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**Rudolf Giffinger
Hui Lü**

**The Smart City
perspective**

**A necessary change
from technical
to urban innovations**

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Globalizzazione

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IL TESTO

L'ebook di Giffinger e Lü ruota intorno alla definizione di *smart city*, identificata come una città che sa investire sul capitale umano e sociale con la finalità di migliorare la qualità della vita dei suoi abitanti.

The Smart City perspective

A necessary change from technical to urban innovation

di

Rudolf Giffinger e Hui Lü



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Presentazione

L'e-book "The Smart City perspective. A necessary change from technical to urban innovations" di Rudolf Giffinger e di Hui Lü del *Centre of Regional Science Department of Spatial Planning* di Vienna contiene le riflessioni che l'autore ha sviluppato in occasione di uno degli incontri in seno al LAB_EXPO Sociologia Urbana di Fondazione Giangiacomo Feltrinelli. L'occasione, che ha reso possibile questa collaborazione, è stato il Seminario "Società e tecnologie. Prospettive per lo sviluppo urbano" tenutosi il 12 novembre 2014 a Milano. L'autore ha preso spunto dalle tematiche proposte nel position paper intitolato "New Urban Governance" elaborato dal gruppo di lavoro di LAB_EXPO Sociologia Urbana, e si è impegnato a ragionare sulla necessità di passare da una lettura della *smart city* che fosse sostanzialmente focalizzata sull'innovazione tecnologica, ad una lettura più complessa che facesse riferimento al concetto di innovazione urbana. Il punto di partenza di Giffinger è la definizione di Caragliu (ed altri 2014) di *smart city*. Quest'ultimo ritiene che una città si può definire *smart* allorquando gli investimenti in capitale umano e sociale, nel trasporto e nelle infrastrutture per la comunicazione favoriscono lo sviluppo economico sostenibile ed il miglioramento della qualità della vita, con una saggia gestione delle risorse naturali e mediante una *governance* partecipativa. In questo testo l'autore si concentra, dunque, su due questioni fondamentali. La prima inerisce a quale sia l'idea di *smart city* sulla quale vale maggiormente la pena di concentrare l'attenzione. La seconda riguarda le componenti principali della *smart city*. L'autore ritiene che le nuove tecnologie sono un aspetto fondamentale dello sviluppo urbano, ma evidenzia anche che l'impatto dal punto di vista della sostenibilità urbana delle nuove tecnologie può essere molto limitato. Tale limitatezza, essendo potenzialmente estremamente dannosa nel disegno e nella comprensione delle caratteristiche principali dei processi di sviluppo

urbano, incoraggia l'autore a parlare di innovazione non solo in senso tecnologico, ma in un'ottica allargata che egli definisce urbana. In altre parole, è possibile affermare che l'obiettivo di questo ampio saggio è quello di esplorare in luogo e in largo il concetto di *smart city* investigando i suoi ambiti di influenza sia nel mondo delle pratiche, che in quello teorico. Nello specifico il *paper* riporta tutte le più note definizioni di *smart city*. Di queste ultime l'autore evidenzia le principali caratteristiche, sottolinea le mancanze, e porta all'attenzione del lettore i rischi ed i necessari cambiamenti. Nelle conclusioni, si discute la necessità, per una città che voglia essere realmente *smart*, di lavorare non solo con le nuove tecnologie, ma soprattutto su un concetto di innovazione più ampio che in se racchiuda tutte le componenti della città e che sia accompagnato da processi di apprendimento *place based*. Per concludere, il messaggio principale lanciato da Giffinger in questo testo è quindi quello di proporre un percorso per le *smart city* che sia maggiormente "umanizzato". Le città possono diventare *smart* allorquando integrano innovazione tecnologica e innovazione sociale e sono animate da processi di mutuo apprendimento. Sebbene il paper, per ammissione dello stesso autore, non riesce a coprire tutte le questioni connesse alla definizione di un quadro teorico di una *human smart city*, vuole essere un invito a sviluppare in futuro ricerche capaci di esplorare la smart city come un sistema di innovazioni sociali e tecnologiche animate da forme di apprendimento collettivo.

