

RADICAL DIGITAL AGENCY AS A FOUNDATION FOR JUST AND SUSTAINABLE SMART CITIES

Johanna Ylipulli
Aalto University
Finland

ORCID 0000-0002-7537-4774

João Hämäläinen
Aalto University
Finland

ORCID 0000-0002-9038-1382

Ella Palo
University of Helsinki
Finland

Abstract: *The article examines the relationship between smart city development, socio-digital inequality, and digital literacy. Furthermore, we investigate the link between city residents' digital competence and so-called smart citizenship. Through these theoretical explorations, we aim to demonstrate the importance of a more in-depth understanding of digital inequality in the context of people-centric smart cities. We then use examples from our hybrid ethnographic fieldwork in Barcelona to show how these perspectives might manifest in practical applications. Barcelona aspires to be the capital of 'technological humanism' and, in recent years, has implemented a number of digital inclusion initiatives. Based on the theoretical discussion and empirical results, we present a framework that combines the theoretical framing and empirical findings, highlighting the intersecting factors that policymakers and educators must consider when developing just and sustainable smart cities.*

Keywords: *smart city, digital city, digital inequality, digital literacy, digital divide, socio-digital inequalities.*



INTRODUCTION

During the first decades of the 21st century, the smart city has emerged as a widely accepted model for urban development that has already impacted tens of millions of people. What exactly is a "smart city" depends on where it is located and the social, political, economic, and environmental arrangements there. Nonetheless, the primary idea of a smart city is to optimize different municipal activities using digital technology (Ylipulli & Luusua, 2020). Artificial intelligence (AI) has emerged as a significant technology behind the smart city movement in recent years, generating both excitement and anxiety and giving rise to new utopian and dystopian visions. The introduction of AI perfectly encapsulates the essence of the smart city agenda, which is to take the latest, most talked-about technology and propose it as a solution to the most serious urban concerns.

The smart city agenda has also received much critical attention from urban scholars over the years. (e.g. Cugurullo, 2021). The critical scholarship has provided empirical insights into the lived and experienced realities, as well as analyzed the numerous discourses that shape our understandings and concrete forms and arrangements of future cities (e.g. Cugurullo, 2021; Zaman & Hertweck, 2022). These lines of research frequently highlight how smart city initiatives often emphasize financial benefits but overlook social and environmental issues. However, given the speed at which AI and other sophisticated technologies are developing along with the acceleration of urbanization, it is likely that urbanism will advance in tandem with technology also in the near future. Therefore, our research contributes to an expanding body of work that aims to forge new routes towards the techno-urban future and critically examine topics that have attracted less attention in the context of smart cities (McFarlane & Söderström, 2017; Monachesi, 2020; Vadiati, 2022).

Many authors have acknowledged *digital equality* as a significant social issue and a critical component in the development of fair and sustainable smart cities (Hatuka et al., 2020; Jang & Gim, 2022; Martin et al., 2018). In this context, 'digital equality' refers to having equal access to the Internet and technology tools that serve as a user interface for smart city services. We also define it to include a broad range of digital abilities and the advantages that come from using them (E. Helsper, 2021; Lutz, 2019). For instance, Hatuka et al. (2020) contend that issues brought about by digitalization in the context of smart cities include the safety of individuals' private information, the disparity in digital literacy among various social groups, and the absence of equal opportunities and means of influencing significant issues. Accordingly, we are focusing on a multidimensional perspective on smart cities (Nam & Pardo, 2011; Yigitcanlar, 2021) entailing technology, policy, and community. This view requires that city residents are considered an essential actors in a smart city.

In this article, we scrutinize the relationships between smart city research and studies on socio-digital inequality and digital literacy. The conversations on digital equality in smart cities appear to bear some of the same difficulties that plague the complicated terrain of digital inequality and digital literacy studies. Simply put, the layered nature of digital inequality is usually oversimplified when ideas are disseminated across different areas of research, and the focus remains on the most evident features such as access and accessibility. The exact impact also applies to digital literacy. Our objective is not to diminish the significance of accessible technologies, but to highlight the multifaceted character of digital inequality in smart cities, which includes many other, more abstract dimensions.

Thus, the aim of this article is to explore intersections of 1) socio-digital inequality research; 2) digital literacy research; and 3) critical smart city literature, focusing mainly on digital citizenship and digital agency. Crucially, through an interdisciplinary investigation, we seek to illustrate the necessity for a more multi-layered understanding of digital inequality within the smart city agenda. It is essential to prevent overly simplistic approaches that lack depth and fail to conceptualize citizens as individuals with a wide range of rights and freedoms (Cardullo & Kitchin, 2019b). We strengthen our theoretical work with an empirical study conducted at Barcelona, Spain: The intention is to highlight how the deeper dimensions of digital inequality in smart cities – conceptualized through analyzing the three different theoretical bodies of work together – can be supported in practice.

METHODS

For the most part, this article is a theoretical paper bringing together three bodies of research described in image 1. We explore the central currents of digital inequality and digital literacy research, filtered through our background as smart city scholars. Further, we explore how digital competence of smart city residents – or so-called ‘smart citizens’ – has been framed in research. We complement some of the central, critical understandings of ‘smart citizen’ with conceptualizations on ‘radical digital citizenship’. Finally, we link these discussions back to socio-digital inequalities and digital literacy with the concept of ‘radical digital agency’.

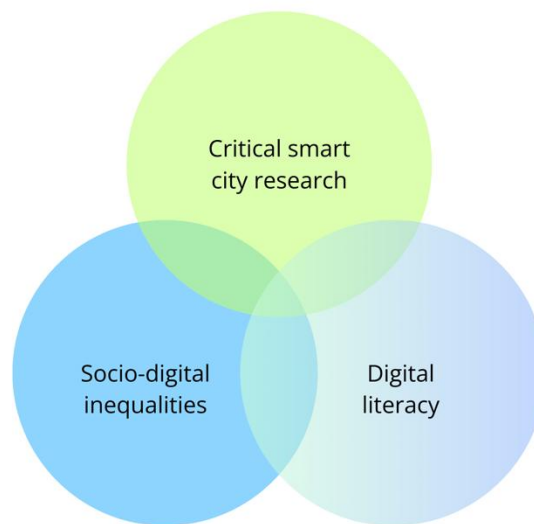


Image 1: The article brings together three bodies of scholarly work.

We combine this theoretical exploration with insights from fieldwork periods conducted in Barcelona, Spain, which focused on investigating how city residents’ digital capabilities are supported in the recent policies and practices of this famous ‘people-centric’ smart city.

The first author of this paper spent 2,5 months in Catalonia in autumn 2022 and conducted brief ethnographic research to understand the general trends of the policies and practices mentioned above. Further, she did a follow-up visit of 1,5 weeks in fall 2023 and arranged several online discussions. Thus, we can consider the fieldwork a *hybrid*: It consisted of off-line and online parts, followed by assembling together notes from in-person interactions and data collected online (Liu, 2022). The fieldwork periods belong to a 5-year research project that scrutinizes relationships between smart city development and digital inequality and explores novel ways to tackle unequal tendencies of techno-urban development.

The goal of the Barcelona-focused research has been to get an overview of relevant public policies and practices by meeting city officials and by visiting different events and public centers. These centers included, for example, *Coboi Lab* (Policy lab) and a center called *Canòdrom* that promotes open technology, digital culture, and democratic participation. The events included the *Smart City Expo and World Congress Barcelona* (x 2) and *Barcelona Conference on Digital Inclusion*. The researcher carried out in-person discussions and meetings with both city officials ($n = 6$) and with Barcelona-based researchers (agreed individual discussions: $n = 4$, complemented with a number of informal group discussions). She usually met the key people representing the City several times to establish trust and longer-term collaboration relationships. Two of the individual meetings took the form of a thematic semi-structured interview, and they were recorded and transcribed. Additionally, we gathered key official documents about digital inequality and inclusion.

The visits and online meetings yielded an ample amount of notes and transcriptions that were read alongside official documents and analyzed with thematic content analysis. The aim was to understand the *key concepts* and *central theoretical and practical approaches* that are utilized in Barcelona in conjunction with efforts to enhance digital equality.

