Technological Forecasting & Social Change 202 (2024) 123299

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

journal homepage: www.elsevier.com/locate/techfore

Smart cities as spatial manifestations of 21st century capitalism

Martin De Jong [a,b,*], Simon Joss [c], Araz Taeihagh [d]

[a] Rotterdam School of Management, Erasmus School of Law, Erasmus University, Burg. Oudlaan 50, Rotterdam, the Netherlands
[b] Institute for Global Public Governance, Fudan University, 220 Handan Road, Shanghai, PR China
[c] Urban Studies, School of Social and Political Sciences, University of Glasgow, 25 Bute Gardens, Glasgow G12 8RS, UK
[d] Lee Kuan Yew School of Public Policy, National University of Singapore, Singapore

ARTICLE INFO

Keywords:
Smart cities
Capitalism
Capital accumulation
Digitalization
Urban policy
Digital economy

ABSTRACT

Globally, smart cities attract billions of dollars in investment annually, with related market opportunities forecast to grow year-on-year. The enormous resources poured into their development consist of financial capital, but also natural, human and social resources converted into infrastructure and real estate. The latter act as physical capital storage and sites for the creation of digital products and services expected to generate the highest value added. Smart cities serve as temporary spatial fixes until new and better investments opportunities emerge. Drawing from a comprehensive range of publications on capitalism, this article analyzes smart city developments as typifier of 21st century capital accumulation where the financialization of various capitals is the overarching driver and ecological overshoot and socio-economic undershoot are the main negative consequences. It closely examines six spatial manifestations of the smart city – science parks and smart campuses; innovation districts; smart neighborhoods; city-wide and city-regional smart initiatives; urban platforms; and alternative smart city spaces – as receptacles for the conversion of various capitals. It also considers the influence of different national regimes and institutional contexts on smart city developments. This is used, in the final part, to open a discussion about opportunities to temper the excesses of 21st century capitalism.

1. Introduction

In 2017, Navigant Research (now part of Guidehouse Consultancy) examined the state of global smart city development and predicted that related spending would grow from then $40.1 billion to $97.9 billion by 2026 (Urenio.org, 2017). More recently, another consultancy, Markets and Markets (2022) published a 'smart cities market' report which estimated that global revenues had already reached $511.6 billion in 2022 and expected it to grow further to $1024.4 billion by 2027. Yet another consultancy, Market Research Community (2022) reported that the value of the global smart city market had surpassed $1060 billion in 2021 and predicted that it would rise to $7346.85 billion by 2030. Undoubtedly, smart city initiatives and the related financial investments across the world have increased exponentially in the past 20 years. Unfortunately, reliable financial information is hard to come by since estimations by market analysts vary widely, as the above examples illustrate. This is partly due to the vested interests involved – marketeers are in the business of creating market expectations and, thus, may exaggerate future investment potential – but it is also due to divergent views as to what counts as 'smart city'. Cities themselves exhibit different approaches to becoming 'smart' and may variously and often concurrently label themselves as 'global', 'eco' and 'smart' cities, as Songdo (South Korea) and Masdar (United Arab Emirates) illustrate (Shwayri, 2013; Cugurullo and Ponzini, 2019). Urban initiatives labeled 'digital-', 'intelligent-', 'information-', 'ubiquitous-' and 'knowledge-city' may overlap with 'smart city' to such an extent that they should arguably be included in global surveys of smart cities. Moreover, as there is no official gatekeeping process for designating cities as 'smart', cities are free to adopt the 'smart' moniker, be they capital and world cities wishing to safeguard their status as global powerhouses and innovation centers (Joss et al., 2019) or third and fourth tier cities signaling their expansionist ambitions (Noori et al., 2020; Tan and Taeihagh, 2020; Praharaj, this volume).

Nevertheless, while the term 'smart city' and related investment information are difficult to pin down, it is clear that smart city developments have become widespread and involve very significant levels of finance. Investment is pursued both by local governments seeking to grow digital infrastructures for information collection and management and by the corporate sector keen on increasing ICT services to urban communities. The smart city and the concomitant application of digital

* Corresponding author at: Rotterdam School of Management, Erasmus School of Law, Erasmus University, Burg. Oudlaan 50, Rotterdam, the Netherlands.
E-mail address: w.m.jong@law.eur.nl (M. De Jong).

https://doi.org/10.1016/j.techfore.2024.123299
Received 28 June 2023; Received in revised form 20 February 2024; Accepted 21 February 2024
Available online 1 March 2024

technologies for data collection, storage and analytics are considered by many urban and corporate actors as essential to solving modern governance, healthcare, mobility, energy and other urban challenges (Castelnovo et al., 2016; Ahad et al., 2020; Trencher, 2019). Realizing these expectations requires vast financial investment from both public and private sectors through various public-private partnerships (European Parliament Directorate-General for Internal Policies, 2014).

The growing presence of the smart city in urban policy and development, however, is far from uncontested (UN Habitat, 2022). Concerns have been raised, among others, about the lack of safeguarding of citizens' and customers' digital privacy and security, especially when large digital technology firms are put in charge of smart city projects (Lim and Taeihagh, 2018; Givens and Lam, 2019; Filion et al., 2023). Critics also point to the risk of a growing digital divide with vulnerable social groups less likely to be able to access essential public and banking services, especially where digital innovation projects are instigated in a top-down developmental mode (Gerli et al., this volume; Sha et al., this volume). And even where smart city initiatives are launched in bottom-up fashion by local stakeholders with more idealistic commitments, these will eventually require municipal endorsement (e.g. planning approval) and financial support to go beyond pilot stage and be rolled out and scaled up in any significant way.

In short, both the number of smart city projects and related financial investment are on a steep upward trajectory, which is likely only going to increase as Machine Learning and Artificial Intelligence technologies take a firm hold in urban planning and governance (Ullah et al., 2020; Ghazal et al., 2021; Cugurullo et al., 2023). Against this background, this article interrogates the smart city conceptually as a phenomenon of 21st century developments in capitalism. This fills a gap in the literature, since among the multitude of smart city studies to date only a small number have sought to conceptualize the smart city in terms of the confluence of several concurrent developments in contemporary capitalism. These have primarily focused on: the significant challenges posed by global capitalism to effective governance and leadership at national level, especially concerning the crises of environmental deterioration and socio-economic inequality; the renewed strength of cities and city regions and their potential to take over some of the nation state's functions; and the growing role of smart and autonomous technologies in governance systems and processes (Calik, 2023; Allam, 2021; Bibri and Allam, 2022; Molchanov and Molchanova, 2022). What we aim to do in this contribution is to take a more analytical look at the essential characteristics of capital, capitalism and capital accumulation, examine how these come together in various manifestations of the smart city and why the emergence and growth of data-driven urbanism is typical of 21st century capitalism. If marketplaces constituted the main locus of merchant capitalism, factory districts represented industrial capitalism, and suburban office parks symbolized post-industrial service capitalism, how do contemporary smart cities spatially manifest 21st century capitalism? Relatedly, how do different smart cities convert financial capital and various non-financial capital (natural, human, social, financial) into physical capital as part of a temporary 'spatial fix' (Harvey, 2001) during the capital accumulation process? Moreover, importantly, how do varieties of national regimes and institutional contexts influence socio-economic and ecological outcomes and, therefore, provide scope for tempering the excesses of 21st century capitalism? These are the three key questions to be addressed in this paper.

The following section first turns to capital and capitalism themselves and examines the main features of their 21st century edition, based on the recent academic literature. It culminates in a summary of three main underlying mechanisms. Section 3 analyses six spatial manifestations of the smart city – namely, science parks and smart campuses; innovation districts; smart neighborhoods; city-wide and metropolitan smart city initiatives; urban platforms; alternative smart city spaces – and the variety of actors and organizations involved in creating and utilizing related investment opportunities. Section 4 considers the different capitalist mechanisms through which smart city projects convert natural, social, human and financial capital into physical capital, and how smart cities in their various manifestation thus become the receptacles of (mainly shareholder) capital accumulation in the information age. Section 5 highlights the modulating role of national regimes and institutional contexts which, therefore, provide opportunities for institutional mechanisms to mediate the processes of global capitalist mechanisms into localized investment patterns. The concluding section 6 summarizes the answers to the three key questions and discusses critical institutional dilemmas that current and future smart cities face in trying to manage localized processes of human, social and natural extraction within the global context of 21st century capital accumulation.

2. Key characteristics of 21st century capitalism

Recent years have seen a resurgence in the popularity of studying capitalism as a significant ensemble of economic institutional structures to help explain technological and societal change (Fulcher, 2015; Kocka, 2016; Jacobs and Mazzucato, 2016). Yet its historical genesis remains a matter of debate (Banaji, 2020). Needless to say, capitalism is based on the existence of capital; it originated from the invention of metal coins (currency) as a means of exchanging goods of usually unequal value. Over time, currency has acquired three distinct functions: unit of exchange (or payment), unit of account (or calculation), and unit of storage (or accumulation) (Rochon and Rossi, 2003, eds). The latter function became crucial to realizing substantial increases in people's wealth over time; a phenomenon now commonly referred to as 'capital accumulation' (Harvey, 2018). While currency had initially been primarily a material means to acquiring physical goods, it eventually became an end in itself, evidenced in the acquisition of wealth in the hands of 'capitalists'.

Hodgson (2015: 259) defined capitalism as a system of production consisting of: (1) a legal system with wide-ranging individual rights and liberties to own, buy and sell private property; (2) widespread private ownership of the means of production; (3) firms producing goods or services for sale in the pursuit of profit; (4) most production organized away from the home and family; (5) widespread wage labor and employment contracts; and (6) a financial system with banking institutions, the common use of credit with property as collateral and the selling of debt. Capitalism as defined by Karl Marx comprises features 1–4 and 6 (but not 5), while capitalism as defined by Joseph Schumpeter includes features 1–5 (but not 6). Through history, capitalism as a system of production and consumption has grown increasingly complex. In recent decades, it has come to include ever more intricate legal elaborations including: sophisticated forms of stockholding (bonds, options, derivatives); ownership of intangibles (patents, copyrights, trademarks, designs); the application of psychological insights for the conditioning of preferences and behaviors to maximize people's willingness to consume (advertising, marketing, branding); and their reinforcement by the ideological normalization of neoliberal policy prescriptions (monetarism, liberalization, privatization). These transformations have made the financial sector increasingly independent from the real economy, with options for government intervention claimed to be virtually nil or

its effects even harmful: cross-national competition to attract businesses is a driver for ever lowering taxation levels, but it has also led to growing indebtedness of the population (Ferguson, 2019).

The combined effect of these complexifications is also that countless aspects of the natural and built environment as well as the personal and social life of individuals have become commodified: their value is calculated and expressed in monetary terms. This is evidenced by the increasingly normalized use of the concepts of 'natural capital', 'physical capital', 'human capital' and 'social capital' to characterize non-financial aspects of modern economies (Hodgson, 2014, 2015).[1] This 'capitalization of life' has rendered all these 'goods and services' subject to monetization in alignment with the dominant role of the financial realm with its particular rationale for what is deemed 'valuable'. The conversion of physical to financial capital and vice versa is far easier than that for the other capital types. Related investments and speculations in urban infrastructure and equipment (representing physical capital) can be seen as a temporary 'spatial fix' for capital accumulation (Harvey, 2001): investors temporarily convert their financial capital reserves into physical capital in promising economic growth hubs, but sell on these physical assets and pull out their financial capital once better investment and speculation opportunities emerge elsewhere, with the ensuing risk of creating 'left-behind' places.