Nunzia Borrelli - Davide Diamantini

The Smart City perspective

A necessary change from technical to urban innovations

Introduction

Trends like globalization and economic restructuring are leading towards an increasing urbanization. These trends are accompanied by growth of population and socio-demographic changes. More than half of world population lives in urban agglomerations, forecasts show this strong increase even for the next decades, with an additional 2.5 billion people living in urban areas by 2050 (United Nations, 2014). In most globalized cities new jobs within the service sector had been created whereas traditional industrial activities had been replaced. Very often high qualified jobs for knowledge intensive activities and low qualified jobs with precarious conditions emerged leading to a post-Fordist organization of urban development and enforcing social polarization and over proportional increase of energy demand. Hence, these trends are provoking a wide range of challenges in economic, social and environmental terms. There is a tremendous need of housing, more and better jobs and an infrastructure which should be capable to meet the increasing demand of a fast growing population (United Nations, 2014). According to UN-Habitat's statistics, with 70% the majority of the total energy consumption is concentrated to urban agglomerations. Approximately 80% of greenhouse gases are produced within city areas through urban activities. Inadequate transport systems consume predominantly non-renewable resources and cause an increasing amount of emissions of CO₂ and congestions (Giffinger, 2014). Facing these challenges there is an increasing discussion in which cities are regarded as the most important players coping with corresponding problems. (OECD, 2010) The idea of 'Smart City' was introduced regarding the city as the crucial object and starting point for providing 'a better life' (Dammann, 2013; Acatech, 2012). In this context usually stakeholders are claiming for technical-economic innovations and data driven solutions in a technically

dominated understanding. At the same time, there are other specific understandings which do not focus on technical issues predominantly but understand the Smart City in a more comprehensive and integrative perspective. However, the concept of 'Smart City' is evolving as a specific approach to mitigate and remedy current urban problems between urban competitiveness and sustainability. But can we in fact expect such a positive impact of a new concept? Or should not we more critically discuss the role and impact of technology in the urban context? In this contribution we will first concentrate on the questions: 'Which understanding of a 'Smart City' can we detect?' and 'Which basic components are emphasized in respective perspectives?' Then, discussing the importance of technology as crucial factor of urban development its limited and problematic impact on sustainable urban development will become evident. In this context, we will examine chances and risks of evidence based and learning understanding assuming that this understanding fosters urban innovations resulting from an interplay of technical and social innovations in an integrative way.

Smart City understanding: Which understanding of ‘Smart City’ can we detect?

The basic understanding of ‘Smart City’ originated from that of the ‘information city’, and step by step evolved to an idea of an ICT-centered smart city which uses new ICTs innovatively and believes in a wired ICT-driven form of urban development. A clear economic understanding of urban development is shown in the definition by Caragliu, DelBoand, and Nijkamp (2011, p.6): “...*When investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.*” Besides investments in technical infrastructure, they are emphasizing human and social capital as driving forces of urban development supporting quality of life. In addition they claim for a participatory setting as a precondition for a sustainable economic growth acknowledging a more process oriented understanding of smart urban development. From a more strategic planning point of view a comprehensive understanding is elaborated in the definitions of Giffinger et al. (2007). In their concept of the Smart City six main dimensions are distinguished: smart economy, smart mobility, smart environment, smart people, smart living, and smart governance. In their model ‘European Smart Cities’ it is acknowledged that urban performance depends not only on the city’s endowment of hard infrastructure (‘physical capital’) in the respective fields of urban development but in particular on its user-orientated collaboration and easy access for all citizens. Hence, well educated citizens are regarded as an important precondition for the participatory governance in front of new challenges of economic, environmental and socio- demographic problems. Analysing the ‘Smart

City' practices in different approaches Nam and Pardo (2011) detected that there are existing different conceptualizations. But all corresponding strategic discussions and efforts are more or less focusing on three core dimensions: 'technology' and its mediated services making infrastructure more efficient; 'people' in the context of social learning for strengthening human infrastructure and collective decision making; 'institutions' in the modified context of governance for institutional improvements and the citizens' engagement. Considering these dimensions the 'Smart City' conceptualization should be understood as the integration of all relevant dimensions to a certain extent. Correspondingly, Nam and Pardo (2011, p. 288) conclude: "*Leading a smart city initiative requires a comprehensive understanding of the complexities and interconnections among social and technical factors of services and physical environments in a city.*" According to this evolving understanding of a smart city as a socio-technical system, most important conceptualizations are discussed subsequently in their main focus on handling of technology to meet most relevant challenges and achieving respective goals.