We do acknowledge that such an approach to ethnographic fieldwork, entailing short field visits and online follow-ups, has its limitations and does not enable as in-depth understanding as more extended fieldwork would. Nevertheless, we gained interesting insights and perspectives through this type of empirical work; notably, it enables showcasing how some aspects of a people-centric smart city agenda emphasizing radical digital agency can be translated into practical actions. In this paper, we introduce only a couple of specific insights drawn from the empirical study: First, we introduce Barcelona's overall approach to digital inequality, and second, describe one of its practical installations, *Canòdrom*, which intends to act as an interface between the city, technologies, and citizens.

SMART CITY

Urbanization can be considered as one of the current megatrends. According to the UN's 2018 *Revision of World Urbanization Prospects* (Nations, 2018), 2007 marked a significant shift in global population distribution. It was the year when the number of people living in urban regions surpassed those living in rural areas for the first time. Estimates on urban populations differ due to variations in the precise definition of an 'urban area'; however, it is anticipated that by 2050, over two-thirds of the global population will reside in urban areas (Ritchie & Roser, 2018). As urban areas expand and become more complex, also the

challenges they pose for governance, environment, housing, traffic, etc., are likely to grow. Thus, there is a need for new tools, services, and methods to manage urban activities and to meet the needs of the various individuals living in and visiting these cities. The smart city agenda was established in the 1990s as a response to these issues; initially, it was promoted primarily by major technology corporations such as IBM. In the 2020s, several decades after its inception, this model of city-making has gained worldwide popularity and is being increasingly embraced by numerous cities and local administrations (Cugurullo, 2021). The term "smart city" generally refers using information and communication technology (ICT) to enhance the efficiency of urban operations.

The exact meanings of the term may differ, as discussed by Echebarria et al. (2021) and Neirotti et al. (2014) – the definition is highly dependent on the specific context. For example, Albino et al. (2015) argue that variations in local politics and urban development goals and interests lead to significant disparities in the features of smart cities globally. Nevertheless, we may outline general historical trends and identify distinct paths of progress based on the available research: In the early 2000s, the smart city definitions emphasized the simplification of municipal operations and the optimization of infrastructure using digital services, as well as the use of data in decision-making (Hall et al., 2000). By the 2010s, the agenda expanded its scope to encompass policy and community dimensions as well. Echebarria et al. (2021) note that the term was redefined to purposefully dissociate it from the idea of technological determinism commonly associated with smart cities approaches. Nevertheless, they contend that smart cities remain too technocratic, despite this intention to break free from techno-deterministic and techno-solutionist visions.

Many authors have attempted to identify central strands in interpreting the smart city concept. In their comprehensive literature review, Echebarria et al. (2021), for example, identify three primary approaches: The first approach is *techno-centric*, (see also Lee et al., 2014) where smart city infrastructure is built upon digitalization, and development is driven by technology corporations. The second approach is *humanist*, prioritizing the significance of human and social capital. Grassroots actors drive change, based on principles of digital equity, democracy, and local knowledge. The third approach is a *collaborative* one that highlights the connection between city people and the governing body. It aims to foster participatory governance, involving both citizens and companies.

Some scholars present a comparable, yet somewhat distinct perspective, that aligns with the collaborative approach of Echebarria et al. (2021). Yigitcanlar (2021) discusses the drawbacks of the smart city paradigm and argues that these limits are primarily due to the smart city agenda's strong focus on technology. Yigitcanlar's research promotes and applies a *multidimensional perspective on smart cities*, initially developed by Nam and Pardo (2011). This perspective goes beyond the conventional technocratic approach by incorporating technology, policy, and community as interconnected and harmonized factors that ensure sustainable urban futures for everyone. This paradigm utilizes technology to address complexity, policy to reduce uncertainty, and community to facilitate discussions on ambiguity.

These brief definitions are necessarily generalizations; the existing literature on smart cities exhibits a vast range of ideas and opinions derived from many disciplines and research areas, resulting in a multifaceted view. Currently, issues such as privacy, security, socio-digital inequality, and digital citizenship are receiving more attention, as evidenced by the

works of Hintz (2019), Jang and Gim (2022), Martin et al. (2018), and Ylipulli and Luusua (2019). In addition, there is a nascent research line that aims to surpass human-centeredness by investigating approaches to smart cities that recognize the significance of *more-than-human entities*, including animals and nature, and occasionally artificial beings such as robots (e.g. Heitlinger et al., 2024; Luusua et al., 2017; Sheikh et al., 2023; Tomitsch et al., 2021; Yigitcanlar et al., 2019). This strand of research is linked to the promise of ecological sustainability, which is typically included in the smart city agenda. Nevertheless, the existing body of literature on smart cities seems to exhibit a consistent conflict between the technology-focused perspectives and the broader perspectives that aim to tackle cultural, social, and even planetary challenges. According to many researchers, the techno-deterministic and techno-solutionist approach that has influenced the development of smart cities for many years will continue to be present also in the new urban visions revolving around data and artificial intelligence (e.g. Cugurullo, 2021). As a result, it is critical to underline the importance of social and environmental themes in smart urban development to avoid solutionist and fragmented approaches.

Ultimately, there is significant divergence among the various smart city definitions found in the research literature. Significantly, a substantial portion of the literature adopts a *pragmatic viewpoint* and is presented as *non-ideological* (Hatuka et al., 2020; Kitchin, 2015); this increases the appeal to adopt smart city as an approach to tackle the perils of expanding urban areas and worldwide environmental risks, both for policymakers and businesses. Hence, we expect that the proliferation of digitization and digital initiatives will continue thriving in cities worldwide in the foreseeable future.

SOCIO-DIGITAL INEQUALITY AND DIGITAL LITERACY

The concepts of digital inequality and digital literacy are multi-layered and complex, as various individual and societal factors affect and shape them. The majority of research in these fields centers around studying the impact of digital disparities on individuals and society, and analyzing the causes that contribute to these inequalities. Moreover, the fields are examining the methods and instruments that can be employed to diminish these disparities. (Hatuka et al., 2020; Helsper, 2019, 2021). It is also important to note that research on digital inequality and digital literacy are distinct research fields; still, they have also been examined simultaneously, and their focus areas and goals frequently intersect (Helsper & Eynon, 2013).

While traditional forms of social inequality do not specifically relate to digital contexts or smart cities, Robinson et al. (2015) argue that digital inequality is a significant emerging form of inequality. They assert that it has the potential to impact people's lives in various ways. Hence, it is imperative to thoroughly examine the progress of smart city development, which strongly relies on digital technology, by considering the concepts of digital inequalities and digital literacy. In the following, we will introduce some of the main currents of academic conversations around socio-digital inequality and digital literacy and present briefly their central connections with smart cities.

Socio-Digital Inequality

Inequality, which refers to the unjust disparity between various groups of people in society, is a prominent research focus in the social sciences. Traditionally, the social inequalities research has been centered around characteristics such as socioeconomic class, gender, race and ethnicity, age, and education. With the continuous progress and evolution of the information society, new types of inequalities have emerged, collectively known as digital inequality. (Robinson et al., 2015).

Nevertheless, digital inequality is not isolated from other types of inequality. On the contrary, for example, Helsper (2021) argues that digital and social inequalities are frequently interconnected, and disparities that arise in the physical world can easily extend into the digital domain. The relationship between digital technologies and inequalities can also be reciprocal since digital technologies have the potential to expedite and strengthen other types of inequalities, including those connected to age or gender. Therefore Helsper (2021) proposes that to thoroughly investigate the combined effects of social and digital inequalities, it is necessary to recognize them as interconnected and mutually reinforcing disadvantages that align with conventional studies on inequality. The term *socio-digital inequality* describes the overlapping and reciprocal nature of social and digital spheres.

The investigation of digital inequality originates back to the mid-1990s, with the term *digital divide* being coined to delineate the inequalities in computer and Internet access (DiMaggio et al., 2004). After the commodification of computers and digital tools, concerns exclusively pertaining to access lost their significance by the mid-2000s, particularly within Western societies. According to DiMaggio et al. (2004) and Hatuka et al. (2020) the issue of *differentiated use* – which highlights the varying degrees of Internet proficiency and digital literacy – replaced the disparity in physical access to technology.

