Applied Geography 49 (2014) 12–17

Contents lists available at ScienceDirect

Applied Geography

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

Connecting the fragments: Looking at the connected city in 2050☆,☆☆

Edward J. Malecki*

Department of Geography, The Ohio State University, Columbus, OH 43210-1361, USA

Keywords:
Cities
Planning
Transportation
Technologies
Forecasting

A B S T R A C T

New technologies enable new urban patterns and new connections within and between cities. This paper reviews new and emerging technologies that are impacting cities internally and in their relations within larger networks. Policy and social attitudes also must change to incorporate and integrate new technologies. Forecasts and visions of urban futures are now more complicated by new technologies and by the global networks within which urban economies and urban dwellers operate.

Introduction

Grappling with how cities will evolve and change in the future has long been a standard feature within urban planning and other social sciences, and climate change and environmental concerns have accelerated recently the need to assess possible futures. New technologies will change how lives are lived in cities and urban regions. Nijkamp and Kourtit (2013) have begun to envision urban agglomerations in the year 2050. Others also have used the mid-century date as a future focus (Angel, Parent, Civco, Blei, & Potere, 2011; Franklin, 2012; Guimarães Pereira & Funtowicz, 2013; Kotkin, 2010; Regional Plan Association, 2006).

Nijkamp and Kourtit (2013: 305) suggest that connected cities "have to seek their development opportunities in the development of advanced transportation infrastructures, smart logistic systems and accessible communication systems through which cities become nodes or hubs in polycentric networks (including knowledge and innovation networks)". Such an image encompasses both "hard" and "soft" networks – that is, both the physical infrastructures of the hard networks and the software and relationships that facilitate the functioning of the soft knowledge innovation networks (Caragliu, Del Bo, & Nijkamp, 2011; ESPON, 2010; Malecki, 2002). Nijkamp and Pepping (1998) suggest five factors for confronting change: technological (hardware), information (software), decision-making and institutional (orgware), efficiency and financial (finware), and environmental and safety (ecoware).

With the mid-century date on the horizon, this paper reviews two sets of issues regarding the future of cities and the networks within and among them. The paper begins by reviewing technologies that are altering cities and interurban interaction. New technologies – both incremental and disruptive – will change cities and their connective networks, but more important will be the policies and social changes that will enable people to change along with the technologies. Both sets of change are crucial, and are the focus of the following section. Finally, the paper reviews briefly the methods planners have for anticipating and confronting change in the adaptation of cities to the changes that will take place.

Technological change

A great deal of technological change is incremental – small changes that individually do not disrupt users and systems. Some technological changes, such as the smartphone, however, are disruptive in many ways (Walker, Stanton, Jenkins, & Salmon, 2011). Not all disruptive technological change is sudden, and much of it requires integration with other systems which themselves also must change. The point is that social and policy changes must not only anticipate technological change but also incorporate them into the everyday lives of people and organizations – and the entire urban fabric – in a way that improves quality of life.

Connecting cities, goods are shipped to factories, offices, shops, and consumers' homes. Logistics networks are a complex mix of systems that rely on data and software, or code, to link the processes that flow through transportation networks and their hubs (Bowen and Leinbach 2011; Capineri & Leinbach, 2004).[1] Schwarz

☆ This article belongs to New Urban Worlds: Application, Policy, & Change.

☆☆ An earlier version of the paper was presented in the session, "The New Urban World: A Place 4 All" at the European Regional Science Association Conference, Bratislava, August 2012. Thanks to James Baginski for helpful comments.

* Tel.: +1 614 571 4991; fax: +1 614 292 6213.
E-mail address: malecki.4@osu.edu.

[1] The city too is reshaped by that code and the political economy of its implementation and use (Kitchin, 2011).

0143-6228/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.apgeog.2013.09.004

Table 1
Technological and non-technological changes needed for a post-car system.

New technologies	New policies and social attitudes
New fuel systems	New transport policies
New materials	New leisure/work practices
Smart vehicles	De-privatizing vehicles
Digitization	
Other disruptive innovations	

Source: adapted from Urry (2009).

(2006) illustrates the interdependencies of physical and virtual space that comprise the logistics industry, in global networks of seaports (Ducruet & Notteboom, 2012) and airports (Matsumoto, 2007). Within the global system, some city regions with major airports and seaports have emerged as *global city logistics regions* (O'Connor, 2010). Logistics is more than merely infrastructure and technology, also involving customs procedures and the financial network as well. These ultimately affect not only costs and timeliness, but also the most important element to many: the seamlessness and overall reliability of the supply chain (Arvis, Mustra, Ojala, Shepherd, & Saslavsky, 2012; Leinbach & Bowen, 2007).

Within future cities, the critical place of transportation – especially private cars – overwhelms in most research. Indeed, research on sustainable cities focuses primarily on problems posed by private vehicles (Banister, 2005). "The car is immensely flexible and wholly coercive" (Sheller & Urry, 2000: 743; Urry, 2004). A second growing research effort focuses on informational or *digital cities*, exploiting information and communication technologies (ICTs) to improve urban life (Castells, 1989; Stock, 2011).