Handling technology in smart city concepts

Due to its origins the concept of the Smart City broadly refers to a city that is using new ICTs innovatively and strategically to achieve its aims. However, the way how to deal with new technologies show strong differences in respective concepts. Along with Nam et al. (2011) we will distinguish three different conceptualizations: The technology based concept of Smart City. This concept emphasizes predominantly technical solutions: for example, implementing a network of sensors – or more generally improving ICT - in the city. The highly instrumented city, it is claimed, will better manage and control city systems by collating ever detailed information about real time functioning. Such investment will be able to optimize decision making in the immediate, short and long term and make existent technical infrastructure systems more efficient. Batty et al. (2012) for instance discuss such innovative ICT improving the possibilities of research and at the same time enabling decision support and different type of information for governance issues. For them a smart city is data driven as sensing and social media providing real time information, allow a more complex analysis of recent trends exploring patterns of development and a more complex forecasting of emergent phenomenon like congestions. Their framework of smart city takes integrated databases in the core but neglects governance and human capital in the peripheral edge. The Oslo Manual stresses instead the role of innovation in ICT sectors and provides a toolkit to identify consistent indicators, thus shaping a sound framework of analysis for researchers on urban innovation (OECD and EUROSTAT; 14th of January 2015). Basically, one can distinguish two ways how to implement technical innovations. One out of these two possibilities is the evolution of an Urban Lab concept based on a niche strategy. *“Higher Education Institutions all over the world have in recent years established so-called “Urban*

Laboratories” to expand and strengthen their competences in the realms of architecture, urban planning and other built environment disciplines. These units have in common, that they are dedicated to inter- or trans-disciplinary research and learning, putting an emphasis on hands-on collaborative research and education, and bringing together the disciplinary resources of the academy with the practical spheres of architecture, urban design and planning” (urban lab, 12th of January, 2015). According to this trans- and interdisciplinary understanding cities which try to implement new technologies for improving energy efficient urban development start technical projects on the local level integrating all relevant stakeholders and controlling economic, environmental and social issues within a certain neighbourhood. This understanding, for instance, is based on Smart City initiatives in Austrian cities which realize ICT investments/innovations funded by KLIEN (Climate and Energy Fund Austria, 12th of January, 2015). An alternative way focusing on technical innovation is based on a more comprehensive understanding which discusses the most relevant factors influencing the emergence of technical innovations (Caragliu A., et al., 2011). Leydesdorff and Deakin (2011) emphasize first of all the interconnections between industry, universities and government but finally enhance this ‘triple helix’ to a ‘multiple helix’. In this multiple perspective the approach emphasizes in particular the meaning of ‘learning’ in order to produce corresponding human capital through adequate (public) education; it emphasizes the interplay between universities with its education and research systems for increasingly knowledge intensive economic activities; and finally it emphasizes the big importance of the interconnections between industry/economy and the government which should provide adequate institutional settings (regulations and conditions) turning technical inventions into technical innovations at the respective market. Against these two approaches focusing on technical innovation and ICT as driving force of urban development a learning based approach is developed by Giffinger et al. (2007 resp. 2009) from a strategic planning point of view. Acknowledging the increasing competitive situation which cities in Europe are facing, in this approach the profile of a city is the main focus. This profile is describing a