The number of academic publications seeking to come to terms with contemporary capitalism has grown rapidly. Along with it has come a great variety of terms used to characterize its essential aspects. Several highly influential economists stress how modern capitalist practices adversely affect the natural environment and socio-economic conditions (e.g. Raworth, 2017; Piketty, 2017). These authors argue that current processes of production and consumption are concurrently in *ecological overshoot* and *socio-economic undershoot* (Jackson, 2017; Henderson, 2020). They are in ecological overshoot in that the demands on natural resources and environmental degradation exceed planetary capacity; and they are in socio-economic undershoot in that inequalities and deprivation have become endemic and negatively affect a growing number of people in developed and especially developing economies. Some argue that the situation can be turned around if neoclassical, market-friendly economic policies are abandoned and lifestyles radically altered. This has been discussed in terms of natural capitalism (Hawken et al., 2010), doughnut economics (Raworth, 2017), inclusive capitalism (Green, 2017; de Jong, 2021), rethinking/reimagining/reinventing capitalism (Jacobs and Mazzucato, 2016; Henderson, 2020; Bakan, 2004, 2020; Mazzucato, 2015, 2018, 2021; Wolf, 2023), prosperity without growth, post-growth or degrowth (Jackson, 2017, 2021; Hickel, 2021), and 'taking back the economy' by putting an end to policies based on behavioral assumptions rooted in 'homo economicus' (Gibson-Graham et al., 2013; Fleming, 2017). Consequently, governments should curb corporate power while adjusting taxation and public expenditure upwards, consumption levels downwards, and marketing activities should be made more responsible and less exploitative of consumers' impulsive behaviors.

Other authors, with a stronger focus on corporate governance, argue that in the past few decades, under the influence of policies associated with the Chicago School of Economics that emphasize the maximization of shareholder value, the interests of workers/employees, suppliers, customers and other stakeholders have been systematically weakened and sacrificed to those of top-level executives, activist shareholders and hedge fund managers (Lazonick and Shin, 2020; Standing, 2017). Since nowadays corporate board members are often also major shareholders in their own companies and shareholders tend to pull substantial revenue out of companies, capital owners have seen their share of the monetary pie across national economies grow steadily since the 1970s while the percentage of labor-generated income (income for non-capitalists) has decreased proportionally (Piketty, 2017, 2020). High taxes on labor and smaller companies with merely national presence, accompanied by low taxation on capital, international corporations and ample opportunity to funnel profits to tax havens, together have resulted in extravagant wealth accumulation among a small elite and, conversely, growing poverty in the wider population. An important consequence of these developments is the significant increase in the power of large international corporations (Flint and Taylor, 2007, Slobodian, 2018, Plehwe et al., 2020, Steger and Roy, 2021). In response, critics on the moderate side call for 'stakeholder capitalism' (Schwab, 2021), 'completing capitalism' (Roche et al., 2017) or a 'new social contract' (Shafik, 2021). More severe critics call for an end to 'turbo capitalism' (Luttwak, 1999), 'rentier capitalism' (Christophers, 2022), 'cannibal capitalism' (Fraser, 2021), 'corrupted capitalism' (Standing, 2017), 'ecocide' (Whyte, 2020) and 'predatory value extraction' (Lazonick and Shin, 2020). The most pessimistic voices expect an outright end to capitalism and the coming of 'anarchy' or 'neofeudalism' (Kotkin, 2020; Streeck, 2016). On their part, adherents of Marxism more keenly explore the merits of relying either on a vanguard left-wing political party to push for anti-capitalist reform or on alternative modes of cooperative organization to pave the way for eventual communism (Zanoni, 2020; Zanoni et al., 2017). Other authors, with reference to 'post capitalism' (Mason, 2016), 'late capitalism' (Buzgalin and Kolganov, 2021) and 'late-stage capitalism' (Delaney, 2020) observe that the global economic system has become highly volatile and unstable and that, therefore, dramatic change may be imminent. Buzgalin and Kolganov (2021) detect signs of late-stage capitalism in the replacement of familiar patterns of neoliberalism and mass production with human creativity as the new source of rent extraction, whereas for Mason (2016) and Delaney (2020) the end of capitalism is closer to being reached.

The central element in a third strand of the recent literature on capitalism is the *extraction, processing and storage of data* and its subsequent use as valuable information and knowledge for marketization purposes. Viewed positively, this aspect of contemporary capitalism is encapsulated by the terms 'digital capitalism' (Schiller, 2000), 'information capitalism' (Marks, 2016), 'big data capitalism' (Mayer-Schönberger and Ramge, 2018) and 'capitalism without capital' (Haskel and Westlake, 2018). From a more critical perspective, it is variably discussed in terms of 'platform capitalism' (Pasquale, 2016; Langley and Leyshon, 2017; Srnicek, 2017), 'gig economy' (Wood et al., 2019) and 'surveillance capitalism' (Zuboff, 2019). Overall, the main point here is that data, information and knowledge as digital capital assets have grown in absolute as well as relative terms compared with all other sources of production and consumption; as such, they constitute the key resources for continued profit maximization. A host of legal instruments have been invented and deployed to give corporations a firmer grasp not only on direct monetary and physical assets but also on intangibles, such as computerized information, R&D-based knowledge, replicable designs and logos, and natural elements previously assumed to be public goods, such as emission rights to land, air and water (Kay, 2004, 2016; Haskel and Westlake, 2018; Milhaupt and Pistor, 2008; Pistor, 2018). Opponents emphasize that big tech capital is making ever more inroads into previously non-capitalized aspects of life, including the human body with serious consequences for human integrity (Storeng and de Bengy Puyvallée, 2021; Tan et al., 2021a, 2021b). This is especially the case with business models pursued by technology companies based on large-

[1] The number of types of capital discerned in the academic literature is exhaustive: beyond the five types in Hodgson (2014, 2015), one encounters reference to 'economic', 'cultural', 'personal', 'intellectual', 'political', and 'legal capital', among others. These are, however, not always convincing, since they are neither mutually exclusive nor particularly measurable. Recently, Ragnedda (2018) introduced 'digital capital' as a specific skill set for people dealing in the digital world and enabling them to grow other types of capital at their disposal, thereby deepening the 'digital divide' with those without digital skills and/or access. Although it is tempting to give space to *digital* capital in an article on capitalism in the digital age, we ultimately consider it a sub-type of human capital and thus prefer to stick with Hodgson's five-fold typology.

scale data extraction from guileless customers through various visible and invisible channels and the subsequent selling of data to third parties for use in surreptitious advertising tactics or even behavioral manipulation. The reach of digital capital, however, goes further through the datafication of different types of flows and relations (social relations, economic transactions, industrial machine data, energy and mobility flows) which are then directly or indirectly monetarized. Examples include algorithmic governance practices used to steer behavior to keep Uber drivers longer on the road (Uzunca and Kas, 2022), guide Google Maps visitors to desired destinations (Zuboff, 2019), improve maintenance of industrial machinery (Grabher, 2020) and sell pesticide sprays to farmers (Visser et al., 2021). Importantly, digitalization has, in combination with the loosening of government regulations of financial markets in recent decades, also turbo-charged stock markets with highly sophisticated financialization and securitization mechanisms boosting the speed and size of asset flows and, thus, further deepening the pervasiveness of 'casino capitalism' (Strange, 2015) and the ways in which these cause global financial crises (Sinn, 2010).

Overall, it is possible to characterize contemporary capitalism in terms of three concurrent features, as follows:

1. *Accelerated capital accumulation*. Storage of ever-growing amounts of capital in fewer hands as a result of financial resources being calculable and convertible into all other resources and, therefore, becoming an end in itself rather than a means to an end.
2. *Increasingly complex governance arrangements for resource extraction and capital conversion*. Legal and cultural values, norms and rules that enable producers to systematically convert natural, human and social capital into physical and ultimately financial capital, encourage consumers to willingly contribute to this process by maximizing their acceptance of goods and services on offer, and condition states to generate the political environment in which this conversion is experienced as 'economic growth'. Physical capital is a collateralizable asset for financial capital in that it serves as a human-made temporary 'spatial fix' to maximize revenue generated from investment and speculation. The lasting consequence of this extraction and conversion process made possible through governance institutions is ecological overshoot and socio-economic undershoot.
3. *Expansive data extraction and surveillance.* Ubiquitous harvesting, storage and analysis of data from the natural and physical environment as well as from human behavior and interactions, with subsequent transformation into marketable information and knowledge aided by machine learning, Artificial Intelligence and other specialized high-tech data processing techniques. The impact of this data processing is dramatically enhanced through financialization and securitization of the economic system which catapults both the speed and size of global transactions and their impact on capital markets. The combination of these above forces further optimizes capital conversion and, thus, the process of capital accumulation.

3. Six spatial manifestations of the smart city

As noted in the introduction and extensively documented in the literature, wanting to be(come) a smart city is remarkably popular among municipal governments, reflected in a multitude of cities launching plans and programs under the 'smart city' banner in recent years (Joss et al., 2019; Karvonen et al., 2019). Large, prosperous cities strive to offer advanced urban infrastructures and facilities to attract leading technology firms and service industry and, thus, secure their 'world city' status, while smaller and less developed cities aim to modernize and become more competitive by looking to leading cities for inspiration and lessons on how to succeed as smart city (Tan et al., 2021a, 2021b; Li et al., 2022; Noori et al., 2023). These motives are understandable since having a strong base in smart technologies tends to come with prestigious, high value-added economic activity, a highly qualified workforce and often substantial tax revenue (de Jong et al., 2018).

The existing literature shows that smart cities come in many shapes and forms (Karvonen et al., 2019; Joss et al., 2019; Caprotti et al., 2022; Yigitcanlar, 2023; Praharaj, this volume). For the purpose of the present analysis, it is useful to consider six spatial manifestations of smart city initiatives: (1) science parks and smart campuses; (2) innovation districts; (3) smart neighborhoods; (4) city-wide, metropolitan and city-regional interventions; (5) urban platforms; and (6) alternative smart city spaces. These are distinct not only by their focus on different urban scales, but also by the variety of actors, institutions and resources involved. Taken together, this provides insight into the underlying rationale for, and approach to, converting financial capital into physical capital (urban infrastructure and real estate) and vice-versa, and the varying emphasis on investing in human and social capital to grow the knowledge economy and develop and sell (digital) products and services as a means of maximizing value added. Importantly, these six spatial manifestations should not be understood as absolute categories; for example, there are overlaps (both conceptually and spatially) between science parks and innovation districts, and between innovation districts and smart neighborhoods. Likewise, some urban platforms developed by non-corporate actors (e.g. community groups, NGOs) constitute alternative smart city spaces since they aim to claim back the control of digital solutions and develop local, place-based alternatives to corporate platforms. Moreover, it is not uncommon to see several smart city initiatives of various types and scales enacted alongside each other, although not necessarily in a coherently planned and complementary manner.

