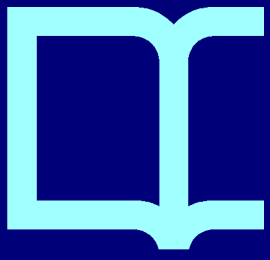

The *Smart City* and other ICT-led techno-imaginaries: any room for dialogue with Degrowth?

Abstract

The 21st century has been hailed as the urban century and one in which ICT-led transformations will shape urban responses to global environmental change. The Smart City encapsulates all the desires and prospects on the transformative and disruptive role technology will have in solving urban issues both in Global North and Global South cities. Critical scholarship has pointed out that private capital, with the blessing of technocratic elites, has found a techno-environmental fix to both reshuffle economic growth and prevent other alternative politico-ecological transitions to take root in urban systems. Against this bleak outlook, the paper shows how ICT may open the possibility of an alternative post-capitalist urban transformation aligned with Degrowth. Through a cross-reading of research on Smart Cities with theoretical perspectives drawn from the literature on Degrowth, I suggest that Degrowth should not refrain from engaging with urban technological imaginaries in a critical and selective way. As the paper shows through alternative uses of Smart technologies and digital open-source fabrication, the question is not so much around technology *per se* but around the wider politico-economic context into which these technological assemblages are embedded.

Keywords: Smart City; Degrowth; urban transformation; digital open-source fabrication; ICT; technological optimism and determinism

1. Introduction

The 21st century will be marked by the critical role of Information and Communication Technologies (ICT) in shaping urban responses to global environmental change. Cities will be both the locus of global environmental problems but also the places where many solutions to them may emerge. The Smart City paradigm has become one of the most important urban strategies to foster green growth and to improve urban sustainability against the backdrop of climate change, austerity politics, inter-urban competition, aging population, rampant social inequality, rapid urbanization, aging infrastructures, high unemployment and stagnant economic growth (Glasmeier and Christopherson, 2015; Luque-Ayala and Marvin, 2015; White, 2016). The Smart City articulates a "fantasy city" and utopian vision based on the emancipatory role of technological progress that aims to be the "common sense" of how 21st-century cities should look (Gibbs et al., 2013; Hollands, 2008; March and Ribera-Fumaz, 2014). In that sense, it "consists of a general but flexible narrative and a common set of logics" for anticipating uncertain global future crisis (White, 2016:574). Cities across the world have embarked on a "quest for technologically enhanced urban management" (Taylor Buck and While, 2015:3) to enable "a more efficient use and organization of urban systems" (Wiig, 2016:538). The global urban scene observes an inter-local competition to attract Smart City investments (Shelton et al., 2015), either to retrofit the existing built environment or to develop neighbourhoods or even to build new cities from scratch.

Since the past few years, the Smart City techno-utopian imaginary is strongly influencing urban debates and shaping contemporary urbanism. Concepts such as ICT, Big Data, sensors, Smart grids, Smart meters, Internet of Things, 3D printers, digital open-source fabrication, circulate not only among large private corporations, start-ups, urban planners, architects and policy makers but are also

progressively making headway into the imaginaries of civic organisations and social movements.

From a critical viewpoint, one may say that hegemonic notions of the Smart City and cognate concepts built upon entrenched promises of capitalist technological solutionism, ecological modernization and depoliticised environmental improvement, which apparently leave small room for post-capitalist alternatives such as Degrowth. However, behind these urban techno-imaginaries and its fetishism of smart technologies, there may lay a set of spaces of intersection with non- or post-capitalist projects, which may open up new opportunities for alternative and emancipatory socio-environmental transitions. If cities are said to be both the locus of environmental problems but also the place where solutions may emerge, and if techno-modernizing narratives such as the Smart City dominate this debate, how does Degrowth need to position itself in front of these technologically-led urban futures?

This paper aims to open up a critical reflection and dialogue on whether and how ICT and paradigms such as the Smart City may be compatible with an urban Degrowth transitions. In other words, are there technological artefacts and assemblages in the Smart City that can be mobilized by the Degrowth movement in envisaging urban transformation for the 21st century? Through a cross-reading of research on Smart Cities and digital open-source fabrication with theoretical perspectives drawn from the literature on Degrowth, the contribution of this paper is double. First, it argues that Degrowth has paid insufficient attention to the question of technology on the one hand, and to the urban question, on the other hand. Second, it suggests that despite all the problems of urban techno-modernizing imaginaries such as the Smart City (which are identified) there are latent technological possibilities that could inform a Degrowth transition. Beyond presenting a comprehensive review of critical social sciences scholarship on the perils of the Smart City, this article reviews how Smart City technology could be appropriated by grassroots for a progressive urban politics. The example of digital open source fabrication demonstrates that the possibilities of ICT could not only be seized to produce data, make visible hidden urban problems and organize contestation, but also to impact upon the way we design, produce and consume at the urban scale. Degrowth should not be a passive observer of this process but may help to inform a process of critical scrutiny, reworking and appropriation of those technologies to enable alternative urban transitions not dictated by the pursuit of economic growth but of socio-environmental justice. In short, this paper argues that a progressive, bottom-up and emancipatory appropriation (or subversion) of ICT and Smart technologies is possible.

After this introduction, the paper is structured as follows. In section 2 I briefly review the main tenets of Degrowth, and I underscore the lack of engagement of Degrowth with the technological and the urban questions. Section 3 documents the emergence of the Smart City concept and shows how it is orchestrating urban transformations in the 21st century. After that, in section 4 I carry out a comprehensive review of perils associated with current hegemonic understandings of technology-led urban transformations for a transformative and emancipatory socio-environmental Degrowth transition. In section 5 I discuss how, within this heterogeneous, nebulous and ambiguous techno-utopian urban imaginary, we can find space for subversive, bottom-up strategies that could potentially be aligned with Degrowth. I end up with a concluding section where I argue for a selective and reflexive use of Smart City technology and ICT by Degrowth.

