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THE DEVELOPMENT OF INFORMATION SOCIETY IN JAPAN: A CASE STUDY OF 21 METROPOLITAN AREAS

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The Development of Information Society in Japan: A Case Study of 21 Metropolitan Areas

Synopsis:

Informational City is the prototypical city of the 21st century with several distinct characteristics (e.g., knowledge and information flows, creativity, digitization, livability).What exactly are Informational Cities and what is the state of their development? In this paper the different building blocks of an Informational City will be discussed in more detail and in context of the Japanese Information Society.

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Abstract

If you live in a developed country, have access to the high-speed Internet and uncensored information, and when you can freely unfold your innovative and creative spirit, you are most probably the member of an Information Society living in an Informational City. Informational City is the prototypical city of the 21st century with several distinct characteristics (e.g., knowledge and information flows, creativity, digitization, liveability). What exactly are Informational Cities and what is the state of their development? What is the typical city of our times? In this paper the different building blocks of an Informational City will be discussed in more detail and in context of the Japanese Information Society. Why Japan? It is one of the most developed and digitized countries in the world. It is also said to be the origin of the term Information Society. Previous research indicates that Tokyo, Kyoto, Yokohama and Ōsaka already are (emerging) Informational Cities. This notion will be revised by broadening this research to 21 Japanese metropolises. Was the urbanization process similar for all the investigated cities? Are Tokyo, Ōsaka, Kyoto and Yokohama indeed the best examples of Japanese Informational Cities or maybe are there other metropolises that outrun them in some areas?

1. Introduction

With the turn of the millennium approaching many researchers shared their visions of (future) cities. Manuel Castells (1989) introduced the so-called Informational City, which is often defined as a prototypical city of the 21st century and inhabited by the Network Society or, depending on the definition, Information or Knowledge Society (Stock, 2011; Yigitcanlar, 2010). What is the state of the modern and developed cities today? With this level of globalization and urbanization that we are facing, what is the typical city of our times? And, is this the best version of a city that we could dream of or is it rather the worst case scenario envisioned by researchers decades ago? First, let us take a look at few concepts of a modern city that we find in the current research.

Despite the concept of Informational City (Castells, 1989, 1993, 1996; Stock, 2011; Barth et al. 2015), characterized by the co-existence of two spaces—space of places (i.e. the geographical space) and the space of flows (including flows of information, money or power) that is created via digital networks—there are concepts of Future, Smart, Knowledge, or Creative Cities. Different scientists emphasize different aspects as the most important for the development of a modern city. Some of them focus on the digitalization and development of an advanced ICT infrastructure, characteristic for a Ubiquitous or Digital City (Droege, 1989; Shin, 2009). Other important factors appear to be knowledge and innovativeness, which are the main aspects of the Knowledge and Creative City (Carrillo, 2006; Florida, 2005; Landry, 2000; Yigitcanlar, 2010). Finally, there is a concept of Smart City (or Green City), based upon green infrastructure and sustainability. This city may be also called Smart City in a narrow sense as opposite to the Smart City in a broad sense, which in principle is similar to the notion of an Informational City (Fietkiewicz & Stock, 2015; Barth et al., 2015). "Smart City" is a fuzzy concept (Nam & Pardo, 2011), but it is possible to synthesize the diverse ideas into these two concepts: Smart City in a narrow sense, strongly linked to natural resources and ICT-driven sustainability, hence a green and sustainable city (Chourabi et al., 2012; Hall et al., 2000; Neirotti et al. 2014), and Smart City in a broad sense—perfectly characterized by Giffinger et al. (2007) enumerating several essential aspects of such city, as e.g., smart economy, smart people, smart governance, smart mobility, smart environment and smart living. The concept of the Informational City, as well as the one of a Smart City in a broad sense, encloses the other mentioned visions of the modern cities (knowledge, creative, or digital) as its

essential features. It appears that especially the term "Smart City" is highly beloved by city planners and governments, as it is used by marketing and PR-specialists the most. Another popular aspect present in press is the so-called liveability or quality of life that a city can provide. There are many organizations nominating the most liveable cities in the world (e.g., Economist Intelligence Unit[1], Mercer[2], Monocle[3]).

These are just few insights into the research on urban development. In this paper the different building blocks of an Informational City (or Smart City in broad sense) will be discussed in more detail and in context of the Japanese Information Society. Why Japan? Because it is one of the most developed and digitized countries in the world. It is also said to be the origin (or at least one of the origins) for the term Information Society. Finally, previous research indicates that the Japanese cities Tokyo, Kyoto, Yokohama and Ōsaka are (emerging) Informational Cities (Fietkiewicz & Pyka, 2014; Fietkiewicz, Pyka, & Sock, 2014; Fietkiewicz & Stock, 2015). This notion will be revised by broadening this research to 21 Japanese metropolises.

2. Development of the Information Society

The concept of Information Society is neither new nor it is agreed upon its origins. The phrase "Information Society" appeared in literature on diverse subject domains (Duff, 1995). But, who did really "invent" it? According to Cawkell (1986), most of the researchers agree that Fritz Machlup introduced the idea of a new stage for the society in 1962, although he called it the Knowledge Industry. Cawkell claims that the "idea of and Information Society" was implicit in Machlup's work (Cawkell, 1984). This notion was negated by Duff, Craig and McNeill (1996), who lead this term back to the Japanese *jōhōka shakai*. Against the idea that Machlup was indeed the first one to point out this societal change, Duff and colleagues argue that "the case for American invention of the information society reduces to claim concerning the invention of the knowledge industry and depending upon the legitimacy of identifying knowledge with information and industry with society […]. A society is […] a complex formation in which industry is only one of many components" (Duff, Craig & McNeil, 1996, p. 118). Their bibliographic research confirmed that there was no use of the term Information Society in English literature prior to 1970 (Duff, Craig & McNeil, 1996).

The Japanese terms *jōhō* and *jōhōka shakai* are translated as "information society" and "informised" or "informatised society". According to Morris-Suzuki (1988), the term Information Society was coined in Japan by Yujiro Hayashi in 1969 in two government reports, hence, before 1970. However, Duff et al. (1996) refer to findings by Yuichi Ito, who in the article "Birth of jōhō shakai and jōhōka concepts in Japan and their diffusion outside Japan", links the origins of the concept to the one of Information Industries. According to Ito, the term Information Industry was first used by Tadao Umesao in the article "Jōhō sangyo ron" ("On Information Industries") published in 1963, which supposedly caused the "information society boom" (Duff, Craig & McNeil, 1996). The phrase Information Society itself was first printed in 1964 in the newspaper Hoso Asahi, one of its editors being Michiko Igarashi. In the mid-1960s the newspaper published series of articles about the Information Society, indicating that the term had already began serving in Japan as "template for social theorizing" (Duff, 1995; Duff, Craig & McNeil, 1996). Still, wherever the term was used for the first time, it is possible that the concept surfaced independently in both countries based on the similar societal and technological developments in the developed regions (multiple discovery theory). Cawkell criticizes the discussion about its origins as "it seems inappropriate to ask: 'Who invented the information society?' Society evolves, it is not invented […]. No attempt is made to assign credit to the

[1] http://www.eiu.com/topic/liveability
[2] https://www.uk.mercer.com/newsroom/2015-quality-of-living-survey.html
[3] https://monocle.com/film/affairs/the-monocle-quality-of-life-survey-2015/

originator of the term – I am interested in evolution and effects" (Cawkell, 1996, p. 123). On this note, how did the concept of Information Society, which leads us to the notion of Informational Cities, evolve?

Fritz Machlup (1962) introduced the term Knowledge Industry and calculated that it represented 29% of the US gross national product. Even though knowledge has always played a part in the economic analysis, since "there has always been the basic assumption that sellers and buyers have knowledge of markets" and it has always been assumed that "producers have knowledge of the technology of the time" (Machlup, 1962, pp. 3f.), the growth of technical knowledge leading to growth in productivity (Machlup, 1962, p. 5) indicated the coming of a new kind of (U.S.) economy—the Knowledge Economy. Machlup also found the new field of information economics and identified information industries such as education, law, publishing as well as media and computer manufacture. This industrial transformation influenced research and urban development throughout the rest of the century.

The term Knowledge Economy was further popularized by Peter Drucker (1969) in his book "The Age of Discontinuity". He emphasized that knowledge "has become the central capital", which changed the labor forces and work (Drucker, 1969, p. ix). Drucker (1969, p. 10) writes:

> Between 1850 and 1870 the center of economic gravity shifted from the industries of the 'Industrial Revolution', coal and steam, textiles and machine tools, to new and different industries: steel and electricity, organic chemicals, and the internal combustion engine. Now, a hundred years later, we are in the early stages of a similar and equally drastic shift to industries based not only on new end different technologies, but on different science, different logic, and different perception. They are also different in their work force for they demand knowledge workers rather than manual workers.

These new industries may provide a "rapid economic growth in jobs, opportunities, income, standards of living, and aspirations for many decades," however, Drucker points out that they are most likely to emerge only in countries that have a "solid industrial and educational foundation," i.e. in developed countries (Drucker, 1969, p. 11). Since the groundwork on post-industrial, knowledge, and information society was laid from the 1960s and 1970s, a lot of research was conducted on modern city development in view of technological innovations and societal changes. More and more cities are "urging the rapid adjustment to a global information society, following Japan which embraced this concept already in the early 1970s" (Webster, 2002, p. 2). Many metropolitan regions increasingly concentrate on knowledge as a resource (Matthiessen, Schwarz, & Find, 2006), which is reflected in rising number of research on the Knowledge Cities.

