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Urban Reconfiguration after the Emergence of Peer-to-Peer Infrastructure: Four Future Scenarios with an Impact on Smart Cities

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Introduction

Today, the majority of human beings are city dwellers. In this increasingly urbanized world, smart cities are emerging as an alternative city model to tackle several environmental, economical, and societal issues. Although there is not any compact and agreed-upon definition of smart cities, cities are generally defined as "smart" when they are infused with information and communication technologies (ICT), and a social infrastructure that promotes sustainability and active engagement of citizens (Caragliu, Del Bo, & Nijkamp, 2009). In the current environment, rapidly progressing ICT and the subsequent emergence of peer-to-peer (P2P) infrastructure are giving rise to potentially limitless innovation that can be implemented in cities to improve efficiency and connectivity.

To be more precise, P2P infrastructure is that infrastructure for communication, cooperation, and common value creation that allows for permission-less interlinking of human cooperators and their technological aids. We argue that such infrastructure is becoming the general condition of work, life, and society with the potential to reshape the idea of the "smart city." P2P relational dynamics, which epitomize the old slogan "Jeder nach seinen Fähigkeiten, jedem nach seinen Bedürfnissen!" (From each according to his ability, to each according to his need!), are based on the distribution of our productive forces.

First, the means of information, immaterial production (i.e., the networked computers) and now the means of physical, material production

(i.e., machines that produce physical objects) are being distributed and interconnected. Just as networked computers democratized the means of production of information and communication, the emergent elements of networked microfactories or what some (see Kostakis, Fountouklis, & Drechsler, 2013) call desktop manufacturing, such as three-dimensional (3-D) printing, are democratizing the means of production.

Of course, this is not by any means an unproblematic process. In a period of extreme socioeconomic polarization and lacking any equilibrium regarding the global governance of the Internet (Mueller, 2010), we have been witnessing conflicts for the control and ownership of distributed infrastructure. On the one hand, commons-based peer production signals fundamental changes in value creation, especially when juxtaposed against an old order that is in decline (see Bauwens, 2005; Benkler, 2005; Kostakis, 2013). On the other hand, the proposed legislations of Anti Counterfeiting Trade Agreement (ACTA)/Stop Online Piracy Act (SOPA)/Protect IP Act (PIPA) enforce strict copyright within a regulatory regime that polices transactions beforehand instead of afterward (Boyle, 1997). Furthermore, the attempt for surveillance and censorship by both authoritarian and liberal countries, and "the growing tendency to link the Internet's security problems to the very properties that made it innovative and revolutionary in the first place" (Mueller, 2010) are only some reasons that have made scholars, like Zittrain (2008), worry that digital systems may be pushed back to the model of locked-down devices centrally controlled information appliances.

Hence, a battle is emerging among agents (several governments and corporations) that are trying to turn the Internet into a tightly controlled information medium, and user communities that are trying to keep the medium independent (Kostakis, 2013). This battle certainly affects the design processes of smart cities as well, because it has a direct relation with the involved stakeholders.

This chapter attempts to simplify possible outcomes by using two axes or polarities that give rise to four possible scenarios (see Figure 7.1) and then tries to adapt the evolution of the smart city in this context. The chapter concludes by drawing some assumptions about what should determine the ideal selection for a smart city.

The Two Axes and the Four Quadrants

The first axis concerns the polarity of centralized versus distributed control of the infrastructure; the second axis relates to an orientation

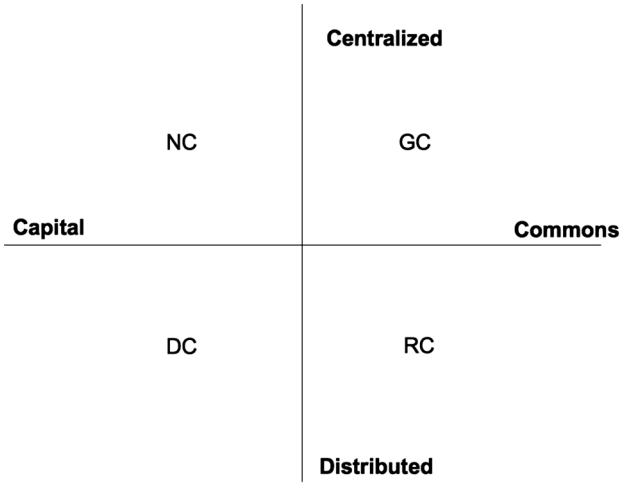

Figure 7.1 The four quadrants of future scenarios.