2. Degrowth and technology-led urban transformation

Degrowth stands in a privileged academic and activist position as one of the most promising and articulated post-capitalist imaginaries (D'Alisa et al., 2014; Demaria et al., 2013; Latouche, 2009). Degrowth is a project of radical and egalitarian socio-ecological transformation that aims to decolonize the social imaginary from the pursuit of endless growth (Asara et al., 2015; Kallis and March, 2015; Schneider et al., 2010). It is inspired by anti-utilitarianism and post-development scholarship, Georgescu-Roegen's entropic limits to growth, and post-Marxist radical ecology of intellectuals such as Ivan Illich, Cornelius Castoriadis or André Gorz among others (Fournier, 2008; D'Alisa et al., 2014). As a matter of fact, D'Alisa et al. (2013) contend that Degrowth has become a confluence point for a heterogeneous set of actors, critical ideas and counter-hegemonic practices, ranging from anti-car activists to local currencies promoters, through defenders of organic agriculture.

Serge Latouche (2012:33), one of the most well-know Degrowth scholars, lays out the eight interdependent steps to enable a Degrowth transition: re-evaluate and shift values; re-conceptualize entrenched capitalist concepts; restructure production; redistributions at the global, regional and local scale; re-localize the economy; and reduction, re-use and recycling of resources. While these steps are widely share among the Degrowth community, Latouche has been criticized for reproducing acritically some environmental notions that may justify the techno-authoritarian and market solutions that Degrowth opposes (Romano, 2012). Fournier (2014:532) suggests that Degrowth implicitly implies "a paradigmatic re-ordering of values, in particular the (re)affirmation of social and ecological values and a (re)politicisation of the economy". This re-ordering of values also includes challenging current forms of representative democracy. Along those lines Asara et al. (2013) show how Degrowth may benefit from a serious engagement with Castoriadis' notion of democracy and autonomy. Degrowth is not a call for "less of the same" capitalist political-economic system but a qualitatively different socio-economic and socio-environmental configuration (D'Alisa et al., 2014).

Degrowth has been very prolific in showing the problems of capitalist development and in theorizing alternatives paths to bypass the imperative of economic growth. There are seminal papers that have argued the need from a shift from sustainable development to sustainable Degrowth in order to endow with the content the so-far hollow signifier of sustainability (Asara et al. 2015; Martínez-Alier et al. 2010). From an applied perspective, several scholars have shed light how Degrowth may inform alternative socio-environmental movements and grassroots such as the Voluntary Simplicity Movement (Alexander, 2013), squatters (Cattaneo and Gavaldà, 2010), the cooperative movement (Kallis and March, 2015) or the *Indignados* and Occupy movements (Asara and Muraca, 2014).

However, Degrowth scholarship still shows some important academic gaps. So far it has paid little attention to the role of technology in the transition to a Degrowth society (van den Bergh, 2011; see editorial in this Special Issue). When this issue has been dealt with in Degrowth meetings and conferences, there has been a confrontation between technological enthusiasm and technological scepticism (see Kerschner and Ehlers, 2016 for an in-depth discussion on researchers' attitudes towards technology). Notwithstanding the lack of a common stance, some researchers have carried out empirical work on how different small-scale and user-controlled technologies may be conducive to a Degrowth transition. For instance, Domènech et al. (2013) compared different decentralized alternatives water technologies through the lenses of Degrowth. Along similar lines, Kunze and Becker (2015) have focused on the possibilities that collectively owned decentralised renewable energy projects may have to contribute to sustainable

Degrowth. While reecently Kostakis et al. (2016) have called for the necessity to develop a political ecology of the digital economy, little research has focused on the potentialities, limits and socio-environmental implications of digital technology and ICT in a Degrowth transition.

On the other hand, this paper also deals with the urban question, another key dimension to which Degrowth has paid little attention. In the past few years, Degrowth scholars have started to focus on the urban scale as a locus of Degrowth projects and not only as the scale where the ills of the capitalist mode of production and consumption are more evident. Scholars have dealt with specific urban issues such as housing (Cattaneo and Gavaldà, 2010; Lietaert, 2010), urban gardening (Anguelovski, 2014) or urban water supply (Domènech et al., 2013). In a more broad level, we can find the analysis by Xue (2014) on the possibilities of eco-villages to enable a Degrowth transition; the impacts of spatial planning on Degrowth (Wächter, 2013); or accounts of extreme instances of urban collapse such as Detroit that open up new possibilities for a local Degrowth transition (Schindler, 2014). Although Degrowth has started to look at cities, it has not engaged sufficiently with how new urban technological assemblages may be both central to fuel growth oriented projects and at the same time they may also articulate post-capitalist alternatives. Exploring urban technological change is crucial to envision possible responses to current global socio-environmental challenges.

In the light of this review, in this paper, we understand degrowth as a constellation of different strategies with different degrees of articulation and implementation that: 1) aim to discursively and materially challenge business-as-usual growth-oriented political-economic models by opening up new conditions of possibility; 2) articulate notions of autonomy, direct democracy, and self-government; 3) that do not understand the environment as a separate sphere from society and the economy; 4) are critique with hegemonic notions of sustainability and/or aim to repoliticize the concept. This broad conceptualization should help to articulate the ensuing dialogue between Degrowth and the Smart City.

3. The Smart City or how technology will allegedly solve 21st-century urban challenges

In a generic way, the Smart City encompasses different urban strategies articulated around ICT and new infrastructures, pursuing a low-carbon, inclusive and participative economic growth and a radical break with 20th-century urbanism (Batty, 2013; Gibbs et al., 2013; Vittanen and Kingston, 2014). The Smart City is composed by both hard infrastructures, e.g. sensors, ubiquitous computing, etc., as well as soft infrastructures, e.g. new forms of governance, shifting towards private and civil society participation, and new processes of innovation (Caragliu et al., 2011; Neirotti et al., 2014).