In general, Knowledge Cities are "designed to encourage the nurturing of knowledge" (Edvinsson & Stenfelt, 1999). This may also include other similar concepts like Technopolis or Learning City (Martínez, 2006). There is a vast research merging the urban development with various kinds of knowledge, from knowledge-based urban development to knowledge management techniques for municipal planning. There are studies on definition of knowledge economy and its relation to globalization (Brinkley, 2006), on models of knowledge-based regional development (Etzkowitz & Klofsten, 2005), or cities as a knowledge tool and one of the most essential dimensions in knowledge economy (Edvinsson, 2006a). Edvinsson (2006b) derived critical success factors for an intelligent community being broadband infrastructure, knowledge work force, and innovative digital democracy. Again, we can see an interplay of knowledge and innovation, this time together with the aspect of digitalization.

According to Dvir and Pasher, "the notion of 'Knowledge City' is interchangeable to a certain degree with similar evolving concepts such as "Intelligent city" (Komnios, 2002), 'education city' (Figueras, 2004), or 'Smart City'" (Dvir & Pasher, 2004, p. 18). The authors also point out that "there

is always a unique combination of intangible factors which turn a specific ordinary urban organ into an innovation engine" (Dvir & Pasher, 2004, p. 21). Therefore, in this research the focus will not be set solely on the knowledge-based development and the Knowledge City, but on several constructs that established themselves in the research on urban development in context of the knowledge and information society. Therefore, despite the Knowledge City aspects, included are the Creative City (Hospers, 2003), which combines diversity and a positive image of competitive urban areas, where a creative process emerges to create a compelling attraction for the creative class (Florida, 2002, 2005), closely related to the aspect of Liveable City as well as Green City. And finally, to also include the solely technological aspect of urban development, the Digital City.

Based on the outlined research about modern city development, several indicators will be defined for the different building blocks of an Information City. This case study focuses on the Japanese Information Society and the development of 21 metropolitan regions. Was the urbanization process similar for all the investigated cities? Are Tokyo, Ōsaka, Kyoto and Yokohama indeed the best examples of Japanese Informational Cities or maybe are there other metropolises that outrun them in some areas?

3. Methods

In order to make founded statements about the investigated indicators statistical data (i.e., official statistics published by Japanese metropolitan governments) was used for this study. Table 1 lists the main sources for the applied statistics.

Table 1. Sources of the statistics.

Name	Source
Statistics Bureau	www.stat.go.jp/english/index.htm
Official Statistics of Japan	www.e-stat.go.jp
Tokyo Statistical Yearbook	www.toukei.metro.tokyo.jp/tnenkan/tn-eindex.htm
Municipal statistics	www.city.yokohama.lg.jp/ex/stat/daitoshi/
	www.city.yokohama.lg.jp/ex/stat/toukeisho/new/
	www.city.sapporo.jp/toukei/index.html
	www.city.sendai.jp/kikaku/seisaku/toukei/index.html
	www.city.chiba.jp/sogoseisaku/sogoseisaku/tokei/top.html
	www.city.kitakyushu.lg.jp/shisei/menu05_0096.html
	www.city.fukuoka.lg.jp/shisei/toukei/index.html
	www.city.saitama.jp/006/013/index.html
	www.city.sagamihara.kanagawa.jp/toukei/index.html
	www.city.niigata.lg.jp/shisei/toukei/index.html
	www.city.shizuoka.jp/000_000237.html
	www.city.hamamatsu.shizuoka.jp/gyousei/library/index.html
	www.city.kyoto.lg.jp/sogo/toukei/Publish/Monthly/index.html
	www.city.Ōsaka.lg.jp/shisei_top/category/1756-0-0-0-0.html
	www.city.sakai.lg.jp/shisei/tokei/index.html
	www.city.okayama.jp/category/category_00000200.html
	www.city.hiroshima.lg.jp/www/genre/1001000001491/index.html
	www.city.kumamoto.jp/html/aramashi/toukei/top/toukeisho.htm

The applied indicators also include the knowledge output in a city, which can be represented by the number of scientific publications (bibliometrics) and applied and granted patents (patentometrics). The number of scientific publications originating in a city can be measured with the help of the interdisciplinary database Scopus. With advanced search options it is possible to restrict the search to a concrete city and year: The patent applications were researched using Patentscope, a patent search system provided by the World Intellectual Property Organization (WIPO).

3.1 Investigated cities

In this study investigated are Japan's capital Tokyo and other 20 designated cities. Tokyo, Kyoto, Yokohama, Ōsaka, Kawasaki, Fukuoka, Nagoya, and Kobe are already advocated in the literature as global or word cities, digital cites, creative cities or smart cities (Droege, 1989; Friedmann, 1986; Hutton, 2004; Ishida & Isbister, 2000; Karan, 2005; Sasaki, 2010; Sassen, 2001). The investigated cities are Japanese megalopolises—Sapporo, Sendai, Saitama, Kawasaki, Nagoya, Kobe and Hiroshima, as well as cities with under 1 million inhabitants (but still of significant size, i.e. with over 700,000 citizens)—Chiba, Sagamihara, Niigata, Shizuoka, Hamamatsu, Sakai, Okayama and Kitakyushu. We already find studies of four Japanese cities (Tokyo, Yokohama, Kyoto, Ōsaka) and their development as Informational Cities (Fietkiewicz & Pyka, 2014; Fietkiewicz, Pyka, & Stock, 2015; Fietkiewicz & Stock, 2014; Fietkiewicz & Stock, 2015). Inclusion of further metropolises might give us more insights in the development of the Japanese Information Society. This research may also reveal (new) Japanese Green, Knowledge, Creative, Digital or Liveable Cities that until now did not find enough recognition in the literature.

Japan has 47 prefectures with 1,718 municipalities and the 23 wards (Ku) in metropolitan Tokyo. Municipalities with 500,000 inhabitants or more are eligible for designation as "ordinance-designated cities" (Statistics Bureau Japan, 2016). Figure 1 shows the 20 designated cities that are, next to Tokyo, in focus of this investigation.

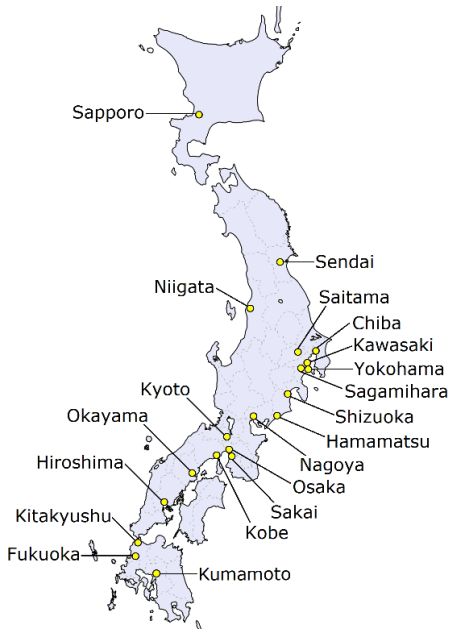

Figure 1 Investigated "designated cities" in Japan.
Source: https://en.wikipedia.org/wiki/File:Ordinance_designed_Cities_English.png.

3.2 Data processing and statistical analysis

In order to evaluate the performance of the investigated cities and to be able to compare them, it was necessary to (1) calculate the relative values of the indicators (since the cities are of different sizes, which in turn has influence on most of the applied measures), and (2) normalize the data (since the gathered measures are of different types). In order relativize the data it was necessary to, for example, set it into relation to the number of inhabitants (e.g., number of cars or number of students per 100,000 inhabitants). The second step, the normalization process, enables a comparison of different data types and leads to an evaluation and ranking of a city relative to the performance of other investigated metropolises. For each indicator that could be assessed with a numeric value, a value of 100 was assigned to the city with the best result. The values for other cities were computed by dividing their value by the non-normalized value for the best city and multiplied by 100:

$$I_{max} = \frac{analyzed\ value}{best\ value} \times 100\%$$

Should the smallest value be "better", for example, lower pollution-levels are better than higher ones, the normalized value was computed as follows:

$$I_{min} = \frac{best\ value}{analyzed\ value} \times 100\%$$

This way for each indicator the value of 100 shows the most desirable, positive outcome that can be reached by the investigated cities. Each investigated dimension consists of several indicators. These indicators were established based on the relevant literature. To ensure the internal consistency within a dimension and the reliability of the test method, the Cronbach's alpha was computed for each dimension. If the indices yield a value smaller than 0.6, they were considered separately for the analysis. The indicators were chosen for year 2016, as this was the year where most of the data was available for all metropolises. The indicators chosen for the dimensions knowledge city, creative city, digital city, smart/green city and livable city will be presented in more detail in the following paragraphs discussing the respective dimension.

4. Dimensions of the Informational City

4.1 Knowledge City

As already indicated in the introduction, knowledge is one of the most important factors in today's economy and, therefore, there is a growing interest in the concept of the Knowledge City. Development towards such city can provide it with the (knowledge) infrastructure that nurtures the knowledge economy. The knowledge city has "instruments to make knowledge accessible to citizens," e.g. network of public libraries, cultural facilities and services with an educational strategy (Dvir & Pasher, 2004). The knowledge economy requires an access to networked infrastructures (scientific, financial, technical and educational) in (preferably central) urban locations, and the special proximity enables an effective generation and exchange of knowledge (Yigitcanlar, Velibeyoglu, & Martinez-Fernandez, 2008). What are the benefits of a Knowledge City? Increase in well-paid employment, growth in community wealth, sustainable economy, revitalization of traditional business, boost of tourism, investments in public domains, creation of knowledge communities, better education services, creation of tolerant environment towards minorities and immigrants. (Ergazakis, Metaxiotis, & Psarras, 2004, p. 9). Universities also contribute innovativeness to a city and play an instrumental role in all visions and

strategic plans of the knowledge cities (Dvir & Pasher, 2004). The knowledge economy requires certain knowledge infrastructure and a vibrant urban life characterized by diversity and tolerance (Florida, 2005). The aspect of creativity and diversity or openness will be further outlined within the paragraph on the Creative City.