Disruptive technologies

By 2050, we can anticipate that disruptive technologies will impact and affect other technologies in different ways. Frequently, it is not the technology itself that is disruptive but how it combines with other factors or how it is applied. Translating disruptions to regions, however, is more difficult (Simmie & Martin, 2010). Both local buzz and global pipelines are needed both to generate innovation and to absorb ideas from elsewhere (Bathelt, Malmberg, & Maskell, 2004). In certain circumstances, radical innovations permit the development of a new technological/industrial sector in the urban economy (Simmie, Carpenter, Chadwick, & Martin, 2008) and new forms of specialization (Pumain, Paulus, & Vacchiani-Marcuzzo, 2009).

New technologies also are difficult phenomena to anticipate. Some technologies evolve in steady, predictable ways, others in revolutionary jumps as systems are combined in new, unforeseen ways. Disruption is inevitable as new technologies and businesses replace old ones (Christensen, 1997). Sood and Tellis (2011) show that disruptive technologies and radical innovations can be predicted to some degree. Major impacts of automated or driverless cars, now seen as inevitable, will be reduced traffic congestion and less land need for parking (Bilton, 2013).

In some situations, however, there has been an absence of disruptive innovations. Within the automotive industry, "significant technological change has been scant" (Wells & Nieuwenhuis, 2012: 1681). This is largely a result of resistance to change on the part of the dominant vehicle manufacturers. As vehicles have scarcely changed, "there has been no comprehensive innovation in urban traffic systems since 1900" (Gullberg and Lundin (2011: 103). Efforts to envision new vehicle systems must incorporate layers of changes – in technologies, policies, and social attitudes and behaviors (Dennis & Urry, 2009; Mitchell, Borroni-Biord, & Burns, 2010). Table 1 shows that several new technologies, such as fuel systems and smart vehicles, must be combined with new social attitudes and policies to encourage adoption of the technological and social changes (Dennis & Urry, 2009; Turton, 2006).

In addition to disruption from new technologies, we can also anticipate disruptions from other forces exogenous to the urban system, such as climate change, which will impact cities and transportation networks (Koetse and Rietveld 2009; Valsson & Ulfarsson, 2012) and other urban infrastructures (Ruth & Coelho, 2007). Gasper, Blohm, and Ruth (2011) and Romero-Lankao (2012) suggest longer lists of likely impacts, including energy shortages, damaged infrastructure, increasing losses to industry, heat-related mortality and illness, and scarcity of food and water. Consequently, urban planning is becoming "strategic" and long-term once again in the context of climate change (Couclelis, 2005).

A result of recent technological changes is the *fragmented* spatial configuration of activities in modern cities, breaking down what we do in particular places, enabled by new information and communication technologies (ICTs) (Couclelis, 2004, 2009) The longer-term result is unclear. Ferreira and Batey (2011) suggest that compact, dense cities (in which the fragmented activities are in proximity) increase congestion and time spent in travel, thereby reducing mobility. Levine, Grengs, Shen, and Shen (2012) find the opposite: density improves (auto) accessibility.

Technological change in urban systems: connections and networks

Individual cities are embedded within urban regions and city-regions, with regional and national urban systems defined by their positions within global systems (Berry, 1964). Urban centers "construct two spaces": the internal space of the urban place itself and the city's space or position within the urban system (Pumain, 2000: 80). The city, then, is a "connector" of multiple – local, regional, and global – networks (Pflieger & Rozenblat, 2010). Local changes are a result of distant forces (teleconnections) that affect cities (Seto et al. 2012).

In general, thanks to ICTs, people have much greater personal mobility than ever before (Kellerman, 2006; Urry, 2007). We can expect continual increased mobility: "shifting from slow to faster modes as income and the demand for mobility rise" (Schafer & Victor, 2000: 198). Cities rely increasingly on infrastructures as the systems that move people, goods, and information both internally and among cities (Graham, 2010; Hanley, 2004). However, urban infrastructures are increasingly "splintered", providing higher quality connectivity and accessibility for some (e.g. rich people and large firms) rather than for all (Graham & Marvin, 2001; Mossberger, Tolbert, & Franko, 2013). However, splintered urban infrastructures also allow wealthy people to "exit" and opt out of public resources and infrastructures (de Sherbinen, Schiller, & Pulsipher, 2007).

Policy responses: making change happen

As urban planning has focused on short-term responses, "there is little evidence to show that the identified growing structural long-term challenges are being met with innovative policy responses and understood in their systemic consequences" (Van Cutsem, 2010: 24). The social changes necessary for major social and policy change must confront varying cultures and temperaments. Many of these are rooted in past structures and networks and will therefore be slow to change; others are a product of interactions with other domains of urban development (Institute for Mobility Research 2013; Othengrafen & Reimer, 2013). WEF (2013) identifies as major challenges legal and regulatory issues, privacy and data ownership, and cooperation between industry and public agencies. Containerization and supply chain management were