The Smart City is capturing the attention of local, national and supranational policy makers, institutions such as the UN, World Bank or European Union, and corporations (March and Ribera-Fumaz, 2014). In a nutshell, the Smart City is becoming a key concept that fully encapsulates the way political and economic elites prefigure the city in the 21st century and anticipate future urban crises. Taylor Buck and While (2015:3) summarize what the Smart City means as a powerful imaginary to rethink urban life in the 21st century:

> "smart city restructuring has emerged as a significant source of hope for urban futures. It promises a new era of optimised 'smart' infrastructural management that connects the supplies and demands of people, organisations and objects in

> new and exciting ways. The smart city formulation is integral to enhancing economic competitiveness, quality of life and a dynamic image –a key urban imaginary for the emergent 21st century city."

The Smart City concept has its seeds in a series of dialogues on the future of cities among scholars and practitioners since the 1980s, coining concepts such as Technopolis, Wired Cities or Intelligent Cities (Bunnell, 2015; Kitchin, 2015; Shelton et al., 2015). Technological utopianism combined with urban entrepreneurialism and competitiveness lie at the foundations of the Smart City (Glasmeier and Christopherson, 2015; Kitchin, 2015). However, the linchpin of the concept is the promise of a more sustainable urban environment and a radical change in the provision of urban services through the production and integration of urban data (Batty, 2013; March and Ribera-Fumaz, 2014; Taylor Buck and While, 2015).

All in all, this paradigm has permeated mainstream urban sustainability discourses and economic growth and urban competitiveness strategies, both in the Global North and Global South. The Smart City has become a concept that travels through different geographies (Crivello, 2015). In Europe, it has become a cornerstone of the Europe 2020 strategy that pursues smart, sustainable and inclusive economic growth (European Commission, 2010). Many European cities, for instance, Barcelona, have embraced the paradigm (March and Ribera 2014). The concept has already received much attention in Asia, with the flagship projects in Songdo (South Korea) and Masdar (Abu Dhabi) (Cugurullo, 2013; Shelton et al., 2015; Carvalho, 2015). More recently, India has released a particularly ambitious Smart City plan for 100 cities (Bunnell, 2015; Watson, 2015). The concept has also permeated the African continent (Watson, 2015) and Latin America (Patiño, 2014). Eventually, it has also been mobilized in North America (e.g. SmartAmerica Challenge) and Oceania (e.g. Smart Cities Plan in Australia). We now have several examples of glamorous cities built from scratch that serve as pilots and prototypes in "'blank sheet" settings where smart technologies can be developed, implemented, tested, improved and showcased (Carvalho, 2015). Nonetheless, most Smart City projects aim to retrofit the existing urban socio-technical fabric adding a new layer of technology or a digital skin to the built environment (Glasmeier and Christopherson, 2015; Rabari and Storper, 2015). All in all, millions of people are currently affected by Smart City initiatives at the global level and the number will continue to increase in the coming years (Monfaredzadeh and Krueger, 2015) with a market value ranging from 20 to 39 billion dollars per year (Hollands, 2015) to over 1.5 trillion dollars in 2020 (Glasmeier and Christopherson, 2015). In any case, it emerges as an attractive business opportunity for corporations in a context of declining industrial profits and financial turmoil.

The concept is still in its infancy and tensions and contradictions emerge along the process of endowing it with content (Carvalho, 2015; Taylor Buck and While, 2015). The Smart City is a contested and complex imaginary (White, 2016). The fact that this paradigm is applied in rather disparate (urban) geographies, with radically different urban problems, may suggest that the concept is both ambiguous and malleable (Hollands, 2008), or even "chaotic" and "nebulous" (Glasmeier and Christopherson, 2015:5; Shelton et al. 2015). This flexibility is what permits to include seemingly contradictory strategies under the umbrella of the concept.

One has only to navigate different Smart City projects to observe that apparently every new urban infrastructure and urban object could be branded as Smart. Nonetheless, for the sake of systematization Table 1 presents some of the most important technologies and technological assemblages under the Smart City

paradigm. Note that the table does not aim to be comprehensive but is intended to give an idea of the type of technologies used, the scales they apply (from the user to the city), and the environmental dimensions they deal with. Most of these technologies do not operate in isolation but are interlinked: e.g. a smart energy meter may be connected to an app whereby the user could control their water use and also to a smart grid and to an integrated city level platform.

Table 1. Examples of Smart City technologies.

	Level	**Environmental dimensions**	**Examples**
Apps (mobile phone)	Individual	Mobility, Energy, Water, Waste, etc.	Mobile phone app to control household energy use
Sensors	Object	Mobility, Energy, Water, Waste, etc.	Wireless sensors in waste containers to gather fill level data
Smart Meters	Home	Energy, Water	Smart Water Meters
Smart Grids	Network	Energy, Water	Smart Energy grid
Integrated management platforms	City level	Mobility, Energy, Water, Waste, etc.	Smart City operating system to integrate data on mobility coming from sensors installed across the city

In the light of the abundant self-congratulatory and enthusiastic discourses around the virtues of these technological-led urban solutions, the articulation of a critical perspective towards the Smart City may seem counterintuitive. However, as Hollands (2015:73) writes, this concept "raises more questions than it answers". Precisely because of the magnitude of the penetration of the concept in urban sustainability discourses and its potentially transformative character, many critical social scientists have shed light on "why, how, for whom and with what consequences" this phenomenon is emerging in different urban contexts (Luque-Ayala and Marvin, 2015:2106; March and Ribera-Fumaz, 2014). It is very important to take into account this critical perspective when discussing the potentialities of Smart City technologies and ICT for an urban Degrowth transition to avoid acritically reproducing the overtly overoptimistic and technologically deterministic discourses that characterize hegemonic Smart City discourses and practices.