In this research, the investigated indicators of a Knowledge City are divided into three dimensions (Table 2): the knowledge infrastructure and its usage, the affordability of education, and the knowledge output. The knowledge infrastructure includes such institutions as universities and libraries. In terms of its usage considered were the relative amount of students, graduates and faculty members at the universities. The affordability of this infrastructure is expressed by the average monthly expenditure on education relative to the total average monthly spending. The knowledge output is measured by the relative number of publications (available on Scopus), and number of patent applications (according to Patenscope). The internal consistency of dimensions with more than one indicator was estimated using Cronbach's alpha. As for the Knowledge City investigation, only the indicators of knowledge infrastructures and its usage can be summarized to one value, as the coefficient alpha is slightly above 0.7.

Table 2. Dimensions and indicators of a Knowledge City.

Dimensions	**Indicators**	**Cronbach's α**	
Knowledge Infrastructure and its usage	Universities per 100k inhabitants Libraries per 100k inhabitants Students per 100k inhabitants Graduate students per 100k inhabitants Faculty members per 100 students	0.742	0.681
Affordability	Expenditure on education	-	
Knowledge Output	Publications per 100k inhabitants Patents per 100k inhabitants	0.239	

4.2 Digital City

The Internet facilitates interconnectivity between individuals and information, hence, it has a significant impact on society, economy and culture (OECD, 2013, p. 6). Furthermore, almost all people on earth are living within the reach of a mobile-cellular signal. Nowadays, these diverse communication networks became indispensable and, therefore, it is important to monitor the ICT-development (International Telecommunication Union, 2013). Broadband can be simply defined as a technology enabling a high-speed data transfer and it became a key priority of the 21st century. It is assumed that it leads to an economic and social growth, because it creates an environment nurturing the technological innovation. The development of broadband technology improves productivity, since it facilitates the utility of more efficient business processes. Furthermore, it accelerates innovation by introducing new consumer applications and services (International Telecommunication Union, 2012). Apparently, "countries with 80% broadband penetration are more than twice as innovative as countries with 40% penetration" (Sabbagh, Friedrich, El-Darwiche, & Singh, 2010). An important aspect of advanced ICT-infrastructure is the universality and affordability of broadband, as it ensures that it is inclusive, and can be utilized in public services, e.g., health, education or social integration (Sabbagh, Friedrich, El-Darwiche, & Singh, 2010).

How did ICT develop in Japan? The major periods in Japanese ICT development since the telecommunications liberalization in 1985 are the age of telephone (1985 to 1995), the age of the Internet and mobile phone (1995 to 2005), and the age of broadband and the smartphone (since 2005) (MIC, 2015). The Internet access services did not become commercially available until the early 1990s, but already by 1998 the Internet household penetration rate passed the 10%-threshold. At the beginning, the Internet connections were mostly dial-up connection via telephone or ISDN line, followed by cable TV internet and digital subscriber line (DSL). The number of mobile phone subscribers increased by 100 million subscription per year from 1996 to 2002 (MIC, 2015, p. 3). With the 2000s the industry shifted to fiber optics as the primary technology for fixed-line communications networks, leading to migration to FTTH. The total FTTH overcome DSL subscriptions in 2008. When comparing the broadband prices per Mb/s among OECD member states in 2014, Japan had the lowest broadband prices, and when "viewed by speed and price together, Japan can be said to have the world's highest standard broadband environment" (MIC, 2015, p. 5).

There are many indicators to quantify the development of ICT (i.e. digital or ubiquitous) infrastructure in countries and/or cities. In this case study adapted are only some of them, since several aspects cannot be investigated at a city level or are irrelevant in case of Japanese cities (e.g., literacy rate). Also, the indices were narrowed to data that was actually available for the cities in question. The final selection incudes two dimensions (Table 3): the infrastructure (with the relative number of mobile phone, DSL, and FTTH subscriptions) and the affordability of ICT (the average monthly expenditure on ICT relative to the total monthly spending). All indicators will be analyzed separately (Cronbach's alpha is smaller than 0.4). It is important to keep in mind that the outcomes of this study only reflect respective city's performance relative to other Japanese cities and does not include objective or agreed upon thresholds for low- or highly-developed Informational City. As for Digital City investigation, it is important to remember that the Japanese broadband environment has one of the highest standards in the world.

Table 3. Dimensions and indicators of a Digital City.

Dimensions	**Indicators**	**Cronbach's α**	
Infrastructure	Mobile phone subscriptions per 100k inhabitants DSL subscriptions per 100k inhabitants FTTH subscriptions per 100k inhabitants	0.347	0.366
Affordability	Avg. monthly spending on ICT	-	

4.3 Creative City

There is a rising interest in the role of creative industries in the urban development as the economy is driven not only by the knowledge and information, but also by the human creativity. It contributes to the entrepreneurship and fosters innovation (UN, 2008, 2010, 2013). In the 19th and 20th century the dominant industries depended on materials as well as science and technology. Now, in the 21st century, it depends on knowledge generation based on creativity and innovation (Landry & Bianchini, 1995). After the decline of traditional manufacturing industries and restructuring leading to de-industrialization, there was a need for new drivers of local and regional economic growth and many governments began to implement culture as a strategy (Zheng & Chan, 2014). Recent works point to the creative economy as a strategy for the fostering of regional development (Fachinelli, Carrillo, & D'Arisbo, 2014). According to Florida (2005), there may also be a relation between the degree of

competitiveness of a country, or city, and its degree of creativity. "Creativity is neither a new concept nor an economic term; however, what is new is the nature and extent of the relationship between economics and creativity, and how the two combine to generate value and wealth" (Fachinelli, Carrillo, & D'Arisbo, 2014, p. 5615). Florida (2002, 2005) carried out a research program on the creative workers, and their impact on public policies that drive the creative economy.

"Historically, creativity has always been the lifeblood of the city. Cities have always needed creativity to work as markets, trading and production centers, with their critical mass of entrepreneurs, artists, intellectuals, students, administrators and power-brokers. They have mostly been the places where races and cultures mix and where interaction creates new ideas, artefacts and institutions" (Landry & Bianchini, 1995, p. 11). The aspect of diversity appears to be important for the level of creativeness, since "similar people will generate similar ideas. Some innovative organizations deliberately increase diversity in the work force. Diverse experience, cultural backgrounds, professions, academic background, ages, and personalities contribute to the creation of fruitful dialogues based on multiple perspectives" (Dvir & Pasher, 2004, p. 20). Therefore the aspects of diversity/openness will be included in the concept of Creative City.

It appears that every city should want to be not only smart and digitized, but also creative. However, is there possibly a bad side to this development? Pratt (2011, p. 125) argues, that the indicators of a creative city are similar to the ones of "quality of life", and both of them have the same two-faced character. Firstly, they appear to be a win-win solution, as the goal is a nice, safe, and clean city with a lot of jobs. But then it gets clear that the strategy targets the life's quality of only limited group of people – managers or cosmopolitan lifestyle migrants (Pratt, 2011). Furthermore, the "process of the influx of higher income and/or different cultural capital is the core of the generalized process of gentrification" (Pratt, 2011, p. 127). The process of gentrification became common in big cities, and is one of the negative effects of the current urban development. However, in this study the negative effects like gentrifications will not be included in the analysis.

Four dimensions were defined for the Creative City investigation (Table 4): the infrastructure (relative number of museums, libraries, and cultural spots), the affordability (average monthly spending on culture and entertainment), creative output (relative number of publications, i.e. scientific creativity, and the relative number of registered patents, i.e. innovative output), and, finally, openness (amount or religious institutions and ratio of foreigners living in the city). When considering Cronbach's alpha values, the indicators should be analyzed separately.

Table 4. Dimensions and indicators of a Creative City.

Dimensions	**Indicators**	**Cronbach's α**	
Infrastructure	Museums per 100k inhabitants Cultural spots per 100k inhabitants Libraries per 100k inhabitants	0.416	0.604
Affordability	Avg. monthly spending on culture and entertainment	-	
Output	Publications per 100k inhabitants Patents per 100k inhabitants	0.239	
Openness	Religious institutions per 100k inhabitants Ratio of registered foreigners	0.027	

4.4 Green City

Most of the world's population lives in urban areas. Modern cities are very complex systems with different modes of transport, communication networks, services and utilities (Neirotti et al., 2014). However, the rapid urbanization often generates traffic congestion and pollution (Neirotti et al., 2014). Cites generate approx. 70% of the worldwide CO2 emissions and cause air, water and environmental pollution (Intelligent Cities, 2013). Considering this development, the green economy (and governance) has been one of the main themes in the international debates on sustainable development (Olivieraa et al., 2013). Urban green space provides critical ecosystem services and promotes physical activity, psychological wellbeing, and the general public health of urban residents. It improves life quality for city dwellers and may filter air, remove pollution, and attenuate noise and cool temperature (Wolch, Byrne & Newell, 2014).

