SDGs primarily arise due to the low level of technological readiness in recipient countries, where they function as consumers rather than producers of ICT services (SDG 9) [48]. This lack of readiness impedes the ability to navigate the consequences of digital adaptation, leading to environmental and social hazards such as electronic waste disposal (SDG 14 and SDG 15), heightened inequality (SDG 10), social exclusion due to marginalization (SDG 5 and SDG 11), and exploitation of cheap labor (SDG 1 and SDG 8) [14,46,50,52,54]. The challenges in developing countries, contrary to critics' portrayals, mainly arise from a lack of IT infrastructure rather than inherent risks in integrating ICT for Sustainable Development [48].

Various ICT-based initiatives highlight the potential of ICT to accelerate progress toward the SDGs [15]. Global interest in ICT's role in sustainable human development was evident in international conferences like the G8 2000 meeting in Tokyo, the WSSD Johannesburg Summit in 2002, and the WSIS Geneva Summit in 2003 [43]. These events underscored the international community's recognition of the mutually dependent relationship between the Information Society (IS) and Sustainable Development (SD). The WSIS aimed to leverage ICT potential for establishing an inclusive and development-oriented Information Society, aligning its action lines with the SDGs to enhance people's lives through optimized ICT utilization (Table 2). While using ICT for Sustainable Development is a comprehensive approach to contextualize SDGs and localize strategies for economic prosperity and political participation, interlinking ICT's action lines with intricately interconnected SDGs adds complexity, making the discussion 'infinitely more complex.' The exhaustive exploration of effects between ICT's action lines and SDGs is notably scarce in research due to the vastness and complexity of this topic [54].

Table 2. The World Summit on the Information Society's (WSIS) Action Lines, based on information from [54].

Action Line	Main focus
C1 The role of public governance authorities and all stakeholders in the promotion of ICTs for development	Focuses on the role of governments and stakeholders in promoting the use of ICTs for development purposes.
C2 Information and communication infrastructure	Emphasizes the development and accessibility of information and communication infrastructure to enhance connectivity and accessibility to ICTs.
C3 Access to information and knowledge	Aims to promote universal access to information and knowledge, emphasizing its importance for social and economic development.
C4 Capacity-building	Focuses on building the capacity of individuals and communities for effectively using and benefiting from ICTs.
C5 Building confidence and security in the use of ICTs	Addresses the need to establish trust and security in the use of ICTs, including measures to combat cyber threats and protect user information.
C6 Enabling environment	Advocates for creating a supportive environment that encourages investment, innovation, and the widespread use of ICTs.
C7 ICT applications	Promotes the utilization of ICTs in government services across various domains, including e-government, e-business, e-learning, e-health, e-environment, e-agriculture, and e-science.
C8 Cultural diversity and identity, linguistic diversity and local content	Aims to preserve cultural richness by leveraging Information and Communication Technologies to safeguard linguistic diversity and promote the creation and dissemination of locally relevant digital content.
C9 Media	focuses on utilizing Information and Communication Technologies to foster a diverse and inclusive media landscape, ensuring freedom of expression, and promoting responsible media use to achieve development goals.
C10 Ethical dimensions of the Information Society	Addresses the moral and principled considerations related to Information and Communication Technologies, emphasizing responsible and inclusive usage for the benefit of society.
C11 International and regional cooperation	entails collaborative efforts to deploy Information and Communication Technologies, promote knowledge-sharing, address global challenges, and mitigate the digital divide for the inclusive development of the Information Society.

This research, centering on Sustainable Development (SD) as a comprehensive plan for people, the planet, and prosperity, primarily explores the substantial role of Information and Communication Technologies, encompassing the dissemination and practical application of these innovations to foster inclusive, safe, resilient, and sustainable cities [54]. Aligned with the SDGs' commitment to "leave no one behind," the study emphasizes the importance of sustainable cities and communities (SDG 11) [47,54] and stresses the need for localized SDG implementation at the community level [48]. The assertion that the "battle for the SDGs will be won or lost in cities [50]" highlights the crucial role of sustainable cities and communities, with SDG 11 identified as a key precursor for the successful implementation of the broader SDG agenda [59]. Hence, the central focus of this study is to explore the prerequisites for constructing sustainable cities and communities, taking into account the transformative socio-cultural and technological shifts facilitated by the advent of inclusive technology access.

Existing studies pinpoint challenges in integrating ICT-driven transformation into urban planning and advocate for focused exploration of these issues and potential solutions. The prevailing concept, smart urbanism, encapsulates the current state of implementing ICT in urban development. Although the term is nebulous, it represents the primary approach emphasizing the need for a paradigm shift recognizing technology as a fundamental facilitator for urban development [49]. Although smart cities define themselves as an approach combining ICT and the Internet of Things with infrastructure, urban planning, and people to address social, economic, and environmental issues, there is a weak connection in both the study and approach of smart cities toward delivering SDGs. Sustainability is not commonly discussed within the concept of smart cities, and they are more inclined towards environmental, technical, and economic concerns, resulting in a social and cultural disparity in their approach [50,54].

The new concept of Information and Communication Technology for Development (ICT4D) emerged to address the limitations of smart cities in achieving SDGs and addressing social disparities by integrating social and human factors with technology. However, persistent issues arise as its approach tends to prioritize assessing technology's contribution to SDGs over aligning development patterns with the digital shift [46]. Furthermore, in acknowledging social dimensions for inclusive development, ICT4D tends to emphasize "hard" attributes of social inclusion [50], functioning primarily as a techno-managerial framework for quantitatively monitoring and assessing socio-spatial attributes of cities [47]. Unfortunately, this approach falls short in analyzing the "soft" attributes of place attachment, such as less quantifiable and context-specific social needs. This one-dimensional approach overlooks the complexity of lived realities and struggles to accommodate local variations effectively [50]. Research has also identified a deficiency in addressing the detrimental effects of ICT on Sustainable Development Goals (SDGs) within the realm of ICT4D [46]. Hence, the ongoing discourse focuses on balancing environmental conservation and human development, aligning with the evolution of the Sustainable Development Goals (SDGs), which have expanded to include the concept of 'quality of life' and emphasize the importance of considering human dimensions beyond purely economic measures [15] (Table 3). This recognition underscores the need to advance human development dimensions, with the emerging Information Society playing a pivotal role in achieving this goal [15,43].

Table 3. Evolution of UN trends in the Sustainable Development Agenda 2030 since its inception, based on United Nations SDGs reports [60].