toward the accumulation or circulation of capital versus an orientation toward the accumulation or circulation of the commons.

First, we introduce the concepts of "netarchical" and "distributed capitalism." Before describing in detail the two forms that shape this emerging model, it is important to highlight their basic difference. Netarchical and distributed capitalism may both be profit oriented, but they are also based on various technological regimes' dependence on the structure of every project's back end. User-oriented technological systems generally have two sides. The front end is the side that users interact with, and the only side visible to them. The back end, however, is the technological underpinning that makes it all possible. This is engineered by the platform owners and is invisible to the user. Hence, a front end that enables a P2P social logic among users can often be highly centralized, controlled, and proprietary on the back end; forming an invisible technosocial system that profoundly influences the behavior of those using the front end, by setting limits on what is possible in terms of human freedom. Then, we present the remaining quadrants, that is, resilient communities and global commons whose ultimate goals are commons driven.

Netarchical Capitalism (NC)

We define "netarchical capitalism" as the first combination (upper left) that matches centralized control of a distributed infrastructure with an

orientation toward the accumulation of capital. NC is that fraction of capital that enables and empowers cooperation and P2P dynamics, but through proprietary platforms under central control. While individuals will share through these platforms, they have no control, governance, or ownership over the design and the protocol of these networks/platforms (e.g., Facebook or Google). Typically under conditions of NC, sharers will directly create or share use value, but the monetized exchange value will be realized by the owners of capital. While in the short term it is in the interest of shareholders or owners, this also creates a longer-term value crisis for capital, because the value creators are not rewarded, and have no purchasing power to acquire the goods that are necessary for the functioning of the physical economy.

Distributed Capitalism (DC)

The second combination (bottom left), called "distributed capitalism," matches distributed control but with a remaining focus on capital accumulation. The development of the P2P-driven currency Bitcoin and the Kickstarter crowdfunding platform are representative of these developments. Under this model, P2P infrastructure is designed in such a way as to allow the autonomy and participation of many players, but the main focus rests on profit making. In Bitcoin, all the participating computers can produce the currency, thereby disintermediating large centralized banks. However, the focal point remains on trading and exchange through a currency designed for scarcity, and thus must be obtained through competition. Furthermore, Kickstarter functions as a reverse market with prepaid investment. Under these conditions, any commons is a by-product or an afterthought of the system, and personal motivations are driven by exchange, trade, and profit. Many P2P developments can be seen within this context, striving for a more inclusionary distributed and participative capitalism. Although they can be considered as part of, say, an antisystemic entrepreneurialism directed against the monopolies and predatory intermediaries, they retain the focus on profit making. Distribution, here, not meant locally, though, as the vision is one of a virtual economy, where small players can have a global compact, and create global aggregations of small players.

Resilient Communities (RC)

Distributed control with a focus on the commons is what we call the "resilient communities" (bottom right). The focus here is mostly on the relocalization and re-creation of local community. It is often based on an expectation for a future marked by severe shortages of energy and

resources, or in any case, increased scarcity of energy and resources, and takes the form of lifeboat strategies. Initiatives like the Degrowth movement or the Transition Towns, a grassroots network of communities, can be seen in that context. In extreme forms, they are simple lifeboat strategies, aimed at the survival of small communities in the context of generalized chaos. What marks such initiatives is arguably the abandonment of the ambition of scale while the feudalization of territorial integrity is considered mostly inevitable. Even though global cooperation and web presence may exist, the focus remains on the local. Most often, political and social mobilization at scale is seen as not realistic, and doomed to fail. In the context of our profit-making versus commons axis, though, these projects are squarely aimed at generating community value.

