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DOI:
10.1080/13511610.2012.660327

Document Version
Peer reviewed version

Citation for published version (Harvard):
Gertner, D 2012, 'Smart networked cities?', *Innovation: the European Journal of Social Science Research*, vol. 25, no. 2, pp. 175-190. https://doi.org/10.1080/13511610.2012.660327

Smart Networked Cities?

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Paper Submitted to:

Innovation

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Abstract

This paper aims to critically assess the lack of a global inter-urban perspective in the smart city policy framework from a conceptual standpoint. We argue here that the smart city policy agenda should be informed by and address the structure of transnational urban networks as this can affect the efficiency of such local policies. The significance of this global network structure is essential as cities do not exist in a vacuum. On the contrary, urban development is heavily based on urban interdependencies found at a global scale. After critically analysing smart city characteristics and the world city network literature, we identify the need for global urban interdependencies to be addressed in a smart city policy framework. While this paper approaches this issue from a theoretical standpoint, some policy examples are also provided.

1. Introduction

A great discussion has taken place about the *smart* character of cities, a characteristic which is usually connected with the utilisation of technology in urban life. While policy makers spent great effort the last 20 years to design policies which promote the use of Information and Communication Technologies (ICT) in order to obtain urban development objectives, it is still vague what distinguishes a smart city from a less smart one. Nonetheless, the digital revolution enabled cities and policy makers to realise the link between ICT and place in enhancing the local knowledge economy. As a result, various forms of policy models have been developed. These include the concepts of *wired cities* (Dutton, 1987), *technocities* (Downey and McGuigan, 1999), *digital cities* (Komninos, 2008), *creative cities* (Florida, 2005b), and *knowledge-based cities* (Carrillo, 2006). One of the latest concepts is the *smart city*, which is the focus of this paper. The distinctive point of this policy framework is the focus both on the *hardware* but also on the *software* of cities (Caragliu et al., 2009).

However, cities do not grow in a vacuum. On the contrary, and at a different scale, cities co-exist, collaborate, compete and evolve together with other cities. ICT and efficient transport networks enable cities to communicate intensively in a way that the burden of distance is not a deterministic factor for inter-urban collaboration (see for example: Cairncross, 2001). Castells' (1996) seminal work on the *space of flows* played a vital role in realising the importance of cities as part of a transnational urban network which is not ruled anymore by national borders. Important contributions both from a theoretical standpoint (Sassen, 1991) but also from an empirical standpoint (e.g. Friedmann, 1986, Taylor, 2004) provided a better understanding on how cities function in the post-modern world.

The importance of such knowledge is not exhausted in the theoretical domain. The knowledge of how cities are ranked and interlinked in the global urban network should feed the local urban policy agenda. Such a feedback loop can support policy makers by providing new insights in the local policy agenda about the (global) urban function. In this framework, the aim of this paper is to link these two approaches. Not only do cities need to adopt smart growth trajectories but at the same time cities need to consider the global urban

interdependencies in their local policy strategies. In more detail, we will highlight the lack of a global perspective in the smart city policy framework and attempt to explain why smart city initiatives should be enhanced by such a global urban perspective. The structure of the paper goes as follows: the next section analyses the main characteristics of the smart city concept; the third section critically presents the fundamentals of transnational urban network research; then effort is spent to highlight the lack and need for a global perspective in a smart city policy framework; and the paper ends with some concluding remarks and policy recommendations.

2. Smart Cities

According to Komninos (2006, p. 6) smart cities can be defined as "territories with high capacity for learning and innovation, which is built-in the creativity of their population, their institutions of knowledge creation, and their digital infrastructure for communication and knowledge management" and are part of the digital city theoretical paradigm along with intelligent cities and regions, virtual innovation islands, regional innovation systems and telematics and online innovation/knowledge management (Komninos, 2002, p.7). The establishment of such a concept is mainly due to the meeting of innovation with information technologies and the Internet (ibid).