Today, three levels of digital inequality are often identified in the literature on inequality and digital technology (Helsper, 2019; Lutz, 2019). The first is the previously noted access to technology, which continues to be a problem, particularly for many individuals in precarious socioeconomic situations. The use of digital services becomes difficult without necessary devices or Internet connection. Subtle nuances can also be seen in the first-level digital inequality. For example, there are variations in the *quality of access*, such as whether or not a person has a high-speed connection. Second, having *prospective access* does not guarantee having *access in reality* (Helsper, 2019). For example inadequate skills, individual attitudes, or community norms can prevent the use. Second-level digital inequality is closely linked to digital literacy and usually defined as disparities in ICT competency. According to Helsper, societal elements play a more significant part at this level: Education, gender, and ethnic origin all impact on the disparities in ICT usage and abilities (Helsper, 2019). Finally, the third level of digital inequality is concerned with the advantages, opportunities, and threats that various people face daily. Stated differently, it highlights the positive or unwanted outcomes arising from the preceding two levels, namely access and competences. Positive outcomes include "establishing positive relationships, feeling respected, saving money, finding employment, and having the authority to participate in civic and political life," according to Helsper (2019; see also Van Deursen & Helsper, 2018). Discrimination, cyberbullying, or online hoaxes that cause financial or other issues are examples of adverse outcomes (Helsper & Smahel, 2020).

As briefly highlighted by these examples, socio-digital inequality is a complex and intersectional issue, which renders it a challenging phenomenon to address. Helsper (2019, 2021) has suggested a *location-based approach* as one potential resolution. Rather than focusing on broader digital access, skills, or awareness campaigns, this approach targets particular city districts, local neighborhoods, and social networks. In terms of enhancing technological competence, the significance of social and physical contexts in daily life is likely to be greater than that of society as a whole or at the individual level.

Digital Literacy

Presently, digital literacy is a significant and robust area of study: it typically refers to the digital competencies that allow people to function in a society that is becoming increasingly digital. Prior studies have established a correlation between digital literacy and agency and power. The classic understanding of the *information society* posits that acquiring information is a valuable resource that confers power and enhances productivity (Castells, 1994). This ownership requires access to and proficiency with digital tools and competencies. Digital illiteracy can substantially diminish an individual's agency, defined here as the capacity to act in a sociocultural context.

The last twenty years have seen a significant growth of scholarly debates around digital literacy. As a consequence, there exists a large number of different definitions for digital literacy, and the field has become fragmented and challenging to navigate. The collection of distinct (sub-)literacies required to navigate and engage in the digital society has grown considerably extensive and, at times, perplexing (Ylipulli & Vigren, 2023). Recent studies have addressed, for example, the following types of digital literacy: *coding literacy* (Vee, 2017), *algorithmic literacy* (Cotter & Reisdorf, 2020), *data literacy* (Livingstone et al., 2020) (Pangrazio & Sefton-Green, 2021), and *privacy literacy* (Livingstone et al., 2020), just to mention a few. Marín and Castañeda (2023) profoundly address these complexities and conclude with a somewhat abstract but apt definition: “DL [digital literacy] emerges as a notion of situated multiple integrated skills and practices (conceptual, attitudinal, procedural, and ethical) that empower people (individuals and groups) to participate and communicate efficiently in society” (pp. 1093).

Hinrichsen and Coombs (2013) have developed another comprehensive definition of digital literacy through the construction of a model that includes five distinct dimensions. According to this framework, digital skills encompass the following:

- 1) using: proficiency in utilizing digital tools in a suitable, efficient, and adaptable manner;
- 2) decoding: understanding of media content, structures, and conventions across various platforms;
- 3) meaning-making: the ability to derive meaning from digital media;
- 4) analyzing: the capacity to analyze and make informed judgments and choices in digital domains while taking into account ethical considerations; and
- 5) persona: the awareness of one's personal reputation, identity work, and online persona, as well as the capacity to actively participate and engage in online communities.

Research does not consistently investigate all of these components. For instance, Helsper (2015) observes that most of studies investigating inequalities in digital literacy mainly concentrate on technical and information-seeking abilities. It is imperative to acknowledge that at a meta-level, the literature on digital literacy frequently emphasizes two separate sets of abilities: 1) technical, functional, and/or design skills and 2) broader theoretical skills that facilitate the critique and evaluation of digital settings. A certain degree of disconnection has existed between these two aspects of digital literacy. According to Pangrazio (2016), this binary opposition has resulted in the fragmentation of critical digital literacy along theoretical lines, which ultimately hinders the framework's ability to effectively cater to the demands of its intended audience, namely the individuals living in increasingly digitalizing societies.

Furthermore, when digital literacy is applied to practice, there is a problematic tendency to lose the critical dimension, as noted by Pangrazio (2016) and more recently by Ylipulli and Vigren (2023). Put in another way, school-based digital literacy initiatives, for instance, seem to focus primarily on technical abilities such as coding. They do not seem to offer tools for challenging current digitalization trends, or for imagining alternatives (see also Williamson, 2015). To phrase our claim a little differently, we can argue that many practical initiatives to improve people's digital literacy emphasize adaptability rather than resistance or change-making abilities. Functional skills do act as an essential condition for engaging in civic life and can also be viewed as a means of gaining greater understanding and wider knowledge of technology. However, we argue that critical thinking skills must be considered a highly significant facet of digital literacy in democratic societies.

Factors Contributing to Digital Inequalities and Digital Literacy in Smart Cities

In the following, we briefly present more detailed examples from past research to show how socioeconomic and sociocultural factors affect digital abilities. The presentation is not exhaustive, but it highlights some of the main causes of digital inequalities that should be considered in techno-urban development. Thus, we claim that the following variables and their interconnections must be addressed in just and socially sustainable smart city development.

Socioeconomic status (SES) can be seen as one of the primary determinants of social inequality. SES is a debated concept that generally refers to the measurement of a person's economic and social standing. It is determined by factors such as work experience, financial resources, and social position in comparison to others. (Baker, 2014). For example, Madden and Rainie (2003) found a correlation between higher household income and the use of the Internet as an informative and work tool, while those with lower income were more likely to focus on entertainment. Further, Peter and Valkenburg (2006)) found that socioeconomic status affects teenage Internet abilities and use. Their findings support Madden's and Rainie's (2003) observation that lower-class adolescents utilized the Internet for fun and had inferior Internet skills. In general, these findings suggest that digital inequality studies should focus on usage rather than access to the Internet and tools. Digital skills and technology use are influenced by socioeconomic factors like material/non-material wealth, hence digital inequalities generally reflect social inequality (see e.g. Van Dijk, 2005).

One of the leading causes of socio-digital inequality is **educational inequality**, which is largely linked to digital literacy. Deursen and Dijk (2014) found that low-educated Dutch

Internet users spend more time online than higher-status users, yet the latter group uses the Internet more productively. According to Robinson et al. (2015) those with access to higher education and better online skills are more likely to find work and earn more. They (ibid.) add that digital competencies are increasingly vital in job searches. As the economy uses more Internet-based intermediaries and job-searching sites such as LinkedIn, professionals who perform better on these platforms certainly have an advantage in the job market. These findings support SES and digital inequality studies: higher education is associated with more complicated Internet use, which boosts productivity and personal advantages gains (Van Deursen et al., 2011; Van Deursen & Van Dijk, 2009). Overall, the research on digital inequality and education contradicts two common beliefs: first, that time will solve digital skills problems as more people are born ‘digital natives’; second, that Internet skills are learned through trial and error experimentation. It can be concluded that these assumptions may apply for operational skills but not for advanced information and strategy abilities, which may require formal education (Hatuka et al., 2020; Van Deursen et al., 2011). Those with access to formal schooling or higher ICT education have a major advantage over those without (Robinson et al., 2015).