Smart city, intelligent city, green or innovation city - there are different terms to describe a sustainable metropolis. These terms are all very vague and allow room for individual interpretation and preferences, however, what seems to be common is that the smart city is considered to be sustainable, efficient, and liveable at the same time (Intelligent Cities, 2013). Vanolo (2013) defines a smart city as an efficient, technologically advanced, green and socially inclusive city. There are also regional studies, as, for example, the Asian Green City Index – a research project conducted by the Economist Intelligence Unit and sponsored by Siemens (Siemens AG, 2011). During this project, the environmental performance of 22 Asian cities was measured (including Tokyo, Yokohama and Ōsaka). The cities' performance is evaluated on a 5-point scale from "well below average" to "well above average" and based on 8 main categories: (1) energy and CO2; (2) transport; (3) water; (4) land use and buildings; (5) waste; (6) sanitation; (7) air quality; and (8) environmental governance (Siemens AG, 2011).

For this study four dimensions of Green City were defined (Table 5): pollution (including several typical pollution components), motorization level (number of registered cars, the less the better), green space, and affordability of public communication (average monthly spending on public communication).

Table 5. Dimensions and indicators of a Green City.

Dimensions	**Indicators**	**Cronbach's α**	
Pollution	NO PM CO SO2	0.654	0.500
Motorization	Number of registered cars per 100k inhabitants	-	
Green space	Number of parks per 100k inhabitants	-	
Affordability	Avg. monthly spending on public communication	-	

4.5 Liveable City

Cities have always been centers of cultural activities, but especially during the post-industrial period the cultural and leisure activities have been gaining importance. The globalization and shifting from traditional to creative or cultural industries are responsible for this growth. Consequently, the production and consumption of culture and leisure, e.g. arts, fashion, music, tourism etc. is in focus of researchers and politicians (Gospodini, 2009, p. 11). Activities and spaces previously perceived as marginal are

becoming significant (Crewe & Beaverstock, 1998). The economic globalization had strong effects on cities and urban networks and due to the mobility of capital, cities are interchangeable entities. Now, an Informational City has to attract many foreign visitors, tourists, or businessmen, and therefore it should include appropriate institutions rising interests of these groups, like e.g. museums, galleries, theatres, or host big events (Stock, 2011). It has to offer more incentives for capital input, either through economic attractiveness (e.g. tax abatements, transport facilities) or by amendments in its soft infrastructure, which involves the development of creative, cultural, and leisure organizations as well as the enhancement of city's image by landscape transformation (Gospodini, 2006, p. 311).

Gospodini (2009) argues that culture can create a new urban image and makes the city more attractive to new capital and professionals. The growth of cultural industries results from an increasing income and disposable time of the middle classes (Gospodini, 2009). The cities become consumer landscapes, including leisure, entertainment and shopping (Stock, 2011). Consumption is currently one of the most active arenas of contemporary sociological research and it undergoes some significant changes. These changes lead to the reorientation of priorities, like i.e. favoring the theme park over the shop floor, shopping over laboring, consumption over production, and lifestyle over class (Emmison, 2003, p. 212). Annually re-occurring rankings show us cities whit the highest quality of life, hence, most liveable metropolises. Some of the considered indicators in these rankings are: stability (safety), healthcare, culture and environment, education and infrastructure (according to The Economist)[4].

There are six dimensions of Liveable City defined for this study: crime (amount of felonies and violent crime), unemployment rate, suicide-rate (note that high suicide rates, mostly related to issues at work, are very common in Japan), shopping possibilities, entertainment spots and affordability (average monthly spending on culture and entertainment). As for the unemployment ratio, the official statistics did not include people doing housework (usually women) as unemployed but defined them as non-labor population (together with young people going to school). Following, this indicator includes all unemployed people (excluding housewives, pupils and students) relative to the number of potential workforce (people over 15 years old). The amount of felonies and violent crimes will be summarized into the dimension "crime" as Cronbach's alpha equals 0.780.

Table 6. Dimensions and indicators of a Liveable City.

Dimensions	**Indicators**	**Cronbach's α**	
Crime	Felonies per 100k inhabitants Violent Crime per 100k inhabitants	0.780	0.085
Unemployment	Unemployment rate (for 2015)	-	
Suicide rate	Suicide rate per 100k inhabitants	-	
Shopping	Retail stores per 100k inhabitants	-	
Entertainment	Entertainment spots per 100k inhabitants	-	
Affordability	Avg. monthly spending on entertainment	-	

5. Results

In the following, the data for 21 Japanese cities and the different Informational City categories (Knowledge, Digital, Creative, Green, and Liveable) will be presented. First, an overview of the

[4] http://www.eiu.com/topic/liveability

indicators will be shown on a spider chart. This visualization enables us to recognize whether there are cities that significantly stand out from the investigated metropolises for some of the indicators or whether maybe the outcomes are rather similar for all cities. Afterwards, a summary of a *k*-means cluster analysis (set to 3 clusters) will follow, to detect potential groups of cities that might have underwent a similar urban development.

5.1 Knowledge City

Figure 2 summarizes the values for Knowledge City dimensions. Especially for the indicators of the knowledge flow, i.e. patents and publications, as well as for the dimension knowledge infrastructure and its use, few cities stand out. Regarding patents, the most registrations are from Tokyo and Ōsaka (this innovative output comes mostly from companies), however, the most publications are from Kyoto (scientific output that originates at universities). As for the affordability of education, the outcomes are rather similar. Few of the smaller cities, like Kumamoto or Kitakyushu, show the lowest average expenditure on education.

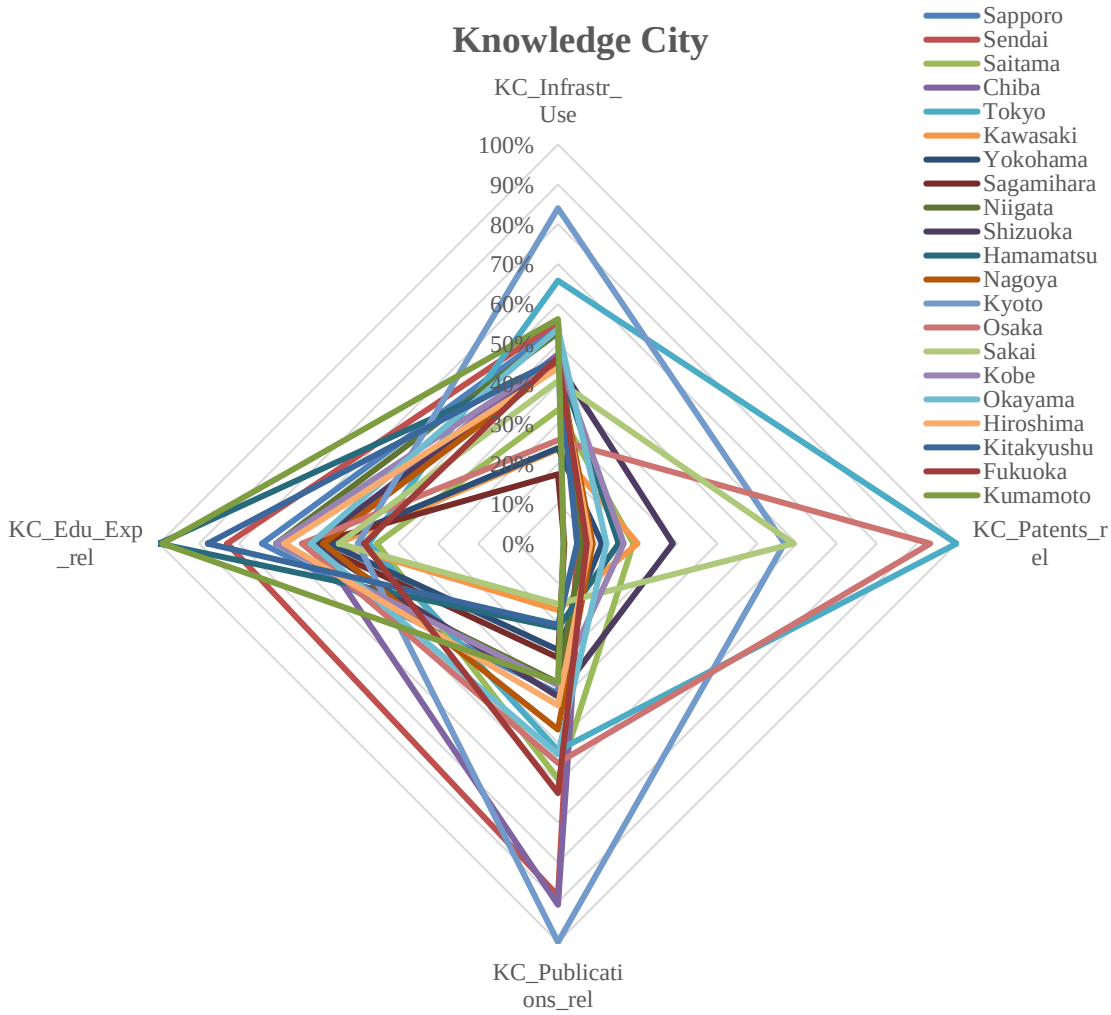

Figure 2. Indicators of the Knowledge City for 21 Japanese metropolises.