The term smart city is a fuzzy concept which is not used consistently within the literature. Indeed, smart is often used interchangeably with *intelligent*, *wired*, and *digital*. One of the main criticisms is "the disjuncture between image and reality [...] the real difference between a city actually being intelligent, and it simply lauding a smart label" (Hollands, 2008, p. 305). Hollands (2008) provides a comprehensive review on the smart city concept. Following on from Hollands, Caragliu et al (2009) add a critical review of the literature from an economic perspective. According to these authors, actual smart cities can be seen to embody specific characteristics which include digital infrastructure and ICT usage, emphasis on business-led urban development, the social inclusion agenda via e-governance, concern with high-tech and creative industries in urban growth, the importance of social capital in urban development and the inclusion of environmental and social sustainability (Hollands, 2008, Caragliu et al., 2009). The main characteristics discussed in both papers are critically analysed below.

The role of ICT is the main smart city characteristic discussed in the literature. Smart cities are mostly related with the philosophy and the applications of ICT – both as digital infrastructure and ICT usage – at the level of cities and regions (Komninos, 2002). Digital network infrastructure is used as a means to improve economic and political efficiency and at the same time to enable social, cultural and urban development (Hollands, 2008, p. 307, see also Komninos, 2006, Eger, 1997). Such infrastructure includes mobile and land line phones, satellite TVs, and mostly the physical layer of the Internet (inter- and intra-city digital networks). The digital infrastructure with the services built upon these networks such as electronic commerce and e-governance are one of the main economic driving forces in cities and urban regions, producing numerous social and spatial effects (Graham, 2002, p. 34). The

Intelligent Community Forum (2011, p.1) further elaborates on the role of ICT in the smart city concept: “it is the community – town, city, country or region – that views internet bandwidth as the new essential utility, as vital to economic growth and public welfare as clean water and dependable electricity. Where communities once raced to build seaports, rail depots, airports and highways to attract businesses and create jobs, many now view broadband communications and information technology as the new keys to prosperity”.

The second characteristic of a smart city is the emphasis on *business-led urban development*. Smart cities aim to attract new businesses and represent what a report conducted by the Centre for Regional Science at the Vienna University of Technology (2007) calls a *smart economy*. The latter is one of the characteristics of a smart city including but not limited to an innovative spirit, entrepreneurship, economic image and trademarks. In the urban development literature, an entrepreneurial city can be seen to have links with the smart city concept with its emphasis on entrepreneurial and innovative strategies intended to maintain or enhance a cities economic competitiveness (Jessop and Sum, 2000). The key is that the strategies are “real and reflexive” and are explicitly developed and pursued in an active, entrepreneurial way (ibid).

The third characteristic of a smart city is the *social inclusion* agenda via the use of e-governance. This refers to the technologically enhanced provision of governmental services to citizens, businesses and employees (Silcock, 2001). Within the smart city concept, e-governance is a tool by which the existing structures, processes and practices of government may be improved. The overall aim is to achieve the social inclusion of urban residents in public services (Caragliu et al., 2009).

The next characteristic concerns the role of *creative industries* in urban growth. This feature, while is not the main characteristic of the smart city concept in comparison to the use of ICT and business-led urban development, touches upon the social and human dimensions rather than hard infrastructure. The creative city concept stemming from the work of Richard Florida (2005a) discusses the importance of attracting creative individuals to cities in order to help stimulate urban growth. In more detail, a smart city policy framework supports urban economic development aims by creating the essential conditions to attract creative workers, the most important input for the establishment and growth of creative industries (ibid). Nonetheless and regardless the importance of this element, developing creative industries is not the main target of the smart city concept, but it acts a supplement to the other ICT related urban development objectives (Hollands, 2008).

The fifth characteristic of a smart city is the importance of *social capital* in urban development. This characteristic addresses one of the main criticisms against the smart city concept, according to which ICT dominates against the soft characteristic of a smart city (Hollands, 2008, Caragliu et al., 2009). In the US, *smart communities* are transforming cities in relation to new knowledge and technology. Smart in this case is more than the mere deployment of technology, but rather about preparing one’s community to meet the challenges of a global, knowledge economy (Smart Communities, 2011). A smart city is a city whose community has to learn, to adapt and innovate (Coe et al., 2001).