Another factor closely linked to inequality and affecting ICT use is **age**. Here we can also find commonly held beliefs on superior capabilities of the younger generations that have been born during the ‘digital age’. Lack of digital literacy may, indeed, result in some elderly individuals experiencing a decline in their autonomy and requiring assistance in managing their daily tasks (e.g. Hänninen et al., 2021). Nevertheless, it is essential to acknowledge that the older population should not be regarded as a uniform entity. Their proficiency in digital skills demonstrates considerable variation, influenced by several other variables, as evidenced by the empirical study conducted by Ylipulli and Suopajarvi (2013) within a smart city setting. Motivation, needs, and social context affect technology use as well as skills and digital literacy. Hatuka et al. (2020) emphasize that use and non-use should also be understood as a choice, so older people who refuse to use digital technology or use it only for specific purposes can be understood as having a strong agency, not weak skills. Further, although digital literacy research shows that young people have better functional Internet skills than older people, van Deursen et al. (2011) found that older generations perform better in content-related skills, i.e., they can work and navigate strategically online. Thus, the conventional idea that the digital gap will shrink when the older population retires is false, as ICT competencies might vary in surprising and complex ways between generations.

Robinson et al. (2015) note that while internet access has narrowed between genders in industrialized nations, **gender inequalities** in online behavior still exist. Women use the Internet less often (Wasserman & Richmond-Abbott, 2005), participate less intensely (Hargittai, 2010), and have a narrower range in their online activities (Haight et al., 2014). Robinson et al. (2015) offer three gender-related observations: first, our online activity reflects our societal roles, interests, and expectations. Second, women underestimate their internet capabilities more than men, which may alter research outcomes. Third, males outweigh women in IT development and design, which may affect what kind of services specialists build. *Smart mobility*, a smart city research and development field, illustrates the last point. In urban areas, smart mobility may improve access, safety, convenience, and comfort, however, Singh (2020) claims that women's mobility patterns and travel demands have gotten little attention, despite being considerably different from men's. Her findings

suggest that some smart mobility solutions are widening the gender gap in cities and that only women who travel like most men, can benefit from those services, as they are primarily developed for those who move “*for commuting purposes, have full-time employment with good income, and are moving without children or elderly in tow*” (Singh, 2020).

In a similar vein, studies have demonstrated that Internet proficiency and utilization can be influenced by **ethnic origin** (Mesch & Talmud, 2011). Primarily since digitalization exacerbates pre-existing privileges and amplifies conventional inequalities, ethnic minorities may experience digital disadvantages. In addition to linguistic and cultural obstacles, immigrants may encounter difficulties when attempting to access digitalized public services (Chen et al., 2020). The conventional axes of inequality comprise an intricate spectrum where various factors intersect and have the potential to either magnify or diminish one another. According to Helsper (2021), digital inequalities can be delineated on this intricate landscape. Smart city strategies must not only entail or engage with initiatives designed to improve digital literacy, but also the underlying socioeconomic and sociocultural inequalities need to be addressed.

The last factor we briefly highlight consists of **birthplace and residency**; they affect socioeconomic status and therefore, also ICT use (Arroyo-Menéndez et al., 2022). However, digital inequality research seldom considers geographical aspects and usually prioritizes the person over the local and spatial living environment (Helsper, 2019). Geographical inequalities need additional investigation because digital gaps can exist, for example, between a country's center and periphery and between nearby cities. In addition, there can be significant differences *within a city*: In locations of smart city development, housing often becomes expensive, making these districts exclusive; thus, only the wealthy get to use smart city amenities. Rather than just poor digital skills or infrastructure, geographic inequality is caused by complex socio-spatial actions influenced by political, cultural, and economic factors (Crang et al., 2006). Some researchers (Fernandez et al., 2018; Hatuka & Zur, 2020) have suggested examining the unequal geography of digital technologies in a city and how it may affect social exclusion. The interconnectedness and pervasive integration of ICTs and their diverse applications in daily routines must be considered when analyzing the results from a smart city service perspective and how they affect city residents' mobility, daily tasks, sense of belonging, social cohesion, and quality of life. Therefore, the way individuals utilize digital technologies is influenced not only by socioeconomic status, education, age, gender, and ethnicity but also by their geographic location and how they engage with their immediate environment, various communities, and other pertinent local networks (Silva & Frith, 2012).

TOWARDS 'RADICAL SMART CITIZENSHIP'

The current smart city research clearly recognizes digital inequality or digital divide as a challenge (Martin et al., 2018). For example, Jang & Gim (2022) aptly note that those who benefit from digital innovation in smart cities tend to be affluent, highly skilled, and well-educated; on the contrary, there exists a growing number of people who are in weaker socioeconomic position, and whose basic needs and position in regards to technologies are ignored. The authors (Jang & Gim, 2022) summarize that “*Digital access and digital literacy directly affect levels of knowledge, income, and even democratic rights in smart cities, as*

public service delivery and participation in decision-making are undergoing digital transformations across the board.” Based on the points above, one may contend that the smart city agenda has the potential to perpetuate several pre-existing inequalities while also generating new ones. Hence, the advancement of smart cities may contradict the concept of a just city (Rosol et al., 2019). This phenomenon may occur if the smart city innovations focus only on the more privileged rather than addressing all city residents (Shamsuddin & Srinivasan, 2021). Below we first look at how discussions on "smart citizens" and "digital agency" could help us understand digital inequality in smart cities in a more complete and critical way. Then, we look at our real-life example, Barcelona, in light of these theoretical discussions.

Conceptualizations of Smart Citizens and Their Digital Skills

We can identify a few research tracks that address the issue of the digital divide in smart cities. One perspective emphasizes the significance of residents' digital proficiency since only those with a strong understanding of technology can adapt to the rapid changes brought about by urban digitalization. Curiously, there is a similar disparity in arguments over digital literacy, particularly in efforts to promote digital literacy education: The focus is primarily on technical and functional abilities, while critical thinking skills are neglected. For example, Ahad et al. (Ahad et al., 2020) recognize digital divide as one of the central socio-economic challenges in smart city ecosystem, and they underline the significance of functional skills: *“The mindset of the inhabitants plays a very crucial role in realization of a smart city ecosystem. If the people are not ready to accept the digital changes around them, we cannot think of having a smart city in a true sense. For its successful implementation, the users must accept the changes and use the services for their benefits.”* This framing of residents' digital skills is connected to *techno-centric* smart city approach, presented in the smart city section (Echebarria et al., 2021).

In addition to this perspective emphasizing the need to address digital inequalities to enable citizens to accept and live with the digital transformation (Williamson, 2015), there exists a strand of smart city research intending to conceptualize ‘smart citizen’ in an alternative, critical way. This view on smart citizens is more in line with the *humanist* and *collaborative* approaches to smart cities, and it also resonates with the notion that people's critical thinking skills concerning technology should be supported. As an example of this strand, Cardullo & Kitchin (2019a) examine the role of smart citizens by examining their participation. Based on their findings, individuals are provided with many opportunities to engage in smart cities, which might have positive effects on participatory democracy. However, the issue lies in the post-political interpretation of these activities: This implies that people are asked to contribute, negotiate, actively participate, and perhaps even create something – but only to solve practical problems. For example, they can be requested to contribute to the creation of an application or provide input on an urban development plan. However, citizens are not compelled to challenge or resist prevailing social and political conventions but rather to conform to pre-established frameworks. According to Cardullo & Kitchin (2019a), in the smart city, most of inhabitants are “empowered” by technologies that view them as customers or testers. They are treated as individuals who can be guided, controlled, and encouraged to behave in specific ways or as data sources that can be

transformed into goods. Similar arguments have been presented in other studies as well, for example in the works of Williamson (2015) and Vanolo (2014).

Further, Cardullo & Kitchin (2019b) have outlined the necessary modifications to move away from the restrictive role that residents are often assigned in most of smart city programs. They argue for the shift away from “*neoliberal conceptions of citizenship, in which people act as consumers or users within a marketplace of services, and beyond initiatives created through stewardship and civic paternalism (in which elites decide what is best for all).*” Currently, smart city programmes are built mainly to serve the state and the market; instead, they would need to be reoriented to focus on the needs and interests of the people inhabiting the cities. The framing of the citizens' position should be designed to empower them as collaborators, co-producers, creators, and leaders, but also allow them to express resistance. This type of transition necessitates the establishment of human rights as a fundamental basis for smart city development, with a particular emphasis on issues such as democracy and social justice. According to Cardullo & Kitchin (2019b) also the role of public assets would need to be reconsidered, and they “*would form commons to be protected and leveraged for the common good*”.