Table 7 summarizes the outcomes of the *k*-means cluster analysis. The first cluster seems to include the most developed Knowledge Cities in Japan: Tokyo, Kyoto and Ōsaka. These cities have the most universities, students and graduates and the highest knowledge output (publications and patents,

whereas the gap between this cluster and the second best cluster is very big). They have second most libraries and faculty members per 100 students (providing enough faculty members is probably a greater challenge for cities with many students and might be easier for smaller cities/universities). The average monthly spending on education is the highest for this cluster, however, it is not necessarily influenced by higher prices, but might also be an outcome of greater interest in education, meaning that people are keener to invest in this area. The second cluster might be seen as Knowledge Cities in making (Chiba, Fukuoka, Kobe, Okayama and Sendai), as included cities have second most universities, students, graduate students and publications as well as the most faculty members per 100 students. However, they have the fewest patents (lower innovative output) and libraries. Finally, the third cluster is characterized by the lowest spending on education (meaning in general either low-priced education or less interest in spending money on it) and most libraries. However, these factors do not seem to positively influence the knowledge output as the cities have the least publications and second least patent registrations. The low output in scientific knowledge might be explained by the lowest amount of universities, students, graduates and faculty members.

Table 7. Summary of the *k*-means cluster analysis results for Knowledge City indicators.

Knowledge City	**Cluster 1 (N=3)**	**Cluster 2 (N=6)**	**Cluster 3 (N=12)**
Cities	Tokyo, Kyoto, Ōsaka	Sendai, Chiba, Nagoya, Kobe, Okayama, Fukuoka	Sapporo, Saitama, Kawasaki, Yokohama, Sagamihara, Niigata, Shizuoka, Hamamatsu, Sakai, Hiroshima, Kitakyushu, Kumamoto
Characteristics	• highest amount of universities, students and graduate students, • most patents (very big gap to the second cluster) and most publications, • 2nd most faculty members per 100 students and 2nd most libraries, • highest expenditure on education.	• 2nd most universities, students, and graduate students, • most faculty members per 100 students • 2nd most publications, • fewest patents, • fewest libraries • 2nd highest expenditure on education.	• least universities, Students, graduate students, faculty members, and publications, • 2nd most patents • most libraries • lowest spending on education.

5.2 Digital City

In Figure 3, we can see the spider chart of Digital City indicators. Here, Tokyo is the one city that stands out most. It has by far the most mobile phone subscription as well as most FTTH subscriptions per 100,000 inhabitants. Hiroshima and Hamamatsu have the most DSL subscriptions, which is, however, the technology that preceded FTTH (hence, a higher FTTH penetration rate is more important for a developed Digital City than, e.g., DSL network).

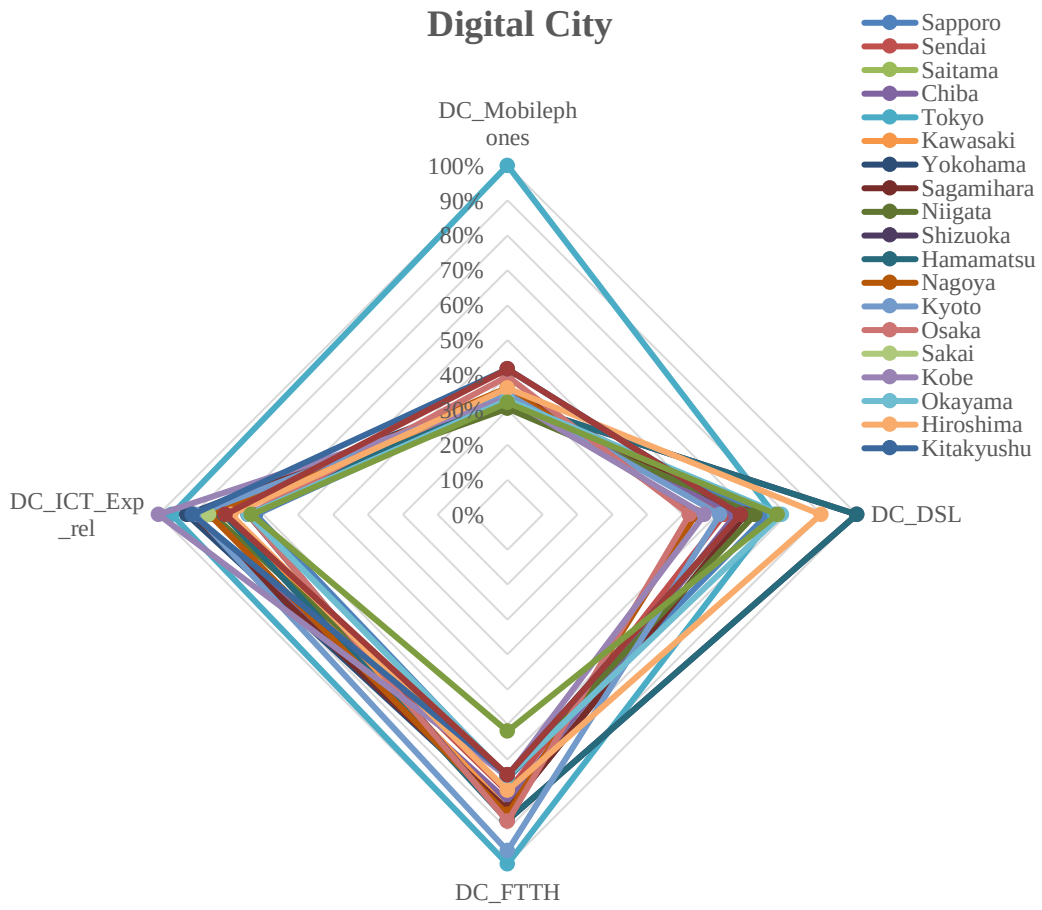

Figure 3. Indicators of the Digital City for 21 Japanese metropolises.

In Table 3, we can see the three Digital City clusters. The most digitized one appears to be cluster 2 including only Tokyo. This exemplification of only one city might be due to the big gap between Tokyo and the other cities regarding the amount of mobile phone subscriptions. Tokyo also has the most FTTH subscriptions, second most DSL subscriptions and the lowest spending on ICT. The third cluster is not so far behind. It has second most mobile phone and FTTH subscriptions as well as second lowest spending on ICT. This cluster includes in total 13 cities, above all Kyoto, Ōsaka, Yokohama or Kobe. Cluster 1 appears to perform the worst, as in these 6 cities (e.g., Sapporo, Hiroshima, or Kumamoto) there are the least mobile phone and FTTH subscriptions but the most DSL connections. Finally, the average monthly spending on ICT is also the highest.

Table 8. Summary of the *k*-means cluster analysis results for Digital City indicators.

Digital City	**Cluster 1 (N=6)**	**Cluster 2 (N=1)**	**Cluster 3 (N=13)**
Cities	Sapporo, Shizuoka, Hamamatsu, Okayama, Hiroshima, Kumamoto	Tokyo	Sendai, Saitama, Chiba, Kawasaki, Yokohama, Sagamihara, Niigata, Nagoya, Kyoto, Ōsaka, Kobe, Kitakyushu, Fukuoka
Characteristics	• least mobile phone and FTTH subscriptions, • most DSL, • highest ICT spending.	• most mobile phone and FTTH subscriptions, • 2nd most DSL, • lowest spending on ICT.	• 2nd most mobile phone and FTTH subscriptions, • least DSL, • 2nd lowest ICT spending.

5.3 Creative City

The indicators for Creative City show very differentiated results within each city's performance (Figure 3). This could indicate that some of the indicators should be re-considered as being suitable to unambiguously describe a Creative City. We can see that Kyoto has the most museums, religious organizations and publications, however, Tokyo and Ōsaka have the highest ratio of foreigners living in the city and the most patents. Kumamoto seems to have the most libraries and the lowest spending on culture and entertainment, however, these are the only aspects where this city performs well. The same stands for Kitakyushu, which might have the most cultural spots, but does not overcome other cities in the remaining aspects.