Another characteristics is *urban sustainability*, which is a complex notion based on the interaction of the three domains which characterise urban systems: physical, social and economic (Camagni et al., 1998). All of these sustainability elements are incorporated in the smart city concept. Firstly, a smart city as an urban development framework aims by definition to increase economic prosperity. In addition, social sustainability refers to the inclusion of people within the smart – digital agenda. According to Amin et al (2000), a progressive smart city needs to establish the balance between the use of ICT by business, government, communities and people who live in cities. Urban sustainability also includes a strong environmental element as smart city policy initiatives include the objective of addressing the negative environmental externalities which accompany the urbanisation process. Such externalities are the outcome of the interaction of the physical with the economic and social urban environment and include among others the reduction of natural resources, the pollution of the physical environment, urban diffusion, and health problems (Camagni et al., 1998). Smart policies which are based on the use of ICT can be utilised in order to address these issues.

While the local nature of all the smart city characteristics is well established among researchers and urban policy makers, what is missing from the above is a global perspective. As it is analysed in the next section, strong urban interdependencies exist at a global scale, which needs to be addressed in the smart city concept.

3. Research on global urban interdependencies

Different terms have been used in order to describe this contemporary phenomenon which is related with the growing interaction and interdependence among a selected set of cities, the importance of which emerges in the frame of the post-industrial globalized economy. Among others, Friedmann (1986) refers to the *world city hypothesis*, Sassen (1991) recognizes *global cities*, Castells (1996) highlights the *global city process* and Taylor (2004) analyzes the *world city network*. Peter Hall almost 30 years ago approached world cities as entities which perform multiple roles (Hall, 1966, see also Hall, 1998, p. 17): they are national and international centres of political power, centres of trade, banking, insurance and related financial services, centres of advanced professional activity, centres of knowledge and technology, information gathering and diffusion, centres of consumption, centres of arts, culture and entertainment, and of the ancillary activities that cater for them.

The increasing discussion about world cities goes hand in hand with a pronounced *relational turn* in urban and economic geography (Tranos and Gillespie, 2011). For Castells (1996, p. 386), global cities are “not a place but a process. A process by which centres of production and consumption [….] are connected in a global network”. This process leads to the concentration of economic activities in selected global nodes. Castells (ibid, p. 415) identifies three reasons among others for the continuous and growing concentration: (1) world cities are mostly “information-based, value-production complexes”. The main elements of advanced service production, that is highly skilled labour and suppliers, can be found in these locales;

(2) such cities are linked in networks of production and management. The flexibility of such networks enables the advanced service producers to gain access to labour and suppliers when necessary and in the needed quantities, using a just in time concept, avoiding the costly internalization of the above inputs of production; (3) such a flexible production model is facilitated by the concentration of production and management networks in specific core cities and the global networking of these core cities and their hinterlands. This networking is dependent on infrastructural networks such as telecommunications and air-transportation (Castells 1996, 415).

In a similar vein, Peter Taylor argues (2004) for the need to conceptualise cities in a relational way given that they are the outcome of networking activities. This conceptual relational turn was accompanied by disproportional empirical research in this area, an observation that led Taylor (2004) to argue that there is an *evidential crisis* in world cities research. However, in recent years three broad types of relational data have been used to examine the position of cities within the world economy (Tranos and Gillespie, 2011): firstly, data on the networks of advanced producer services (APS), secondly data on physical transport-based networks such as airline networks, and thirdly data on the virtual networks of the information age, notably the collection of computer networks which together constitute the Internet. Indeed, regardless of some criticism (Derudder, 2006) both physical and digital infrastructural approaches can provide informative insights of the world city network (Townsend, 2001b, and 2001a, Tranos, 2011, Tranos and Gillespie, 2011, Devriendt et al., 2008). From an economic geography view point, both the Internet (Malecki, 2002) and the aviation network (Graham, 1998) facilitate the *knowledge-based economy* (OECD, 1996): while the Internet transports the informational goods (O'Kelly and Grubesic, 2002), the aviation network transports the main actors of the knowledge economy, the people who form the *managerial elites* (Castells, 1996, Beaverstock, 2002) across the distributed centres of production and consumption in order to interact and acquire complex and tacit knowledge (Rimmer, 1998). In reality, the "spatial organisation of the new international division of labour" (Friedmann, 1986, p. 69) is materialised by the advances in these two networks. The spatial distribution of these *facilitators* might reflect in or affect the agglomeration of specific – global – economic activities (Matsumoto, 2007).