Year	Theme	Main focus
2015	Adoption of 2030 Agenda and SDGs	Establishing global goals for Sustainable Development
2016	Universal Vision for a Just World	Promote global development towards achieving social, economic, and environmental justice
2017	Eradicating Poverty and Inequality	Promoting global prosperity, gender equality, and social empowerment
2018	Building Sustainable and Resilient societies	Enabling inclusive action for global Sustainable Development Goals
2019	Science-Driven Sustainable Development	Interlinking domains and accelerating SDGs through science and knowledge
2020	Decade of Accelerated Transformative Change	Building resilience for global challenges
2021	Environmental Sustainability and Global Security	Ensuring a safe and secure environment for all to shape our common future
2022	Post-Pandemic Resilience and Recovery	Rebuild and advance SDGs in the aftermath of the COVID-19 pandemic
2023	Global Action for SD and Climate Resilience	Fostering collaboration and inclusivity in major initiatives to drive Sustainable Development and climate resilience worldwide

Various concepts have emerged to explore the instrumental role of ICT in facilitating Sustainable Development. This recurring thematic convergence underscores the significance of identifying a viable approach to address the identified limitations. This exploration aligns with research on the combined effects of the Information Society (IS) and Sustainable Development (SD), introducing the ‘Sustainable Information Society (SIS)’ concept. This concept emphasizes the human dimension in SD discussions, highlighting the importance of balancing technological progress with environmental and social concerns. It underscores the interconnectedness of democracy, Sustainable Development, human rights, and good governance [15,40,43]. The evolving SIS concept envisions using ICTs as a facilitator to promote Sustainable Development, enhance social inclusion, stimulate economic growth, and minimize negative environmental impacts [17,43]. Yet, it is crucial to adopt a new perspective that acknowledges ICT as both a catalyst and a pivotal force in achieving Sustainable Development, especially in an era where every aspect of life is infused with information.

To conceptualize this novel notion, we will draw a parallel with Castells’ informational economy concept [4]. The “information economy” emphasizes information’s role in economic processes, while the “informational economy” goes further, highlighting a societal structure where generating, processing, and transmitting information are key drivers of productivity and influence. This conceptual framework signifies a shift towards an informational paradigm in the economy, wherein an entity’s productivity and competitiveness are inherently connected to its ability to generate, apply, and manipulate information [40]. “Informational Sustainability” expands on this notion, proposing that information fundamentally transforms the mechanisms, institutions, and practices associated with Sustainable Development, diverging from traditional approaches by emphasizing its transformative potential as a driving force, not just a facilitator.

Informational Sustainability underscores the role of Information and Communication Technology (ICT) as a precursor in the digital shift, acting as a tool for resistance and reintroducing human and social dimensions to Sustainable Development, fostering “technological urban emancipation” [11]. In an era where communication is no longer just a means to address structural injustice but is recognized as a fundamental structure itself, ICT serves as a vital enabler, leveraging globalization for greater mobility, networked individualism, societal emancipation, and public participation to foster Sustainable Development, global economy, Information Society, world cities, democracy, the Right to the City, and contextualization [6]. As conventional participation methods fall short in representing diverse populations, fostering genuine participation, and providing ample information for decision improvement, Information and Communication Technology (ICT) emerges as a pivotal element in safeguarding and facilitating human rights, particularly the right to freedom of expression and information [9,12,49]. From the perspective of those in power, digital media is seen as a fertile ground for political involvement, community engagement, and social participation, aiming to maximize returns with minimal input, reduce adverse environmental or social impacts, and enhance contributions to natural capital conservation [22,50]. On the public side, utilizing networks offers extensive possibilities for information exchange, knowledge creation, feedback, debate, learning, and innovation [13]. Digital media, serving as a platform for social engineering, challenges established power control over the city by facilitating decentralized information [3,10], enabling grassroots citizenship claims over time and space, and educating citizens to question social and structural inequalities through reflection on institutional strategies [22,48]. Given that Sustainable Development strategies rely on critical factors such as awareness, trust, coordination, and mechanisms for dialogue, effective communication becomes crucial for active engagement between the public and decision-makers [3]. The role of ICT is paramount in fostering inclusivity, transparency, and accountability in this partnership [41,57,58].

As Sustainable Development engages with cross-sectoral entities, encompassing ecology, economy, and society, the shift towards an informational paradigm has similarly expanded to encompass various dimensions, with numerous actors participating at local, national, and global levels [40,43]. However, this evolution has led to a decline in cohesive movements and the emergence of rivalries rather than fostering cooperation [10]. An informational reform within sustainable approaches is thus centered on integrating these dynamics of global challenges through multi-level and multi-actor arrangements, aiming to construct sustainable communities that recognize the dependence of Sustainable Development on the actions of individuals from every sector [40,43]. In this study, Informational Sustainability is introduced as a cradle for developing socially and environmentally sustainable cities and communities, where social cohesion and environmental protection go hand in hand, aiming to enhance the representativeness of the SDG indicators in alignment with local needs and aspirations. It emphasizes the significance of information access, sharing, and communication in constructing sustainable communities while underscoring the adverse consequences of an information-deficient society on environmental exploitation and social equity. These transformative efforts also prompt a reconsideration of the concept of the ‘Right to the City,’ highlighting the need to reassess how individuals’ rights to actively participate in urban development and decision-making are shaped in the evolving landscape of information dynamics.

3.2. Connecting Threads: Bridging Gaps with the ‘Right to the City’

Lefebvre’s 1960s work gains renewed relevance in today’s networked world, offering valuable insights into the intricate interplay between urban spaces, societal aspirations, and the digital realms of the 21st century. His concept of “social space” offers a crucial tool for analyzing social actions in urban environments, unveiling an intermediate phase that reveals the interplay between spatial functions and forms shaping perceptions of social dynamics. Lefebvre’s production of space concept extends beyond physical presence, encompassing mediation in individuals’ interactions, attributions of meaning to urban spaces, and shaping of social reality [21]. This aligns with urban theorists like David Harvey, emphasizing the connection between personal change and the ability to influence transformation within one’s city [61]. These categories outline dimensions in Lefebvre’s production of space theory:

1. **Perceived Space;** In this dimension, space is conceptualized as an abstract entity, divorced from practical applications. It serves as a caution against oversimplifying space by reducing it solely to logic, overlooking its inherent values. This abstract space can be wielded as a tool for control and even the potential destruction of nature. Despite its political implications, it exhibits limited rationality.
2. **Conceived Space;** The discourse on space seeks to shape society’s perception by presenting designated spaces as reflections of ideologies. It actively manipulates these spaces, influencing people’s perceptions, aspirations, and needs to exert control and advance its own agenda. This manipulation involves reducing three-dimensional space to two dimensions, as seen in drawings, sections, and projections. Planners, in their role, act as agents who diminish the true reality of these spaces, turning both subjects and objects into passive entities reduced to mere images. As this process unfolds, space ultimately loses its social presence, becoming a medium defined by intense, forceful, and oppressive visualization.
3. **Lived Space;** Synonymous with representational space, lived space is actively experienced and claimed within socio-spatial realities. It embodies intricate symbolisms, occasionally coded and linked to underground facets of social life. Despite being dominated and passively experienced, lived spaces are also areas where the imagination seeks to change and appropriate. The notion of appropriation in this dimension demands more than mere reflection—it requires active engagement [21].

Lefebvre argued that the persistence of space abstraction through homogenization would continue until a new space emerged, emphasizing differences through direct individual experiences rather than calculations and projections [21]. In the Information Society, mediated spaces enable comprehensive analysis of social dynamics, surpassing historical limitations that favored scientific knowledge over lived experiences, simplifying complex social spaces by eliminating unquantifiable values [58,62–65]. Lefebvre emphasized the imperative of reintroducing these complexities to attain a comprehensive understanding, while concurrently highlighting interconnected dualistic illusions, notably the “realistic illusion” (quantitative) and the “illusion of transparency” (qualitative). Lefebvre’s advocacy for bridging various forms of space to prevent social division and his introduction of the “space of spaces” concept—encompassing broader societal and cultural dimensions that influence space perception and organization—posed a key theoretical challenge in understanding these spheres and their mediations [21].