(1) *Science parks and smart campuses*. While the concept of science park (also science and technology park; technopark) predates the smart city, it has been increasingly discussed under the latter's umbrella (e.g. Batty et al., 2012; Angelidou, 2015; Glasmeier and Christopherson, 2015; Hajduk, 2016; Brochler and Seifert, 2019). Among other issues, the question of how science parks can be better integrated into their local settings and thus positively contribute to urban development has come to the fore (e.g. Brochler and Seifert, 2019). On its part, the concept of smart campus arose in tandem with the smart city (e.g. Verstaevel et al., 2017: Villegas-Ch et al., 2019; Dong et al., 2020). Its focus is on how various smart technologies can be applied not only to run campus facilities more efficiently and sustainably (improved monitoring, real-time data analysis etc.), but also to support new forms of learning, knowledge innovation and collaboration. Both science parks and smart campuses occupy concentrated spaces, typically smaller than a neighborhood or district but larger than a single plot or building block. Science parks serve the co-location of universities, research institutions, and technology firms. The close-quarter proximity of university and industry partners is expected to facilitate networking and collaboration and, thus, to stimulate R&D, technology transfer and commercial spin-offs. Smart campuses act as both small-scale showcases of, and living laboratories for, smart city innovation, thus carrying significance beyond their host universities for the wider city. In both cases, investment opportunities arise in relation to new or upgraded science and technology facilities (campus building, research labs, testing facilities, offices), research and development programs, educational and skills training programs, and data mining and analytics. The involvement of government (mainly local and regional) is mostly indirect, consisting of the provision of financial subsidies, tax relief, and planning permissions or exemptions.

(2) *Innovation districts.* The delineation between science parks and innovation districts is a matter of debate (e.g. Parry, 2018; Yigitcanlar et al., 2020; Kayanan, 2022). The innovation district is a more recent concept, again being related to the smart city (e.g. Cosgrave et al., 2013; Aldusari, 2015; Ricci and Mariano, 2018; Yigitcanlar et al., 2020). Similar to science parks, innovation

districts seek to cluster leading knowledge, technology and creative industries in support of the knowledge economy. Yet, they are different in two important regards: first, they typically have a significantly larger spatial footprint and are located in, or near, urban centers. Second, in addition to hosting knowledge, technology and creative organizations, they offer dense, mixed-use housing, office, retail and neighborhood amenities to cater for the workforce and students. Consequently, the development costs are much greater than those of science parks, thereby offering large investment opportunities to national and international firms, financiers and consultants. In turn, the realization of these 'mega projects' typically require complex governance arrangements, such as public-private-partnerships and 'special purpose vehicles'. A recent comparative case study of innovation districts in the USA (Boston, St Louis) and Ireland (Dublin) pointed to "new governance arrangements that shift the burden of urban revitalization onto entrepreneurs who catalyze growth through their consumption and production activities" (Kayanan, 2022: 50). From the perspective of the city officials who endorsed these innovation districts, the districts were "a stopgap policy measure to accumulate economic benefits while waiting for market activity to resume" in the aftermath of the global financial crisis of 2008 (ibid: 50). While innovation districts seek to achieve and improve socio-spatial integration within their own perimeters through dense mixed-used development – see, for example, the analysis of two innovation districts in Singapore (Gao and Lim, 2023) – they may produce negative externalities in the form of segregation and socio-economic disparity if surrounding neighborhoods lose out on investment (e.g. Heaphy and Wiig, 2020). These can be counter-acted with targeted interventions by local government, such as improving affordable public transport in and out of the innovation districts, as illustrated by the innovation district in Chattanooga, USA (Morisson and Bevilacqua, 2019).

(3) *Smart neighborhoods.* Opportunities for smart city implementation also arise in residential neighborhoods, which provide a well-delineated, bounded context in which to materialize the smart city. An important driving force behind the growing focus on the neighborhood has been low carbon transition policies with their emphasis on decarbonizing energy systems and the built environment. This has given rise to numerous 'zero energy', 'low emission', and 'climate neutral' neighborhood projects (e.g. Bulkeley and Stripple, 2021; Baer and Ekambaram, 2021; Jansen et al., 2021). As Viitanen et al. (2015: 19) noted, the intersection of urban energy, infrastructure, and digital technology has produced a global burgeoning industry that offers an array of solutions for smart neighborhoods and cities. Viitanen et al. (2015: 803) view this outsourcing to the global industry critically because "city systems become a digital marketplace where citizen-consumers' participation is increasingly involuntary and the hegemony of global technology firms is inflated". In response, the authors analyze, with two examples of brownfield regeneration projects in Leeds and Sheffield (UK), alternative approaches to smart neighborhood development based on community participation and the social embedding of technology with attendant focus on social and ethical challenges (Viitanen et al., 2015). Another example of an attempted more 'inclusive urbanism' approach (Gebhardt, 2020) is Brainsport Smart District currently under construction in Helmond (Netherlands); it draws on the resources of both citizens and social entrepreneurs and is promoted as a "smart neighborhood where residents own their data" (Block, 2022). According to findings from a recent Japanese study of the Minato Mirai 21 district in Yokohama, the neighborhood is an important urban management scale for smart city implementation to enhance residents' social capital (Nakano and Washizu, 2021).

(4) *City-wide, metropolitan and city-regional smart city initiatives.* While the three preceding smart city interventions occur at sub-city levels, smart city implementation also takes place – though not without significant coordination challenges – at the city-wide level as well as at metropolitan and city-regional levels in the case of large cities and large conurbations with shared administrations (e.g. Yu et al., 2019; De Falco et al., 2019; Andersson, 2021; Bundgaard and Borrás, 2021; Kitchin and Moore-Cherry, 2021). The scale of intervention is, therefore, typically significantly greater and more substantial than in the case of the aforementioned categories. In turn, this creates considerably larger investment opportunities and involves more complex governance arrangements. Intervention is also more systemic in that it relates to comprehensive urban infrastructures, such as the energy grid, public transport systems, public housing and government buildings, waste management systems and green infrastructure (parks, waterways etc.). It may also relate to health and social care systems, education, as well as e-government (electronic voting, citizen dashboards etc.). All of this requires extensive digital infrastructure and data analytics capabilities and capacities and, consequently, it opens vast opportunities for data mining and extraction. City governments play a central role in shaping related policy, initiating projects and commissioning services. They, however, routinely rely on the involvement of management consultants, technology firms, utility companies and financial organizations, often in the form of outsourcing or substantial public-private partnerships. They themselves may struggle to coordinate internally, as illustrated by the case of Metro Boston (USA) whose smart city-region initiative suffered from effects of territorial politics and fragmented (data) governance (Kitchin and Moore-Cherry, 2021). City governments may also succumb to incremental, piecemeal approaches without an overarching smart city strategy, as illustrated in the Australian cases of metropolitan Melbourne and Sydney (Dowling et al., 2019). There are, however, examples of cities achieving system-wide innovation through effective co-operation, as in the case of Rogland region (Norway) where eleven towns teamed up to deliver a wholesale smart street and park lighting roll-out through a jointly run, publicly owned industrial company which avoided the need for outsourcing and allowed for ongoing innovation (UN Habitat, 2022: Ch.9).

(5) *Urban platforms.* This is another city-wide manifestation of the smart city, which has quickly gained a foothold across cities and begun to change the way urban life is organized and experienced. The category refers to both commercial digital platforms offering consumer services, such as ride-hailing (e.g. Uber), bike-sharing (e.g. Lime); food delivery (e.g. Deliveroo) and lodging (e.g. Airbnb), and public digital platforms providing public/visitor information, citizens' services and community information and engagement. There has been growing interest in urban platforms as a particular articulation and extension of the smart city (e.g. Barns, 2018; Repette et al., 2021; Sadowski, 2021; Caprotti et al., 2022; Smith and Martín, 2022). Relevant to the present discussion, Caprotti et al. (2022: 4), citing Srnicek (2017), relate urban platforms to the emergence of platform capitalism, "a new business model predicated on the extraction and control of vast amounts of data and favoring large monopolistic firms". Unlike smart city programs that are initiated by, designed for, and implemented in, specific cities (see preceding categories), urban platforms – especially commercial ones – constitute data-centered digital systems that are purposefully designed as templates to be applicable across multiple towns and cities. As such, however, they necessarily have to 'land' in cities, relying on existing urban infrastructure (e.g. roads, electricity grid), business partners (e.g. restaurants), workers (e.g. drivers) and consumers. They are, thus, enacted within, and co-produce, urban

space. They also rely on licenses and permits to operate as business. Related questions about the appropriate regulation and governance of platform companies by city authorities – for example, whether Uber is merely a technology company or rather a transport provider, whether workers have any employment rights, who owns and has access to collected data – have provoked much discussion and in practice even led to legal disputes (e.g. Pelzer et al., 2019; Ranchordás and Goanta, 2020; Chandler, 2023). In their comprehensive study of 200 urban mobility platforms, Stehlin et al. (2020, 1260) draw attention to the speculative investor interest driving "massive capital inflows into nascent platforms…which are out of proportion to both revenues and assets". In turn, they raise concerns about the long-term infrastructural reliability and the attendant risk of a "new infrastructural bubble" (ibid). Their concern, too, is that, in contrast to previous spatial fixes that built durable infrastructures (roads, rail etc.) resulting in long-term urban development, the emergent mobility platforms constitute a more "fragile spatial fix" both in terms of the interstitial (in-between) urban space that they occupy and produce and their temporal ephemerality, since platforms may be withdrawn, or collapse, at short notice (ibid: 1262–1263).

(6) *Alternative smart city spaces.* Another category of often ephemeral and punctual spatial manifestations is represented by alternative approaches to enacting the smart city. They are important to note for the present discussion as they signify critical interventions by urban activists into the corporate smart city and its dominant mode of entrepreneurial urbanism (Hollands, 2015). There is no unified approach to these alternative spaces; rather, they are characterized by diverse ways in which citizens, residents and activists mobilize and collaborate to propose and trial alternative smart city initiatives. As such, they are local manifestations occupying small urban spaces flexibly and dynamically. Conceptually, they are captured by overlapping terms including 'digital grassroots innovation' (Boni et al., 2019), 'grassroots digital urbanism' (Vadiati, 2022), 'smart commons' (Cardullo, 2019), 'civic hacking' (De Waal and De Lange, 2019), 'participatory experimental urbanism' (Thompson and Lorne, 2023), 'insurgent digital citizenship' (Stockols, 2023) and 'urban commoning' (Peter and Meyer, 2023). Practical examples include a non-profit organization championing 'smart citizens' in Amsterdam (Netherlands) (Veenkamp et al., 2020), a grassroots movement for 'technological sovereignty' in Barcelona (Spain) (Calzada and Almirall, 2019), and three 'urban commons' experiments in Durban and Stellenbosch (South Africa) and Kinshasa (Democratic Republic of Congo) (Peter and Meyer, 2023). Some of these civic initiatives, especially those classed as digital grassroots innovations, are primarily constituted as digital platforms. Nevertheless, they necessarily interact with, and depend on, physical spaces, thereby creating an expanded, digitally mediated urban space (Vadiati, 2022). Other social movements, such as exemplified by the 2019–2020 protests in Hong Kong (China) which Stockols (2023) conceptualizes as a form of 'insurgent smart city', use open-source digital infrastructure (e.g. Telegram) instrumentally as a means of mobilizing and appropriating various physical spaces in the city, including pop-up markets, wall displays and public meeting places. In the context of African alternative smart urbanism, which essentially extends to informal settlements, the focus shifts onto enabling the collective governing of, and right to access, urban resources and infrastructures (Peter and Meyer, 2023). Altogether, as alternative digital-urban spaces, these various initiatives often struggle to gain a firm foothold in the city. Indeed, trying to incorporate them in formal participatory and political processes of local government may be missing the point, since they typically arise in opposition to mainstream smart city policies and seek to engage in insurgent practices.

