

Informational Urbanism

Wolfgang G. STOCK

Dept. of Information Science, Heinrich Heine University Düsseldorf, Germany

ABSTRACT

Contemporary and future cities are often labeled as “smart cities,” “ubiquitous cities,” “knowledge cities” and “creative cities.” Informational urbanism includes all aspects of information and knowledge with regard to urban regions. “Informational city” is an umbrella term uniting the divergent trends of information-related city research. Informational urbanism is an interdisciplinary endeavor incorporating on the one side computer science and information science and on the other side urbanism, architecture, (city) economics, and (city) sociology. In our research project on informational cities, we visited more than 40 metropolises and smaller towns all over the world.

In this paper, we sketch the theoretical background on a journey from Max Weber to the Internet of Things, introduce our research methods, and describe main results on characteristics of informational cities as prototypical cities of the emerging knowledge society.

Keywords: Informational urbanism, Informational city, Smart city, Informativeness, Cityness.

1. INTRODUCTION

Nowadays, more than half of mankind is living in cities. The world is still changing into an “urban world” [24]. This is our basic idea: Just as there are prototypical cities of the industrial society (for example, Manchester in middle of the 19th century) or the service society (such as New York’s Manhattan in the second half of the 20th century), so there are (or will be in the near future) typical cities of the knowledge society [50]. Sometimes, those cities are labeled “smart.” Smart cities bank on ambient intelligence in information spaces city-wide [33] as well as in the homes [8]; they are built on computer science and cybernetics [29]. However, the term “smart city” is often fuzzy [3][19] and has its origins rather in marketing than in science; for example, the computer company IBM holds the trademark “smarter cities” and applies it in its smarter city campaign [41]. Besides “smart city,” there are further approaches conceptualizing cities and regions of the knowledge society. Similar to smart city approaches, “ubiquitous city” [40] and “urban informatics” [14] refer to the city’s well developed information and communication technology (ICT) infrastructures; research on “knowledge city” concentrates on knowledge-based urban development such as higher education, science parks and libraries [4], and, finally, “creative city” studies creative people, the “creative class” [11], as human capital in urban spaces. All mentioned

approaches address important topics of the description, analysis and planning of urban regions in contemporary and future cities of the knowledge era, but they do not reflect the whole story. In contrast, “informational urbanism” studies all aspects of knowledge and information, be it digital or physical or man or machine generated, which has implications for cities, their spaces, their institutions and—most important—their people. Following Castells [5], we call such prototypical urban regions of the knowledge society “informational cities” [44]. The term “information urbanism” was coined by Stallmeyer [42] to study “spatial transformations brought about by informational developments” [43, p. 2]. In short, informational urbanism studies informational cities.

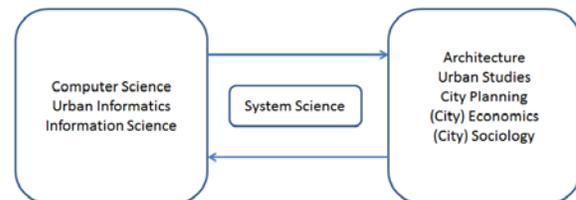


Figure 1: Informational urbanism as an interdisciplinary challenge.

Informational urbanism has interdisciplinary theoretical background both in urban studies, city sociology, city economics, architecture and city planning on the one hand as well as in computer science, urban informatics and information science on the other hand. The both building blocks are held together by system science (Figure 1). There are interdependencies between the more technological oriented disciplines and their practical results (left hand side) and the more city-oriented studies and practices (right hand side).

Two examples may illustrate those mutual dependencies. (1) For mobile communication one needs wireless Internet access. So computer scientists developed smartphones and further wireless devices. City planners provide for cell towers equipped with antennas. And architects should make sure that the cell towers are harmonically and aesthetically well integrated into the cityscape (by the way, most of them are not). (2) City planners recognize the problem of a magnitude of potholes in their possibly very large town. Computer or Information Scientists develop a motion sensor, reporting every pothole with its GPS-data to a central unit. Citizens or taxi drivers install this tool in their cars. After some weeks our city planners have a complete overview on every pothole in their area of operations.