Design acts as a mediator, connecting mental perception to social activity in physical space. However, the creators of space sometimes impose representational space on users, prioritizing the interests of influential actors who conflate what is lived and perceived with what is conceived [61]. Integrating lived space in social space formation requires recognizing and incorporating individuals’ subjective experiences and practices within the broader spatial organization. Lefebvre calls for a revolutionary socio-spatial tool, enabling individuals to actively shape their relationships with surroundings, not only interpreting space but also producing it by ‘supercoding’ underlying ideologies and influences that shape how space is produced and understood by a larger group [21]. He introduced the ‘Right to the City’ as the endeavor to express one’s identity within the city’s formation through claim-making, voicing, and the pursuit of recognition. It aims to attach personal values to spatial construction, creating functional and inclusive spaces to address discrimination and marginalization. The goal is to build just, safe, healthy, accessible, affordable, resilient, and sustainable cities that foster prosperity and quality of life for all inhabitants, guided by the fundamental principle of ensuring equal rights, opportunities, and provisions [10]. As urban life thrives on diversity, the creation of inclusive urban spaces requires a collective effort shaped by individual interventions. Emphasizing the importance of a fair distribution of power to empower individuals in decision-making implies a need for a paradigm shift challenging traditional control by national powers, as observed in the decentralizing power of the informational revolution [4,5,9,40].

To establish authority over a space, the acquisition of knowledge becomes crucial, serving as the foundation for individuals to articulate thoughts about everyday objects. Lefebvre’s concept of a ‘new space’ provides insights into

how societies shape social and temporal dimensions, influencing representational spaces and spatial representations. This qualitative understanding of social space, envisioned by Lefebvre, holds transformative potential for daily life, language, and the creation of a unified spatial theory through technical systems resembling a ‘technological utopia.’ These systems, encompassing information, communication, messages, codes, and signs, elucidate spatial truth within an illusory space. Utilizing multidimensional methodologies, including geometric space, visual representations, and firsthand experiences, these systems bridge the gap between spoken and unspoken elements, contributing to the creation and appropriation of various space types within contemporary society [21]. Furthermore, leveraging digital media as a self-reflective tool holds significant implications for “technological urban emancipation” [11], improving the realization of the “Right to the City” by directly capturing diverse public ethos and enhancing the representativeness of urban spaces [4]. This transparent communication facilitates space interpretation, suggesting that it can lead to a comprehensive understanding and resolution of social issues, ultimately enhancing the representativeness of urban spaces [21]. Lefebvre’s vision of a virtual socio-spatial realm, once surreal, aligns with society gaining spatial control through the exchange of qualitative knowledge via information systems. This assumes that an encrypted reality can be deciphered, laying the foundation for a universal “language of the city” [66] as a ‘metalanguage’ or comprehensive spatial code embedded in all languages.

In a technological society, easy and instantaneous access to knowledge, connectivity, and information facilitates the enhanced concreteness of social participation and the practice of rights, such as the “Right to the City” [9]. ICTs offer potential beyond mere technology, as their true power is realized through how individuals, communities, and institutions employ them for positive change [11]. The transformative impact of Information and Communication Technologies (ICTs) on social relationships and spatial dynamics embodies Lefebvre’s concept of the “space of spaces.” Lefebvre acknowledges that a society’s space is continually shaped by a triad of lived spatial practices, perceived experiences, and, most crucially, abstract representations of space found in various forms, such as maps, drawings, schematics, ideas, and information. Despite this recognition, he expresses reservations about information-based systems potentially serving as reliable and transparent tools for the ‘readability of the city.’ His skepticism arises from concerns about technology’s autonomy reinforcing domination and the importance of distinguishing between an envisioned “science of space” and the actual knowledge of space production through abstracting qualities within quantifiable social space. Lefebvre emphasizes the necessity for careful consideration and reflection to fully comprehend this new space [21]. The effective transformation brought about by ICTs must align with principles of equity and social justice. Here, the crucial link emerges—the pivotal recognition that the Right to Information precedes the Right to the City. This underscores the need for a meticulous understanding of the interplay between technology, information, and urban development to ensure the positive contribution of ICTs to sustainable and inclusive cities.

3.3. Novel Solutions: The ‘Right to Information’ Paradigm

While Lefebvre focused on theoretical aspects of space dimensions [21], Castells offered a practical approach by analyzing the impacts of the Information Age on spatial relationships [4]. The modern embodiment of Lefebvre’s dualistic realities is evident in Castells’ concept of the “space of flows” and “space of places.” In Castells’ theory, the “space of flow” encompasses global interconnected networks of information, communication, and economic exchanges, enabling rapid information sharing and transcending traditional boundaries while still having its geographical presence. In contrast, the “space of places” refers to physical, localized environments where people experience their daily lives and interactions [4,12]. Recognizing that the conceived space forms the foundation for lived experiences highlights the interconnectedness of flows, space, and time, emphasizing that flows are enacted within a space. When contemplating space, it is essential to consider its occupants and how these flows interact with it within a defined timeframe [21].

Contemporary cities embody both these dimensions, as individuals physically move while remaining globally connected, carrying flows and engaging with places. This synthesis between places and flows finds its realization in public spaces, where the “new space” emerges as a social refuge, facilitating the exchange of ideas, ideologies, and cultural representations across various locations and cultures, all embedded within virtual spaces [16]. When compared with Lefebvre’s perspective, the “space of flows” can be equated to what Lefebvre referred to as the “mental space” or “appropriated space,” characterized by subjective knowledge or “Connaissance,” representing the truth of space. On the other hand, the “space of places” aligns with what Lefebvre called “true space,” signifying the utilitarian “object” and the physically “dominated” reality of space, often reduced to a practical science “savoir” and utilized by passive consumers [21]. Both Castells and Lefebvre underscored the importance of bridging dualistic realities [4,21]. While Lefebvre’s time may not have allowed a full grasp of the stark contrast between mental, social, and physical spaces, he

conceptually laid the groundwork for bridging these emerging spaces. Lefebvre identified the emergence of a new social space operating between the physical “space of places” and the mental “space of flows.” This space became a means for individuals to leave traces of their lived subjective experiences, collectively forming “rhythms” between the “lived” and “conceived” that invest in places without having a distinct place of their own, “an absolute space”. It can be seen as a modern manifesto for analyzing the space of flows to provide feedback on improving the conceived space through the process of “appropriating domination,” transitioning from discourse on space, described as “thought thought,” to “thinking thought,” which represents the operation of knowing the truth of lived space. Lefebvre termed this bridging process “Co-operation,” representing an intermediate practice between domination and appropriation.