From an urban geography perspective, both networks support the world city process (Castells, 1996). Telecommunications just like transportation are friction reducing technologies because of their ability to reduce the cost of distance (Cohen et al., 2002, Cohen-Blankshtain and Nijkamp, 2004). They enable global interaction by facilitating global economic activity (Malecki and Wei, 2009) and supporting the emergence of a world cities network. As Derudder (2006) highlights, cities gain importance from what flows between them rather than from what stays stable within them (Amin and Graham, 1999, Allen, 1999, Castells, 2001). Both networks carry a significant part of these flows (Taylor, 2004). Smith and Timberlake (2002, p. 139) recognize world cities as the "spatial articulations of the global flows that constitute the world economy" and Rimmer (1998, p. 439) identifies them "as junctions in flows of goods, information and people rather than as fixed locations for the production of goods and services". However, these flows are not transported in an abstract

space but rather on this specific infrastructural layer identified by Castells (1996) as the first layer of the space of flows, which is (unequally) spread around the world following a network topology and mostly consists of the Internet and the aviation network (Taylor, 2004).

Parenthetically, it can be mentioned here that transportation and communication networks are also affected by the evolving world city system (Keeling, 1995). Because of the private character of the telecommunications and aviation industry, the spatial distribution of their networks is mostly shaped by the spatially differentiated demand for such services (Tranos, 2011). Considering that demand for communications is maximised among world cities and their *hinterworlds* (Taylor, 2004), carriers primarily invest in locating their networks among such locations. This enables Graham and Marvin (1996, p. 3) to announce cities as the "power houses of communications". Despite their global reach, both networks are selective on which nodes of the urban network they interconnect with and on the intensity of the connections following a cherry-picking pattern (ibid).

Sassen (1991) further highlights the importance of digital infrastructure and ICT in supporting the global city process. ICT are essential in the two main processes which aid the spatial concentration of control and ownership: both the spatial dispersion of economic activity and the reorganisation of the financial industry are strongly based on ICT. Such infrastructure enables the long distance management of production and instant financial transactions regardless of the physical distance. In addition, Sassen (1991) highlights the agglomerative character of ICT as well as their developmental impact: the high entry cost for providing extensive ICT infrastructure is an agglomerative factor itself since not all cities can afford such an investment; yet, she continues, the established provision of high quality ICT is equivalent to "an almost absolute advantage" for a city (ibid, p. 19).

This discussion highlights the importance of ICT in the function and the formation of global transnational urban links. While different approaches have been proposed in the literature, global digital networks seem to be able to reflect such transnational urban structures. The above analysis in conjunction with the previous section highlighting the smart city concept and the importance of ICT in such an urban policy framework lead us to the next section which aims to bridge the two different research areas. Based on the above analyses we will underline the need for smart cities to incorporate into their strategies a global inter-urban perspective.

4. Smart cities: the lack of a global perspective

This section aims to critically discuss the smart city concept from the world urban network stand point. After analysing the general framework of the global cities and the world urban network, it can be observed that the smart city policy framework is lacking an inter-urban approach. As it is presented in the literature, apart from very few exemptions (Centre of Regional Science, 2007, and also Komninos, 2002) the smart city concept only focuses on the local-urban scale and does not consider the global urban interdependencies. Therefore, questions emerge on how a city may become a learning territory with high capacity for

innovation if it is not intensively linked with the distributed centres of production and consumption and with the world recognised research sites? Put simply, how can a city become smart in the frame of the post-industrial networked economy without including such global urban interdependencies in an urban development policy framework? In the post-industrial *spiky world* (Florida, 2005b), which is anything but flat (Friedman, 2005) and consists of intensively interlinked distant sites of production and consumption, cities climb in the global hierarchy not because of what they contain but rather because of what flows between them (Amin and Graham, 1999, Allen, 1999, Castells, 2001, Derudder, 2006). Such flows include everything from trade, foreign direct investments, tourists, knowledge, international students, air passengers and APS firms etc. Following Beaverstock et al. (2002), we argue here that urban competitiveness, which is an overall objective related loosely or more intensively with any urban development policy framework including the smart city one, cannot be understood by focusing (only) on the internal urban characteristics. On the contrary, it is essential to approach urban economic success and competitiveness also as the outcome of the external links and the quality of these links with other world cities. While it is more or less established nowadays both in urban policy and urban research arenas that cities do not exist anymore in isolation (Storper, 1997), it is rather surprising that the smart city concept ignores this global dimension and only focuses on the internal urban characteristics.