4. The dark side of the Smart City: ills and perils for a progressive and emancipatory urban transformation

In the past few years critical social scientists, and specifically urban scholars, have been prolific in showing the perils of the dominant global Smart City narratives (March et al., in press). Through an in-depth and comprehensive review of this literature I have organized these problems around: 1) technological determinism, reductionism and solutionism; 2) private profit orientation; and 3) depoliticisation. Critical urban scholars, however, miss a fourth critical problem of the Smart City: the socio-environmental impacts associated with the production of ICT.

4.1.Technological reductionism, solutionism, and determinism

Technology is depicted as a compulsory passage point through which the Smart City discourse is built (Monfaredzadeh and Krueger, 2015; Söderstrom et al., 2014). Dominant discourses around the Smart City "are deeply rooted in seductive and normative visions of the future where digital technology stands as the primary driver for change" (Luque-Ayala and Marvin, 2015:2105; Vittanen and Kingston, 2014). Smart City proponents show a strong technophile stance, whereby technology is acritically and enthusiastically expected to translate into the improvement of the quality of life and the solving of social problems (see Kerschner and Ehlers 2016:144). In those accounts, technological change is championed to spearhead social change.

Mainstream Smart City discourses and practices are characterized by an ontological perspective that frames sustainability and urban questions essentially as engineering and technical challenges (Bell, 2011; Gibbs et al., 2013; Viitanen and Kingston, 2014). As Morozov (2015) argues, we are living in an era where technological solutionism is privileged as the way to tackle any existing problem. By doing so, Smart City initiatives frequently fetishize and overestimate the transformative power of technology while underestimating or totally ignoring the non-technological aspects of urban problems (Hollands, 2015; Monfaredzadeh and Krueger, 2015; Taylor Buck and While, 2015). This also results in the prefiguration of interventions in a-geographic, a-spatial and decontextualized way (Glasmeier and Christopherson, 2015; Shelton et al., 2015; Wiig, 2016). In other words, mainstream Smart City imaginaries assume that the implementation of new technologies is automatically translated into an improvement of urban sustainability, economic efficiency, economic growth and social inclusiveness regardless of the structural and contextual causes of urban problems. In an era of radical reconfiguration of capitalism, it may be considered cynical to reduce urban problems to efficiency problems solvable through Smart technologies especially when millions of people, not only in the Global South but increasingly in the Global North, lack access in adequate quantities to the most basic services, such as water or energy provision, that enable everyday urban life. As White (2016:585) argues, current and future urban challenges necessitate "more fundamental and wide-reaching responses that have thus far been articulated within smart city discourses". A critical engagement of Degrowth with the Smart City should, first and foremost, question the technological determinism and solutionism that characterizes the latter.

4.2. Prioritization of private interests

Cities are said to be engines to reshuffle economic growth in the 21st century. In that sense, the Smart City paradigm can be understood as a product of the search for new markets during phases of sluggish economic growth and neoliberal urban restructuring (Glasmeier and Christopherson, 2015; Söderstrom et al., 2014; Vanolo, 2014). In other words, the Smart City may become, basically, an instrument of economic promotion as Wiig (2016) shows for Philadelphia, USA. It can also be seen as an effective political device that provides a technical lexicon to support austerity as the solution to the economic and social crisis in Southern Europe, as Pollio (2016) shows for Italy. In a context of austerity urbanism, combined with the impending environmental crisis, the Smart City emerges as a lucrative framework for technologically driven climate change governance (Luque-Ayala and Marvin, 2015). Against this backdrop, ICT companies, large international consultancies and private utility companies are positioned as central actors in the design, experimentation, deployment and management of Smart City strategies and technologies (Carvalho, 2015; Viitanen and Kingston, 2014). While this is not a new trend, the Smart City discourse has allegedly accelerated to an

"unprecedented degree" the involvement of private companies, especially ICT corporations, in the process of prefiguring urban futures (Bunnell, 2015:46; Vanolo, 2014).

In the light of this dominance of corporate and entrepreneurial versions of the Smart City, there is the risk that the city increasingly expresses the desires, images and values determined by the private sector instead of public values (Hollands, 2015; Vanolo, 2014). This becomes crystal-clear when private corporations are granted full-fledge control over the construction and management of Smart Cities built from scratch by local governments. However, this problem is also very vivid in most of Smart City projects applied to the existing built environment, where private companies are given in many cases monopolistic control over technology implementation and the management of the urban data produced. Beyond questions around social justice, depending on these proprietary technologies may risk incurring into a socio-technical lock-in precluding the emergence and development of alternative socio-technical arrangements (Luque-Ayala and Marvin, 2015; Söderstrom et al., 2014). To sum up, the Smart City could be interpreted as a way of disciplining the city to fit it into new political-technological assemblages (Vanolo, 2014). This may naturalize new rationalities and new spheres of growth-oriented capital circulation and rent extraction that are at odds with the basic foundations of Degrowth.

4.3. Depoliticisation of urban governance

Mainstream Smart City discourses are impregnated with the widespread notion that technology-driven change is politically neutral. Under the guise of smart technological solutionism fuelled by 'win-win' rhetoric, urban issues shift from the political sphere of consensus and dissension to the technical and commercial sphere (March and Ribera-Fumaz, 2014). Still, Smart City ideology does not operate on a blank sheet or pristine environment (Carvalho, 2015), but it is inserted in cities that have specific politico-economic dynamics and entrenched power relations.

The large gap between commercial imaginaries of Smart Cities and real urban issues is probably one of the most critical contradictions that those projects face. While this detachment from real urban life is evident in Smart Cities built from scratch, smart strategies for existing cities, especially of the Global South, also risk portraying images of urban futures, i.e. digital inclusion and sensored urban environments, which overshadow the most pressing contemporary problems such as poverty, discrimination or inequality (Hollands, 2015). Even worse, smart technologies can deepen urban splintering, enhancing social disparities and exclusion of some stakeholders (Glasmeier and Christopherson, 2015; Graham and Marvin, 2001; Luque-Ayala and Marvin, 2015). The digitization of some urban services may have splintering effects on social cohesion as some social groups (e.g. ageing population, migrants, etc.) may have limited access to digital resources (Angelidou, 2014). Indeed, urban technologies may reinforce existing power relationships (Viitanen and Kingston, 2014). Along those lines, March and Ribera (2014) show how Smart City strategies and technologies to improve urban life in the district of 22@ bypass some of the most vulnerable citizens. Elsewhere Gabrys (2014) through a Foucauldian analysis shows how Smart City imaginaries through what she calls "Biopolitics 2.0" may delimit what is constitutive of urban citizenship in the 21st century.