Lefebvre identified three crucial components for mediating rhythms: means, medium, and intermediary. However, he recognized that during his time, understanding the relationship between the rules governing physical space and rhythmic movements was challenging due to the absence of a suitable medium for analyzing social space. Means can be associated with the physical space forming the basis for spatial practices. To analyze how various mediators within social space generate rhythms and leave their marks on space, a medium is necessary. This medium acts as a channel through which interactions and exchanges are reflected [21]. In the context of ICT and social media, the “medium” could refer to technological platforms and networks facilitating communication between the “space of flows” and the “space of places” [5,12]. The essence lies within the experiential realm of the “intermediary,” serving as a conduit connecting diverse dimensions, thus facilitating interactions and exchanges [2,6,9,12,14,19,20,66]. In the contemporary era, technological tools reveal the previously concealed link in Lefebvre’s theory, shedding light on previously inaccessible dimensions of space production in the virtual parallel world of values (space of flows). This open and unrestricted platform enables time-sharing social practices, serving as the key to understanding nuanced facets of the “lived experience,” encompassing values, meanings, and perceptions, transcending mere abstractions and conceptual spaces [5,7,12].

As the digital landscape continues to evolve, embracing this conceptual triad offers a crucial perspective for examining the convergence of physical and digital spaces, providing insights into the intricate complexities of spatial practices and their profound societal implications in urban development. These spaces act as the foundational elements of culture, serving as organizers of sociability and systems of communication. Within them, we can discern a spectrum of relative order and/or disorder. They can either promote the healthy ‘production’ that fosters democracy through the practice of citizenship and natural stewardship or, as Lefebvre suggested, follow an “anti-nature” approach that leans towards more of a ‘consumption’ pattern, viewing citizens as mere consumers and nature as nothing more than raw materials to be rudely manipulated, where the ‘practice’ becomes a means for gradual destruction. Therefore, the crucial task of Sustainable Development is to ‘discipline sustainability,’ which involves considering both mediations and mediators in practice. This encompasses examining the actions of various groups, factors related to knowledge, common ideologies, social ties, and the layers of society presented through the “absolute space” provided by networks and pathways that facilitate the exchange of values and information. It is intriguing to consider how Lefebvre’s inquiry into the mode of existence of an absolute space relates to the concept of virtual reality and the tangibility of the imaginary layers that have influenced our perception of space. These layers serve as essential tools for bridging the gap between the conceived ‘bodily space’ and the lived experiences of ‘bodies-in-space.’ As Lefebvre stated, the emergence of such a space would be one that contains things but is not itself a tangible object; rather, it is a floating “medium” of “mental” contents that encapsulates the abstractions of social activities and lived experiences. Although imaginary, these contents have social existence, blurring the boundaries between the real and the imaginary, resulting in a ‘surreal’ yet somewhat concrete space [21].

Human beings, as social beings, actively shape their consciousness of the world, even nature itself is apprehended in social life. Thus, humans can be seen as the producers of all products. Lefebvre recognized the need to reflect upon the social space for the practice of appropriating space production, yet he was uncertain about the source capable of providing “a system of feedback between distorting mirrors” [4]. Castells, on the other hand, identified media as an expression of culture, serving as a reflective mirror of social space. This “mirror-consciousness” concept that Lefebvre sought [21] but couldn’t find in his time has become feasible with the rise of ICT and the era of social representation. Lefebvre explores the intricate relationship between perception and reality using the metaphor of mirrors, emphasizing the complex interplay between subjective experiences and the external world, and highlighting the influential role of consciousness and interpretation in shaping our reality. He distinguishes between a ‘real’ mirror, often found in our external world, and an ‘imaginary’ mirror within the living body. When the mirror is ‘real,’ the space it reflects is considered ‘imaginary,’ suggesting that what we see in it is a mental construct, shaped by the ‘Ego’ or the self. Conversely, in the ‘imaginary’ mirror within a living body, the reflections aren’t of external objects but rather internal experiences, thoughts, and perceptions. Precisely as noted by Castells, “all reality is virtually perceived through symbols that frame practices,” establishing unequivocal meanings that extend beyond the confines of semantic definitions [4].

The profound insight here is that the impact of this ‘imaginary’ reflection is genuine, affecting our self-perception and understanding of the world. In this context, when we consider the imaginary mirror as the space of flows and the reflection as the space of places, and we introduce personal imaginaries into this mirror from the perspective of the ego, what emerges is a reflection grounded in one’s self-perception. To illustrate, if our physical environments within the space of places are unsustainable, they subtly guide individuals towards adopting unsustainable lifestyles. This influence is tied to their subjective perception of the reality they inhabit, shaping their choices and behaviors accordingly. This highlights the significance of reevaluating and possibly transforming these perceptions to encourage more sustainable practices, particularly in the dynamic landscape of our digital and physical spaces. As Lefebvre himself identified, reflecting upon the virtual aspects not only guides our understanding of the real (or actual) but also simultaneously illuminates the antecedents and necessary preconditions of that reality [21]. The production of space is dynamic, reflecting ever-evolving elements over time, mirroring social space’s constant flux through flows, space, and time. This necessitates a tool to capture these dynamics, underlining the importance of reshaping perceptions for sustainability, especially in our digital and physical realms. Virtual reality is therefore a concrete visualization of the ‘zeitgeist’ of dominant culture crystallized in time and can be employed to generate, produce, and guide the appropriation of living approaches favoring sustainability.

Both Lefebvre and Castells highlight significant issues that are highly relevant in the current era, particularly in the context of social and environmental challenges, and they agree on the importance of addressing the tension between global forces and local agency in shaping the complex dimensions of our society, aiming to undo the traditional domination of nature which invested in anti-nature approaches and behavior by aiding an information-driven civilization, where symbolic representations of the environment link the global space of flows with local spaces of place [4,16,21,40]. Castells suggests that the interplay between the space of flows and the space of places triggers significant shifts in the production of function, form, and meaning in contemporary cities, involving the struggle between global-local influences, addressing the individual and communal dynamics in city planning, and appropriating a shared identity for addressing the problematic of social implications between the personality and cultural interrelations [4]. Lefebvre emphasized that inflexible functionalization obstructs appropriation, exposing the persistent tension between global and local influences [21], as evident in the contemporary dysfunction of many sustainable approaches prioritizing a global strategy over local needs [47,48]. While significant transformations have occurred since Lefebvre’s time, such as the shift from fixed to floating capital and from traditional material-based production to Informationalization, the transition from viewing nature as infinite to recognizing its finite nature, and the prevalence of domination over appropriation with nature often regarded as a commodity rather than a necessity, along with the ongoing consumption of social space as a material commodity, the area of space production through appropriation remains relatively unexplored [4,21,40]. Lefebvre believed that the worldwide will not abolish the local, nor does it aim to do so, as Castells puts it into words, “we are not living in a global village, but in customized cottages globally produced and locally distributed” [4]. This perspective makes Lefebvre’s vision for the “collective management of space and the social management of nature” [21] possible through the decentralization of power, democratization of knowledge, and the embrace of a more inclusive and sustainable approach to spatial organization and the harmonization of human and natural systems. It recognizes that the mobilization of large-scale movements, such as Sustainable Development (SD) and public emancipation, necessitates active social participation achieved by integrating societal imaginary layers into the envisioned space for projecting the idealized image (SDGs) (Figure 2).