city's performance in the six dimensions: Smart Economy, Smart Mobility, Smart Environment, Smart People, Smart Living, and Smart Governance. These six dimensions described by a set of indicators based on traditional regional and neoclassical theories of urban growth and development. In particular, the dimensions are related to theories of urban competitiveness and sustainable urban development as well as to a participatory understanding of governance. The respective performance of a city is empirically defined by a set of indicators which are aggregated and allow a benchmarking and in-depth description at the same time in a relative transparent and easy way (Giffinger, et al., 2009). Based on this urban profile describing a city's performance in an integrative way one can easily discuss whether (1) a city's development is well-balanced across all key fields, (2) what are the assets and deficits regarding influencing factors, and (3) which other cities show comparable or interesting performances as result of good practices. Discussing and answering these questions for instance in stakeholder forums and expert workshops, consequently, fosters learning processes and may result in effective strategic projects meeting specific challenges on the urban level. See for instance, SMART_KOM project which aims at making Krakow a smart city (SMART_KOM: 12th of January 2015). In the run of this project several workshops were organized on respective smart dimensions (key fields) of urban development, discussed assets and deficits, evaluated strengths and weaknesses and identified corresponding strategic projects which will become part of a road map. Besides, in the run of the PLEEC project a comprehensive matrix about key fields and domains relevant for energy efficient urban development had been detected and assessed by local stakeholders and actors regarding their innovation potentials (Giffinger et al., 2014). This innovation potential is defined in a comparative way: based on the local stakeholders' evidence assessing the real standard of energy efficient development against potentials and best practices from other cities. In this context it is important to mention that the comparison does not only focus on technical standards and potential technical innovations but also on standards in urban structures and thermal sanitation as well as on changes in behaviour and life style: for instance

collecting and managing waste, active mobility instead of private car use, etc.

Perspectives: limits of the technology driven understanding

The ideas of 'Smart City' which are centred on ICT convincingly show two important impacts: First, Batty et al. (2012) demonstrate how a 'Smart City' and respective urban development are characterized through a predominantly data driven process. Due to new types of ICT much more information is provided in integrated databases for scientific purpose on the one hand. Hence, new types of and more complex modelling efforts become feasible in the field of mobility and transport behaviour, urban land use transport, urban supply chains and market transactions. Facing the complexity of these systems the improved models can provide better insights into trends and dynamics and thus can provide more realistic forecasts improving decision finding in the respective fields of urban development. On the other hand new ICT delivers real time information through high capacity sensors which enable real time reaction and controlling intervention on recent trends and problematic situations. Hence, this approach basically tries to optimize decision making in the short and long term as well as better to manage and control respective city systems based ever-on detailed real time information. The second approach focusing on technical innovation regards the 'Smart City' as a corresponding urban fabric steered through the interplay of the multiple helix (Leydesdorff and Deakin, 2011). Therefore, main attention is put on the six dimensions described above which should positively influence the emergence of technical-economic innovation as decisive factor. Starting with Schumpeter's idea ([1912] 1934) this approach focuses predominantly on technical innovations which can be established at respective markets. Hence, this approach aims improving economic and urban competitiveness and

fosters the process from information to knowledge society. In general, the predominantly technically understanding of a 'Smart City' produces severe risks. According to the ambition to increase energy efficiency of infrastructures this approach in practice fosters the risk of a perfectly controlled city without considering the social impacts on urban quality of life and the legal problems on civil rights. In practice the perfectly managed city becomes a technically defined commodity (Greenfield, 2013). Usually, this kind of a smart city concept is realized by large internationally acting ICT enterprises as for instance in Songdo, South Korea (Der Standard, 2015). Regarding the increase of urban competitiveness one should even consider that technical innovations will predominantly support to increase the urban economic performance but tend to neglect the socio-spatial disparities and respective impacts of technical innovations. At the same time the risk of social polarisation and spatial fragmentation will increase through the concentration of new technologies introduced by economically powerful stakeholder groups on most attractive places within the urban territory (Graham, 1997). Despite the high importance of technical innovations in an urban and socio-political context immediately two questions have to be raised: First question: *If technical innovation takes place, how one can handle the 'rebound effect' in effective way reducing energy consumption and emissions?* Generally, a 'rebound effect' denominates the impact of cost reductions resulting from technical innovations improving for instance energy efficient supply which are resulting in additional consumption of the same (more energy) or more other goods (Herring and Roy, 2007). In recent discussion of energy efficiency it is shown that technical innovations may have positive effects reducing energy consumption (for instance, lightning or life cycle of a building). But, this effect will only take place in a sustainable way if direct and indirect rebound effects are not leading to cost reductions and to changed behaviour inducing additional energy consumptions in other segments of daily life. Hence, the considerations of Herrings and Roy (2007) indicate that technical innovations usually are not sufficient for the reduction of energy consumption and emissions but need complementary changes in behaviour and structural or of systemic