4. Smart cities as receptacles for various types of capital

Digitalization keeps an ever-growing proportion of the global consumer population tied to their smart phones and computer screens for ever-growing amounts of time. Underlying this relentless process of digital expansion is a vast global producer industry driven by global capital owners' goal to generate the highest possible profit margins (Sassen, 2001; Zuboff, 2019; Lazonick and Shin, 2020). Given that smart cities are typically posited to answer the need for technological innovation and open up new opportunities for further integration of digitalization with other industrial functions, they have evolved into the ideal receptacle for large flows of different kinds of capital: financial, physical, human, social and natural (Srnicek, 2017; Sonn and Park, 2023). This section examines which types of capital are infused into the various spatial smart city manifestations and what processes of capital conversion prevail.

In terms of *financial capital*, smart cities offer new investment opportunities for shareholders of various private corporations to grow the size and variety of their portfolios by placing their bets on the development of new technical hardware and digital software in the hope of securing lucrative future revenue (Filion et al., 2023). While private finance is injected into smart city development primarily through the capital market, on their part national and especially local governments direct public funding towards the creation of attractive smart city projects by using various fiscal means, including taxation and the reallocation of funding from other areas of spending (Anttiroiko, 2014; Anttiroiko, 2015). In several countries, national governments have used innovation competitions to channel funding to cities on the back of competitive selection processes (Cowley and Joss, 2020). Since many local governments aspire to the status of 'smart city' and, thus, compete to attract relevant private capital, the resulting intermunicipal competition can further drive up their local expenditure by having to commit to creating high-quality urban environments that are seen as essential for attracting private sector investment.

Consequently, both public and private sector players also make *physical capital* investments in the smart city in the form of various network infrastructures (transport, energy, ICT, water, waste) and buildings. Where the public sector is the main investor, the costs are paid for from core budgets or bespoke investment programs, whereas the private sector invests its own revenues (profits from developments elsewhere) unless projects are commissioned directly by local government. Frequently, physical capital investment is based on public-private partnership agreements. As mentioned, David Harvey (2001) labeled these vast investments and speculations in infrastructure and buildings a 'temporary spatial fix' for capital accumulation until more advantageous opportunities emerge elsewhere to generate further investment returns.

Human capital is another essential asset captured by smart cities as they seek to offer outstanding employment opportunities and a high-quality living environment for the highly educated and skilled workforce. Alongside engineers and IT specialists, the smart city caters for a range of professionals working in service industries, including finance, accountancy, law and real estate. When large amounts of financial, physical and human capital are seen coalescing in designated urban areas, one witnesses a true accumulation of capital resources in, and through, the smart city. Various manifestations of the smart city may do this to different degrees and in various proportions of types of capital and public-private partnerships. For example, city-wide smart city initiatives tend to be highly capital intensive and, consequently, rely on financial, physical and human capital input from national as well as municipal governments, various private sector organizations and sometimes research institutes. In contrast, most urban platforms are initiated, financed and rolled out by technology companies with support from private investors. On their part, initiatives that draw inspiration

from open-source urbanism or other alternative smart city spaces are implemented in bottom-up fashion by civil society organizations and chiefly rely on human capital input (including voluntarism); their mainstreaming beyond the initial small-scale experimental stages would require substantial financial, physical and human capital contributions from various public sector, private sector and academic actors (in so-called 'quadruple-helix' actor constellations) to achieve longevity. More limited partnerships ('double-helix' or 'triple-helix') can be seen at work in science parks and smart campuses that involve main partnerships between local universities, research organizations and municipal governments. Additionally, sometimes private sector input is sought to secure additional financial investment and strengthen applied research and knowledge transfer. Finally, in the case of smart neighborhoods and innovation districts, these rely on a mixture of public and private sector capital investments to enable urban infrastructure upgrades and the development of high-quality residential areas. Here, human capital investment occurs both directly by making R&D a central component of innovation districts, and indirectly by creating livable mixed-used neighborhoods to attract a skilled, professional workforce. In short, different smart city manifestations in different localities display specific, partially overlapping characteristic configurations of financial, physical and human capital allocation and distribution involving a variety of actors' constellations. They, consequently, also exhibit differing patterns of (mainly financial) capital extraction over time.

The role that natural and social capital play in smart city development is different from that of financial, physical and human capital. *Natural capital* is critical to smart city development insofar as access to attractive public parks and healthy environmental conditions enhances the attractiveness and experiential value of techno-parks, innovation districts and neighborhoods as places to live, work and visit. That said, while brownfield sites may be transformed into green space (effectively a conversion of financial or physical to natural capital and, therefore, considered a 'cost') to enhance biodiversity and provide recreational opportunities, more often the opposite applies: greenfield space is turned into built environment to accommodate smart city developments. Natural capital is, thus, partially if not fully converted into physical capital.

On its part, *social capital*, which denotes trust and (weak) ties among strangers that allow for constructive social interaction and higher levels of prosperity (Fukuyama, 1995; Nooteboom, 2002), is not easily created from scratch or forced upon social actors. Rather, it is embedded in broader institutional patterns where reliable behavior prevails in society and the cheating of strangers for short-term gain is avoided (Raguna-than, 2006; Greif, 2006; Lin and de Jong, 2017). The nurturing of social capital can be encouraged by organizing common facilities or events – frequent features of smart city initiatives – where people meet quasi-spontaneously, learn to gradually confide in each other and engage in constructive business interaction, though there is no guarantee of successful outcomes in advance. Where such existing trustful social networks are successfully mobilized to implement smart city initiatives, social capital is subsequently converted into financial capital. From this perspective, the argument that current 21st century capitalism is deeply exploitative – and so in an increasingly sophisticated manner – does not seem far-fetched: natural, social and to a large extent human capital merely serve as instruments for the eventual conversion into, and accumulation of, financial capital, with physical capital commonly acting as temporary storage to enable that process. Nor is it particularly surprising that alternative smart city spaces, where other more inclusive public values than profit maximization dominate as the primary developmental motive and where 'weaker' types of capital (mainly human, social and natural) are used as the main resources, fail to attract attention from powerful investors and face difficulties when scaling up. If their main output is not ever-growing amounts of monetary resources, what is their viable business model?

When observing the mechanisms underlying the process of capital accumulation in smart cities, one can see that all three thematic strands in the literature on 21st century capitalism (discussed in Section 2) interact. 'Rentier capitalism' manifests itself whenever shareholder value is maximized: large financial capital owners – both extractive shareholders and shareholding board members jointly deciding where dividends and remaining profits are redirected – pull out resources from more traditional industries and companies with lower expected future profit margins. With powerful extractive shareholders of large corporations at the helm, the benefits of other stakeholders in the corporation (employees, suppliers, customers) are substantially reduced: most of the profit and other valuable resources are extracted from 'ailing' companies and their related places and reinvested in firms operating in the new digital economy even though the amount of employment the latter offer is comparatively low (Shin & Lazonick, 2020; Kotkin, 2020). Surplus capital is, thus, extracted from some industries and areas and poured into new smart city developments, amounting to a major reallocation of capital with important distributive consequences.

Rentier capital accumulation in the digital age is precipitated by various mechanisms of surveillance: big tech firms are largely reliant in their profit maximization on processes of extracting raw data from a great variety of sources and transforming them into information or knowledge useful to mostly other business clients. Privacy constraints on data gathering from people would limit both the amount and the market value of the collected data and are, therefore, circumvented by the digital industry as much as possible, turning smart technology firms into a vital part of 'surveillance capitalism' (Zuboff, 2019). Until the late 2010s, much of the data were fodder for sophisticated advertising campaigns. More recent advances in platform capitalism, enabled by machine learning and Artificial Intelligence, allow industrial buyers to use these platforms to improve manufacturing processes and service delivery (Srnicek, 2017; Cugurullo, 2021). Although the platform economy is at its core an online phenomenon, the physical concentration of data extraction, processing and sales in geographical areas and physical spaces where the clustering of information and knowledge innovation takes place is equally essential: smart cities typically are just that (Srnicek, 2017; Caprotti et al., 2022). National and local government organizations have also grown increasingly susceptible to the temptation to collect data from, and about, their citizens with a view to promoting governance efficiency, safety and control (Meijer, 2018). As in the case of the private sector, this may well improve the quality of public services and help achieve policy goals, but it also tips the balance in government's favor. In surveillance capitalism, consumers and citizens alike may know little about their suppliers, but both public and private sector organizations increasingly know a very great deal about them.

The connections between the five different types of capital bring us to corporate management and governance in 21st century capitalism, which show that some capitals are decidedly more important than others. In the production of smart technologies, financial capital essentially acts as the benchmark for the other types of capital: it is the currency in which all digital economic activity is expressed, and into which all others are ultimately converted. Capital accumulation, thus, refers to the maximization of financial capital by those that hold it. Physical capital in its various forms is instrumental to creating financial capital, but still only secondary, because it is a direct 'collateral' to financial capital and into which it is most easily liquidated (Hodgson, 2015). Human capital is likewise important, though focused on the section of the labor market with relevant educational background and skills to enable and expand the digital economy. In practice, the related workforce (digital creative class) may be in short supply, thus attracting favorable job offers and premium salaries, but their labor effort often far exceeds the regular 40-hour working week and may, therefore, be considered extractive (Florida, 2014). For the working class, the labor conditions have overall worsened substantially in the past decade, as have their living conditions in urban areas (Florida, 2017): advanced smart city neighborhood and districts rarely include them, thereby acting as exclusionary enclaves and reinforcing the digital divide.

Natural and social capital, too, ultimately have an instrumental function serving the maximization of financial capital. Trustworthiness, good reputation and smooth interpersonal interaction may be inherently good and worthwhile. However, in the digital and service industries in the smart city, such social capital is supported primarily with the aim of maximizing the development and output of products and services. Concerning natural capital, the effects of its capitalization into finance are probably the most painful of all to see: human, animal and plant organisms are explored and exploited in laboratories and the information emerging from those experiments serves to maximize human sensitivity to the temptations of advertisement, to test and improve the effects of industrial pharmaceuticals and cosmetics and to artificially enhance specific types of food production for a continually growing human world population. Meanwhile, natural life within and outside the smart built environments is faring worse than ever, leading some authors to conclude that 'ecocide' is being committed (Whyte, 2020).