Global Commons (GC)

This approach (upper right) is against the aforementioned focus on the local, focusing on the global commons. Advocates and builders of this scenario argue that the commons should be created for and fought for on a transnational global scale. Although production is distributed and therefore facilitated at the local level, the resulting microfactories are considered as essentially networked on a global scale, profiting from the mutualized global cooperation both on the design of the product and on the improvement of the common machinery. Any distributed enterprise is seen in the context of transnational phyles, that is, alliances of ethical enterprises that operate in solidarity around particular knowledge commons. In addition, political and social mobilization, on regional, national, and transnational scale, is seen as part of the struggle for the transformation of institutions. Participating enterprises are vehicles for the commoners to sustain global commons as well as their own livelihoods. This latter scenario does not take social regression as a given and believes in sustainable abundance for all humanity.

Discussion

These four scenarios differ in their vision for the prime focus of the accumulation of value, either for the benefit of global shareholders, for a network of small for-profit enterprises, for the local community, or for transnational commons. It can be argued that the prevalence of each scenario will have different impacts on the smart city model to be adopted.

All four scenarios take the existence of P2P-enabling infrastructure as a given, and mutualize both immaterial and material resources to obtain economies of scope. Indeed, while economies of scale are advantageous

in the context of temporal eras dominated by an abundance of resources and energy—that is, producing more of a thing creates competitiveness—economies of scope become essential in periods of increased energy and resource scarcity—that is, doing more with less. Open source is mutualization of immaterial resources such as knowledge, which become operative for the whole of humankind, rather than fragmented and privatized through intellectual property. The mutualization of physical resources increases the efficiency of resource and energy use, and combats the idleness of physical resources and the waste that is inherent in fragmentation.

The new P2P production modalities are global-local (or glocal). While they enable production at the local scale through microfactories using distributed manufacturing technologies, both the knowledge work on the product and on the machinery can be global. As a general rule, one can say that the principle is this: "what is heavy is near, what is light is far"; thus we design global, but manufacture local responding to certain needs. Cooperation on the immaterial productive processes (i.e., design) is maximized, but the global transportation of material good is minimized. This new productive model should be carefully considered during policy making for urban development as it can have a profound impact on the city itself.

In our four scenarios, what differentiates the strategies are first of all, the aim of the cooperation, that is, are they aimed at capital accumulation, or at improving the circulation of the commons? And second, where is the focus of control? Is control distributed through free self-allocation by commoners who can affect the governance and design of their infrastructure of cooperation? Or is the design of the infrastructure in the hands of centralized privately owned platforms? The answer to the these questions will probably define the final form of the so-called "smart city."

If we want to locate the "smart city," as it is conventionally understood, in the context of our scenarios, we should look at the top-left quadrant of netarchical capitalism (see Figure 7.1). What we have for the time being is smart cities in terms of ICT deployment and not actual smart urbanism. Citizens are able to contribute by providing "big data," which are gathered from the utilization of an array of sensors throughout a city, to offer governments/firms solutions to their needs. But as it happens in this scenario, control and governance in today's smart cities are located within a single proprietary hierarchy, where the main motive is profit maximization. As a result, it is questionable whether citizens actually take part in the decision-making process, in order to meet their true needs, or just constitute another source of information without knowledge and influence at the back end.

The circumstances could be slightly different in the distributed capitalism scenario, where control is located in the network of participating for-profit entrepreneurs. Here, citizens may enjoy an increased capacity to influence the shaping of smart city infrastructure, leading to more transparent and democratic decision making for specific issues. However, profit maximization remains the ultimate goal for all parties involved. This can, arguably, have a negative impact on the aforementioned decision-making process and lead to unsustainable outcomes.