conditions. If this is not the case, direct and indirect rebound effects are summing up to an amount of energy consumption clearly larger than the reduction effects are in fact. In this case, one denominates this surplus as a 'backfire'-effect which can easily be identified in the development of the extent and intensity of lightning across the continents. Hence, one can easily conclude that technical innovations are inducing more or less strong rebound effects without any behavioural and structural measures or without specific pricing as a regulative. Second question: *How one can support an integrative way of smart city development focusing on local problems and integrating the interests of different groups of stakeholders?* In the above mentioned technical understandings 'governance' is described as own decision entity using information which is delivered by smart ICT processes (Batty, et al., 2012). In the innovative urban fabric 'governance' is only implicitly considered as the sum of regulations enabling market transactions, knowledge production and learning processes (Leydesdorff and Deakin, 2011). In fact a rather comprehensive understanding! But it is not explicitly discussed why and in which form a technical innovation might be important for the city itself. Correspondingly, the technology driven understanding of the smart city has been introduced as a strategic device to encompass modern urban production factors in a common framework and to highlight the growing importance of Information and Communication Technologies. ICT has become the major issue in this smart city discussion and even in the implementation of such concepts. In those cities technical innovations are considered as important tools and means for smart city what immediately will increase the risk of co-modification on the one hand and of 'backfire-effects' on the other hand. Hence, the question rises how one can overcome this dominant trend avoiding such negative impacts on sustainable urban development but still improving a city's competitiveness.

Conclusions: from technical to urban innovations

In a strategic planning point of view (Paskaleva, 2014; or Giffinger et al., 2014) the smart city is regarded as the outcome of a learning process which is based on local evidence placing the individual at the centre of urban policy. Based on this understanding a (wide) range of persons as stakeholders from politics and economy or citizens representing different interests at different levels is asked to assess recent performance, to indicate necessary improvements and to elaborate a road map which meets the local problems. In this multilevel perspective strategic efforts do not only consider technical innovations but also behavioural components of involved actors and even structural components in the urban context. Hence, well-educated citizens (as stakeholder, entrepreneurs and politicians and so on) play a decisive role for the elaboration of effective and inclusive strategies. The availability and quality of knowledge and the capability for cooperative efforts (based on components like human and relational capital) are regarded as decisive for smart urban development in an increasingly competitive situation of most European cities. From a social science perspective the importance of ‘governance’ is also discussed in the Smart City concept. Diamantini and Borrelli (2014, p. 4) emphasize to adopt governmental strategies of the territory fostering the capacity building at different levels. Such kind of adaptive governmental strategy “...means putting into practice measures of participation and mechanisms of learning in the communities.” Following this idea of governance which should adapt to local conditions (and evidence) finally implies the logics of government including practices of participation, awareness and the collective learning. Hence, a learning based approach should take specific governance regulations and human (and relational) capital as important factors concerning a place based solution finding. However, enforcing a learning process does not mean that the

discussion of specific challenges will necessarily lead to common interests. Decision finding is not easy and meets severe obstacles the less local evidences and a clear common vision are driving the process. At the same time, dominant technical- economic interests of global players increase the risk of co-modification of the city. This risk presumably will be reduced the more such interests of investment are encountered in an integrative approach through decision finding from below. In front of such different interests and risks a learning based understanding of the Smart City will therefore become a major strategic challenge. Anyhow, technical innovations should be implemented under criteria of economic and environmental effectiveness but should be socially affordable and inclusive at the same time.