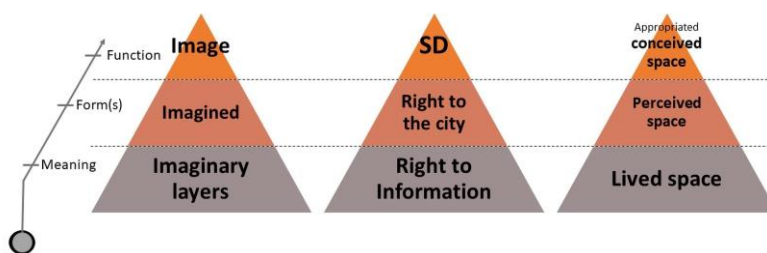


Figure 2. Navigating Networked Spatial Dynamics through Lefebvre’s Social Space and Castells’ Information Society for the Appropriation of Inclusive Sustainable Approaches. Source: Authors.

Lefebvre acknowledged the intricate relationship among technology, social dynamics, and the environment and how they influence the creation, perception, and utilization of space [21]. While cities are currently being shaped to accommodate the requirements of the “space of flows,” [16] it’s becoming increasingly evident that the trajectory of social

and environmental reform, particularly in the context of information and environmental justice, should take a different course [67]. This shift in perspective calls for a transformation in urban development theory [16]. Instead of solely concentrating on adapting physical urban spaces to align with the “space of flows,” the emphasis should pivot toward the translation of the dynamics inherent in the “space of flows” into the creation of meaningful “spaces of places.” This shift aims to foster a more equitable and just concept of the “Right to the City” while building sustainable communities.

While the Information Society serves as a cradle for advancing environmental justice and constructing socially and environmentally sustainable communities [16], grassroots efforts in promoting Informational Sustainability add their own challenges to the practice of the Right to the City by introducing an extra dimension to be considered: the Right to Information [66]. The intersection where information complements the Right to the City is a more contextual matter of analysis of complex aspects of political struggles [6]. In the emerging urban world, it appears to be dominated by the dual movement of inclusion and exclusion into networks, where urban justice and injustice are now intertwined with the concept of the Right to Information and will increasingly rely on it in the near future [16]. The adoption of ICT in urban development follows a distinct lifecycle, progressing from initial adoption to widespread diffusion and eventual maturity [6]. However, it is crucial to recognize that a society’s e-readiness alone cannot ensure the successful establishment of Informational Sustainability. Equally significant are aspects like ecological knowledge governance, civic society relationships concerning sustainability policymaking, and citizen empowerment.

Three key prerequisites underpin the development of Informational Sustainability: motivation, access, and skills [15]. Access for the public entails availability of technical access points, access to information and communication devices, and technological literacy to facilitate information sharing and participation in sustainable initiatives [6,13,19,41,67]. Governments must also acquire the skills necessary to establish policies and professional capacities, ensuring open access, equal Right to Information, addressing the digital divide, and fostering transparency, accountability, and participatory democracy [3,19,58]. These elements are essential for building public trust and motivation to engage in information exchange for Sustainable Development. However, the motivation of the public may wane if they feel unequal in agency, fearing their voices will be lost through the digital divide or mediation, leading to selective representation and concerns about data usage, privacy, and security [57,58]. Governments may also exhibit hesitation regarding the authenticity of shared information and its sources [67]. Non-transparent, unaccountable, and restricted governance can be detrimental to development [57]. Conversely, transparent, accountable, and inclusive governance is advantageous, as ICT can facilitate information dissemination, broaden participation in political processes, and enhance transparency in governance [20,40]. However, when ICT integration for Sustainable Development occurs in societies unfamiliar with its use and governments unsure of its applicability, structural uncertainties must be addressed. This underscores the idea that the integration of ICT for Sustainable Development is context-specific and varies across different countries.

4. Results: A Comparative Analysis to Validate the Conceptual Framework of Informational Sustainability

In a world characterized by environmental challenges, social inequalities, and technological transformations, the convergence of these factors creates a notable scenario where democratic and technocratic ideologies intertwine to establish the foundation for a sustainable socio-technical ecosystem, fostering social empowerment and equal opportunities in urban development [3,20,48,57]. Nevertheless, despite increased access to information, significant urban injustice persists [11]. This is primarily because the fundamental criteria for developing sustainable cities and communities are rooted in both cooperation for developing strategies—underscoring the importance of partnerships to collaboratively address issues—and the co-production of plans—integrating citizen-centric and participatory approaches for local involvement in decision-making [48,50]. Similarly, the intricacy of incorporating ICT into planning processes becomes evident in the need for both vertical and horizontal coordination. Vertical coordination pertains to communication and collaboration between multiple levels of governmental and administrative hierarchies [13,68]. In contrast, horizontal coordination involves collaborative efforts among various actors, including governmental organizations, non-governmental organizations (NGOs), and citizens, aiming to co-create planning approaches through collaborative decision-making processes [40,69]. Recent scholars have highlighted a significant issue in ICT implementation, namely the absence of context-specific knowledge, which contributes to the implementation gap in planning [68,69]. In this regard, Lefebvre’s analogy to hydrodynamics can aid in understanding the complex interplay between global movements and local tendencies by taking the two major and minor determinants into account: 1. social loci would be mobilized in the wider “space of flows,” colliding and interfering with one another to form global networks; and, 2. the networks, which in turn, permeate the representation of the weaker tendencies consisting of localized interactions, smaller-scale movements,

and specific social contexts within their broader social space [4,21]. The analogy underscores a dynamic interplay between the top-down implementation of ICT, commanded from above, facilitating global communication and collaboration, and the bottom-up enactment of localized SDGs, demanded from below, addressing local priorities (Figure 3). These two approaches interact, influencing and informing each other [21,70].

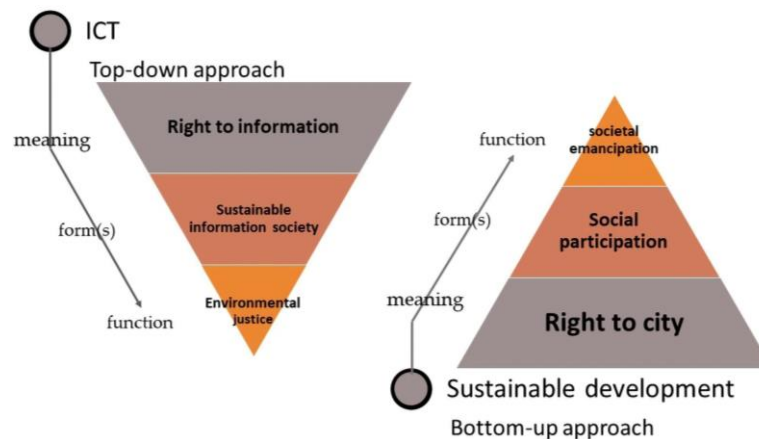


Figure 3. The Transformative Power of Rights in the Interdependence of ICT and Sustainable Development within the Framework of Informational Sustainability. Source: Authors.