The rationale for raising such questions lies on Castells (1996) work on the *network society* and the *new economy*, the starting point of which was the new *technological paradigm* (Perez, 1983) which was the result of the adoption of new technologies and ICT and their impact on the economy and society in general. The new economy is a world scale economic system which appeared in the last quarter of the twentieth century and is "informational, global and networked" (Castells, 1996, p. 77). The new economy is *informational* and not just *information-based*, just like the industrial economy was not just an economic system based on manufacturing but rather a wider socio-economic paradigm affecting every aspect of society. The second element is scale as the new economy is not universal but rather global: the new economy is "an economy whose core components have the institutional, organizational, and technological capacity to work as a unit in real time, or in a chosen time, on a planetary scale" (Castells, 1996, p. 101-2). From an evolutionary point of view, the global economy comes as a successor of the *world economy* which has existed since the sixteenth century (i.e. the Mediterranean world economy as described by Braudel (1984, p. 22) and Wallerstein (2004). It is based on capital accumulation throughout the world, contrary to the integration of global actors for capital accumulation which is the main characteristic of the global economy (Castells, 1996). The integration element leads us to the third characteristic of the new economy: its network character. The new economy is *networked* because productivity and competition are materialised at a global scale through different type of networks (ibid). Such networks are global but not universal, meaning that they are spread around the world but they do not include every settlement on earth. On the contrary, they are very selective on which nodes of the world cities network they include.

At a more detailed level, a broader view is necessary for most of the characteristics of the smart city concept. Firstly, ICT and the digital infrastructure while important at the local

level, are based on a global inter-urban technical system. Although, new technologies and ICT are not the only characteristics of both world city networks and the smart city concept, such technologies play a vital role in both. As noted elsewhere (Tranos and Gillespie, 2009), the global city process is materialised by the informational flows that connect world cities. Information, knowledge and the products of the knowledge economy are being distributed around world cities through digital highways, diminishing the importance of traditional barriers such as national borders, but at the same time highlighting the locational advantage of being part of those networks. To use an analogy, the valuable goods of the modern economy are being transported over the Internet in much the same way as transport networks have carried industrial goods over the last 200 years (O'Kelly and Grubesic, 2002). Both the flows upon which the world city network expands and the services used to improve the quality of life in a city are based on a hardware layer: the digital infrastructure. Because of the massive expansion of the Internet, nowadays most of the digital communication infrastructure converges to the Internet infrastructure. From the technical point of view, despite what the average Internet user thinks, the Internet is not a unique system evenly scattered across the globe, regardless of core or periphery (Gorman and Malecki, 2002). And despite being a fairly young Large Technical System (LTS), at least for commercial usage, users consider it a black box, something which is usually related with other older urban infrastructure networks such as water, sewerage etc. (Graham and Marvin, 2001). In reality, geographic location affects Internet connectivity and the speed at which data can be transmitted and received. The latter is the result of the uneven spatial allocation of the Internet's physical infrastructure (routers, switches, fibre optic links, etc.) across space (Malecki and Moriset, 2008). So, it is fair to assume that the quality and the capacity of such infrastructure can affect both the relative position of a city in a global urban hierarchy but also the ability of policy makers to successfully promote smart related initiatives. Put simply, while global internet connectivity can happen almost everywhere nowadays, it is still important for a city to have enough and redundant installed capacity with other important Internet hubs as well as internal capacity to support the function of *digitally intensive* sectors related with financial markets, creative industries, telecommunications and ICT, etc.

However, the non-deterministic nature of the digital infrastructure needs to be underlined here as the digital infrastructure appears to be a necessary but not a sufficient condition neither for a city to climb the global urban hierarchies nor to become a smart city. Nonetheless, efficient (and smart) use of this infrastructure is included among the conditions for success. Following Harvey's concept of *spatial fix* (Harvey, 1982), while investments in urban infrastructure are necessary, there is no guarantee that capital accumulation will accompany such investments. Harvey (ibid) links globalisation with capitalism and more specifically with capital's tendency to remove spatial barriers and to accelerate its turnover time. In order to accommodate this process, investments in fixed and immobile spatial configurations such as urban infrastructure are necessary (Brenner, 1998). Nevertheless, global urban competition in attracting such capital does not allow for any guarantees in whether such investments will be able to attract capital and benefit from its accumulation. The position of a city in the global transnational urban networks can improve its potential to successfully attract such capital. To the degree that the success of urban development policy

initiatives is linked with the accumulation of international capital, smart city initiatives should also be informed about the transnational urban competition of attracting and accumulating global capital.