2. BACKGROUND: FROM MAX WEBER TO THE INTERNET OF THINGS

How can we understand cities in the emerging knowledge society? Max Weber's "The City" is one of the first sociological analyses of urban regions [49] in which he stresses the anonymity in cities in contrast to rural regions, their role as capitalist market centers as well as corporate bodies with a definable area.

From the 1960s onwards, the exploration of world cities has experienced a big boost. A remarkable example is "The World Cities" by Peter Hall [17], who defines world cities as centers of politics, commerce, finance, professional services, luxury consumption and entertainment. For Hall, administrative boundaries are not important; he considers connected regions (such as Randstad Holland) as one world city. The economy of cities is analyzed by Jane Jacobs [21]. Jacobs underlines the essential roles of human capital and competition between firms as externalities of economic success of cities. Manuel Castells "Informational Cities" [5] exerts massive influence on city research. In the network society, no longer the physical "space of places" (buildings, roads, etc.) dominate, but the "space of flows" including flows of power, capital and information. Of course, a pure "City of Bits," introduced by William J. Mitchell [30], is not possible. But people act—driven by ICT and the Internet—not only in the physical space, but also in the area of information flows, i.e. in the digital space, for example in social media.

John Friedmann proposes the "world city hypothesis" [15]. World cities are the centers of the world economy and urban areas with dense patterns of interactions. In a second attempt [16], he defines world cities—following Castells—through their position in the space of flows. On top of Friedmann's world city hierarchy, we find London, New York and Tokyo. For Saskia Sassen [38], "global cities" are centers of the globalized world. They host headquarters of major companies and their suppliers, first of all service providers (financial services, advertising, media, consulting, etc.). All these companies depend on information—face-to-face information flows are as important as global digital information streams. The global city is an extremely intense and dense information loop, so that the city itself becomes an information center. Peter J. Taylor [46] shows that the world cities generate a network formed by leading service companies' power and information flows. Taylor also stressed the "green" component of cities that makes these worth living in. Taylor et al. [47] use the term "cityness" to describe the position of a city in the global networks (as opposed to the "townness," which captures the role of a city to its hinterland).

Besides conceptual and structural properties that describe informational urbanism there are other driving forces shaping the city: inhabitants, appearance, and technological advancement. Richard L. Florida [11] identifies the creative class as a driving force of contemporary cities and regions. The economic development of cities is dependent on the 3Ts, i.e. technology (innovation, high concentration of high-tech companies), talent (share of highly educated people, but

also of the creative folks, recognized by the "Bohemian Index") and tolerance (openness to all ethnic groups, races or forms of life, captured for example through the "Gay Index") [12]. Following Jan Jerde, "community-oriented ideas for architecture" [36] help to create the city as an event in itself. So-called "architainment" [23] with the example of Las Vegas and landmark buildings (after the success of Frank O. Gehry's Bilbao Guggenheim called "the Bilbao effect" [37]) increase the attractiveness of the city. Data from cell phones and sensor-based devices (e.g., CCTV cameras) and their rapid application in urban systems (for example, in traffic control) lead—according to Carlo Ratti et al. [35]—to "mobile landscapes" and the "real-time city." For Vlacheas et al. [48], the ultimate technological framework of informational cities is the Internet of Things, because it connects all components of the digital and some of the physical world.

Although there is extensive work on the nature and anatomy of informational urbanism it lacks approaches that aim at unifying basic concepts as well as at describing and evaluating them by quantifiable units. Our work particularly investigated how the different concepts explained before could be combined and arrived at the notion of the "informational city." Further, we explored what characteristics constitute an informational city and how these features can be measured. Those quantifiable units have been empirically evaluated and now support the assessment of to what extent a city is informational.