If it is true that growing socio-economic inequality and planetary destruction are the direct consequences of financial accumulation in 21st century capitalism, smart cities are not the logical successors of eco cities, green cities, low carbon cities, resilient cities and sustainable cities in bringing about a sustainable harmony between people, planet and profit (de Jong et al., 2015), but rather a successful business model for turning all else into currency: maximizing money as the ultimate driver of all productive action, particularly by using information as the new vehicle to marketize indiscriminate consumption and, in the course of doing so, sacrificing natural resources, social relations and human capabilities.

5. Varieties of capitalism and their moderating effects

Can civil society organizations and citizens – hailed so much in the recent critical smart urbanism literature – act together to engender a more bottom-up and digitally inclusive approach (Borkowska and Osborne, 2018; Hasche et al., 2020; Roman and Fellnhofer, 2022)? Overall, government and industry normally hold sway in establishing the headlines for smart city development, with the academic community as a helpful provider of knowledge, staff and entrepreneurship. This combination often leads to a distinctly top-down flavor in planning, decision-making and finance. That said, recent scholarship (e.g., Karvonen et al., 2019; Zhilin, 2023; Gerli et al., this volume) has evidenced across a range of cities the emergence of a variety of bottom-up initiatives by civil society organizations and individuals who are committed to rendering digital urban development less driven by commercial interests, more respectful of privacy concerns and more responsive to local residents and communities' preferences for urban regeneration. With appropriate organizational support, some of these initiatives may develop into cooperatives or social enterprises and, thus, become more enduring and effective. Too often, though, they face the challenge of being typically small-scale with limited financial and staffing resources and relying on governmental support, including permits and special dispensations, to allow the implementation of experimental projects. They also risk being sidelined if they come up against smart city plans put forward by large public-private consortiums.

Such bottom-up initiatives may fare better or worse depending on institutional contexts. Much depends on the role that nation states play in regulating the position of various types of players in large urban development projects. Offe (1974) and Offe and Ronge (1975) in his work on the theory of the state, and Hall and Soskice (2001) and Hancke (2009) in their works on varieties of capitalism, all pointed out that national and local institutional frameworks matter much more to understanding capital flows than orthodox economists typically assume. At the same time, they differentiate themselves both from the orthodox (instrumentalist) Marxists' position that the state is an instrument in the hands of the capitalist class (as Ralph Miliband claimed) and from the contrasting structuralist position that the state acts fully autonomously from capital or labor with the goal of 'saving capitalism in the long run' (Nicos Poulantzas' contention) (Nash and Rich, 1975). Rather, according to their work, it is crucial to empirically examine how the state operates as an interlocking system consisting of various governmental organs and institutions at various levels with sometimes divergent interests and attitudes. This then also recognizes that across countries and cities, national and local governments are subject to different patterns of interaction and institutionalization depending on underlying constitutional frameworks and the geographic and socio-economic environments in which they operate.

As the dominant neoliberal ideology has led to a global situation in which shareholder interests are systematically placed above those of other stakeholders, the position of capitalists has been dramatically strengthened while reducing opportunities for employees, small suppliers and consumers to benefit from corporate profits, this has not happened in the same way and to the same extent across different countries (Jacobs and Mazzucato, 2016). In Liberal-Democratic Economies (LDEs), of which the United States and the United Kingdom are considered archetypes, real estate markets serve landlords better than tenants, education policies are aimed at producing generalist knowledge and skills and tend to overlook vulnerable groups, (especially large) business lobbies are dominant and labor unions made powerless, dividend, corporate and income tax rates are low, public regulation of the private sector is weak, public infrastructures hard to establish and underfunded and untrammeled private consumption the highest public virtue. These characteristics obviously also permeate the digital economy and urban developments, and this can be observed in the leading role private investors, real estate firms, digital technology companies and other commercial actors play in smart cities, and conversely in the relatively weak position of national and local governments in the regulation and provision of public services. Smart city projects within an institutional context of LDE countries are primarily based on commercial considerations which substantially facilitate private (financial) capital accumulation. This, however, comes at the risk of generating and exacerbating socio-economic inequality, segregation and a persistent digital divide (Fainstein, 2010; Anttiroiko and de Jong, 2020).

In contrast, many continental European countries, with Germany and Scandinavian countries often taken as most telling examples, have been labeled Corporatist-Democratic Economies (CDEs). Here, very different institutional equilibria have evolved across these various markets, with generally much stronger national states, local governments and regulatory practices. Likewise, they are characterized by stronger labor unions and protective safeguards for low-income groups, public provision for (typically high-quality) housing and built infrastructure, more specialized and advanced vocational education, and lower levels of private consumption.

Hall and Soskice (2001) indicate that LDEs and CDEs are equally capable of creating wealth, but that there is a systematically higher level of disparity between capital and labor in LDEs. Piketty (2017) also showed that capital accumulation occurs much faster in Britain than it does in Germany, with the British precariat, working class and service class in worse shape than their German counterparts. Hancke (2009) attempted to finetune the LDE-CDE typology and concluded that countries, such as France and Japan, do not fit into this simplified classification because their governments and labor unions operate differently from the two archetypes. For non-democratic countries, such as China and Saudi Arabia, yet other types would need to be discerned to characterize their respective state-business-academia-civil society relations. This is further reason for adopting the idea of varieties of capitalism without placing too firm a belief in neat typologies of capitalist systems (Kurlantzick, 2016). Karvonen et al. (2019), Raven et al. (2019), Noori et al. (2020) and Cugurullo (2021) in recent studies have shown that smart cities such as Abu Dhabi, Amsterdam, Barcelona, Dubai, Dublin, Hamburg, Hong Kong, Ningbo, and Santiago de Chile all have institutional features reminiscent of their national state, yet also display not fully predictable local specificities. In Barcelona, for instance, civil society involvement in the Catalan capital's smart city initiatives has been

particularly pronounced. Overall, it is essential to recognize and, thus, analyze the variety of national and sub-national institutional contexts and how these differently mediate and condition global trends of 21st century capitalism, with differential impacts on the allocation and distribution of various types of capital.

Arguably, no urban theorist is more exemplary of the gradual reversal in enthusiasm for intellectual elites governing 21st century capitalism than Richard Florida. In his seminal work, 'The rise of the creative class' (2002), he hailed the growing importance of a group of people from diverse professions whose work is characterized by creative thinking and innovation and who are essential for generating new economic growth, favorable social dynamic, and urban renewal. However, his more recent work, 'The new urban crisis' (2017), revealed that much of the earlier optimism had been replaced with pessimism: the most 'creative cities' – which can be seen as a predecessor to the smart cities (Schraven et al., 2021) – with the highest concentration of new knowledge workers also happen to be the most socio-economically unequal ones, at least in the United States. They have experienced exorbitant surges in land and real estate prices that have driven the working and service classes out of the attractive, livable neighborhoods of the city and produced a fast-growing new precariat of people for whom having decently paid work and good housing have become unattainable.

This casts a dark shadow over the emergence and ongoing evolution of smart city developments, with Florida's observations concerning cities in the USA likely resonating with experiences in cities and countries in other global regions. At the same time, as noted, national and institutional contexts do matter. Countries and municipalities are more likely to experience serious forms of socio-economic inequality and a stark digital divide whenever minimum labor prices are absent, healthcare services are mostly provided by the private sector, little land is publicly owned, private transport is not taxed to compensate for the environmental harm it causes, regulation to safeguard the data privacy of citizens and consumers is not enacted, few small agricultural and energy companies are organized as cooperatives, and civil society initiatives tend to be met with distrust by public authorities and the wider public. Such cities will concentrate their digital investments in a small number of wealthy neighborhoods rather than more evenly across their full municipal territories; these enclaves can then be expected to have superior digital infrastructure and Internet access. Capitalism may be an unstoppable force, but its degree of ravage does depend on mitigating institutions and not all cities need to undergo San Francisco's roughshod experience.

6. Conclusions

The positive story commonly told about smart cities is that the digitalization of urban space creates superior-quality services to the public and enhanced two-way communication between authorities and citizens and between companies and customers. It is also supposed to boost innovation among start-ups and other small companies and improve social and environmental sustainability by making people aware of their consumption and emission patterns through real-time data access. The key takeaway of this contribution is not so much to determine whether these claims are true or false, although the evidence of persistent socio-economic undershoot and ecological overshoot suggests that global problems are discussed rather than tackled. Rather, the main message is that underlying the hoorah story of digital progress and impressive profit margins is an ongoing consolidation of enormous capital resources of different kinds into spatial projects owned and controlled by a limited number of actors. In short, smart city development has become big business. In the 21st century, extracting, generating, processing and disseminating data constitutes a major economic activity that attracts major attention from the public and private sectors.

Smart cities manifest themselves in a variety of urban (physical-digital) spaces: science parks, smart neighborhoods, innovation districts, city-wide smart city initiatives, urban platforms and alternative smart city spaces. These manifestations reflect the variable presence or absence of different spatial functions and facilities (housing, various infrastructures, laboratory, office and storage equipment, cultural and recreational facilities, green spaces, research and educational institutes etc.). Although these variations of the smart city appear distinct at first sight, they may co-exist or even require each other, as when urban platforms are enabled by smart neighborhoods and vice versa. Different manifestations also imply the presence of different actor constellations: for example, smart neighborhoods may involve local associations alongside architecture firms and construction firms; science parks essentially involve academic and other research organizations; and open-source urbanism require participation from civil society.

It is, however, mostly the larger players – (local) government, large technology and real estate firms and investment banks – that can muster the resources required to make the necessary high capital input for smart cities projects to get off the ground. The processes of concentrating natural, human, socio-cultural and financial resources inside spatial enclaves filled with physical capital to enable profit extraction from digital innovation and technological development are buttressed by regulatory mechanisms and ideological norms that buttress the 21st century version of capital accumulation. In this context, smart cities can be considered a spatial fix: they represent a perfect investment opportunity for the conversion of ever more human, social and natural resources into temporary receptacles of physical real estate and technological equipment. These smart city receptacles are, however, temporary fixes that will be abandoned and once again turned into financial capital as soon as new types of investment opportunities come along that are seen as more profitable. In that sense, smart city development represents a recent but not yet final stage in the approximation of capital accumulation's ultimate state: the financialization of everything else that our planet has to offer.