This alternative form of urban governance can be understood as drawing from Henri Lefebvre's (1996) popular ‘right to the city’ idea, taking us beyond the non-political, predefined boundaries of participation. ‘Right to the city’ has been a theoretical starting point for many scholars addressing smart citizens. For example, Anastasiu (2019) explores how the ‘right to the city’ perspective might facilitate the analysis of the participatory city-making notion. Significantly, Anastasiu (ibid.) highlights that Lefebvre's ideas extend beyond the mere right to access the smart city, information, data, and the right to utilize services or technology. Instead, ‘right to the smart city’ encompasses the right to actively produce, oversee, and possess all of these elements as a means of political and economic empowerment, primarily aimed at promoting the collective welfare and enhancing social connections.

This brief recap of studies emphasizing the necessity of comprehending the role of smart city residents in a more complete manner and the significance of strengthening citizen involvement and empowering people brings us back to the issues of digital inequality and digital literacy. For instance, Anastasiu (2019) acknowledges the importance of ‘media literacy’ as a requirement for participating in smart cities, but does not provide any details as her primary emphasis is on other aspects. The significance of digital skills, encompassing technical and functional competencies, is evident for ‘smart citizens.’ However, to effectively contribute to the development of people-centric smart cities, it is imperative to possess a comprehensive understanding and awareness of the societal, economic, and ecological impacts of technologies. Without a sufficient level of profound comprehension – which will be expanded upon in the subsequent section – it becomes very difficult to grasp the mechanisms that underpin our routine behaviours, such as those associated with the data economy or the use of AI-powered services. Lacking the understanding of how our social media updates and clicks are transformed into large amounts of data and monetized (Zuboff, 2019), or the ability to critically evaluate the limitations of AI and the ethicality of its practices¹, it becomes challenging for citizens to engage as a political entity and actively

¹ <https://time.com/6247678/openai-chatgpt-kenya-workers/>

participate in society. Hence, one may posit that a comprehensive understanding of technology, encompassing the social, cultural, political, environmental, and economic aspects of digitalization, emerges as an essential requirement for gaining any kind of power and control. This form of digital literacy surpasses most of the current definitions of the term. According to Emejulu & McGregor (2019, 131), the education surrounding digital citizenship suppresses some issues and parts of the concept that are connected to the exploitative character of digital spheres, in addition to failing to center critical understanding of the digital. As the authors point out, many mainstream approaches concentrate on teaching students about cutting-edge technology and how to use it effectively rather than examining political dimensions of digitalization, like "who has power" (Ibid, 2019, p. 133) and the ways in which this power is expressed. In the following section, we deepen our exploration of smart citizenship by exploring the concept of radical digital agency.

Radical Digital Agency

- *Radical digital citizenship*, as presented by Emejulu & McGregor (2019), consists of both being able to critically analyze digital technologies and their sociopolitical, environmental, and economic effect, as well as participating in collective action and imagining alternative views for technological developments. The authors (ibid.) contend that digital citizenship needs to be viewed in the context of broader discussions about social justice, bringing an alternative perspective to discussions focusing on issues such as the distribution of wealth, representation, and democratic engagement. This type of digital citizenship is radical in the sense that it challenges the very foundations of digital development. In this context, we can challenge the individualistic, skills-focused and technocentric views on digital society through community and collective digital agency. Choi & Cristol (2021, 366) argue that radical digital citizenship requires reconsidering "previously unchallengeable institutional power structures and systemic oppressions" and acting based on intersectional and inclusionary participation in democracy, primarily focusing on elevating marginalized voices. As a result, digital participation should be examined not only in terms of practical and limiting socio-digital inequalities, but also in terms of the power struggles that residents encounter when contributing to a digitalized society.
- In the light of these conceptualizations, we can investigate the possibilities of *radical digital agency* as a competence to act with digital technologies and/or within digital realms, subjected to critical understandings of digital power struggles and alternative visions for the future (Emejulu & McGregor, 2019; Passey et al., 2018). In general, *agency* can be defined as the socio-culturally defined ability to influence one's surroundings and circumstances (Pangrazio & Sefton-Green, 2021, 22). In the digital environment, the concept of agency expands into the individual's capacity to perceive societal and digital structures and their role within them, safeguarding themselves from harm and recognizing opportunities to act towards meaningful change in these environments, as discussed by Pangrazio and Sefton Green (2021) and Hintz et al. (2017). The ability to act in one's own best interests, as well as an understanding of digital power systems, are thus critical components of digital agency. The agency is a

prerequisite for the conscious and autonomous use of digital media, online civic engagement, and understanding of one's digital rights (Pangrazio & Sefton-Green, 2021).

- Radical digital agency questions the notion of agency being directly linked to digital skills or even digital literacy. Agency can take many different forms, sometimes contradictory, such as refusing to adopt new technologies or participate in digital societies entirely. According to Ylipulli and Vigren (2023), critical analysis of digitally transformed societies and their futures does not require high-level technical proficiency. Resistance and critical reflection should not be restricted to any demographic. Based on arguments of Emejulu and McGregor (2019) and Ylipulli and Vigren (2023), digital citizenship should be built through agency, which not only raises awareness but creates space for resistance, collective action, and possibilities for alternative visions about digital futures. These radical forms of digital agency are critical when discussing digital or smart citizenship, and potential paths to them should be investigated in greater depth.
- Emejulu and McGregor (2019) present a two-fold approach to fostering radical digital citizenship: first, they stress the need to raise awareness and resistance to narratives that portray technology as a neutral societal factor, and second, supplement understanding with collective action, such as independent platforms, grassroots organizing, and mobilization outside of the corporate and neoliberal spheres. Additionally, Emejulu and McGregor (Ibid., p. 143) argue for carving space for citizen-centered future imaginaries of smart and digital citizenship.
- Incorporating such a vision for building digital citizenship is challenging in the smart city context. As argued by Cardullo and Kitchin (2019a, 825), smart city initiatives are rarely built to increase citizens' digital agency and instead prioritize private interest over citizen perspectives (see Hollands, 2008; Jirón et al., 2021; Zaman and Hertweck, 2022). Following Hintz et al. (2017, 735), digital citizenship should be approached by providing citizens with the tools to exercise self-determination in datafied environments. This could be accomplished by establishing secure infrastructures and regulations, increasing public awareness and discourse about digital citizenship, and facilitating the responsible use of relevant digital platforms and technologies.

Barcelona's Approach to Smart Cities

This part aims to enhance the core findings of the theoretical part by incorporating insights from praxis. We have drawn the insights below from short-term and hybrid fieldwork conducted in Barcelona, Spain, between 2022–2023. Several scholars, including Cardullo & Kitchin mentioned above, point to Barcelona as an example of a city that has made recent efforts to develop and implement policies that are consistent with the fundamental ideas of a people-centric smart city. Barcelona has been dubbed a 'rebel city' by international media, and its approach has been described as 'radical municipalism', which refers to efforts to build cities from the ground up by 'radically' increasing citizens' power (Rushton, Steve, 2019). This is done, for example, by emphasizing the role of civic movements, social innovation,

and also repurposing digital platform technologies (Aragón et al., 2017; Charnock et al., 2021). The roots of Barcelona's reputation for being an example of global urbanism can be traced back to the 1990s and are out of the scope of this article; however, it is important to note that during the 2000s, the city successfully branded itself as the 'world's leading smart city' (Charnock et al., 2021). In general, this development was initially based on a more techno-centric approach to smart cities, as discussed earlier in this article (e.g. Echebarria et al., 2021).

The smart city vision was steered towards a new direction with political shifts in 2015, during a period when a left-wing, green, social movement coalition governed the city; however, as Charnock et al., (2021) write, the smart city ecosystem of Barcelona has been 'polyphonic' for a long time, and the change is not necessarily as radical as presented in public. Overall, we should not take the current development at face value; we still need to ask, for example “-- *whether they awaken among citizens a sense of their own productive and political subjectivity that runs counter to the reproduction of entrepreneurial, docile and ambivudual conceptions of citizenship*” (Charnock et al., 2021, 585). Following these lines of thought, we do not wish to present that Barcelona's approach would be ideal and without any contradictions and pitfalls; however, when analyzed in the light of the presented literature on socio-digital inequalities and digital literacy, we do see a lot of exiting actions and practical initiatives bearing potential for change. The effect of these developments on citizens is another question for which we cannot (yet) offer any answer.