While previously, achieving such a degree of global and local cooperation through multi-level and multi-actor collaboration seemed complex, the COVID-19 pandemic has offered key lessons in how urban knowledge can be collaboratively harnessed among regulators and communities to foster equitable and socially just cities through capacity building and the production of collaborative, evidence-based research, both globally and locally. These changes extend beyond health measures and can be applied to a broader system of environmental, economic, and social inequalities in urban governance [13,71]. Expanding beyond conventional participatory methods to integrate ICT-mediated interaction transforms the comprehension and practice of rights, decision-making, and actions, overcoming spatial and temporal constraints while introducing social inequalities, particularly driven by factors such as the digital divide and other disparities [67,69]. Though digital engagement enables local communication and global interaction, its effective application in planning extends beyond acquiring technical capacity, organizational skills, and digitally connected citizens to translate knowledge into communicative action, a challenge often observed in developing countries [13,14,67]. The success of implementing participatory planning through online platforms relies on various factors such as infrastructure, human capacity, digital diffusion, and policy [70], requiring customized and context-specific interventions tailored to the characteristics and needs of each specific context [13,68].

Comparing urbanization patterns across different contexts reveals a spectrum of trajectories, with extensive urbanization more pronounced in developing countries, while developed nations have already undergone significant phases of their urbanization processes [72], exhibiting patterns resembling J-curves and S-curves, respectively. The S-curve represents a more controlled, healthy, and sustainable form of urbanization characterized by gradual urban growth, followed by a rapid acceleration as industries and infrastructure develop, ultimately stabilizing when the majority of the population resides in urban areas, as observed in developed countries [18]. The J Curve urbanization pattern indicates rapid and exponential urban population growth, particularly in developing countries aligning with swift economic development to match global trends [39]. This approach, while indicating progress, brings challenges like resource strain, inadequate infrastructure, informal settlements, environmental impacts, and growing social inequalities, necessitating sustainable urbanization efforts to foster balanced and inclusive growth [18]. The consequences encompass pollution and the depletion of natural resources, which in turn give rise to socio-economic challenges such as poverty, conflict, and instability. Conversely, societal complexities can worsen environmental degradation, thus perpetuating a destructive cycle of negative feedback loops between the natural environment and human society.

In alignment with the recognized periodization of new modes of production [4,21], the Information Society signifies a transformative era where exclusion from ICT exacerbates the disparity between developed and developing nations [43,70,71], yet the underlying technologies of ICT offer practical avenues to foster Sustainable Development within this evolving mode of production [13]. Developed countries, while more inclined to embrace technological transformations compared to developing nations, have limited potential for redirection due to their established industrialization-based structures. Developing countries, with their limited commitment to traditional industrial

structures, have the potential to revitalize intermediate towns through knowledge-based industries [18,70]. They can harness ICT for Sustainable Development, benefiting from leapfrogging technology, tailored solutions, scalability, and affordability, which aids in promoting inclusive development, data-driven decision-making, global collaboration, environmental sustainability, economic growth, and resilience. Nonetheless, infrastructure deficiencies and limited policymaker awareness continue to hinder ICT diffusion and economic progress, perpetuating a cycle of underdevelopment [43,70]. Indeed, some of these challenges can also apply to developed countries, albeit with variations in their extent and nature (Table 4).

Table 4. Summary Table: Enablers and Disablers of ICT implementation for Sustainable Development: Developed vs. Developing Countries.

	Developed Countries	Developing Countries
Enablers	Advanced ICT infrastructure Skilled workforce Access to financial resources Established governance systems Availability of data and research Strong regulatory frameworks High level digital literacy Strong public-private partnerships Robust research and development investment	Growing ICT infrastructure Potential for leapfrogging International aid and partnership Innovative tech startups Low-cost technology solutions Scalable ICT projects Increasing digital literacy Community-driven initiatives Youthful and adaptable population
Disablers	High initial implementation costs Digital divide within the population Privacy and security concerns Resistance to change Technological obsolescence Bureaucratic challenges Strain on existing infrastructure Data privacy and protection regulations Funding reliance on NGOs and private sector Citizen collaboration without effective planning	Limited ICT infrastructure Digital divide and inequalities Limited financial resources Regulatory barriers Lack of digital literacy Political instability Dependence on donor funding Limited access to data and research Lack of Governmental funding Challenges in public-private collaborations

The challenges in developing nations include issues with ICT infrastructure, digital disparities, limited technical skills, content relevance, cybersecurity and privacy concerns, as well as governance and policy frameworks [43]. Developed countries generally have more resources and infrastructure, but they can still learn from each other's experiences in addressing these ICT-related challenges and advancing Sustainable Development Goals. A notable divergence in the implementation of Information and Communication Technology (ICT) for Sustainable Development is influenced by policy capacity, technological readiness, and preferences for specific dimensions, highlighting the distinction between developed countries prioritizing environmental aspects and developing countries focusing on socio-economic considerations [3,13,41,48,54,57,58]. Sustainability trends in the Information Age encompass two key aspects:

1. Governance through information, primarily observed in developed countries, emphasizes practical bottom-up management of information flows, with a focus on internet use for public administration (e.g., Hungary, Spain, Greece, South Korea) and environmental monitoring (e.g., New Zealand, the US, Portugal) [13]. Developed nations prioritize efficiency and cost reduction in public services, demonstrating a greater emphasis on quantifiable strategies, while showing a lesser commitment to addressing social exclusion and evaluating social attributes in locally informed sustainable applications [63–65]. This data deficit is particularly notable for goals with a social focus, such as gender equality (SDG 5) and social equity (SDG 16) [49,54].
2. Institutional change due to information flows, frequently addressed in the context of developing nations, involves addressing top-down political capacity building challenges for the effective implementation of information as a means for market development (e.g., India, South Africa, Ghana, Kenya, the Philippines, Tunisia) [13,48,57]. Similar to the social disparity observed in the context of developed countries, developing nations face challenges not only in utilizing ICT for social implication assessment but also in implementing basic levels of service redistribution and monitoring [47,48,57]. This stems from their limited technological and institutional infrastructure, as they rely on traditional centralized power structures. This limitation impedes data collection due to insufficient training, skills, and a reluctance for coordination and collaboration, leading to challenges in transparency, accountability, and corruption, hindering local social participation [47,48]. Interestingly, academic studies on the crisis of representative democracy in Sustainable Development are more prevalent in developing

countries than in developed ones [48,57,72–76]. Castells emphasizes that expanding ICT platforms enable new civic engagement forms, such as online activism, participatory mapping, and digital platforms for community organizing [4]. These advancements offer social movements opportunities to gauge political engagement on the Internet, giving rise to cyber-activism [22]. Extensive research has been conducted on self-organization practices for locally sustainable livelihoods, including women's rights in developing countries, indigenous knowledge in sustainable practices, and addressing vulnerable communities and urban areas suffering from environmental and socio-cultural degradation (e.g. Chile, Japan, India, Middle East) [13].