This depoliticisation process could be clearly observed regarding urban environmental issues. Notwithstanding the fact that sustainability is at the core the Smart City discourse, its social and equity dimensions such as behavioural change,

asymmetrical power relations, affordability, social justice and participation are obliterated (Carvalho, 2015). As Viitanen and Kingston (2014) argue the Smart City replaces the pursuit of social justice with that of the democratisation of technology and digital participation, giving place to a flat ontological understanding of society. Hollands (2015) correctly underscores that most Smart City initiatives only encompass the "right to use technology", instead of "the right to shape the city using human initiative *and* technology for social purposes to make our cities better and more sustainable" (p. 72). Acritical understandings and implementation of the Smart City may foreclose more radical approaches towards rethinking the city in the 21st-century and contributes towards creating a post-political urbanity (Swyngedouw, 2009). Briefly, an obsession with technical parameters renderable through technology, such as efficiency, may act "to obscure both the relations which prefigure and maintain those technological assemblages, as well as the social and political configurations which might, conceivably, be pursued in the service of more effective and long-lasting solutions" (White, 2016:585).

4.4. Socio-environmental impacts associated with the production of ICT and Smart City technologies

In general terms, ICT-based solutions are said to contribute to the dematerialization of the economy (Berkhout and Hertin, 2004). More specifically they may help to mitigate water or energy use, lower CO_2 emissions and mobility-related pollution in an efficient and cost-effective way (Williams, 2011). In that sense, the Climate Group (2008) argued that ICT would be a key sector to curb greenhouse gas emission by 15% at the global level by 2020. As a matter of fact, urban sustainability improvement lays in the heart of ICT-based Smart City solutions. However, this automatic translation of smart technologies into sustainability improvements should be subjected to critical scrutiny through a Degrowth lens. First, efficiency improvements can simply lead to Jevons paradox, increasing overall use of resources. Second, Smart Cities require high-technology consumer lifestyles, and these are not guaranteed to be inherently neither environmentally or socially friendly. Despite de-materialization claims behind ICT and digital revolution, there is a very material side concerning the manufacturing, operation and disposal of those technologies (Berkhout and Hertin, 2004; Williams, 2011). ICT actually requires important quantities of scarce elements such as critical metals and rare earths (Chancerel et al., 2015). The extraction of these materials may result in local socio-environmental impacts and conflicts as well as they represent a concern regarding recycling (Ali, 2014). Those new technologies may only lead to an increase in the consumption of goods and services without bringing about significant changes in production and consumption patterns (Carvalho, 2015; Hollands, 2015). Therefore, the relation between ICT and environmental improvement is not unidirectional, but complex, uncertain and scale-dependant (Berkhout and Hertin, 2004). Third, it is a fallacy that Smart technologies reduce and remove uncertainty: while they may reduce human errors, they may produce unforeseen risks (Viitanen and Kingston, 2014). Last but not least, and building on Illich (1974), it can be also argued that relying on advance and complex technologies that require experts to manage them and this may lead to undemocratic and non-egalitarian outcomes.

The problems associated with the Smart City paradigm (Table 2) reviewed in this section may lead Degrowers and critical environmentalists to jettison the Smart City concept and urban ICT-related technological assemblages. Nonetheless, given the fact that a technology-light urban future is unlikely, Degrowth may miss an

opportunity to engage critically with the opportunities latent in the present urban techno-utopian dream.

Table 2. Challenges brought about by Smart City technologies

Issue	Implications
Technological reductionism and optimism	Technology appears as the driver of social change. Overoptimistic views on the potential of technology to solve urban issues
Predominance of private interests	Pro-growth and private profit-seeking orientation Monopolistic control of large private corporation over smart technologies
Depoliticisation of urban governance	Technification of urban problems such as inequality Splintering urbanism
Socio-environmental impacts associated with ICT production	Jevons paradox? Efficiency improvements leading to higher use of resources Use of rare metals and rare sands for ICT and Smart City technology Socio-environmental conflicts over the extraction of those materials Problems during disposal and recycling Unforeseen risks Need of experts

5. Alternative understandings of ICT and Smart City technology for a progressive and democratic urban transformation

A central tenet of this paper is that it may be productive for Degrowers to engage in a serious reflection on the Smart City that goes beyond pointing out the perils of those technologically led urban imaginaries. This should include exploring how a Degrowth-oriented use of Smart City technology and ICT could contribute to a progressive civic, citizen-based and community-led urban transformation neither dictated by technocratic elites and corporate capital nor subsumed to the pursuit of endless economic growth. This resonates with the call by urban geographer Stephen Graham (2002) to democratize the opportunities brought about by the high-tech urban revolution. More recently, Hollands (2015:62) has also asked urban scholars and practitioners to look for "more cooperative and participatory uses of new technology that show glimpses of another kind of smartness that might provide a counter-point to current conceptions" (p.62) dominated by "efficient high-tech 'quick fixes' and corporate profit-making activities" (p.74). In a similar vein Bunnell (2015) urges researchers to think about Smart City futures that instead of reinforcing top-down urban governance models enable forms of

localized, grassroots resistance and political dissent. Actually, as Glasmeier and Christopherson (2015) highlight, there might be something potentially game-changing behind the Smart City. While Viitanen and Kingston (2014) are less enthusiastic about its transformative capacity, they also urge to think about a "set of values promoting openness and choice about the presence and influence of ICTs in cities and in the private lives of citizens [...] to reverse the tide of rampant consumerism and 'progrowth' ideology" (p.815) that currently dominates the Smart City paradigm.