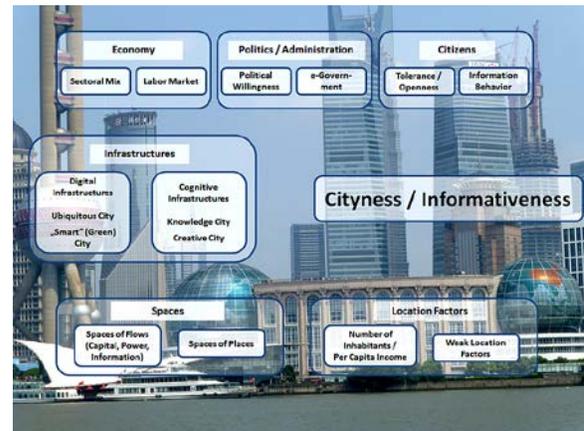


Figure 2: Research Framework of Informational Urbanism: Cityness and Informativeness of Urban Regions in the Knowledge Society. (Background: Pudong in Shanghai, China; Photo: W.G. Stock)

3. RESEARCH FRAMEWORK

The informational city is characterized by the two general aspects of cityness and informativeness [9]. *Cityness* includes indicators which exhibit the city's position within the network of all cities on the world, especially the indicators of the spaces of flows and the spaces of places as well as the location factors, but also "soft" indicators of tolerance and openness. *Informativeness* is directed on indicators of the information infrastructures, the knowledge-based sectoral mix and its labor market, the political willingness to create an informational city, the

maturity of e-government and the citizens' information behavior. The large number of indicators (Figure 2) requires a wide range of research methods. Objectives are to obtain reliable empirical data on as many indicators of cityness and informativeness of the cities as possible.

4. METHODS

Our research project employs a systematic combination of methods (rapid ethnography, case research on-site, questionnaires, semi-structured qualitative interviews, bibliometrics and patentometrics, content analysis of websites, official statistics), which are held together by grounded theory and lead to the formulation of hypotheses and theories.

Our research program is currently pursuing three main directions: First, it is important to identify informational world cities and to distill its essential characteristics; second, we perform regional studies (regardless of the level of cityness) in particularly exposed regions of the world (among others, London [32], Singapore [22], the Arabian Gulf cities, metropolitan regions in Japan); and third, we analyze specific features of informational cities, e.g. our analyses of libraries [27], of e-government and m-government [26][28], of the citizens' information literacy and information literacy instruction [18], of Twitter activities in those cities [13] and of the use of social media [1][2]. Until today, we visited and studied 31 informational world cities, four cities in Japan, seven cities in Arabia, three so-called "ubiquitous cities," three Canadian cities to study information literacy instruction programs and two cities in order to capture citizens' information behavior (see Appendix).

5. RESULTS: CITIES IN THE KNOWLEDGE SOCIETY

Based on the results of field and desktop research on more than 40 cities as well as—primarily—on semi-structured interviews with informed people in those cities (administrators, architects, faculty members, librarians, etc.), we are going to present a comprehensive catalog of essential characteristics of informational cities (ICs), all of them being research areas of informational urbanism (and waiting for further, more detailed scientific analyses).

Ubiquitous Cities and Urbanity

ICs put comprehensive ICT infrastructures into the whole urban area and develop a ubiquitous city. For new cities, developed from scratch (as Songdo City in Korea or Masdar City in Abu Dhabi, UAE), ICT is integrated into the city as well as in the homes (Figure 3) from the very beginnings [20]. Here, problems arise in missing urbanity. On the other side, old cities with an evolved urbanity are confronted with a reconstruction of the community as a living organism—leading to massive (legal, social and political) adjustment problems during ICT integration. Oulu in Northern Finland is an example of an "old" and at the same time ubiquitous city [39].



Figure 3. Master panel of apartments in the ubiquitous city of Songdo. (Photo: A. Ilhan). Source: [20, p. 463].

Smart Green City

ICs increase the quality of life of its residents through the use of ICT in green and sustainable projects. Most of them market these actions using the buzzword "smart city." Smart city actions include projects of "smart mobility and transportation," so in Shanghai, China, and Tokyo, Japan [10]. Many of the ICs (as well as many other cities) are well aware on short distances, walkability, cycle-friendly traffic and the preference of public transport over private automotive traffic, but they still suffer (despite sometimes introduced city tolls for cars) to extremely heavy car traffic in inner city areas. A positive counterexample is Singapore with very low individual transport (due to high car taxes). In Seoul, Korea, a highway was destructed in favor of the renaturation of a small river [7] (Figure 4). Newly build large metro systems (as in Shanghai, China, Hong Kong, China, SAR, or Singapore) reduce private traffic; environmental-friendly electric or hybrid-busses and lots of green spaces downscale CO₂ emissions (as in San Francisco, CA).