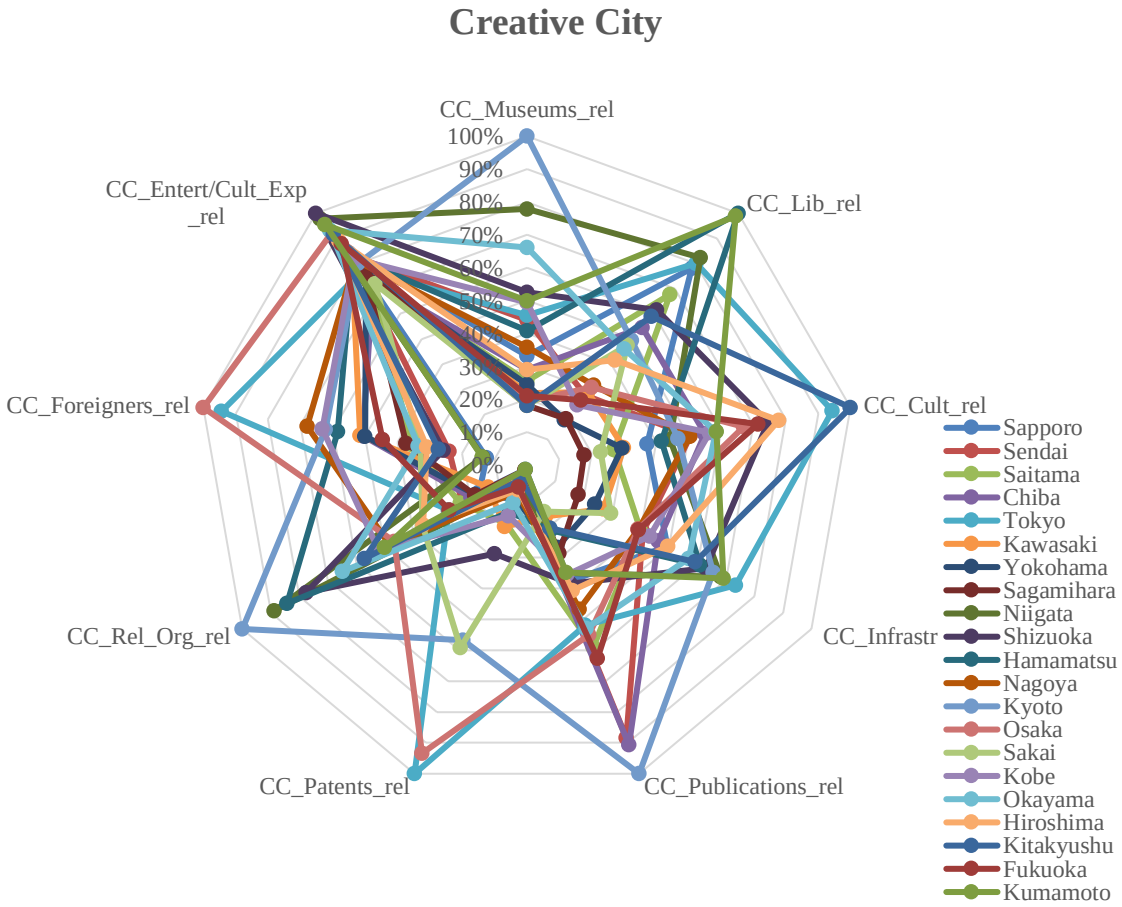

Figure 2. Indicators of the Creative City for 21 Japanese metropolise**s.**

When considering the outcomes of the cluster analysis (Table 9), again Tokyo, Ōsaka and Kyoto stand out. They seem to be the most distinct Creative Cities, however, of slightly different types. This is indicated by the fact that Kyoto occupies cluster 2, whereas Ōsaka and Tokyo are in a separate cluster (3). In Kyoto we find the most museums and religious organizations, there are also the most publications. However, there are the least libraries and cultural spots. In Kyoto live second most foreigners (around one-third less than in Ōsaka and Tokyo, however, one-third more than in remaining cities from cluster 1). Finally, in Kyoto the expenditure on culture and entertainment is the highest (however, there are no big gaps between the clusters regarding this aspect). When considering the second type of advanced Creative City (cluster 3), the cities have the least museums and religious organizations, but the most libraries, cultural spots as well as most patent registrations and foreigners living in the city. They have second most scientific publications and the lowest expenditure on entertainment and culture. The differences between cluster 2 and 3 can be explained by the different cultural and historical development of the cities. Kyoto was the former capital of Japan and is not only

a historical, but also a sacred site. Therefore it is not surprising that we find the most religious spots next to the most museums there. The scientific output is very high, which can be explained by high amount of universities. Tokyo and Ōsaka are more modern and "globally"-oriented and with the highest ratio of foreigners in the city (and most probably foreign companies), they also have the most patent registrations.

Table 9. Summary of the k means cluster analysis results for Creative City indicators.

Creative City	Cluster 1 (N=18)	Cluster 2 (N=1)	Cluster 3 (N=2)
Cities	Sapporo, Sendai Saitama, Chiba, Kawasaki, Yokohama, Sagamihara, Niigata, Shizuoka, Hamamatsu, Nagoya, Sakai, Kobe, Okayama, Hiroshima, Kitakyushu, Fukuoka, Kumamoto	Kyoto	Ōsaka, Tokyo
Characteristics	• 2nd most museums, libraries, cultural spots and religious organizations, • least publications and patents (very big gap to other clusters), • least foreigners, • 2nd lowest expenditure.	• most museums, publications, and religious organization, • least libraries (small differences), least cultural spots, • 2nd most patents and foreigners, • highest expenditure on entertainment.	• least museums and religious organizations, • most libraries and cultural spots, • 2nd most scientific publications, • most patents, and foreigners, • lowest expenditure.

5.4 Green City

In Figure 4 we can see the data for Green City evaluation. There is no city that significantly stands out in this category. The most parks are in cities like Kitakyushu or Niigata, the lowest pollution seems to be given in Kumamoto and Niigata, however, the least cars are registered in some of the biggest cities, like Tokyo and Ōsaka.

It is not easy to clearly define which one of the clusters includes the most advanced Green Cities (Table 10). Cluster 3 comprises, among others, the biggest cities (Tokyo, Ōsaka, Yokohama, Kyoto). In these cities we find, for example, the least registered cars. It could be influenced by the fact that having a car in a city like Tokyo is not only impractical (heavy traffic and insufficient parking space) but also very expensive (expensive parking). Cities in this cluster also have the second most parks and the highest expenditure on public transportation (this can be attributed either to higher prices of public transportation or to a more frequent use of it, which seems more plausible since there are fewer cars registered). Compared to other clusters, the pollution is partially the highest (particular matter, CO) or second highest (SO2, NO2). In cluster 2 we find cities with the most parks and lowest spending on transportation. The latter aspects could be also influenced by the fact that these cities have the most registered cars per 100,000 inhabitants. As for the pollution levels, they are lower than in cities from cluster 3. Finally, cluster 1 includes cities with the least parks and second most registered cars. The pollution levels oscillate from high (CO2), through medium (NO2, particular matter), to low (SO2).

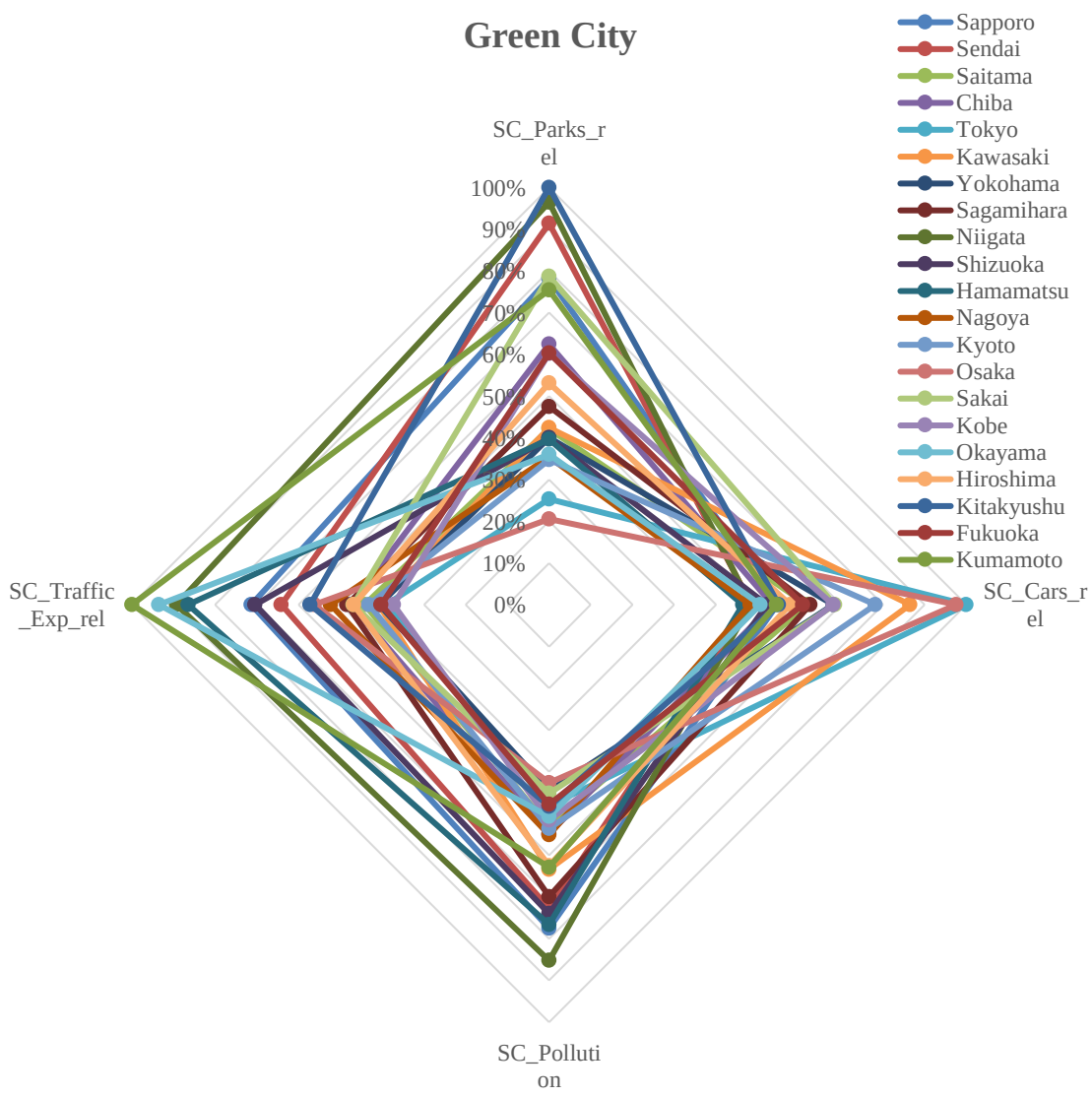

Figure 3. Indicators of the Green City for 21 Japanese metropolises.

Table 10. Summary of the k means cluster analysis results for Green City indicators.