21st century capital accumulation is not a uniform process everywhere. Although the essential driver behind this process may be similar around the world, different countries and cities have come to adopt different rules of the game and these evoke different interaction patterns among various bodies of the state, private sector players, academic institutions and civic groups. In some societies more than in others, these institutions will provide greater freedom to alternative smart city initiatives driven by non-commercial motives, with local governments open to adopting and mainstreaming their ideas and practices. Again, some political and legal frameworks are more attuned to safeguard the interests of the digitally disadvantaged and protect green spaces. Some cities care more than others about what happens to their precariat and feel greater responsibility for homelessness on the fringes of their high-end smart neighborhoods and, consequently enact policies to temper the worst excesses of 21st century digital capitalism. Likewise, smart cities do not constitute a conceptual unity. Around the world, one can observe different spatial manifestations and capital conversion patterns owing to the aforementioned variety of institutional and actor constellations which drive their development. Drawing on these insights, there is a clear need for further research in this domain in terms of both theory development and policy prescription. For example, comparative studies across countries, cities and neighborhoods should address questions concerning how institutional frameworks, actor constellations, organizational structures and leadership styles affect the emergence and evolution of various spatial manifestations of the smart city and how they affect patterns of resource allocation and distribution in societies (Sancino and Hudson, 2020). Moreover, research into the varieties of 21st century capitalism and their different spatial manifestations and related ex−/inclusionary practices should provide important insights into what opportunities are available to institutions and actors to intervene in, and thereby moderate, the relentless capital accumulation processes.

In conclusion, behind the alluring story of the smart city as a promising way of making human life ever more convenient, efficient and intelligent, there is a far less elevating reality of hard-nosed and ruthless shareholders subordinating any aspect of natural, human and social life

to technological innovation to further add to their already vast investment portfolios. While it is hard to avoid the conclusion that capital accumulation as a process appears ineluctable as long as currency is the ultimate denominator of value, it seems particularly important to compare the variety of institutional contexts and conditions of smart city development, in order to find ways to temper the excesses of 21st century capital accumulation and design institutional recipes for smart cities to achieve desirable allocative and distributive outcomes for people and planet.

CRediT authorship contribution statement

Martin De Jong: Investigation, Conceptualization, Writing (Original draft, Review & Editing). **Simon Joss:** Conceptualization, Writing (Original draft, Review & Editing). **Araz Taeihagh:** Consultation, Writing (Review & Editing).

Data availability

Data will be made available on request.

Acknowledgement

The authors are indebted to Erwin van Tuijl, Yunhong Liu as well as the anonymous reviewers for the constructive feedback received on the earlier versions of the article. The study was undertaken as part of the Erasmus Initiative Dynamics of Inclusive Prosperity. It received funding from the Dutch Research Council (NWO, grant no. 482.19.608) and the National Science Foundation of China (NSFC, grant no. 72061137071). Simon Joss's contribution was funded through the 'data governance' workstream of the Urban Big Data Centre (Economic and Social Research Council grant no. ES/S007105/1). Araz Taeihagh's contribution was supported by the Singapore National Research Foundation, Prime Minister's Office, Singapore under its Campus for Research Excellence and Technological Enterprise (CREATE) programme (NRF2018-ITS004-0015) and the Lee Kuan Yew School of Public Policy, National University of Singapore.

References

Ahad, M.A., Paiva, S., Tripathi, G., Feroz, N., 2020. Enabling technologies and sustainable smart cities. Sustain. Cities Soc. 61, 102301.
Aldusari, A.N., 2015. Smart city as urban innovation: a case of Riyadh north-west district. Journal of Sustainable Development 8 (8), 270.
Allam, Z., 2021. Big data, artificial intelligence and the rise of autonomous smart cities. In: The Rise of Autonomous Smart Cities. Sustainable Urban Futures. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-59448-0_2.
Andersson, M., 2021. Smart city and metropolitan governance. In: Solving Urban Infrastructure Problems Using Smart City Technologies. Elsevier, pp. 235–246.
Angelidou, M., 2015. Smart cities: a conjuncture of four forces. Cities 47, 95–106.
Anttiroiko, A.V., 2014. The Political Economy of City Branding. Routledge.
Anttiroiko, A.V., 2015. City branding as a response to global intercity competition. Growth Chang. 46 (2), 233–252.
Anttiroiko, A.V., de Jong, M., 2020. The Inclusive City. Palgrave Macmillan, The theory and practice of creating shared urban prosperity.
Baer, D., Ekambaram, A., 2021. Integrating user needs in sustainable neighbourhood transition of the Smart City–expanding knowledge and insight among professional stakeholders. In: REAL CORP 2021: CITIES 20.50. Creating Habitats for the 3rd Millennium. Smart–Sustainable–Climate Neutral. Proceedings of 26th International Conference on Urban Planning, Regional Development and Information Society. CORP.
Bakan, J., 2004. The Corporation. The Free Press, The pathological pursuit of profit and power.
Bakan, J., 2020. The New Corporation. How 'Good' Corporations Are Bad for Democracy. Vintage Press.
Banaji, J., 2020. A Brief History of Commercial Capitalism. Haymarket books.
Barns, S., 2018. Smart cities and urban data platforms: designing interfaces for smart governance. City Cult. Soc. 12, 5–12.
Batty, M., Axhausen, K.W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., Portugali, Y., 2012. Smart cities of the future. The European Physical Journal Special Topics 214, 481–518.
Bibri, S.E., Allam, Z., 2022. The Metaverse as a virtual form of data-driven smart urbanism: on post-pandemic governance through the prism of the logic of surveillance capitalism. *Smart.* Cities 5 (2), 715–727. https://doi.org/10.3390/smartcities5020037.
Block, I., 2022. Unstudio develops smart neighbourhood where residents own their data. https://www.dezeen.com/2019/03/05/smart-neighbourhood-brainport-smart-district-unstudio-netherlands/.
Boni, A., López-Fogués, A., Fernández-Baldor, Á., Millan, G., Belda-Miquel, S., 2019. Initiatives towards a participatory smart city. The role of digital grassroots innovations. Journal of global ethics 15 (2), 168–182.
Borkowska, K., Osborne, M., 2018. Locating the fourth helix: rethinking the role of civil society in developing smart learning cities. Int. Rev. Educ. 64, 355–372. https://doi.org/10.1007/s11159-018-9723-0.
Brochler, R., Seifert, M., 2019. STP development in the context of Smart City. World Technopolis Review 8 (2), 74–81.
Bulkeley, H., Stripple, J., 2021. Climate smart city: new cultural political economies in the making in Malmö. Sweden. New Political Economy 26 (6), 937–950.
Bundgaard, L., Borrás, S., 2021. City-wide scale-up of smart city pilot projects: governance conditions. Technol. Forecast. Soc. Chang. 172, 121014.
Buzgalin, A., Kolganov, A., 2021. Twenty-First-Century Capital. Manchester University Press, Critical post-Soviet Marxist reflections.
Calik, S., 2023. Green technology and smart solutions for capitalist cities in the twenty-first century. In: Ari, A. (Ed.), *Capitalism at a Crossroads*. Springer Studies in Alternative Economics. Springer, Cham. https://doi.org/10.1007/978-3-031-23257-2_17.
Calzada, I., Almirall, E., 2019. Barcelona's Grassroots-led Urban Experimentation: Deciphering the 'Data Commons' Policy Scheme. Zenodo (DOI, 10).
Caprotti, Federico, Chang, I-Chun Catherine, Joss, Simon, 2022. Beyond the smart city: a typology of platform urbanism. Urban Transformations 4, 4.
Cardullo, P., 2019. Smart commons or a "smart approach" to the commons?. In: The Right to the Smart City. Emerald Publishing Limited, pp. 85–98.
Castelnovo, W., Misuraca, G., Savoldelli, A., 2016. Smart cities governance: the need for a holistic approach to assessing urban participatory policy making. Soc. Sci. Comput. Rev. 34 (6), 724–739.
Chandler, C., 2023. Contested autonomy in "smart" and "inclusive" innovation: test-driving transportation technology and policy in Pittsburgh. Urban Geogr. 44 (8), 1608–1627.
Christophers, B., 2022. Rentier Capitalism: Who Owns the Economy, and Who Pays for it? Verso Books.
Cosgrave, E., Arbuthnot, K., Tryfonas, T., 2013. Living labs, innovation districts and information marketplaces: a systems approach for smart cities. Procedia Computer Science 16, 668–677.
Cowley & Joss (2020): Urban transformation through national innovation competitions: Lessons from the UK's Future City Demonstrator initiative: *Journal of Urban Affairs*: Vol 44, No 10 (tandfonline.com).
Cugurullo, F., 2021. Frankenstein Urbanism: Eco, Smart and Autonomous Cities, Artificial Intelligence and the End of the City. Routledge.
Cugurullo, F., Ponzini, D., 2019. The transnational smart city as urban eco-modernisation: the case of Masdar City in Abu Dhabi. Inside Smart Cities, Routledge pp 149–162.
Cugurullo, F., Caprotti, F., Cook, M., Karvonen, McGuirk, P., Marvin, S., 2023. Artificial Intelligence and the City: Urbanistic Perspectives on AI. Taylor and Francis.
De Falco, S., Angelidou, M., Addie, J.P.D., 2019. From the "smart city" to the "smart metropolis"? Building resilience in the urban periphery. European Urban and Regional Studies 26 (2), 205–223.
De Jong, M., 2021. Inclusive capitalism: the emergence of a new purpose paradigm in economics and business administration and its implications for public policy. Glob. Public Policy Gov. 1 (2), 159–174.
De Jong, M., Joss, S., Schraven, D., Zhan, C., Weijnen, M., 2015. Sustainable–smart–resilient–low carbon–eco–knowledge cities; making sense of a multitude of concepts promoting sustainable urbanization. J. Clean. Prod. 109, 25–38.
De Jong, M., Chen, Y., Joss, S., Lu, H., Zhao, M., Yang, Q., Zhang, C., 2018. Explaining city branding practices in China's three mega-city regions: the role of ecological modernization. J. Clean. Prod. 179, 527–543.
De Waal, M., De Lange, M., 2019. Introduction—The Hacker, the City and their Institutions: From Grassroots Urbanism to Systemic Change. Digital media and Collaborative city-making in the network Society, The Hackable city, pp. 1–22.
Delaney, P., 2020. Late Stage Capitalism; A 21st Century Analysis of the Political, Economic, and Sociological Impacts of Capitalism. independently published.
Dong, Z.Y., Zhang, Y., Yip, C., Swift, S., Beswick, K., 2020. Smart campus: definition, framework, technologies, and services. IET Smart Cities 2 (1), 43–54.
Dowling, R., McGuirk, P., Gillon, C., 2019. Strategic or piecemeal? Smart city initiatives in Sydney and Melbourne. Urban Policy Res. 37 (4), 429–441.
European Parliament Directorate-General for Internal Policies, 2014. Mapping smart cities in the EU, Brussels.
Fainstein, S., 2010. The Just City. Cornell Ithaca Press.
Ferguson, N., 2019. The Ascent of Money. Penguin Books, A financial history of the world.
Filion, P., Moos, M., Sands, G., 2023. Urban neoliberalism, smart city, and big tech: the aborted sidewalk labs Toronto experiment. J. Urban Aff. 1–19.
Fleming, P., 2017. The human capital hoax: work, debt and insecurity in the era of Uberization. Organization Studies 38 (5), 691–709.
Flint, C., Taylor, P.J., 2007. Political Geography: World-Economy, Nation-State, and Locality. Pearson education.
Florida, R., 2014. The creative class and economic development. Econ. Dev. Q. 28 (3), 196–205.