In this section, I first succinctly review the academic literature on alternative use of ICT and Smart City technology at the urban scale, including some practical examples. Then I shift the focus to digital open-source fabrication, which despite not being strictly an outcome of the Smart City paradigm, is a clear example of an ICT-enabled progressive technological assemblage that shows how new technologies may be used to enable citizen-led design and production at the local scale. Third, based on the findings of this section I reflect on how a Smart City could look like through the lenses of Degrowth.

5.1. Alternative uses of Smart Technologies for alternative urbans socio-environmental transformations

Some commentators, such as Paul Mason (2015), argue that ICT may erode the basic principles of capitalist growth and set out the possibility for a post-capitalist transition. Following this reasoning, ICT-based urban interventions are said to contribute to the re-organization not only of urban governance and management (Subirats, 2015) but also of design, production and consumption (Anderson, 2012). A thoughtful use of ICT is said to be a pillar of the so-called sharing economy (Martin, 2016), permitting collaboration beyond the market and fundamental changes in value creation (Benkler, 2015; Mason, 2015), sustainability and social inclusion (McLaren and Agyeman, 2015; Smith et al., 2013). Degrowers might be attracted by all those possibilities.

These potentialities of alternative ICT use could be more specifically imagined in the case of the Smart City. Smart City projects encapsulate a latent tension between centralization and decentralization, and between giving free-reign to the economic and political elites or opening up of those urban experiments to local communities and empowering them (Carvalho, 2015; Luque-Ayala and Marvin, 2015). As a matter of fact, grassroots and civic movements have demonstrated in many locations that they have the ability to appropriate, enact and adapt Smart City technologies to advance their agendas (Calzada and Cobo, 2015; Glassmeier and Christopherson, 2015; Luque-Ayala and Marvin, 2015). Pollio (2016:514) argues that while the techno-utopian vocabulary of the Smart City has worked in Italy to legitimize urban austerity ("doing more with less"), it has also "created spaces where other meanings and, potentially, alternative political outcomes were made possible by diverse alignments of knowledge and expertise". As an example of this, the author points to the "Human Smart Cities Manifesto", signed in Italy in 2013 by cities from around the world, as an example of a counter-narrative to business-ridden Smart Cities imaginaries (Periphèria, 2014; Pollio, 2016), proposing frugal, small-scale and simple ICT solutions, following citizen-centric, co-production and participatory approaches. Tironi and Sánchez Criado (2015), from a Science and Technology Studies (STS) perspectives, through different examples, ranging from mapping apps to DIY sensors show that this type of assemblages may contribute to more intricate and richer forms of sensing urban experiences beyond the plans of municipal and corporate-led Smart City projects. These alternative uses, the authors suggest, open up the possibility to vindicate neglected urban problems, such as health issues or urban pollution, and to reclaim "the production of

knowledge about the city and its inhabitants" (Tironni and Sánchez Criado, 2015:99). Shelton et al. (2015) document different examples in North American cities where a thoughtful use of Smart technologies by grassroots has made visible hidden urban problems (e.g. housing access) for a wide audience. Along similar lines, Bunnell (2015) reports how Smart City plans in Malaysia unexpectedly opened up new channels for political dissent exceeding official plans. These alternative practices show that there are notions of smartness that are radically different than the corporate, profit-seeking and top-down imaginaries that tend to dominate the concept of Smart City. Instead, they revolve around the collaborative redistribution of 'intelligence' amongst neglected actors to engage actively in the reconfiguration of the urban environment in more progressive ways (see Tironi and Sánchez Criado, 2015:101) aligned with a Degrowth perspective that aims to escape from the fetish of economic growth.

All in all, Monfaredzadeh and Krueger (2015) argue that if held under citizen-centric approaches, Smart City technology may open up the opportunity to rethink urban politics while boosting social participation, inclusion and socio-spatial justice (see also Araya, 2015). These approaches can also enhance co-design and co-production through collaborative and bottom-up experimentation with ICT. This is arguably the case of one of the most promising grassroots socio-technical innovations: digital open-source fabrication. While having a different origin and trajectory than corporate Smart City imaginaries, digital open-source fabrication reverberate across alternative understandings of urban ICT deployment as a powerful technological assemblage to give autonomy and agency to citizens to challenge the political economy of design and production of goods.

5.2. Grassroots ICT-based technological assemblages: digital open-source fabrication

In the past few years, we have observed the emergence of Makerspaces, Hackerspaces or Fablabs across the globe inspired by the open-source, free software and free culture (Anderson, 2012; Kostakis et al. 2015a,b,c; Troxler and maxigas, 2014). There are thousands of Makerspaces and Hackerspaces globally (Smith et al., 2017). Fablabs, whose origins can be traced back to an initiative of the Massachusetts Institute of Technology (MIT), add up to over 600 (data from 2016; https://www.fablabs.io/labs). These workshops could be defined as "innovative spaces where people come together to learn about and use versatile digital design and manufacturing technologies and create things in collaborative a project" (Hielscher and Smith, 2014:2; Smith et al., 2013; Smith et al., in press). They function following a 'design global-manufacture local' configuration (Díez, 2014). These spaces host "a suite of digital design and manufacturing technologies, including 3D printers, open-source and web-based design tools, electronic kits, vacuum formers, computer controlled milling machines, welding equipment, sewing machines, and laser cutters" (Smith et al., 2013:4; see also Diez, 2012; Gress and Kalafsky, 2015; Kostakis et al., 2015a,b,c; Troxler and maxigas, 2014). In these workshops, anyone can "make (almost) anything: from integrated circuitboards to complete houses" (Diez, 2012:462). Beyond the possibilities to design and fabricate these workshops offer the opportunity to repair or readapt existing things to fit other purposes and needs (Smith et al., 2017).