Green City	**Cluster 1 (N=4)**	**Cluster 2 (N=6)**	**Cluster 3 (N=11)**
Cities	Sagamihara, Shizuoka, Nagoya, Hiroshima	Sapporo, Sendai, Niigata, Hamamatsu, Kitakyushu, Kumamoto	Saitama, Chiba, Tokyo, Kawasaki, Yokohama, Kyoto, Ōsaka, Sakai, Kobe, Okayama, Fukuoka
Characteristics	• least parks, • 2nd most cars, • pollution: highest level of CO, 2nd highest level of NO2 and particular matter, lowest level of SO2), • 2nd lowest expenditure.	• most parks, • most cars, • pollution: lowest level of PM, NO2, and CO, 2nd lowest level of SO2, • lowest spending on transportation.	• 2nd most parks, • least cars, • pollution: 2nd lowest/highest level of PM and CO, highest levels of SO2 and NO2, • highest expenditure on transportation.

5.5 Liveable City

The final category are the Liveable Cities. Looking at Figure 5 we can find few cities standing out (either positively or negatively). Okayama, Sendai and Sapporo have the most retail stores. Tokyo, Yokohama and Kawasaki have the lowest unemployment rate. Kawasaki, Hiroshima and Okayama have the lowest suicide rate. Regarding the rather negative outliers, we find the highest unemployment rate in Kumamoto and the highest suicide rate as well as crime rate in Ōsaka. These outcomes do not necessarily indicated that, e.g. Ōsaka is more dangerous and crime-driven than other cities in the world. In general, Japanese cities (including Ōsaka) are some of the safest cities worldwide[5]. The values that are presented in this research are relative to the numbers of crime rates in other investigated Japanese cities (hence, the standards are set very high).

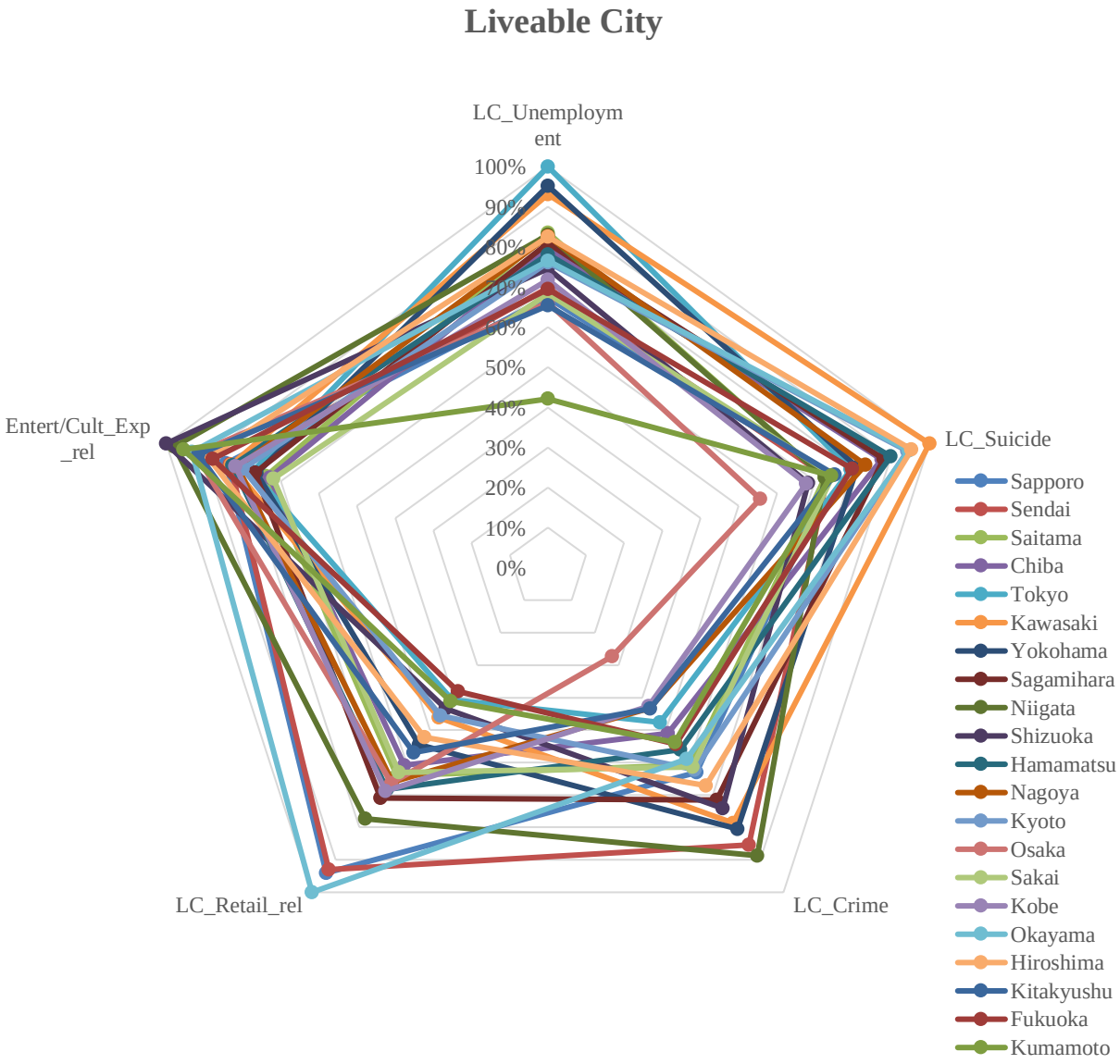

Figure 4. Indicators of the Liveable City for 21 Japanese metropolise**s.**

In Table 11 we find the Liveable City clusters. Cluster 2 and 3 seem to score better regarding the investigated aspects. Cluster 3 includes 14 cities, e.g. Tokyo, Kyoto and Yokohama. In these cities both, the unemployment rate and the suicide rate, are the lowest. Furthermore, the level of crime is

[5] https://safearound.com/danger-rankings/cities/

second lowest/highest. They also have the lowest amount of retail stores and second lowest/highest amount of entertainment facilities. Regarding cities in cluster 2, which include Sapporo, they have the second highest/lowest unemployment and suicide rate as well as the lowest crime rate. They have the most retail stores, however the fewest entertainment spots. Finally, in cluster 1 we find cities that, compared to other Japanese cities, did not perform well. In Kitakyushu and Ōsaka we find the highest levels of unemployment and suicide as well as the highest level of crime. Still, they have the most entertainment spots as well as the lowest spending on entertainment and culture.

Table 11. Summary of the k means cluster analysis results for Liveable City indicators.

Liveable City	**Cluster 1 (N=2)**	**Cluster 2 (N=5)**	**Cluster 3 (N=14)**
Cities	Kitakyushu, Ōsaka	Sapporo, Sendai, Sagamihara, Niigata, Okayama	Saitama, Chiba, Tokyo, Kawasaki, Yokohama, Shizuoka Hamamatsu, Nagoya, Kyoto, Sakai, Kobe, Hiroshima, Fukuoka, Kumamoto
Characteristics	• highest level of unemployment, suicide, and crime, • 2nd most retail stores, • most entertainment spots, • lowest expenditure on entertainment and culture.	• 2nd lowest unemployment and suicide rate, • lowest crime level, • most retail stores, • least entertainment spots, • 2nd highest expenditure.	• lowest unemployment and suicide rate, • 2nd lowest crime rate; • least retail stores; • 2nd most entertainment spots • highest expenditure on entertainment

6. Discussion and limitation

What exactly are Informational Cities and what is the state of their development? In this paper we took a look at different building blocks of an Informational City and discussed them in more detail in context of the Japanese Information Society. The results indicate that the most developed Informational Cities in Japan are Tokyo, Ōsaka and Kyoto. This, however, is not a definite ranking. The cities performed very different in each category. Kyoto, the former capital of Japan, has a very distinct Knowledge and Creative City characteristic, e.g. many universities and students, scientific publications, and in terms of creativity and openness, a lot of museums and religious organizations. Other distinct Knowledge and Creative Cities are Tokyo and Ōsaka, however, with slightly different traits. Like Kyoto, they have many universities and students, but also the most patents registered and the biggest ratio of foreigners living in the city. Finally, in all three cities we can see some tendencies in Green City development—disregarding the amount of parks and pollution level (these factors are more difficult to control and improve in bigger metropolises than in smaller cities), they have the least registered cars and the highest expenditure on public traffic. This shows that the population is turning away from private cars towards public transportation (or bicycles, car sharing, etc.), which is one of the first important steps in the development of a sustainable city. As for digitization, Tokyo was the one city with most mobile phone and FTTH subscriptions. However, other cities with very high FTTH subscription rate were Ōsaka, Kyoto, Hamamatsu and Shizuoka. Tokyo, Kyoto and several other cities have the lowest unemployment and suicide rate. In terms of liveability, Ōsaka performed poorer than in other categories. Still, this outcome is relative to the performance of the remaining investigated cities and when compared to cities in countries other than Japan, Ōsaka is actually one of the safest places to live in.

Tokyo, Kyoto, and Ōsaka were the top cities in the most categories. Which other metropolises did stand out? Surprisingly Yokohama was not the top city, however, it did perform mediocre in the most categories. Another cities that could also be defined as Informational Cities in making are Chiba,

Nagoya, Kobe, Sendai and Fukuoka, since they performed mediocre in several categories. In terms of Knowledge and Liveable City, Okayama performed similarly. It is probably safe to say that the metropolises will not evolve to Informational Cities by excelling in all categories simultaneously. A solid knowledge or creative infrastructure could be, however, a good start. The Green City indicators are partially hardly comparable as the smaller cities are more likely to have more green space and lower levels of pollution. Still, a significant group of bigger metropolises is characterized by the typical shift from private cars towards other means of transportation. These cities are, despite the already mentioned top three, Saitama, Chiba, Kawasaki, Yokohama, Sakai, Kobe, Okayama and Fukuoka. Finally, the liveability indicators are also very diverse and the cities performed differently for each indicator. This was also indicated by the very low Cronbach's alpha value (0.085). Here, Tokyo, Yokohama and Kawasaki had the lowest unemployment rate, Kawasaki, Hiroshima and Okayama the lowest suicide rate, whereas Okayama, Sendai and Sapporo hat the most retail stores.