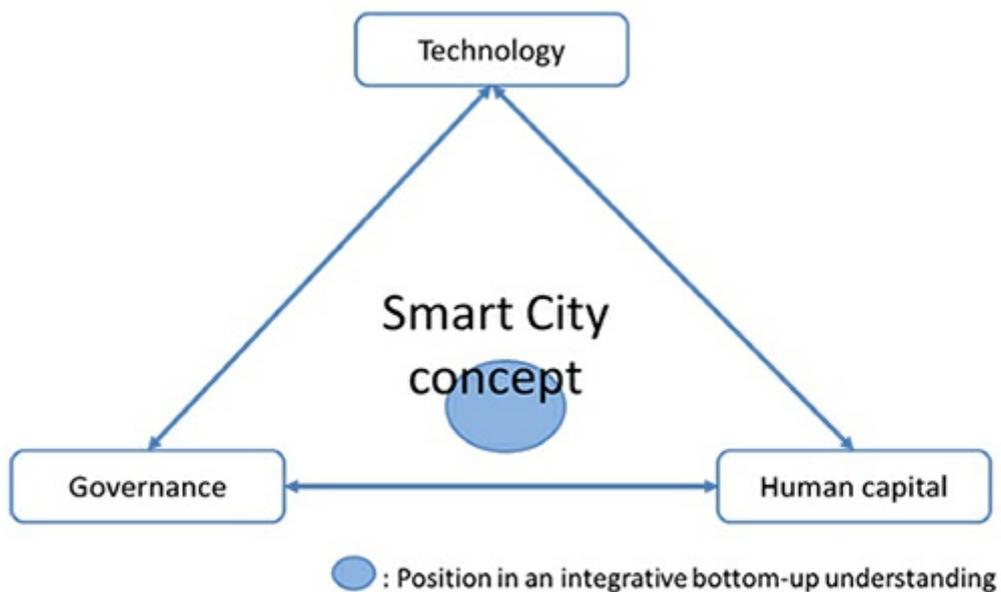


Figure: integrative bottom-up understanding of 'Smart City' in a three-dimension Perspective

As the figure above shows, governance and human capital become crucial in this smart city perspective based on learning processes integrating technical innovations into urban development. And in this context social innovation has to be emphasized as a second important dimension: The above described interrelation between technical and social aspects in a

learning process provides the chance for cities to enforce integrative solutions affecting positive changes in the smart city approach. This changed understanding will break through the more the learning based governance process is taking the advantage of technologies while avoiding the risks of deliberate abuses or unmeant rebound effects. Therefore, the learning process is necessary not only related to local conditions in the context of a city's general situation but also related to the interplay of technical and social innovations. Social innovation, as defined by Moulaert et al. (2012), has three core dimensions: (1) the satisfaction of human needs as content dimension; (2) changes in social relations especially with regard to governance as process dimension; and (3) an increase in the socio-political capability and access to resources as empowerment dimension. Hence, the above described integrative Smart City understanding supports to a certain degree the idea of social innovations as they are considered as place based, with governance from up down and self-organization from bottom up. However, a special attention in future urban research is necessary regarding the interrelations of the three core dimensions which are not as intensively discussed as those of technical innovations. Besides, their explicit consideration in strategic concepts for Smart City development have to be claimed in order to overcome a non-sustainable urban development based on predominantly technical innovations only. To conclude, smart city should be regarded as a socio-technical system in which a transition process takes place. However, it needs further discussion in a multi-level perspective considering both the institutional socio-technical landscape and network of niches (Geels, 2002, 2011). Nevertheless, strategic planning which takes positioning as a decisive task, would play an important role in bridging different levels and supporting decision making in smart city practice. The need of change towards place based urban innovations integrating technical innovations and social innovations in a mutual learning process, is to make the way to achieve smart city more efficient. This paper is, of course, not a full answer on how to steer Smart City development and to bring forward human capital, but is opening the discourse of this crucial topic for making the 'Smart City' more inclusive as

central element of a sustainable development. Hence, future research needs to explore smart city as a socio-technical innovation system with a learning process in greater detail.

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