Furthermore, a key characteristic of the smart city concept is business-led urban development, which is also heavily based on transnational urban networks. As smart city policies aim to attract businesses (Hollands, 2008), specific conditions should exist in order to achieve this objective. Cities need to create a vibrant economic environment which can provide the necessary conditions for business growth. Such an objective can be utilised by policies considering mostly the local scale. However, at a second level, global links and the position of a city in the world urban hierarchy are also important. The most profound example for this argument can be found in the core of the world city research. As mentioned above, one of the most widely used methods in mapping and analysing the world city network is based on APS firms. Financial, legal and specialised service firms are important structural players in the post-industrial economy in general, but also for the economic base of city-regions (Scott et al., 2001) and are grouped together under this label. Taylor in his extensive work on the world city networks (e.g. Taylor, 2004, Taylor et al., 2010) utilises such data in order to understand the structure and the importance of transnational urban links. Based on Sassen's argument (Sassen, 1991) APS firms appear to be key elements for the formation of the world city network (Beaverstock et al., 1999). And even more importantly, if we accept Taylor's (2004) concept according to which the centrality of a city in the world city network is merely based on the APS located within the city and their global linkages, then the intensity of the extra-city links and the positioning in the global urban network appears to be an even more important factor for the success of a smart city. APS include sectors which are crucial in business creation and innovation activity such as financial, law, advertisement, accountancy and management. Attracting such services in a city can support the above smart city objectives. The attraction and the function of APS is based both on urban and inter-urban characteristics. On the one hand, market size, agglomeration economies and urban infrastructure (for an extensive discussion see Eberts and McMillen, 1999) can act as pull-factors for such economic activities. On the other hand and at the inter-urban scale, APS are also attracted by the intensity of the city interdependencies with other important nodes of the world urban network. Such interdependencies are reflected in a rather extensive variety of physical and non-physical links: from transportation and (tele)communications networks to financial, business and even cultural and political links. In total, the centrality in such global networks enables cities to attract flows which are vital for enchasing the smartness of a city. Smart city initiatives should incorporate this discussion and include a world strategy in order to attract such firms and create a vibrant economic environment.

Linked with the business-led urban development strategy, a smart city has a high capacity for innovative activity and displays elevated levels of entrepreneurship. This objective cannot be achieved without global awareness in order to attract flows of information, human and financial capital. Innovative activity is affected not only by local conditions and regional and urban innovation systems, but also by the position of a city in the dynamic global networks of research and development, business collaboration, finance and most importantly the networks

of the creative class usually responsible for the high scores of urban entrepreneurship and innovation. This argument can be seen in the systems of innovation literature where the "cross-scalar nature of innovation" has been argued to be important. The latter is supported by the theoretical proposal (Bunnell and Coe, 2001) highlighting the need for a qualitative turn in innovation research, which would enable the in-depth understanding of relationships functioning between and across different scales, contrary to the traditional single-scale innovation research focus. Indeed innovation requires the interaction of a multitude of actors at both a local and inter-urban scale. Such network connections provide access to a variety of ideas and enable for comparison with local routines that are produced in other cities[1] (Amin and Thrift, 1992). At a regional level, external connections inform local actors of the changing markets and help them develop relations with external agents such as producers, customers, scientists and support agencies (Oinas and Malecki, 2002). The global pipelines argument also highlights the importance of the incorporation of "multiple selection environments that open different potentialities and feed local interpretation and usage of knowledge hitherto residing elsewhere" (Bathelt et al., 2004). Additionally, we have recently seen the emergence of research underlining the interdependencies between the various systems of innovation (NIS, RIS and SIS) and important for our argument, the rise of another spatial scale termed International Systems of Innovation (ISI). ISIs demonstrate that a nation and region can benefit from exogenous inflows of know-how or extra-national influences which have been underemphasised in both the NIS and RIS literature (Fromhold-Eisebith, 2007).