The motivations and reasons to join one of these workshops may widely vary. Some users could be appealed by the possibilities digital open-source fabrication offers to create personalised objects in a convivial and a fun way without any further political motivation. More radical notions, aligned with a Degrowth perspective searching for wider autonomy, self-governance and direct democracy (Asara et al. 2013) could encompass "opening up (increasingly seamless) technologies to scrutiny, sometimes out of mere curiosity, sometimes for fixing and

repurposing, and in other cases as an overtly political act of technological citizenship" (Smith, 2017:n.a.). Other users and grassroots may be appealed by the possibilities decentralised digital design and production may open up to enable alternative and sustainable economic models that are not subsumed to the dictates of economic growth and exchange-value but that are guided by the creation of use-values and commons. This later motivation behind digital open-source fabrication is also clearly compatible with the essence and objectives of Degrowth.

These new collaborative open-source, common value creation, peer-to-peer production models are praised to bring about radical new possibilities in material production (and consumption) that reconfigure, relocate and recalibrate innovative capabilities in society, bringing about improvement in areas such as social inclusiveness and democracy, sustainability and creativity (see Smith et al., 2013; Diez, 2014; Kostakis, 2015a,b,c). They open up new ways of how people relate with technology producing new subjectivities and socialites (Troxler and maxigas, 2014), such as that of the 'digital artisan' (Diez, 2014). Such positive claims around the potentialities of these workshops are, nonetheless, still highly speculative (Hielscher and Smith, 2014) and they depend on why and how people associate with such spaces (Smith et al. 2017)

Michel Bauwens, key figure in the peer-to-peer movement, warns that these emerging socio-technical assemblages could be instrumentalized to reinforce capitalist accumulation processes and nourish economic growth (as surplus value that can be monetised is produced out of free labour) (Bird, 2010; see also Martin 2016 for a structured critique of the sharing economy). As Smith et al. (2017) show, some digital fabrication workshops may function as incubators for entrepreneurial prototyping. The case of Makerbot serves here to exemplify the thin line separating not-for-profit projects and entrepreneurial and commercial ventures: a project that started in a hackerspace in NYC became a commercial venture that was eventually bought by a 3D-printer manufacturer (Kostakis et al., 2015c; Smith et al., 2017). On the other hand, many corporations are seeing in those spaces, especially Fablabs, a new seed of technological entrepreneurship. As a matter of fact, there are examples of entrepreneurs opening fee-paying workshops (Smith et al., 2017). This case shows the thin line between not-for-profit orientations and commercial and entrepreneurial ones.

Notwithstanding the inherent risk that these technological assemblages reshuffle a new wave of netarchical or distributed capitalist growth, they also contain the seed to supersede it and create a new political economy around commons-oriented property regimes that transcend hegemonic visions of market-oriented urban governance (Kostakis et al., 2015a,b; 2016). Beyond pointing at the perils of being captured by corporate and pro-growth imaginaries, Michel Bauwens highlights that these emerging socio-technical assemblages simultaneously contain post-capitalist elements (Bird, 2010). As Asaro (2000) states, it is through direct engagement, exploration and experimentation with technological possibilities that one can judge whether a given technology fulfils the aims it was designed for (see also Smith et al., 2013). While it is argued that the collaborative, not-for-profit and non-hierarchical logics of these spaces in general challenge the logics of cognitive capitalism, Smith et al. (2017) correctly point out to the fact the question is whether these spaces can connect to broader alternative movements pursuing social justice and sustainability, such as Degrowth.

Above all, Smith et al. (2017) are right in pointing out that it is misguided to think that those workshops alone will substitute the existing design, manufacturing, and consumption growth-oriented model. Rather, as the authors suggest, these workshops serve to expose the inability of the current political economy system to

address the demands for new convivial, sustainable, citizen-centric and democratic forms of production and consumption. Briefly, these experiments, beyond its material implications contribute to the production of new imaginaries and framings of alternative models of production, consumption and sociability (Smith et al., 2017). If these prospects are correct there is much room for the confluence of Degrowers with the more radical articulations of digital open-source fabrication.

5.3. A speculative proposal of how a Smart City could look like through the lenses of Degrowth

In the light of what has been discussed so far, how could a Smart City look like through the lenses of Degrowth? A Degrowth-compatible Smart City should first and foremost escape embracing the rationale of "doing more with less" that characterizes corporate Smart City plans (Pollio, 2016). Degrowth, as we shown in section 2, does not calls for "less of the same" capitalist development through the use of sustainable and green technologies. Rather it pleads for a qualitatively different socio-economic and socio-environmental organization (D'Alisa et al., 2014). While it is true that hegemonic understandings of the Smart City are dominated by corporate views and may have different apparently unsolvable issues vis à vis a radical project such as Degrowth (section 4). Smart technologies in fact, if applied following the needs of citizens and taking into account the context where they are embedded may help to inform transformative movements pursuing a more just, equal, sustainable and democratic urban life. An urban politics of a Smart City compatible with Degrowth would need that municipal governments rethink how they are using Smart City technology and to fit what purposes, and shifting their locus of attention from large ICT, consultancies and private utilities to citizens. What is problematic about the Smart City is not technology per se but the political economy underpinning top-down, a-spatial and pro-growth imaginaries. If designed by cooperatives or non-for-profit organization, many Smart technologies, such as smart meters, sensors, smart grids and open platforms may be compatible with a Degrowth vision by helping to politicize hidden urban issues such as urban pollution and urban inequality. A future could be envisage where those technologies are produced following an open source and distributed logic of global circulation of free knowledge and local production of durable goods and repairing of existing ones in digital fabrication workshops. The deployment along those lines of Smart City technology would be aligned with the 8 Rs that Latouche proposed for a Degrowth transition: re-evaluate values; re-conceptualize entrenched concepts; restructure production; redistribution; re-localization of the economy; reduction; reuse; and recycling. However, to be successful, alternative Degrowth-compatible technologies and governing models must grow beyond the niches in they were developed (see Kunze and Becker 2015) and permeate the existing built environment and widely impregnate social and economic relations. In other words, what matters is how technology is embedded into (and articulates) a broader urban politics; if the latter does not accommodate the concept of Degrowth in its rationale, hardly any Degrowth-friendly ICT assemblage alone will make any substantial difference to the everyday life of citizens in the near future.