Figure 4. Highway to greenway reconstruction of Cheonggyecheon River in Seoul, Korea.

Photos: The Preservation Institute, 2007; W.G. Stock.

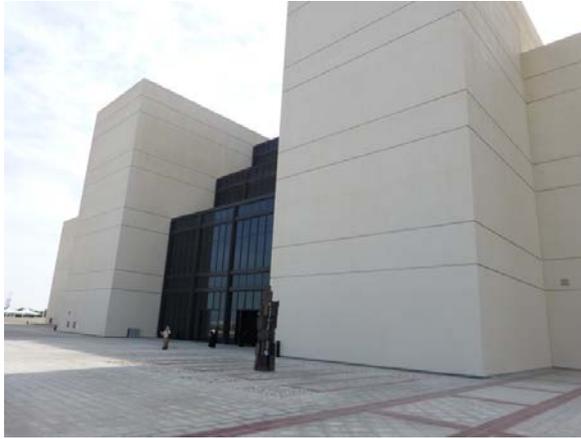


Figure 5. The library building of Qatar University as part of Doha's knowledge infrastructure.
Photo: W.G. Stock.



Figure 6. Vancouver Public Library as an important building block of Vancouver's knowledge city.
Photo: W.G. Stock.

Knowledge City

ICs take the production and use of scientific, technical, medical (STM) knowledge, but also of everyday knowledge very serious and build on education, their universities and science parks ("knowledge city") (example: Melbourne, Australia). The advancement of knowledge cities is measureable, e.g. by science input indicators (knowledge infrastructures, academics, expenditures on R&D) and output indicators (amount of STM publications and patents as well as number of graduates). In cities on the Arabian Gulf we found world-class infrastructures (as Education City and Qatar University in Doha, Figure 5), mostly imported knowledge (insofar most of the academics are expats) and a very problematic transition of the native graduates into the labor markets as natives prefer to work in well-paid routine jobs over knowledge-intensive jobs in private companies or institutions of higher education.

Some ICs bank on their public libraries and transform these into comprehensive information centers including physical as well as digital library services [27]. In Informational Cities, libraries become important elements of the cities' knowledge infrastructures. They re-define their role in society and create physical spaces for learning and meeting as well as digital spaces for providing information. Based upon our score on physical and digital library services, the Vancouver Public Library (Figure 6) performed best among all analyzed informational world cities.

Creative City

Some ICs understand openness and tolerance in the sense of Florida [11] as a prerequisite for creative actions, thus establishing the "creative city" (prime example: San Francisco, CA, USA). In some creative cities we are able to identify theater clusters (as Broadway in New York or West End in London) or clusters of galleries and artists' studios (as M50 in Shanghai; Figure 7).

In ICs located in the United States and (to lesser extend) in Asia (but surprisingly not in Europe) creativity correlates positively with economic welfare [31].

Space of Flows

ICs occupy a prominent position in the "space of flows." They have a central position in international money flows (by major stock exchanges; prime examples are New York and London), power flows (through headquarters of important companies in their city as for example London, New York, Hong Kong, Paris, Tokyo or Singapore) and information flows (through global cooperation in business and science). Face-to-face information flows are fostered through MICE (meetings, incentives, conferences, events). A good example for a prospering MICE economy is Doha, Qatar. Located in Doha, the Qatar MICE Development Institute fosters the local MICE economy. Besides top-level world cities, some regional or national centers (as, e.g., Montréal, Canada, Boston, MA, or Amsterdam, The Netherlands) are on their ways to ICs concerning the space of flows.



Figure 7. Shanghai's M50 as an example of a gallery cluster. Photo: W.G. Stock.

Space of Places

ICs are within easy reach in the "space of places," above all by air traffic and by high-speed trains as, e.g., Frankfurt/M., Germany, where air and rail passengers find—inside one

complex of buildings—an international airport, a high-speed train station, and a local traffic (*S-Bahn*) station [34]. Successful air-rail intermodal agreements lead to benefits for the customers, the airlines and airports, the rail operators and, finally, the environment [6].