Although a prevailing connectivity gap exists in both contexts due to the rural-urban disparity and digital divides—more pronounced in the developing context [77]—the technical capacity to facilitate various forms of communication and user engagement online is not the only prevailing factor in the effective utilization of locally generated information [13,46,48,58]. Despite concerns about ICT exacerbating inequalities in Sustainable Development [9,52], studies indicate that challenges in social implication assessment and community empowerment stem not from technological shortcomings but from centralized control consolidating power, hindering political interest in localizing approaches and impeding investment in ICT for development [48]. Hence, the inadequacy of infrastructure in developing countries is attributed not to technological unpreparedness but rather to a deficiency in the decentralization of power, hindering vertical coordination. The absence of vertical coordination hampers progress toward sustainable cities and communities since inclusiveness, safety, resilience, and sustainability can only be achieved when those in power empower communities to act as co-decision-makers through horizontal coordination [47]. This suggests that 'decentralizing power through Informationalization' (vertical coordination) should precede 'participatory decision-making' (horizontal coordination) for effective Sustainable Development, given that participation relies on equitable access to agency-generated information and the ability to facilitate horizontal coordination through user-generated content [20].

Developed nations encounter fewer obstacles in vertical coordination owing to decentralized power structures. However, they grapple with challenges in horizontal coordination, where despite unrestricted access to information, effective implementation for development remains elusive. Concurrently, issues of collaboration among multiple levels and sectors are present in both developing and developed nations (e.g. Europe, Australia, New Zealand, Africa and the US) [57,70,72,78,79]. While the challenge of multi-level and multi-actor partnership collaboration is evident in both developed and developing nations, the emphasis on bottom-up social participation in environmental or any other decision-making processes is primarily noticeable in developing countries. This social empowerment issue regarding bottom-up approaches arises due to inadequate top-down access to information and the lack of necessary infrastructure for effective participatory decision-making, which further compounds challenges in vertical and horizontal coordination, particularly in developing nations [48,72].

The central challenges in implementing development initiatives, especially in utilizing ICT for localizing approaches and social implication assessment, lie in the reductionist approach of Sustainable Development research, favoring measurable elements and neglecting unquantifiable social dimensions [26,65,80–83]. Additionally, the silo mentality in ICT implementation for Sustainable Development focuses exclusively on social dimensions, detached from other attributes [46–50,54]. The same principles of vertical and horizontal coordination should be applied when studying ICT implementation for Sustainable Development. Horizontal coordination in the systemic study of Sustainable Development means placing all dimensions (economy, environment, and social) on the same hierarchical level to ensure equal emphasis for a comprehensive approach. Meanwhile, vertical coordination in ICT implementation requires collaboration, communication, and decision-making across organizational hierarchical levels. This ensures the effective integration of technology for informed and inclusive decision-making processes, both from top to bottom and vice versa, to align sustainability with the specific local needs of society. The analysis identifies hierarchical organizational strategies for Sustainable Development, emphasizing the initial prioritization of vertical coordination to establish necessary infrastructure, decentralize power, and localize approaches. This foundation sets the stage for subsequent horizontal coordination, promoting effective participation. In this context, ICT plays a significant role in emphasizing inclusion and exclusion considerations, ensuring that development approaches strive to "leave no one behind" [47].

5. Discussion

In the theoretical exploration, the review delved into the intricate relationship between Information and Communication Technology (ICT) and Sustainable Development (SD), illuminating how classical urban theories, including the Right to the City, seamlessly linked with the contemporary emergence of the informational revolution and the Network Society, collectively underscored the mutual interdependence of ICT within the realm of Sustainable Development. Of paramount importance, the review placed a pronounced emphasis on the critical role played by ICT, serving as a foundational element in shaping the trajectory of sustainable cities and communities. This emphasis was particularly vital, given the review's primary focus on researching the evolution of SD and ICT integration, with the explicit aim of validating the use of ICT for addressing social disparities. The reliance on classical urban theories and foundational research works significantly contributes to understanding why certain sources might seem dated. This inherent reliance reflects the deliberate choice to draw insights from historical contexts and the evolution of concepts in the field, underscoring the enduring significance of these foundational elements in shaping contemporary perspectives on ICT and Sustainable Development.

The study encountered a notable limitation due to a lack of current sources on the role of the Right to the City in Sustainable Development (SD), particularly in the context of ICT implementation, despite acknowledging social disparity as a gap in SD approaches. A significant limitation in the comparative analysis was the absence of contemporary studies comparing disparities in implementing Information and Communication Technology (ICT) for Sustainable Development (SD) across developed and developing countries. Existing literature underscores the importance of departing from a one-size-fits-all approach in Sustainable Development, recognizing persistent contextual disparities, yet it neglects to address the evolving contextual differences brought about by the information revolution. Recent studies predominantly focus on case studies rather than comprehensive comparative analyses, indicating a gap in addressing the dynamic challenges posed by the information renaissance. This study contributed theoretically by underscoring the imperative role of ICT in Sustainable Development (SD), specifically in uncovering the dimensions of implementing Informational Sustainability through a comparative analysis of integrating ICT for Sustainable Development Goals (SDGs). The study challenged the traditional model of achieving globally unified Sustainable Development Goals (SDGs) through local bottom-up approaches. It advocated for a transformative shift, suggesting a top-down unified approach facilitated by global ICT for the bottom-up enactment of localized goals.

The examination of integrating Information and Communication Technology (ICT) for urban development faced challenges due to the broad coverage across diverse fields. In practical discussions, the incorporation of ICT into urban development plans is fragmented, persisting despite a consistent theme of implementing ICT for Sustainable Development (SD). The transformation of distinct goals into diverse frameworks highlights the interrelation between ICT and Sustainable Development, exposing an implementation gap that calls for a more effective resolution under an updated heading. Built on the premise that Information and Communication Technology (ICT) is crucial for Sustainable Development (SD), practical implementation gaps have been identified, primarily linked to the absence of vertical coordination resulting from centralized power practices. Despite the decentralizing impact of ICT, the persistence of centralized power structures hinders collaborative efforts across hierarchical levels, obstructing crucial horizontal coordination needed for localizing Sustainable Development Goals (SDGs) and promoting inclusive participatory decision-making. Recognizing the significance of both vertical and horizontal coordination becomes crucial for achieving robust policy coherence and addressing challenges arising from conflicting silo policies. However, the study primarily focused on validating ICT's role in localizing Sustainable Development Goals (SDGs) through virtual decentralization, overlooking complex political and governance factors influencing ICT initiatives. This omission may pose challenges in generalization due to the review article's limited scope, lacking in-depth investigations, case studies, or detailed country-level analyses. Acknowledging the potential of broad comparative studies for generalizations, the study emphasizes the need for more profound analyses to explore specific contexts and address challenges such as cultural and contextual variations, data availability and quality, economic disparities, and varying priorities among nations. Furthermore, recognizing the dynamic nature of technology and the evolving landscape of Sustainable Development Goals demonstrates a realistic understanding of complexities.