An inter-urban approach is also necessary for a smart city in order to achieve goals related with creativity, innovation and human capital. All of the three policy objectives found in the core of the smart city conceptualisation are linked up to a degree with attracting talent at a global level. Migration flows of highly skilled and creative human capital is a key globalisation process of the network society (Beaverstock, 2002, Beaverstock and Boardwell, 2000, Castells, 1996): inflows of such migrants come along with established cosmopolitan networks, cultural partnerships and social relationships (Hannerz, 1996, Smith, 2001). Indeed, the positive impact of migration in business creation is well established in the literature (e.g. Reynolds et al., 2004, Saxenian, 1999, Kirchhoff et al., 2002) and many cities around the world have established policies in attracting high quality urban capital (Houston et al., 2008). Such policies include actions focusing both on the urban scale but also on the global inter-urban network. While the former are mostly related with the quality of life and the urban form per se as a pull factor for highly skilled migrants, the latter are based on positioning the city in the global inter-urban network. Malecki and Ewers (2007) refer to the *transnational business class* of expatriate employees of global firms which usually 'tour' around the remote establishments of their firm in order to gain global experience. However, such flows do not take place in a vacuum. On the contrary, cities compete with each other in order to attract such managerial elites, the input of which in the local production system will

[1] It is important to note that for specific industries such as electronics and pharmaceuticals, international networks are fundamental while in other industries, national or regional networks may be sufficient (Bunnell and Coe, 2001).

be valuable. This process places global cities at the top of the spatial division of labour (for a discussion see Malecki and Ewers, 2007), which represents according to Castells (1996) one of the manifestations of the new spatial form identified as the space of flows. Nonetheless and regardless the importance of the above, highly skilled migration and the global city process – set aside from the smart city concept – have not yet received sufficient interest in the literature. Ewers (2007) justifies this by the common and oversimplifying assumption that migration flows towards global cities is just a result of financial flows of Foreign Direct Investments (FDI). In reality, the complex inter-urban interactions in the world city network falsify such assumptions. And because of this complex global urban landscape, smart cities need to be active in attracting talent and precious human capital in order to support policy objectives related with creativity and innovation.

Lastly, environmental sustainability is also an issue which can be approached at a scale larger than the local level. Cities apart from being the main polluters are highly vulnerable places as they host more than half of earth's total population (IHDP, 2005). Apart from the localised environmental issues which could include issues such as air pollution and water resources management, cities face great risk because of the projected climatic changes due to greenhouse gas emissions. While adaptation for such changes appears to be mostly a local scale issue, mitigation has a greater importance at the global scale (Davoudi et al., 2009). Indeed, collaboration at a global level is necessary firstly for mitigation policies but also to exchange experience and knowledge on adaptation issues for cities facing common challenges such as the sea level rise. At a more practical level, expectations are rather high for smart cities in contributing to environmental sustainability: while cities around the world are responsible for 80% of global energy consumption (Webb, 2010), 15% of CO_2 emissions could be saved by smart urban policies (The Climate Group, 2008). Such policies could include the extensive use of ICT in motor systems, logistics, buildings and grids (ibid). Contrary to the above smart city characteristics, the importance of global interdependencies in the sustainability arena is more related with the outcome of the smart city policy rather than with formation of such policy. While inter-urban collaboration is important in mitigation issues in terms of knowledge exchange, what is more important is the aggregated effect against global environmental issues. It is important for different cities to apply smart policies with mitigation effects, but what is important overall is the expansion of such smart policies among the main polluters, the global areas around the world.

To sum up, the post-industrial urban environment, which is characterised by intensive trans-national urban interdependencies, requires awareness of the global inter-city links. Indeed, the extra-urban links are important element for some of the smart city characteristics such as ICT, business-led urban development, innovation, creativity and talent attraction and up to a degree sustainability issues. Nonetheless, some of the smart city characteristics are applied to the local scale. For instance, people need to work mostly locally in order to enhance social inclusion and develop social capital. This differentiation leads us to expand Hollands (2008) question of whether or not cities can address all the aspects of the smart city policy framework. In a similar way, the question of whether the extra-urban interdependencies can be treated in all smart city elements could be also raised. The answer to such a question

would be no. While global urban links are vital for most of the smart city conceptualizations, there are still elements which need to be dealt with at the local scale. However, this does not diminish our argument here that the smart city concept needs to be broadened with a world city perspective. Cities, in the frame of spaces of neo-liberalism (Brenner and Theodore, 2002), compete together at a global level in order to attract the highly mobile monetary and human capital. Non-informed local policy agendas about the structure of the global scale urban network will most probably be unsuccessful in attracting such resources and this can affect local development trajectories. The next and final section summarises and provides some policy recommendation.