Sectoral Mix and Labor Markets

We were able to identify key branches driving the development towards an informational city. In ICs, we find many companies in the information and communication sector. In London, about 8 per cent of all employees work in such an ICT firm. Further important (always very information-rich) labor markets are financial and insurance activities (in London, 13 per cent of the whole work force), professional, scientific and technical activities (in London, 13 per cent), education (in London, 8 per cent) and arts, entertainment and recreation (3 per cent) [32].

Political Willingness

One of the key objectives for the success of planning and constructing ICs is the political willingness of the city's administration to build or re-build the city under the conditions of the knowledge society. Mostly those ideas are fixed in master plans; always they are adequately funded either by public or private funds. In Singapore [22], we are able to identify political programs for the construction of a knowledge society since 1992 ("Intelligent Island"), followed by numerous further master plans as, e.g., "Intelligent Nation 2015" (Figure 8) or the current development of the "Smart Nation Platform."



Figure 8. Advertising for Singapore's Intelligent Nation Initiative. Source: mndsingapore.

E-Government

ICs' administrations rely on e-government [25], m-government (applying mobile apps and websites) [26] and e-participation (through social media channels and preferentially apps). Some governments communicate with their stakeholders via elaborate websites (in terms of maturity and usability). We found top mature e-government websites in Barcelona, Spain, Vienna, Austria, and Singapore; top usable sites come again from Vienna, but also from Seoul, Korea, and Shanghai, China. Other ICs prefer to use social media (especially Facebook, Twitter, and YouTube). Paris' Facebook site achieves by far the highest number of "likes." Governments in ICs tend to open their non-personal data ("open urban data") for reuse by everyone. Prime examples are Hong Kong, China, SAR, and Vienna, Austria [26]. Many ICs offer mobile applications based upon their open urban data (often also together with other open data, e.g. maps or photos). Those

m-apps are produced and financed either by governmental bodies or by private persons or companies (and so for free for government agencies). Examples for government-driven m-app development are Hong Kong, China, and Barcelona, Spain; an example for non-government-driven development is Vienna, Austria, while Singapore applies a mixed strategy (Figure 9).

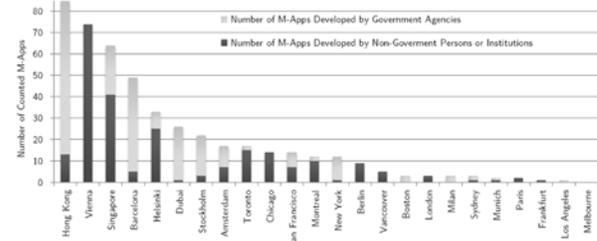


Figure 9. Urban mobile applications developed by government agencies and by non-government persons or institutions. Source: [26, p. 8].

Tolerance and Openness

If we are going to study tolerance and openness in a city, we can use four indicators: the ethnicity index (share of foreigners in the city), the refugee index (the amount of asylum applications and grants), the gay index (the amount of civil partnerships or the share of homosexual people in the city), and the cult site index (the amount of cult sites of different religions inside the city). There is a clear result of our IC research: The ICs behave differently. In all cities on the Arabian Gulf, the ethnicity index exhibits extremely high values, while the other three indexes only show low values. The gay index is relatively high in New York, NY (largest gay population in the U.S. by number, 760,000 people) and in San Francisco, CA (largest gay population in the U.S. by share, more than 6 per cent of the population). The cult site index exhibits for Tokyo thousands of temples and churches (Shinto, Buddhist, Christian and other religions).

Information Behavior

In the upcoming knowledge society the citizens' information literacy becomes a basic skill. Information literacy includes the abilities of creation and representation as well as of searching and finding information [45]. Many public as well as academic libraries in well-developed ICs offer courses in information literacy [18].

Due to network effects information markets on the Internet tend to quasi-monopolistic structures. There is only one standard service in a certain market and a certain world region. Google dominates in the search engine market in many regions, but not in Russia (here it is Yandex), South Korea (Naver) and China (Baidu). While Facebook dominates in many countries, Russian users prefer Vkontakte [2]. If we study information behavior in ICs, we have to consider these world-wide and local standards.

Are differences in Twitter activities in informational world cities? Förster et al. [13] collected more than 18 million tweets from the ICs and on those ICs. Paris in France has the highest amount of tweets from the city (found by

searching for geo-location), while Tokyo in Japan is in lead by the number of tweets on the city (found by search terms).