6. Conclusions

This theoretical review underscored the crucial role of Information and Communication Technology (ICT) as a transformative catalyst in addressing social disparities within Sustainable Development (SD) frameworks for an inclusive practice of constructing sustainable cities and communities. The study recognized gaps in SD approaches,

specifically the oversight of the social dimension, and reintroduced the concept of the Right to the City. To offer a solution for a novel implementation of the Right to the City and to address social disparities within SD approaches, ICT is introduced as a tool to revitalize and empower localities through electronic connections. Furthermore, there is an acknowledgment of the growing importance of the 'Right to the City' concept in the context of contemporary dualistic spatial existence. This is evident as the social space experienced by individuals becomes encoded in the virtual parallel world of values—facilitated by networks—reflecting the cultural projection of social dynamics in physical places. This highlights the disjunction, exerted control over space, and paradoxical realities that exist between the space of flows and physical places. Consequently, it underscores the awareness of a deficiency in actual physical space for projecting identities, intensifying forceful exclusion within the production of physical space. The study emphasized the critical necessity of integrating virtually projected values seamlessly with physical space for the development of sustainable cities and communities. This integration, facilitated by Information and Communication Technology (ICT), is identified as a grassroots element that supports the implementation of social implication assessments. With the growing influence of the Network Society, the Right to the City is redefined, allowing communities to collaboratively generate knowledge within a cyber-driven global tapestry of local identities. Importantly, the Right to Information is recognized as a precursor to this transformative shift, playing a pivotal role in enabling inclusive approaches to address social disparities in Sustainable Development (SD) and enhance the representativeness of urban spaces.

However, this study does not aim to idealize or portray a technological utopia of the role of ICT for development. It recognizes that even the ostensibly free open space of the network is subject to exclusion and can be considered a double-edged sword. ICT, a powerful force shaping lives, can be harnessed by elites for control or by society to reclaim rights. The technological potential necessitates the active guidance of social actors, directing ICT towards a path where information and participation can progress collaboratively. Hence, ICT coevolves with society, limiting the study of how ICT and SD integrate due to the rapid evolution of technology, potentially outpacing research timelines in this area. This study also acknowledges that ICT, as a potential pathway to informational democracy, is susceptible to exclusion owing to the digital divide, biased algorithms, misinterpretation of information (apophenia), and subjective interpretation. Additionally, issues questioning the inclusiveness of ICT and acknowledging infrastructure limits have been identified. However, in an era marked by the informational revolution, the future trajectory of development leans towards the Informationalization of every aspect of life, where ICT becomes the foundation for all development, including Sustainable Development (SD). Continuing this line of thought, the study aimed to theoretically challenge the holistic unified approach aimed at achieving an inclusive SD in the current communicative turn. It addressed social disparities in SD and suggested that, instead of locally approaching global Sustainable Development Goals, we should aim for a global approach that facilitates the implementation of localized goals.

In this study, the exploration of Sustainable Development (SD) implementation revealed ICT as a transformative top-down approach facilitating the bottom-up localization of SDGs for inclusive and just sustainable cities and communities. While the practice of the Right to the City is inherently bottom-up and localized, its innovative and accountable empowerment of the voice of the unheard necessitated a preliminary top-down global approach of implementing the macro-level infrastructure for global internet access, embodied in the Right to Information. The study highlighted the critical role of *accountability within the ICT framework* to address challenges hindering coordinated efforts for inclusive localization, emphasizing ICT's precedence in SDGs.

The social empowerment challenge associated with bottom-up approaches arises from inadequate top-down access to information and a lack of necessary infrastructure to voice local needs, especially in developing nations. This results in difficulties in both vertical coordination (partnerships at different levels) and horizontal coordination (collaboration among different actors), exposing a practical gap in implementing ICT for Sustainable Development Goals (SDGs). Recognizing this gap underscores the importance of vertical coordination (infrastructure for decentralization) to enable horizontal coordination (participatory decision-making for localizing SDGs). The implementation gap stems from a lack of *accountability in decision-making processes*, emphasizing the involvement of various actors at different spatial levels in the implementation of SDGs. Effective urban planning, crucial for SDG achievement, necessitates collaboration through participatory processes and multi-level, multi-sectoral partnerships across governments, academia, businesses, and the public. This collective preparation is essential for the ICT-empowered transformation while fostering trust and collaboration.

Given that ICT serves as a powerful tool for virtual decentralization, it holds the potential to assist governments in localizing Sustainable Development efforts, facilitating better service delivery. Simultaneously, it empowers the public by distributing ownership of the SDGs, promising improved representativeness of SDG indicators. The study's results aimed to affirm the concept of Informational Sustainability, asserting that in a globalized era, ICT should be viewed as

a prerequisite for inclusive Sustainable Development approaches. Considering the overarching goal of Sustainable Development is to leave no one behind, recognizing ICT as essential for localizing SDGs based on local needs stems from the understanding that access to information and the right to participate form the foundation for building sustainable communities. However, the study acknowledges the inherent complexity in integrating Lefebvre's Right to the City and Castells' Network Society to conceptualize "Informational Sustainability" for addressing social disparities in Sustainable Development. This complexity arises from the interpretative nature of these philosophical urban theories and nuanced interpretations within foundational frameworks.

It is important to emphasize that this review article, synthesizing existing literature, primarily identified gaps in sustainable approaches, proposed solutions for addressing social disparities within SDGs through the Right to the City, and introduced a new conceptual framework of Informational Sustainability as a novel participatory approach for localizing strategies to enhance the representativeness of identities in sustainable urban approaches. This study serves as a foundational exploration, aiming to provide valuable insights for future, more comprehensive research endeavors. The study's limited scope restrained an in-depth analysis of sustainable domains within specific nations. Future research should undertake a comprehensive examination across these domains, involving a systematic analysis at various levels—policy, professions, and the research sector. This approach, including a systemic analysis of Sustainable Development (SD) and a systematic examination of multi-level and multi-actor decision-making processes within the ICT framework, aims to strike a delicate balance. This balance addresses the challenge posed by the complexity of managing interdependence among SD domains while simplifying monitoring through ICT-enabled collaboration. These tools enhance participation, monitoring, evaluation, and implication assessment more efficiently than traditional methods, contributing to both vertical and horizontal coordination and achieving equilibrium between control and creativity in the innovative approach to building Informational Sustainability for co-creating sustainable community planning. In the intersection of the Information Society and Sustainable Development, both the Internet and Sustainable Development initiatives should analyze digital engagement across countries with diverse perspectives. A comprehensive exploration of disparities between developing and developed nations is crucial for a profound understanding of outcomes. This enriched comprehension can establish a foundation for more robust collaborative frameworks, leveraging the collective wisdom, knowledge, and experiences of each community to identify highly effective interventions. For instance, investigating successful ICT and Sustainable Development integration in specific contexts, whether in developing or developed regions, can provide insights for enhancement in similar settings.

Information and Communication Technology (ICT) is not an ultimate objective but a crucial developmental tool for broader goals, particularly Sustainable Development. Its exclusion can worsen disadvantages for countries, limiting their participation in the global economy. The integration of ICT is essential for efficiently managing information and knowledge, enabling improved monitoring of environmental data, fostering transparency, and expanding access to valuable knowledge—fundamental elements for achieving global sustainability. Despite numerous studies emphasizing the integration and reciprocal impact of ICT and Sustainable Development (SD), there is currently no specific international organization or initiative solely dedicated to monitoring this critical aspect of Informational Sustainability. Recognizing the profound influence that ICT can have on SDGs and vice versa, there is an imperative to establish a dedicated international framework actively monitoring and fostering synergy between these two domains. Such an initiative could effectively leverage the transformative power of ICT to expedite progress toward Sustainable Development Goals for the benefit of the global community.

Author Contributions

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