5. Conclusions

The aim of this paper was to highlight the importance for the adoption of a wider – global – perspective in the urban development agenda especially when a smart city framework is the main policy perspective. After analysing the smart city concept and the wider framework of the inter-urban global interdependencies, it became apparent that the smart city concept was lacking a global outlook. Based on this, the main objective of the paper was to highlight this inconsistency: how can a city adopt a smart development trajectory without understanding its relative position in the trans-national urban networks and without addressing the global urban interdependencies. In order to support the need for such a conceptualisation, the two literatures were cross-examined and we brought into light that although some of the smart city characteristics have a strong focus at the local scale, most of the objectives of a smart city policy framework cannot be materialised unless a global urban perspective is adopted. What is interesting though is the fact that such argumentation has not been introduced before, at least to our knowledge, in a smart city theoretical framework.

In addition, such a global perspective seems to be also missing from the urban policy arena as policy-makers tend to neglect the global scale when designing urban policies (Doel and Hubbard, 2002, see also Harvey, 1989, Leitner and Sheppard, 1999). While this paper has a conceptual starting point, effort is spent in the remainder of the conclusion section to offer some policy examples for a networked smart city concept. Firstly, it could be highlighted that after the hype that accompanied the digital infrastructure as the panacea for urban development even until mid 1990s, it became apparent that hardware is not enough. Smart human capital is of equal importance and there is a need to compete globally for its attraction. In addition, issues of equity and inclusion in a smart agenda have been also raised as vital for a successful smart framework. Central is also the issue of a participatory approach in decision making and designing smart policies (Hollands, 2008).

In order to address the absence of a global view in the smart city policy agenda, cities need to be aware of their relative position in the global urban hierarchy and even more actively to adopt a *local foreign policy* (Cappellin, 2000). Simple macro-economic indicators are not enough to evaluate the potential of a city. Policy design process needs to be informed about where the city stands in global networked urban space. In addition, there is a need for an

urban policy turn: while the focus is merely on place-based themes, there is a need to include in the urban policy agenda issues related with connectivity, performance and flow (Doel and Hubbard, 2002). One such example can be extrapolated by the Singapore case, which has adopted a smart city strategy. As stated in Singapore's strategy, in order to maintain its strong global position and given its rather limited market size, it is necessary not only to continue investing on ICT per se, but also to further reinforce the hub roles Singapore performs at a global scale (Mahizhnan, 1999). An extensively used example is airports (Malecki, 2004). It is common place that airports are vital infrastructure for urban development but this is not the case for policies related with attracting aviation flows. However, a smart city concept should incorporate such policies in order to achieve the urban development objectives discussed above. In the same vein, active policy approaches should be adopted against other global networks including political, cultural, criminal and flows of money and of immigrants (Malecki, 2004). More detailed examples (ibid) include the Hong-Kong diasporas network introduced to enhance knowledge global-local flows (Jessop and Sum, 2000) and the similar purpose links between Taiwanese in Silicon Valley and in Taiwan (Saxenian and Li, 2003).

The above advocate the strengthening of city-to-city communication and collaboration. Such links could exploit cities' comparative advantages and at the same time enable policy makers to exchange experiences and knowledge for the implementation of urban development strategies. Emphasis needs to be given on *horizontal* links between cities of similar rank in the global urban hierarchy (Keeling, 1995) as this could result in the formation of *urban dyads* as a means to compete at a global level. As a means to accommodate this collaboration process, the active participation of cities and city policy makers in international urban fora is necessary. While such initiatives are not something new in the urban policy agenda[2], their utilisation is essential in such an interdependent global urban environment. They can enable cities to work together to share ideas, knowledge and experiences but most importantly to incorporate a global urban network perspective in the local – smart city policy agenda.

[2] See for example European Digital Cities project in mid 1990s, the main activities of which involved the publication of regular newsletters, organisation of four conferences and coordination of working groups on specific topics defined by the cities themselves (Komninos 2002), but also the most current Eurocities (2011) and URBACT (2011) initiatives.

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