Florida, R., 2017. The New Urban Crisis: Gentrification, Housing Bubbles, Growing Inequality, and What we Can Do about it. Simon and Schuster.
Fraser, N., 2021. Cannibal Capitalism. How our System Is Devouring Democracy, Care and the Planet, and What we Can Do about it. Verso books.
Fukuyama, F., 1995. Social capital and the global economy. Foreign Aff. 74, 89.
Fulcher, J., 2015. Capitalism: A Very Short Introduction, vol. 108. Oxford University Press, USA.
Gao, T.Y., Lim, S., 2023. Socio-spatial integration in innovation districts: Singapore's mixed-use experiment. Cities 140, 104.405.
Gebhardt, C., 2020. The impact of participatory governance on regional development pathways: citizen-driven smart, green and inclusive urbanism in the Brainport metropolitan region. Triple Helix 6 (1), 69–110.
Gerli P., Mora L., Zhang L., *Will they survive? Governance of grassroots digital innovations in post-pandemic smart cities, (this volume).*
Ghazal, Taher M., Hasan, Mohammad Kamrul, Alshurideh, Muhammad Turki, Alzoubi, Haitham M., Ahmad, Munir, Akbar, Syed Shehryar, Al Kurdi, Barween, Akour, Iman A., 2021. IoT for smart cities: machine learning approaches in smart healthcare—a review. Future Internet 13 (8), 218.
Gibson-Graham, J.K., Cameron, J., Healy, S., 2013. Take Back the Economy: An Ethical Guide for Transforming our Communities. U of Minnesota Press.
Givens, J.W., Lam, D., 2019. Smarter cities or bigger brother? How the race for smart cities could determine the future of China, democracy, and privacy. Fordham Urb. LJ 47, 829.
Glasmeier, A., Christopherson, S., 2015. Thinking about smart cities. Camb. J. Reg. Econ. Soc. 8 (1), 3–12.
Grabher, G., 2020. Enclosure 4.0: seizing data, selling predictions, scaling platforms. Sociologica 14 (3), 241–265.
Green, D., 2017. Inclusive Capitalism: How we Can Make Independence Work for Everyone (Civitas).
Greif, Avner, 2006. Institutions and the Path to the Modern Economy. Cambridge University Press, Lessons from medieval trade.
Hajduk, S., 2016. The concept of a smart city in urban management. Business, management and education 14 (1), 34–49.
Hall, P.A., Soskice, D., 2001. An Introduction to Varieties of Capitalism. op. cit, pp. 21–27.
Hancke, B. (Ed.), 2009. Debating Varieties of Capitalism; a Reader. Open University Press, Oxford.
Harvey D. (2001). Globalization and the "Spatial Fix." *Geographische Revue – Marxism in* Geography, 23–30.
Harvey, D., 2018. The Limits to Capital. Verso.
Hasche, N., Höglund, L., Linton, G., 2020. Quadruple helix as a network of relationships: creating value within a Swedish regional innovation system. Journal of S*mall Business & Entrepreneurship* 32 (6), 523–544. https://doi.org/10.1080/08276331.2019.1643134.
Haskel, J., Westlake, S., 2018. Productivity and secular stagnation in the intangible economy. VoxEU. org 31.
Hawken, P., Lovins, A.B., Lovins, L.H., 2010. Natural Capitalism: The Next Industrial Revolution. Routledge.
Heaphy, L., Wiig, A., 2020. The 21st century corporate town: the politics of planning innovation districts. Telematics and Informatics 54, 101459.
Henderson, R., 2020. Reimagining Capitalism in a World on Fire. Penguin Books.
Hickel, J., 2021. Less Is More. Windmill Books, How degrowth will save the world.
Hodgson, G., 2015. Conceptualizing capitalism; Institutions, evolution, future. University of Chicago Press.
Hodgson, G.M., 2014. What is capital? Economists and sociologists have changed its meaning: should it be changed back? Camb. J. Econ. 38 (2014), 1063–1086.
Hollands, R.G., 2015. Critical interventions into the corporate smart city. Camb. J. Reg. Econ. Soc. 8 (1), 61–77.
Jackson, T., 2017. Prosperity without Growth. Foundations for the economy of tomorrow, Second edition, Routledge.
Jackson, T., 2021. Post Growth. Polity Press, Life after capitalism.
Jacobs, M., Mazzucato, M. (Eds.), 2016. Rethinking Capitalism: Economics and Policy for Sustainable and Inclusive Growth. John Wiley & Sons.
Jansen, S., Mohammadi, S., Bokel, R., 2021. Developing a locally balanced energy system for an existing neighbourhood, using the 'smart urban isle' approach. Sustain. Cities Soc. 64, 102496.
Joss, S., Sengers, F., Schraven, D., Caprotti, F., Dayot, Y., 2019. The smart city as global discourse: storylines and critical junctures across 27 cities. J. Urban Technol. 26 (1), 3–34.
Karvonen, Andrew, Federico Cugurullo & Federico Caprotti (eds) (2019): Inside smart cities*; Place, politics and urban innovation,* Routledge.
Kay, J., 2004. The Truth about Markets. Penguin books.
Kay, J., 2016. The long and the short of it. A guide to finance and investment for normally intelligent people who aren't in the industry, Second edition. Profile books.
Kayanan, C.M., 2022. A critique of innovation districts: entrepreneurial living and the burden of shouldering urban development. Environment and Planning A: Economy and Space 54 (1), 50–66.
Kitchin, R., Moore-Cherry, N., 2021. Fragmented governance, the urban data ecosystem and smart city-regions: the case of metropolitan Boston. Reg. Stud. 55 (12), 1913–1923.
Kocka, J., 2016. Capitalism: A Short History. Princeton University Press.
Kotkin, J., 2020. The Coming of Neo-Feudalism: A Warning to the Global Middle Class. Encounter Books.
Kurlantzick, J., 2016. State capitalism: How the return of statism is transforming the world. Oxford University Press.
Langley, P., Leyshon, A., 2017. Platform capitalism: the intermediation and capitalisation of digital economic circulation. Finance and society 3 (1), 11–31.
Lazonick, W., Shin, J.S., 2020. Predatory Value Extraction: How the Looting of the Business Corporation Became the US Norm and how Sustainable Prosperity Can Be Restored. Oxford University Press.
Li, L., Taeihagh, A., Tan, S., 2022. What factors drive policy transfer in smart city development? Insights from a Delphi study. Sustain. Cities Soc. 84, 104008.
Lim, H.S.M., Taeihagh, A., 2018. Autonomous vehicles for smart and sustainable cities: an in-depth exploration of privacy and cybersecurity implications. Energies 11 (5), 1062.
Lin, Y., de Jong, M., 2017. Moving up the hierarchy: kinship and career advancement in a Chinese township. J. Contemp. China 26 (103), 134–150.
Luttwak, E.N., 1999. Turbo capitalism. Winners and losers in the global economy, Harper.
Market Research Community, 2022. Smart cities market size, share & trends analysis, by smart utilities (water management, waste management, energy management), by application (smart building, smart governance, smart utilities), by smart governance (CCS, E-governance, City surveillance). Region and Forecast Period 2022–2030. https://marketresearchcommunity.com/smart-cities-market.
Markets and Markets (2022):, *Smart Cities Market by Focus Area, Smart Transportation, Smart Buildings, Smart Utilities, Smart Citizen Services (Public Safety, Smart Healthcare, Smart Education, Smart Street Lighting, and E-Governance) and Region – Global Forecast to* 2027, *https://www.marketsandmarkets.com/PressReleases/smart-cities.asp*.
Marks, S.G., 2016. The Information nexus. Cambridge University Press, Global capitalism from the renaissance to the present.
Mason, P., 2016. Postcapitalism; A guide to our future. Penguin Books.
Mayer-Schönberger, V., Ramge, T., 2018. Reinventing Capitalism in the Age of Big Data. Hachette UK.
Mazzucato, M., 2015. The entrepreneurial state. Debunking public versus private sector myths, Penguin Books.
Mazzucato, M., 2018. The Value of Everything; Making and Taking in the Global Economy. Penguin Books.
Mazzucato, M., 2021. Mission Economy: A Moonshot Guide to Changing Capitalism. Penguin Books.
Meijer, Albert, 2018. Datapolis: a public governance perspective on "smart cities". Perspectives on Public Management and Governance 1 (3), 195–206.
Milhaupt, C., Pistor, K., 2008. Law & Capitalism; What Corporate Crises Reveal about Legal Systems and Economic Development around the World. University of Chicago Press.
Molchanov, M.A., Molchanova, V., 2022. Smart City—A global project of late capitalism. In: Lebedeva, M., Morozov, V. (Eds.), Turning Points of World Transformation. Palgrave Macmillan, Singapore. https://doi.org/10.1007/978-981-19-1758-5_3.
Morisson, A., Bevilacqua, C., 2019. Balancing gentrification in the knowledge economy: the case of Chattanooga's innovation district. Urban Res. Pract. 12 (4), 472–492.
Nakano, S., Washizu, A., 2021. Will smart cities enhance the social capital of residents? The importance of smart neighborhood management. Cities 115, 103244.
Nash, E., Rich, W., 1975. The specificity of the political: the Poulantzas-Miliband debate. Econ. Soc. 4 (1), 87–110.
Noori, N., Hoppe, T., de Jong, M., 2020. Classifying pathways for smart city development: comparing design, governance and implementation in Amsterdam, Barcelona, Dubai, and Abu Dhabi. Sustainability 12 (10), 4030.
Noori, N., Hoppe, T., de Jong, M., Stamhuis, E., 2023. Transplanting good practices in Smart City development: a step-wise approach. Gov. Inf. Q. 101802.
Nooteboom, B., 2002. Trust; Forms, Foundations, Functions, Failures and Figures. Edward Elgar.
Offe, C., 1974. Structural problems of the capitalist state; Class rule and the political system; On the selectiveness of political institutions. In: Von Beyme, K. (Ed.), German Political Studies, 1. Sage Publications, pp. 31–57.
Offe, C., Ronge, V., 1975. Theses on the theory of the State. New German Critique 6, 137–147.
Parry, M., 2018. The future of science parks and areas of innovation: science and technology parks shaping the future. World Technopolis Review 7 (1), 44–58.
Pasquale, F., 2016. Two narratives of platform capitalism. Yale Law & Policy Review 35, 309.
Pelzer, P., Frenken, K., Boon, W., 2019. Institutional entrepreneurship in the platform economy: how Uber tried (and failed) to change the Dutch taxi law. Environ. Innov. Soc. Trans. 33, 1–12.
Peter, C., Meyer, C., 2023. Organizing for the smart African city: leveraging the urban commons for exerting the right to the city. Organ. Stud. 01708406221089609.
Piketty, T., 2017. Capital in the Twenty-First Century. Harvard University Press.
Piketty, T., 2020. Capital and Ideology. Harvard University Press.
Pistor, K., 2018. The Code of Capital. Princeton University Press, How the law creates wealth and inequality.
Plehwe, D., Slobodian, Q., Mirowski, P. (Eds.), 2020. Nine Lives of Neoliberalism. Verso Books.
Praharaj, Sarbeswar. An appraisal of the 100 smart cities mission in India: lessons for post-pandemic urban future. (this volume).
Ragnedda, M., 2018. Conceptualizing digital capital. Telematics Inform. 35 (8), 2366–2375.
Ragunathan, 2006. Games Indians Play. Penguin Books, Why we are the way we are.
Ranchordás, S., Goanta, C., 2020. The new city regulators: platform and public values in smart and sharing cities. Computer law & security review 36, 105375.
Raven, R., Sengers, F., Spaeth, P., Xie, L., Cheshmehzangi, A., de Jong, M., et al., 2019. Urban experimentation and institutional arrangements. Eur. Plan. Stud. 27 (2), 258–281.