When conducting fieldwork in Barcelona and attending various events hosted by a variety of smart city actors, it became clear that smart city means different things to different stakeholders, and its consequences are interpreted differently. The perspectives presented below focus on the strand of Barcelona's smart city policies and practices that aim to emphasize *digital inclusion* as the core of smart cities. In discussions with various actors, ranging from Barcelona-based smart city scholars to city officials, it was repeatedly stated that the covid-19 pandemic had painfully brought digital inequality to light – for example, some children did not have access to digital environments to study at home during the pandemic restrictions. This awareness is seasoned with a particular urban culture, emphasizing the importance of participation, equality, activism, and even anarchism (Juris, 2010).

When it comes to broader philosophies behind Barcelona's current approach to digital inclusion in smart cities, we can find at least two frameworks, namely *technological humanism* and *digital rights*. Technological humanism is a thinking paradigm recently surfaced in Spanish political debates. Its roots lie in the Spanish philosophy of technology, and it has gained greater popularity than the concept of *digital humanism*, which is frequently employed in English-speaking nations. Its utilization has witnessed a surge among policy documents and media outlets nationwide. Furthermore, the City of Barcelona has declared that it aspires to transform itself into the capital of technological humanism² – an approach defined as follows in a document by the City Council: “*A model of technological development centerd on the human being, that reduces social inequalities and protects human rights, and in which technology is at the service of people and the general interests.*” (Digital Future Society, 2022). In contrast, *digital rights* primarily pertain to the rights-

² <https://citiesfordigitalrights.org/city/barcelona>

oriented methodology that Barcelona plans to implement to advance its techno-urban environment. The *Manifesto in Favor for Technological Sovereignty and Digital Rights for Cities*³ defines these rights as follows: “Citizens’ digital rights include the rights of privacy, security, information self-determination and neutrality, giving citizens a choice about what happens to their digital identity, who uses their data online, and for which purposes. Digital democracy enables more citizen participation in design and governance of cities and city services.” Furthermore, the post-2015 ‘rebel’ urbanism is built on top of other broad conceptualizations too, such as *technological sovereignty*, which plays a role in some of the digital inclusion initiatives as well; *technological sovereignty* pertains to the reestablishment of authority over data and information produced by digital technologies, while advocating for the establishment of public digital infrastructures founded upon free and open source software, open standards, and open formats (Bria, 2017).

We find it very interesting that in Barcelona, and throughout Spain, such frameworks have become popular in non-academic, political, and popular contexts. However, the more important question for this article is how they are perceived in relation to citizens and translated into action. During the on-site phase of the fieldwork, the first author of this article attended *Barcelona Conference for Digital Inclusion; Bridging Gaps for a Just Digital Transition* (1st of December 2022). At this conference, high-level city officials from Barcelona but also from several collaborating European Cities, such as Amsterdam, discussed the challenges of digital inclusion. Overall, the discourse focused on *digital access* and *skills*, which were widely assumed to be interconnected. On a few occasions, access was viewed as consisting of two layers: personal devices and public infrastructure such as high-speed Internet access. Furthermore, in a few talks, it was emphasized how digital gaps are inextricably linked to other inequalities; in Catalonia, the most important ones were argued to be economic inequalities, gender disparities, and language barriers (it was noted that there should be a possibility to use digital services and platforms in Catalan).

During this event – and on several other occasions – numerous practical actions and initiatives surfaced, demonstrating the steps Barcelona has taken towards integrating digital rights in the city’s decision-making. These approaches include measuring the digital divide regularly (BIT Habitat, 2021). Further, the City has built different kinds of initiatives to enhance citizens’ digital competencies: Barcelona Digital City webpages list ‘46 citizen initiatives for defending digital rights’¹. For example, the city has an *ICT Agents* program⁴ which offers digital assistance for people who need advice in their everyday lives. A training center called *Cibernàrium*, established already for over 20 years ago, provides training to improve technological competence of the people, covering everyday skills and professional digital skills (Cibernàrium team, 2020). *Antenes Cibernàrium* program extends the technology training to a larger geographic area, mainly to Barcelona’s municipal libraries. Further, there is a pilot project in the city to ensure free and safe access to digital technology for all public primary and secondary schools, carried out in collaboration with Xnet and the Barcelona Education Consortium.

³ <https://www.barcelona.cat/digitalstandards/manifesto/0.2/>

⁴ <https://bithabitat.barcelona/es/proyectos/agents-tic-2/>

Canòdrom as a Nest for Radical Digital Agency?

We focus here in more detail on one of the digital rights initiatives, a center called *Canòdrom*⁵. Aims of the center reflect the comprehensive conceptualization of digital literacy and an approach towards radical digital agency that we believe are prerequisites for ‘smart citizenship’ as defined in the previous sections. In other words, we can see Canòdrom as an example of how these rather abstract ideas could be transformed into an actionable initiative. Since 2020, a former greyhound stadium in Sant Andreu (a low-middle income district) has housed a center that acts as a link between the neighborhood and the city, promoting Barcelona's digital inclusion agenda at the grassroots level. While the center provides workspaces for visiting researchers and the *Decidim* team, who manage Barcelona's famous citizen participation platform, one of its primary objectives is to engage and benefit the public. We connected with the center's managers online and have visited the center four times in total to get a sense of their approach and concrete activities. In addition to several more informal discussions, we interviewed one of the management team members.

Firstly, it is essential to acknowledge that Canòdrom does not solely focus on offering digital training. The center's managers are actively striving to develop a genuine connection with the residents and to involve them in their activities; they stated that this was quite hard at first. All the activities do not revolve around technology; the local community uses the facility for a variety of purposes, including hosting community meetings. When we last visited the center in autumn 2023, the building's terrace was open to everyone in the afternoons and evenings, and games were available to children, young people, and families, which had proven to be a popular activity. The interviewed management team member emphasized that by building connections with the inhabitants of the neighbourhood and acquainting them with the premises, they have taken steps towards a governance framework that would empower the locals to engage in the administration of the space. According to the respondent, the concept of space is perceived as a commons, aligning with the theoretical discussions surrounding the citizens' ‘right to the city’ (Lefebvre, 1996). However, digital technology is a crucial component in Canòdrom's agenda. Our interviewee explained that *“The space is primarily devoted and focused on offering a place where we can reflect on and delve into technology with a more humanistic approach.”* This approach does not just cover problems and challenges, but it also addresses opportunities new technologies bring along.

The facility has provided a diverse range of events tailored to the needs of different urban residents, encompassing workshops, seminars, exhibitions, music performances, book presentations, festivals, and open-air cinema screenings. With the primary objective of the center being to lower the threshold to participate in debates about technology and democracy, the various events focus thematically around digital culture, open-source technology, digital rights, and democratic engagement. In addition, the center provides courses for people who want to enhance their digital skills, and the level of courses ranges from fundamental skills to more advanced ones. Their goal is not only to encourage people to use technology, but also to foster a healthy relationship with digital technologies, as they offer 'digital detox' sessions.

To provide some more specific examples of their activities, we briefly describe two events for very different target groups: During our previous visit, Canòdrom had an ongoing

⁵ <https://canodrom.barcelona/en/el-canodrom>

campaign to collect local memories from when the center was still a greyhound stadium, in the form of photographs. They had about 12 people, all older adults and mostly women, who helped collect historical images and discuss their memories before beginning to digitalize the pictures. The idea was that this activity would teach participants how to use technology to digitalize images, which would be empowering for them. The second example comes from a lecture and workshop on artificial intelligence that we attended in autumn 2023. The event's presenters were from a collective called *Taller Estampa*, which is a group of artists and technologists. They create creative installations revealing how AI works and reflecting its working mechanisms critically. This event had around 12 adult participants. The presentation described AI's history and how it works; notably, they framed the technology as "Not a futuristic technology but a product of sociohistoric processes." The latter part of the event consisted of testing some of the interactive artworks of the collective.