Location Factors

ICs exert attractive living, working and studying spaces (and other hard locational factors, most important a high wage level) as well as soft location factors (such as a fascinating city and optimal shopping and leisure activities) and a “magnet effect” on potential companies, employees and tourists. London, UK, banks on its historically grown urbanism; most Arabian Gulf cities prefer huge high-end shopping malls and futuristic cityscapes (Figure 10).



Figure 10. Cities of the knowledge society try to attract companies, employees and visitors by creating fascinating cityscapes. Especially some cities of the Gulf region as Dubai or Doha (photo) bank on architaument and futuristic buildings.
(Photo: W.G. Stock).

Problem Areas: Gentrification, Exploitation of Labor, and Loss of Identity

We have to pinpoint negative aspects of some specific informational cities. According to our interview partners, the reasons of these undesirable developments can often be found more in cultural and societal values than in the advancement towards the knowledge society.

We see gentrification in two forms. In some cities people with low incomes are dispelled from attractive downtown locations (as in Sao Paulo, Brazil, and Tokyo, Japan); and we observe people who are not able to migrate into ubiquitous cities due to their low income (e.g., in Songdo).

In Arab cities, but also in Singapore, the workforce mainly consists of expats. One cannot overlook the fact that well-trained professional groups are welcomed and highly paid, while unskilled foreign workers have to suffer from relatively low incomes and sometimes slave-like exploitations. However, the native Arab population is confronted with a massive foreign workforce given up to nearly 90% expat rates (as in Dubai and in Doha). For some citizens in Arab Gulf cities, the dark side of this special kind of globalization leads on to feel as strangers in their own country. Political counteractions as “Emiratization,” “Qatarization,” etc. with the goal of re-integrating domestic

workforce into jobs outside (very well paid) public services still fail.

Some of our interview partners talked about the possible loss of identity of “their” city: In many cities of the world the same architects and the same construction companies design exchangeable cityscapes, and in their shopping malls and shopping streets always nearly the same products are offered. Due to globalization, there is probably no single informational world city which does not host at least one Gucci or Cartier shop.

6. LESSONS LEARNT

What lessons have we learnt? Informational urbanism is a new interdisciplinary research area combining city sociology, architecture and urban planning, economics, information science, and computer science. The prototypical city of the knowledge society does not only bank on “smart city” initiatives, but additionally on the city’s knowledge, creative, and digital infrastructures, not to forget specific location factors attracting knowledge workers, the political willingness to create such an informational city, the city’s position in the space of flows (capital, power, and information) and the space of places (easy reachability), the information behavior of the citizens and the government (e-government, m-government) and—on the dark side of informational cities—gentrification, problematic labor conditions in some cities and the danger of a loss of the cities’ identity in a globalized world.

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Appendix: Analyzed Cities

- (1) World city project: Amsterdam (Netherlands), Barcelona (Spain), Beijing (China), Berlin (Germany), Boston (U.S.A.), Chicago (U.S.A.), Dubai (U.A.E.), Frankfurt (Germany), Helsinki (Finland), Hong Kong (China, SAR), Kuala Lumpur (Malaysia), London (United Kingdom), Los Angeles (U.S.A.), Melbourne (Australia), Milan (Italy), Montréal (Canada), Munich (Germany), New York (U.S.A.), Paris (France), San Francisco (U.S.A.), Sao Paulo (Brazil), Seoul (South Korea), Shanghai (China), Shenzhen (China), Singapore, Stockholm (Sweden), Sydney (Australia), Tokyo (Japan), Toronto (Canada), Vancouver (Canada), Vienna (Austria);
- (2) Regional project on Japanese cities: Tokyo, Yokohama, Osaka, Kyoto;
- (3) Regional project on Gulf cities: Kuwait City (Kuwait), Manama (Bahrain), Doha (Qatar), Abu Dhabi, Dubai, Sharjah (all United Arab Emirates), Muscat (Oman);
- (4) Project on ubiquitous cities: Oulu (Finland), Masdar City (U.A.E.), New Songdo City (South Korea);
- (5) Project on information literacy instruction: Montréal, Toronto, Vancouver (Canada);

(6) Project on information behavior (especially on social media use): Moscow (Russia), Düsseldorf (Germany).

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