Raworth, K., 2017. Doughnut Economics: Seven Ways to Think like a 21st-Century Economist. Chelsea Green Publishing.
Repette, P., Sabatini-Marques, J., Yigitcanlar, T., Sell, D., Costa, E., 2021. The evolution of city-as-a-platform: smart urban development governance with collective knowledge-based platform urbanism. Land 10 (1), 33.
Ricci, L., Mariano, C., 2018. The network construction of the "public city". @22Barcelona: a smart neighbourhood in a Smart City. TECHNE - Journal of Technology for Architecture and Environment 1, 121–126.
Roche, B., Jakub, J., Mayer, C., Radvan, M., 2017. Completing Capitalism: Heal Business to Heal the World. Berrett-Koehler Publishers.
Rochon, L., Rossi, S., 2003. Modern Theories of Money; the Nature and Role of Money in Capitalist Economies. Edward Elgar.
Roman, M., Fellnhofer, K., 2022. Facilitating the participation of civil society in regional planning: implementing quadruple helix model in Finnish regions. Land Use Policy 112, 105864.
Sadowski, J., 2021. Who owns the future city? Phases of technological urbanism and shifts in sovereignty. Urban Stud. 58 (8), 1732–1744.
Sancino, A., Hudson, L., 2020. Leadership in, of, and for smart cities–case studies from Europe. America, and Australia, *Public Management Review* 22 (5), 701–725.
Sassen, S., 2001. The global city, Second edition. Princeton.
Schiller, D., 2000. Digital capitalism. MIT Press, Networking the global market system.
Schraven, D., Joss, S., De Jong, M., 2021. Past, present, future: engagement with sustainable urban development through 35 city labels in the scientific literature 1990–2019. J. Clean. Prod. 292, 125924.
Schwab, K., 2021. Stakeholder Capitalism: A Global Economy that Works for Progress, People and Planet. John Wiley & Sons.
Sha K., Taeihagh A., de Jong M. *Governing disruptive technologies for inclusive development in cities: A systematic literature review (this volume)*.
Shafik, M., 2021. What we Owe each Other. A new social contract for a better society, Princeton University Press.
Shwayri, S.T., 2013. A model Korean ubiquitous eco-city? The politics of making Songdo. J. Urban Technol. 20 (1), 39–55.
Sinn, H.W., 2010. Casino Capitalism: How the Financial Crisis Came about and What Needs to Be Done Now. Oxford University Press.
Slobodian, Q., 2018. Globalists. Harvard University Press.
Smith, A., Martín, P.P., 2022. Going beyond the smart city? Implementing technopolitical platforms for urban democracy in Madrid and Barcelona. In: Sustainable Smart City Transitions. Routledge, pp. 280–299.
Sonn, J.W., Park, J., 2023. Smart city, eco city, world city, creative city et cetera: a Marxian interpretation of urban discourses' short lifecycles. Cambridge Journal of Economics beac069.
Srnicek, N., 2017. Platform capitalism. John Wiley & Sons.
Standing, G., 2017. The Corruption of Capitalism. Biteback Publishing, Why rentiers thrive and work does not pay.
Steger, M., Roy, R.K., 2021. Neoliberalism; A very short introduction, Oxford.
Stehlin, J., Hodson, M., McMeekin, A., 2020. Platform mobilities and the production of urban space: toward a typology of platformization trajectories. Environment and Planning A: Economy and Space 52 (7), 1250–1268.
Stockols, A., 2023. The insurgent smart city: how a social movement created an alternative imaginary of the smart city. J. Urban Aff. https://doi.org/10.1080/07352166.2023.2216887.
Storeng, K.T., de Bengy Puyvallée, A., 2021. The smartphone pandemic: how big tech and public health authorities partner in the digital response to Covid-19. Glob. Public Health 16 (8–9), 1482–1498.
Strange, S., 2015. Casino capitalism. Manchester University Press.
Streeck, W., 2016. How Will Capitalism End?: Essays on a Failing System. Verso Books.
Tan, S.Y., Taeihagh, A., 2020. Smart city governance in developing countries: a systematic literature review. Sustainability 12 (3), 899.
Tan, S.Y., Taeihagh, A., Sha, K., 2021a. How transboundary learning occurs: case study of the ASEAN smart cities network (ASCN). Sustainability 13 (11), 6502.
Tan, S.Y., Taeihagh, A., Tripathi, A., 2021b. Tensions and antagonistic interactions of risks and ethics of using robotics and autonomous systems in long-term care. Technol. Forecast. Soc. Chang. 167, 120686.
Thompson, M., Lorne, C., 2023. Designing a new civic economy? On the emergence and contradictions of participatory experimental urbanism. Antipode 55 (6), 1919–1942.
Trencher, G., 2019. Towards the smart city 2.0: empirical evidence of using smartness as a tool for tackling social challenges. Technological Forecasting and Social Change 142, 117–128.
Ullah, Z., Al-Turjman, F., Mostarda, L., Gagliardi, R., 2020. Applications of artificial intelligence and machine learning in smart cities. Comput Commun 154, 313–323.
UN Habitat (2022). World Cities Report. Chapter 9: Innovation and Technology: Towards a Knowledge-based Urban Futures. World Cities Report 2022 (unhabitat.org).
URENIO (2017): Smart City Tracker Report 1Q17, *https://urenio.org/2017/05/01/smart-city-tracker-report-1q17/*.
Uzunca, B., Kas, J., 2022. Automated governance mechanisms in digital labour platforms: how Uber nudges and sludges its drivers. Ind. Innov. 1–30.
Vadiati, N., 2022. Alternatives to smart cities: a call for consideration of grassroots digital urbanism. Digital Geography and Society 3, 100030.
Veenkamp, J., Kresin, F., Kortlander, M., 2020. Smart citizens in Amsterdam (The Routledge companion to smart cities).
Verstaevel, N., Boes, J., Gleizes, M.P., 2017. From smart campus to smart cities issues of the smart revolution. In: In *2017 IEEE SmartWorld, Ubiquitous Intelligence & Computing, Advanced & Trusted Computed, Scalable Computing & Communications, Cloud & big Data Computing, Internet of People and Smart City Innovation (SmartWorld/SCALCOM/UIC/ATC/CBDCom/IOP/SCI)*. IEEE, pp. 1–6 (August).
Viitanen, J., Connell, P., Tommis, M., 2015. Creating smart neighborhoods: insights from two low-carbon communities in Sheffield and Leeds, United Kingdom. J. Urban Technol. 22 (2), 19–41.
Villegas-Ch, W., Palacios-Pacheco, X., Luján-Mora, S., 2019. Application of a smart city model to a traditional university campus with a big data architecture: a sustainable smart campus. Sustainability 11 (10), 2857.
Visser, O., Sippel, R.S., Thiemann, L., 2021. Imprecision farming? Examining the (in) accuracy and risks of digital agriculture. J. Rural. Stud. 86, 623–632.
Whyte, D., 2020. Ecocide. Kill the corporation before it kills us, Manchester University Press.
Wolf, M., 2023. The Crisis of Democratic Capitalism. Allen Lane.
Wood, A.J., Graham, M., Lehdonvirta, V., Hjorth, I., 2019. Good gig, bad gig: autonomy and algorithmic control in the global gig economy. Work Employ. Soc. 33 (1), 56–75.
Yigitcanlar, T., 2023. Smart City Blueprint. Routledge.
Yigitcanlar, T., Adu-McVie, R., Erol, I., 2020. How can contemporary innovation districts be classified? A systematic review of the literature. Land Use Policy 95, 104595.
Yu, J., Wen, Y., Jin, J., Zhang, Y., 2019. Towards a service-dominant platform for public value co-creation in a smart city: evidence from two metropolitan cities in China. Technological Forecasting and Social Change 142, 168–182.
Zanoni, P., 2020. Prefiguring alternatives through the articulation of post-and anti-capitalistic politics: an introduction to three additional papers and a reflection. Organization 27 (1), 3–16.
Zanoni, P., Contu, A., Healy, S., Mir, R., 2017. Post-capitalistic politics in the making: the imaginary and praxis of alternative economies. Organization 24 (5), 575–588.
Zhilin, S., 2023. Open Source Urbanism: A Design Method for Cultivating Information Infrastructures in the Urban Commons. Delft University Press.
Zuboff, S., 2019. The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power: Barack Obama's Books of 2019. Profile books.

Martin de Jong, scientific director of the Erasmus Initiative for the Dynamics of Inclusive Prosperity, and cross-disciplinary research centre on the causes and remedies of various forms of inequality and exclusion in modern society. He is also professor at Rotterdam School of Management and Erasmus School of Law, all at Erasmus University Rotterdam. He holds Bachelor and Master's degrees in public administration from that same institute, has completed his PhD in Systems Engineering and Policy Analysis at Delft University of Technology and publishes and teaches in topics of urban and infrastructure development, city branding, policy and management in China, corporate responsibility and intercultural management. He has held visiting scholar positions at Aalto University, George Mason University, Harbin Institute of Technology, Dalian University of Technology and has been 1000 Talent Programme professor at Fudan University. He is currently still adjunct professor there.

Simon Joss, Professor of Urban Futures, and Head of Urban Studies, at the University of Glasgow (UK). He gained a PhD in Science & Technology Studies from Imperial College, University of London in 1998, following which he pursued an academic career in environmental and urban policy with special focus on sustainable urban development, smart urbanism and urban technology. He leads the workstream on digital governance in the ESRC-funded Urban Big Data Centre at the University of Glasgow. He is an Associate Editor of the international journal Cities. He is a Fellow of the Royal Society of Art.

Araz Taeihagh, (DPhil, Oxon) is the Chair of the PhD Programme in Public Policy at the Lee Kuan Yew School of Public Policy, Principal Investigator at the Centre for Trusted Internet and Community and NUS Cities at the National University of Singapore. Taeihagh's research interest is on socio-technical systems and the challenges that arise from the introduction of new technologies to society. Taeihagh's current interests include Governance of AI, Autonomous Systems and Robotics; Governance of Platforms and Smart Cities; and Comparative Public Policy with a focus on Policy Design, Analysis and Analytics. Araz has two decades of experience providing technical and policy consultations on environmental, transportation, energy, infrastructure, and technology-related issues.