Crucially, Canòdrom stands out from other centers and projects that provide digital training by utilizing open-source technologies for all operations, including programs that teach fundamental digital skills like email usage. The objective is to enhance knowledge regarding alternative tools instead of utilizing common services, platforms and applications provided by major technology corporations. Our interviewee stated that alongside classes or sessions that emphasize fundamental abilities, they also offer additional courses that enhance and elaborate on the critical perspective: *"When you come here to learn about a certain tool, there is no such talk initially; there is just the introduction of the tool. However, in parallel to that, if people wonder why we offer these kinds of tools instead of Google or Microsoft or others, there are certain courses that expand on this critical point of view. There are people who just come here to learn how to use digital tools or software. This is the entry-level. And in this group of people some want to learn more about the alternatives."*

This approach is linked not only to technological humanism and digital rights, but also to digital sovereignty; the goal is to expose the central mechanisms of data capitalism, which operate by collecting, tracking, and analyzing personal data without people's consent. Further, through its different activities, Canòdrom wishes to resist black box algorithms, reproduction of discrimination and inequality, social media bubbles, hate discourses, information manipulation and other threats to democratic societies that powerful technology companies have introduced us.

Canòdrom is a unique physical space, intending to offer a low-threshold forum for techno-political debates. The initiative's main objective is to enhance the agency of urban residents and emphasize the potential of everyday decisions in shaping alternative technology trajectories. The employed approach considers a whole spectrum of digital interests and competencies, starting from learning the basic skills and singular tasks such as digitalizing photographs, extending towards studying emerging technologies' social, political, and environmental impacts through artistic experiments. Furthermore, it is important to note that the center is located in a typical community in which a large proportion of the residents are elderly or economically disadvantaged. This approach aligns with Helsper's (2019) suggestion to prioritize the *meso-social* level when aiming to tackle digital inequalities. In essence, it is imperative to recognize communities and pre-existing networks as pivotal focal points for endeavours aimed at enhancing individuals' digital proficiency. The approach of Canòdrom also resonates with Emejulu's and McGregor's (2019) two-fold approach to fostering radical digital citizenship: they highlight the importance of first creating awareness

and resistance to the narratives of technology as a neutral societal factor, and secondly, they suggest enhancing this awareness by incorporating collaborative efforts, such as autonomous platforms, grassroots mobilization, and organizing beyond the realm of corporate and neoliberal influence.

Despite beautifully embodying some of the central facets of our explorations on digital inequality and radical digital agency as a prerequisite for smart citizenship, the approach and example set by Canòdrom has its challenges. For example, the scale of its activities is quite small, focusing on the quality and depth of the interactions rather than intending to reach large segments of the city inhabitants. To raise awareness, each neighborhood would require its own canòdrom. Creating change through this type of effort is likely to take a long time, and the center's existence is dependent on who governs the city. Furthermore, assessing the impact of such an initiative can be difficult, and the managers did not have a clear answer for how to evaluate the change they may cause. This issue is related to the previous one: without a proven effect, it can be difficult to justify funding these types of projects, particularly for governments that do not share the same values.

DISCUSSION AND CONCLUSIONS

We begin by presenting key findings from the study on socio-digital inequalities and digital literacy, followed by a discussion of how these concepts should be considered when developing citizen-centric smart cities and improving critical smart citizenship.

Through our theoretical exploration, we noted the layered nature of digital inequality and digital literacy; both consist of intersecting factors that can reinforce or diminish the effect of other factors. Furthermore, traditional axes of inequalities are superimposed on digital inequalities, and they have a strong impact on how digital disparities manifest themselves in society. Moreover, it seems that research on socio-digital inequalities and research on digital literacy form two separate research traditions; however, when dealing with the effects of broad and complex agendas accelerating digital transformation such as smart cities, we should be able to consider issues connected to both areas simultaneously. We also noticed that, while several scholars have emphasized the importance of critical thinking skills in digital literacy frameworks, the majority of the research focuses on technical or functional skills. This tendency is reinforced when digital literacy is implemented and taught at schools, for example: the educational programs easily overemphasize the role of technical skills. Following the arguments of Toscano (2011) and Ylipulli & Vigren (2023), we claim that digital literacy should include the dimension of *technological understanding*, which highlights societal, cultural, political, environmental, and economic dimensions of digitalization, and includes the *ability to imagine other kinds of futures*. We believe that these skills, particularly in the context of smart cities, are critical to ensuring democratic urban development. We have collected and combined the central findings from this part of the inquiry into the image 2. The model follows, to some extent, the conceptual framework by Helsper & Eynon (2013) which analyzes connections between digital inclusion and digital skills. Our model differs from their framework (ibid.) because we intend to display the interaction between different socioeconomic and sociocultural factors and digital skills with a vocabulary and in a format that would assist in aligning these insights with the body of work

concerning critical smart citizenship. We also wanted to create a representation that would enable applying the model in practical initiatives.

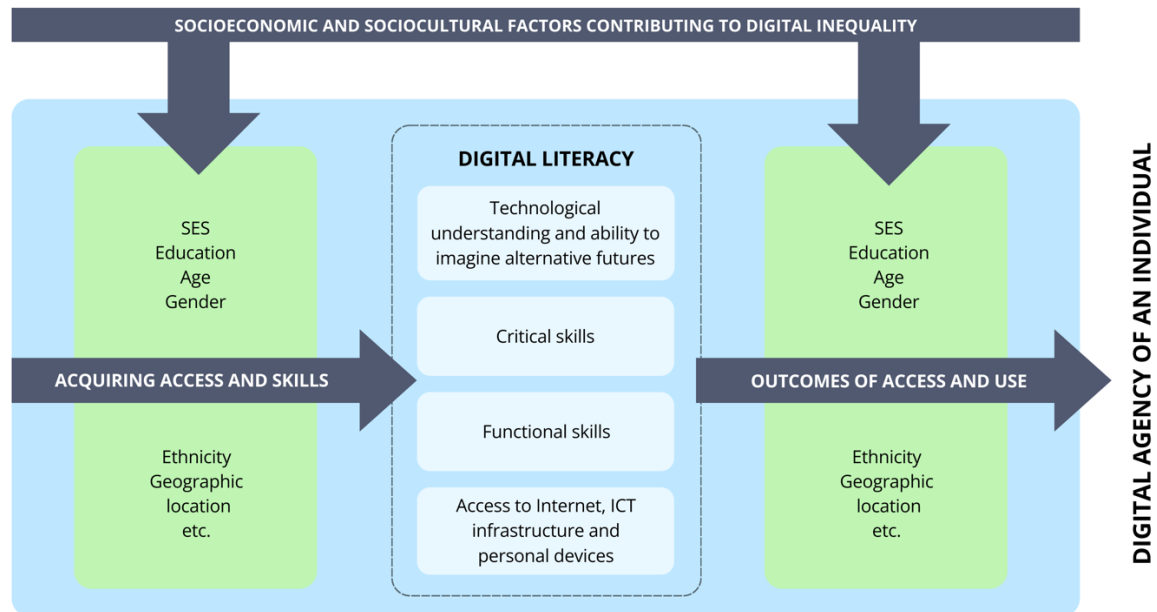


Image 2: The framework combining central findings from theoretical review on digital inequality and digital literacy research. A prior version of the framework was published in Ylipulli & Hämäläinen (2023).

Initially, our model emphasizes how various societal inequities, referred to as socioeconomic and sociocultural factors, affect an individual's ability to obtain Internet access and various digital devices, as well as the individual's chances of acquiring various forms of digital literacy and skills. These are referred to as first and second-level digital inequalities in the literature. The factors above also impact an individual's potential to benefit from diverse skill sets and access positively; this constitutes the third tier of digital inequality. As defined by Helsper & Eynon (2013), this concept may also be called "digital engagement."