The further we move toward the right quadrants, those of resilient communities and global commons, the higher the potential for bottom-up civic engagement and support of citizen empowerment and user-driven innovation. In the local community model, control is located in a particular geographical territory, and depends on the governance model of the initiating community. The adoption of this scenario while planning a smart city—or even a smart town—could lead to successful practices, as designing in a smaller scale includes strong predefined goals that can be bounded with measurable results and quick decision making. Contrary to similar interventions in big cities, a small area means a smaller chance for failure. However, the knowledge and know-how produced in this case may not be widely applicable or even available for adoption elsewhere, due to the fact that it is locally oriented. This potentially hinders the circulation of the commons and the subsequent diffusion of innovation regarding smart cities.

At the grander scale of the global-local commons model, governance is located in the triarchical model of the community practicing the social self-allocation of resources, of the for-benefit associations that manage the physical infrastructure of cooperation (e.g., the multitude of Free/Libre Open Source Software Foundations) and of the entrepreneurial alliance that cooperates around the same commons. In this model, it is essential that the commons orientation is guaranteed by new governance models of the participating entrepreneurs. For example, in the case of the largely corporate Linux Commons, open source code commons are clearly integrated in the processes of capital accumulation of the participating for-profit enterprises. A countermodel would require the creation of commons-friendly, ethical enterprises, consisting of the commoners themselves, who also control their own governance and have ownership. Such enterprises would be legally structured so that theirs is an obligation to support the circulation of the commons. We suggest a plural form of ownership that combines maker ownership (i.e., a revisiting of worker ownership for the P2P age), with user ownership (i.e., a recognition that users of networks co-create value, and eventually a

return for the ethical funders that support the enterprise). In this model, profit making is allowed, but profit maximization remains a taboo.

The manifestation of the smart city in this scenario is highlighted by wide citizen engagement while designing and implementing interventions and an ongoing circulation of the commons, which promotes continuous innovation and knowledge diffusion. In this case, the production of commons on a global scale will lead to a more sustainable city model, which could perform better than the current dominant model while solving a number of systemic problems.

To enhance user participation, the creation of a unique culture is vital. This can be accomplished through implementing small-scale, low-cost actions that have little bureaucratic requirements and encourage citizens to reclaim common open spaces in the urban environment. These processes should serve as a user-driven platform for the local community and lead to the creation of a robust paradigm aiming to collaboration.

Toward that direction, governments and local authorities should provide appropriate facilities to enable the deployment of participative ways of working, which will help in producing social innovation outcomes, that is, commons. This could be done by promoting the creation of collaboration spaces, such as microfactories, all over the city and creating wired and wireless networks that will enhance the connectivity between citizens. Moreover, the establishment of social enterprises should be promoted. This will certainly lead to the development of business models, but instead of seeking easy financial gains, social enterprises will be focusing on sustainability and development in the long term.

After ensuring the existence of the basic infrastructure for a commons-driven smart city, the next step would be to integrate them into everyday social interaction and make all the data available to the citizens in a format that they can use. Because several cities will deploy different infrastructure and adopt various approaches, this procedure may become quite challenging. In order for locally produced innovations to diffuse and be adopted globally, the aforementioned infrastructure should comply with some "standards" that will enhance interoperability. These "standards" should be based on open source technologies, so they would be easily accessible, transparent, and open to modification and adaptation to local conditions and individual needs.

Conclusion

One of the most fundamental characteristics of a smart city should be its direct link with the needs and concerns of urban residents. However, it

has already been observed that this citizen perspective is often ignored in the smart city discussion. While technology is a powerful tool able to help improve urban infrastructure, citizen engagement is essential to make cities truly sustainable and livable.

In the discussion above, we argue that different applications of certain productive infrastructure have different impacts on urban life, depending on the model of governance and strategies of citizenship they embody. Notwithstanding the fact that community-driven, commons-driven, and distributed versus centralized for-profit–driven infrastructure coexist, smart cities will be organized differently depending on the dominance of any of the four scenarios.

What is needed, in our view, is a more commons-driven smart city that will provide the capacity for open participation and democratic problem-solving practices that can potentially lead to social, environmental, and economic sustainability.

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