6. Smart Degrowth? Towards a conscious and deliberate engagement with alternative ICTs

The Smart City and its articulation around ICT constitute a new language of governance that shapes the urban imaginaries of policy makers, architects, and urban planners both in the Global North and the Global South. If impregnated by

technological over-optimism and determinism Smart Cities might become an empty, hollow and depoliticised signifier built in the image of capital, mobilizing weak notions of sustainability and fuelling business pro-growth strategies. However, it is not the intention of this paper to jettison the concept, but rather to show that there are progressive examples of technological assemblages and experimentation with ICT and Smart technologies that may contribute to alternative socio-environmental transitions. This paper argues that if Degrowth is to thrive as a serious alternative to growth-dictated capitalist modes of production and consumption, it should critically engage with the technological and the urban question as both are at the core of hegemonic narratives on the futures of 21st-century society such as the Smart City. This critical engagement requires understanding urban ICT, Smart technologies or digital production as contentious concepts embedded in broader political economies and ecologies, and thus critically understanding how everyday actions are mediated by those technological assemblages.

This paper has been a first attempt to enable a critical exploration of the compatibility of the Smart City with Degrowth. First of all, this critical engagement requires debunking hegemonic and uncontested smart technological solutionism, which usually serves corporate interests, reduces urban issues to technical challenges and depoliticizes socio-environmental transformation. However, as it has been shown in this paper, there are other alternative understandings of ICT-enabled technological assemblages that could inform post-capitalist imaginaries such as Degrowth. There are alternative and potentially emancipatory uses of ICT and smartness that, despite being still modest, portray (participatory) technology as a means to accomplish a progressive agenda. For instance, a reflexive use of smart technologies (e.g. sensors) and the data they produce may help to shed light on hidden urban problems and articulate a politics of urban contestation. The example of digital fabrication workshops also shows that despite not being the panacea for subverting the current design and production system, they may help to think about alternative production and consumption futures. Technology could be at the service of citizens helping to produce and circulate knowledge and creating (use) values but not necessarily (or only) through the market. Progressive and reflexive use of new technologies may also actually generate new socialites and new urban configurations in a more collaborative and bottom-up way.

In any case, it is important to avoid techno-optimistic and depoliticized readings of the capacity of the technological revolution to lead urban change, idealizing the digital revolution and overestimating the agency of citizens in this process. The democratisation of technology should not be a final goal but a potent tool to pursue socio-environmental justice in the 21st century. Fetishizing technology as the solution to all urban issues, without questioning the root of structural problems such as inequality, poverty or unsustainability, may only contribute to perpetuating them. Degrowers, both activists and academics, may have an important role here to point out at those structural problems. A progressive use of Smart technologies should grant the possibility to shed light on hidden problems and articulate new models of democracy, deliberation and participation to discuss how to tackle them. Those issues do not have a technological solution but a political economy one.

Technology, as Castoriadis (1957) argued, is not socially neutral, and neither are ICT and Smart City technologies (Troxler and maxigas, 2014; Viitanen and Kingston, 2014). Degrowth may maintain a critical and selective dialogue with what these Smart and ICT-enabled technologies open up. The difficult task, in Castoriadian terms, is to perform a conscious and deliberate transformation of

those existing assemblages and rethink and subordinated them to social needs. That is, reorganizing social practices and establishing new relationships with infrastructure and technology. The challenge for Degrowth is to think critically about how to foster open and transformative transformational technologies, in Morozov's terms (2015). Beyond providing good technical results, Degrowth-compatible technologies should potentiate critical capacity, debate, and deliberation, encouraging people to engage as citizens and not as consumers. Some of the examples of grassroots' use of Smart technologies and digital open-source production go precisely in that direction. It is critical to explore further as to whether these new technological assemblages are evolving in ways that shape more sensitive interventions in urban ecologies or in ways under a Promethean growth-oriented attempts that open the way for new forms of commodification, exclusion, control, exacerbation of inequality or injustice, and that make the city less resilient to future social and environmental risks.

The debate around technology and Degrowth should not be only around technologies alone (e.g. sensors, 3D-printers, new urban networks, apps, mobility innovations, etc.) but it should also focus on the networks of actors, rationales, and narratives that articulate them. For instance, what has converted the RepRap project (Kostakis et al., 2016) a central element of many digital fabrication workshops is not the specific technology and hardware (a self-replicating 3D printer) per se but arguably the network of individuals and digital workshops that freely circulate open designs and give support to the project. It is urgent that progressive alternatives such as Degrowth move the focus beyond technical questions and challenges and trigger a wider debate as to how 21st century socio-environmental and politico-economic transformation should be organized and what is the role of technology in it. Debunking hegemonic Smart City models do not imply discarding all the technologies associated with improvement in urban management, but first and foremost addressing the politico-economic configurations that sustain them. It is about enacting an alternative post-capitalist (urban) political economy and ecology, not only drafting a checklist of what technologies (or assemblages of technologies) are "Degrowth friendly". It is crucial not to fall into apolitical technological innovation determinism, as Eden Medina (2015) warns, but to focus our efforts on thinking creatively how technology might be democratically harnessed to contribute to a progressive and emancipatory social change. This resounds will Illich (1974) call for convivial technologies that are democratically produced, managed and controlled. Instead of technologising the way out of current socio-environmental urban issues (Carvalho, 2015), what is important is to create the conditions regarding social embedding and technological learning so that those new technological assemblages offer an alternative to current regimes of urban provision. It is not just a question of "what technologies" but "who produces, manages and controls them" and "to whom" they benefit.

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