The first column of the model explains how a person's ability to acquire ICT or a variety of skills might be impacted by socioeconomic and sociocultural factors. For instance, a person with a limited income might have challenges affording digital devices or a high-speed Internet connection. Likewise, inadequate ICT proficiency is frequently the consequence of a lack of education. The column on the right-hand side serves as a reminder that, even with varying degrees of access and competence, an individual may not be able to benefit from use for various reasons. As previously stated, access and usage are insufficient if one's educational background or social milieu only allows or promotes recreational use, for example. Another example is discrimination based on gender: Even though a person who identifies as female may have (limited) access to and can develop a high level of digital literacy, she may be unable to use these skills to advance her own or society's interests because she is not acknowledged as an expert or because she lacks human rights. Therefore, socioeconomic and sociocultural factors are complex and multi-level variables that require careful consideration when devising policies and interventions to address digital divides.

In addition, our approach identifies four categories of digital literacy. Since access is still a problem, it needs to be covered in any framework that aims to explain the various issues related to digital inequality and smart cities. Furthermore, it is essential to consider multilayered digital skills. Digital literacy studies frequently mention two skill sets: critical skills and functional skills. Most definitions of critical skills seem to revolve around the ability to critically examine and produce digital material as well as the capacity to critically assess one's own place within digital domains (e.g. Hinrichsen & Coombs, 2013). Thus, these criteria focus on the immediate digital context and an individual's capacity to comprehend, reflect, and create digital content. We have included the *level of understanding* in our framework because of the importance of competencies related to understanding societal roles and the societal embeddedness of technologies. We could view the proposed level of understanding as a unique set of skills, complementing the standard categories of functional and critical skills.

When it comes to digital inequality in smart cities, it is recognized as a challenge in literature, but it is framed in many ways. Mapping and analyzing these different framings would probably constitute a study of its own; still, in this paper, we highlighted two different types of framings: a) A smart citizen needs digital skills to adapt to inevitable digital transformation and to act as a user and customer for private and public sector actors providing the increasingly digitalized services; b) a smart citizen needs digital skills to participate, to co-create, and to act as a leader; and also to express resistance. We are more interested in this latter type of smart citizenship, which is aligned with the humanist and collaborative smart city models and intends to distribute power in more equal ways within the digitalizing urban context. However, we also noted that investigating digital competence as a prerequisite for the critical 'smart citizenship' has not received significant attention in research.

We take the first steps towards targeting this research gap in two ways: We draw from Emejulu's and McGregor's (2019) notion of radical digital citizenship and from the practical example offered by Barcelona's Canòdrom center. According to Emejulu and McGregor (2019), the ability to critically analyze digital technologies and their effects on the economy, society, and environment is a requirement for radical digital citizenship. It also means crafting alternatives for technology development and participating in cooperative projects. They (ibid.) stress that we should view digital citizenship within the larger context of social justice discourses. The 'radicality' of the approach lies in the fact that it underlines citizens' possibilities to investigate and question the very fundamentals of digital development. To advance radical digital citizenship, Emejulu and McGregor (2019) propose two strategies: first, dispelling the myths that view technology as an objective social force, and second, advancing understanding through collective action such as independent platforms, grassroots organizing, and mobilization outside of the corporate and neoliberal spheres. Both Ylipulli & Vigren (2023) and Emejulu and McGregor (2019) point out the need for carving out space for alternative future imaginaries. In our comprehensive (yet tentative) model, we suggest that radical digital citizenship is achieved by strengthening digital agency. This means having the skills to interact with digital technologies and/or in digital spaces while being aware of digital power struggles and other possible futures.

To present a practical example, we introduced *Canòdrom* in Barcelona, a community and digital training hub functioning under the local smart city agenda. It provides access to

technology and digital training covering different skill levels and targeted for different groups of people, and intends to enhance citizens' awareness of technologies' societal, cultural, political, environmental, and economic dimensions. As part of their agenda, they also stress the potential of alternative technologies that might lead us towards alternative futures. Canòdrom demonstrates that supporting radical digital agency in a smart city context in practice is possible. We identified the small scale of Canòdrom's activities and its dependency on prevailing city policies as challenges.

Finally, we emphasize that even though we have explored and highlighted the interconnectedness of socio-digital inequality, digital literacy, and agency, a radical digital agency cannot be understood as a result of all the components presented in image 2. being in perfect configuration. A professional programmer, for example, might be highly educated and wealthy and has exceptionally high functional and technical skills; a YouTuber, on the other hand, might have excellent production skills, a superior understanding of the subtleties of video content, and the ability to manage their online persona with extreme skill (i.e. critical skills). The outcomes these imagined individuals get from being in a favorable socioeconomic and sociocultural position and possessing advanced digital skills in some areas can be highly rewarding on a personal level. This does not imply that they have technological understanding, though, in the sense that we have defined it. Possessing strong critical and functional skill sets does not guarantee that one can understand how one's activities fit into the larger political and economic structures of the world. Beyond the practical and personal advantages made possible by digital technology, radical critical agency critiques unfavorable societal and environmental trends and consequences.

IMPLICATIONS FOR SMART CITY POLICIES

Based on the empirical and theoretical research presented in this article, we can formulate a few practical guidelines for people-centric smart city policies. Before anything else, it is critical to emphasize the importance of addressing socio-digital inequalities and digital agency in the development of just and sustainable smart cities. We also need to think in terms of *citizenship* which shifts the focus from an individual and their digital competence to the relationship between society and the individual. In the case of 'smart citizenship', this means acknowledging that the digital abilities of people living in digitalizing cities are also on the responsibility of urban decision-makers, policymakers and urban planners.

Furthermore, it is imperative that smart city strategies not only incorporate or collaborate with endeavors aimed at enhancing digital literacy but also address the fundamental socioeconomic and sociocultural inequalities. Hence, in addition to socioeconomic status, education, age, gender, and ethnicity, geographic location and how individuals interact with their immediate surroundings, diverse communities, and other relevant local networks also impact how individuals employ digital technologies (e Silva & Frith, 2012). We propose an evolving and progressively intersectional strategy for tackling socio-digital disparities within the smart city. As stated by Helsper (2021) and Robinson et al. (2018), we must view the digital capabilities of city residents from a multidimensional perspective that avoids generalizations. For example, when it comes to digital assistance for older adults, it is crucial to cater to their unique requirements without employing a homogeneous categorization

approach. As technologies and societies evolve, we should frequently question notions of socio-digital inequality.

Additionally, we suggest that the interdependence between socio-digital inequalities and digital agency should be considered: improving digital equality and augmenting the digital competencies of the general public do not not inherently result in robust digital agency. Ylipulli and Vigren (2023) contend that a diminished capacity to envision alternatives can result in a decreased sense of agency; understanding and awareness of complex relations between technology and society alone are often not sufficient. Resources should be directed towards initiatives which draw, for example, from future studies or design fields in which diversity of futures is recognized and addressed through practical methods and tools.

To support collective action and alternative platforms, smart cities will need to start creatively building connections between their residents, technologies, innovation, and democracy – in a manner that reaches also those who are not at all interested in ‘smart experiments’ touted by the cities and companies. The Canòdrom center in Barcelona sets one example, but these initiatives should always pay attention to local conditions on many levels and take into account spatial arrangements of different cities, the role of pre-existing local communities, and, naturally, the digital needs of urban inhabitants living in a particular area.

AUTHORS’ NOTES ON PRIOR PUBLICATIONS AND ON THE USE OF AI TOOLS

An earlier version of the study by Ylipulli & Hämäläinen was published in the *Proceedings of Communities and Technologies Conference 2023 (C&T’23)*. The newer version differs from the prior publication in following ways: We have included in this article results from a second fieldwork period in Barcelona, which was conducted after the publication of the prior paper. Due to these additions, we rewrote a large part of the empirical section and extended the empirical analysis. Further, we strengthened the theoretical part by adding a new section on radical digital citizenship and agency. These changes affected the discussion and conclusion which were modified and complemented with new insights. In addition, we wrote a new section focusing primarily on implications for smart city policies. AI-powered text editor (Quillbot) was used to shorten and rephrase some sections of the article. The original text is written by the authors.

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Authors' Note

All correspondence should be addressed to

Johanna Ylipulli
Aalto University
Finland
johanna.ylipulli@aalto.fi
ORCID 0000-0002-7537-4774

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