It is important to stress that the applied indicators were not weighted according to their importance. For some of the indicators this would be a very difficult task exposed to subjectivity of the researcher. In other cases, e.g. number of retail stores vs. unemployment, criminality or suicide rate, it seems easier to classify some aspects as more valuable than others. Furthermore, some of the indicators, even though based on long established research, seem obsolete or not that significant anymore. For example the aspect of openness represented by the number of different religious organizations in the city. Here, the openness towards guest-workers and foreign companies might be more valuable, especially with the rising secularization and change in mentality of younger generations growing up in digitized and connected world. It is obvious that Kyoto is a special case of Knowledge and Creative city built on complex academic infrastructure and its history as sacred site. Tokyo and Osaka's creativeness and knowledge output seem to be fueled by other factors—foreign inhabitants and complex (partially foreign) network of companies.

This study gave us first insights in the development of Informational Cities in Japan by taking into account 21 metropolitan regions. It is still a very small sample size, which is one of the limitations of the study. In further research either further Japanese cities should be added (however, these cities would be significantly smaller and it is questionable if a fair comparison would be possible) or other big metropolises from all over the world should be included. Since with the applied approach the outcomes were relative to the best city performance, an inclusion of non-Japanese cities would be interesting to put the investigated aspects into other perspective (e.g., criminality or unemployment rate). Also, the indicators should be adjusted (e.g., number of religious organizations as indicator for openness could be reconsidered) and complemented (e.g., gender equality in terms of openness, entrepreneurship in terms of innovativeness, recycling in terms of Green City).

7. References

Barth, J., Fietkiewicz, K. J., Gremm, J., Hartmann, S., Ilhan, A., Mainka, A., Meschede, C., & Stock, W. G. (2017). Informational urbanism. A conceptual framework of smart cities. In *Proceedings of the 50th Hawaii International Conference on System Sciences* (pp. 2814-2823). Washington, DC: IEEE Computer Society.

Brinkley, I. (2006). Defining the Knowledge Economy. London.

Carrillo, F. J. (2004). Capital cities: A taxonomy of capital accounts for knowledge cities. Journal of Knowledge Management, 8(5), 28–46.

Carrillo, F. J. (2006). Knowledge cities: Approaches, experiences and perspectives. New York: Butterworth-Heinemann.

Castells, M. (1989). The informational City. Information technology, economic restructuring, and the urban-regional process. Oxford, United Kingdom, Cambridge, MA: Basil Blackwell.

Castells, M. (1993). European cities, the informational society, and the global economy. In L. Deben W. Heinemeijer, & D. van der Vaart (Eds.), Understanding Amsterdam: Essays on Economic Vitality, City Life & Urban Form (pp. 7–23). Madrid: Sistema.

Castells, M. (1996). The Rise of the Network Society. Oxford, UK: Blackwell.

Cawkell, A. E. (1984). The information society: Technology, politics, infrastructure. Electroncis and Wireless World, 90(1580), 62–66.

Cawkell, A. E. (1986). The real information society: present situation and some forecasts. Journal of Information Science, 12, 87–95.
Cawkell, A. E. (1996). Evolving and information society (a postscript to Duff, Craig and McNeill). Journal of Information Science, 22(2), 123–124.
Chourabi, H. Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., Pardo T. A., & Scholl, H. J. (2012). Understanding smart cities: An integrative framework. In Proceedings of the 45th Hawaii International Conference on System Sciences (pp. 2289-2297). Washington, DC: IEEE Computer Society.
Crewe, L., & Beaverstock, J. (1998).Fashioning the city: Cultures of consumption in contemporary urban spaces. *Geoforum*, *29*(3), 287-308.
Cybriwsky, R. (1993). Tokyo. Cities, 10(1), 2–11.
Droege, P. (1989). Japan's advanced information cities. *Places*, *5*(4), 39-41.
Drucker, P. F. (1969). The Age of Discontinuity. London: Heinemann.
Duff, A. S. (1995). The "information society" as paradigm: a bibliometric inquiry. Journal of Information Science, 21(5), 390–395.
Duff, A. S., Craig, D., & McNeill, D. A. (1996). A note on the origins of the "information society." Journal of Information Science, 22(2), 117–122.
Dvir, R., & Pasher, E. (2004). Innovation engines for knowledge cities: an innovation ecology perspective. Journal of Knowledge Management, 8(5), 16–27.
Edvinsson, L., & Stenfelt, C. (1999). Intellectual capital of nations - for future wealth creation. Journal of Human Resource Costing & Accounting, 4(1), 21–33.
Edvinsson, L. (2006a). Aspects on the city as a knowledge tool. Journal of Knowledge Management, 10(5), 6–13.
Edvinsson, L. (2006b). K-City and Society Entrepreneurship for Intellectual Capital Growth. In Knowledge Cities (pp. 59–73). Elsevier.
Emmison, M., (2003). Social class and cultural mobility. Reconfiguring the cultural omnivore thesis, *Journal of Sociology 39*(3), 211-230.
Ergazakis, K., Metaxiotis, K., & Psarras, J. (2004). Towards knowledge cities: conceptual analysis and success stories. Journal of Knowledge Management, 8(5), 5–15.
Etzkowitz, H., & Klofsten, M. (2005). The innovating region: Toward a theory of knowledge-based regional development. R and D Management, 35(3), 243–255.
Fachinelli, A. C., Carrillo, F. J., & D'Arisbo, A. (2014). Capital system, creative economy and knowledge city transformation: Insights from Bento Gonçalves, Brazil. Expert Systems with Applications, 41(12), 5614–5624.
Fietkiewicz, K. J. & Pyka, S. (2014). Development of informational cities in Japan: A regional comparison. International Journal of Knowledge Society Research, 5(1), 2014, pp. 69-82.
Fietkiewicz, K.J., Pyka, S., & Stock, W. G. (2015). Evaluating infrastructures of the 21st century city: Informational cities in Japan as case studies. Advances in Research, 3(3), 2015, pp. 297-311.
Fietkiewicz, K. J. & Stock, W. G. (2014). Cityness and informativeness of the emerging informational cities in Japan. Creative and Knowledge Society, 4(1), 2014, pp. 43-56.
Fietkiewicz, K. J. & Stock, W. G. (2015). How 'smart' are Japanese cities? An empirical investigation of infrastructures and governmental programs in Tokyo, Yokohama, Ōsaka and Kyoto, in Proceedings of the 48th Hawaii International Conference on System Sciences (pp. 2345-2354), IEEE Computer Science, Washington, DC.
Figueras, P. (2004). Educating Cities. Retrieved from: www.bcn.es/edcities/aice.
Florida, R. (2002). The Rise of the Creative Class. New York, NY: Basic Books.
Florida, R. (2005). Cities and the Creative Class. New York, London: Routledge.
Friedmann, J. (1986). The World City Hypothesis. Development and Change, 17(1), 69–83.
Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic, N., & Meijers, E. (2007). Smart Cities – Ranking of European Medium-Sized Cities. Centre of Regional Science, Vienna, Austria.
Gospodini, A. (2006). Portraying, classifying and understanding the emerging landscapes in the post-industrial city. Cities, 23(5), 311–330.
Gospodini A. (2009). The landscapes of cultural and leisure economies in Greek cities. In A. Gospodini (Ed.), The post-industrial city: new economies, spatial transformations and new

landscapes, a theme-issue, *Aeichoros - Papers on Planning and Development, 6*(1), 10-28.
Hall, R. E., Bowerman, B., Braverman, J., Taylor, J., Todosow, H., & von Wimmersperg, U. (2000). The vision of a smart city. In 2nd International Life Extension Technology Workshop, Paris, France, September 28, 2000.
Hospers, G. J. (2003) Creative Cities: Breeding places in the Knowledge Economy. Knowledge, Technology, & Policy, 16(3), 143-162.
Hutton, T. a. (2004). Service industries, globalization, and urban restructuring within the Asia-Pacific: New development trajectories and planning responses. *Progress in Planning*, *61*(1), 1–74.
Intelligent Cities (2013). Intelligent Cities. Retrieved from: www.intelligent-cities.net.
International Telecommunication Union. (2012). Impact of Broadband on the Economy. Broadband Series 2012. Geneva.
International Telecommunication Union. (2013). Measuring the Information Society 2013. Geneva.
Ishida, T., & Isbister, K. (2000). Digital Cities - Technologies Experiences and Future Perspectives. Kyoto, Japan: Springer.
Karan, P. P. (2005). Japan in the 21st Century. Environment, Economy, and Society. Lexington, KY: The University Press of Kentucky.
Komninos, N. (2002). Intelligent Cities: Innovation, Knowledge Systems, and Digital Spaces. New York, NY: Taylor & Francis.
Landry, C. (2000). The Creative City: A Toolkit for Urban Innovators. London, UK: Earthscan.
Landry, C., & Bianchini, F. (1995). The Creative City. London: Demos.
Machlup, F. (1962). The Production and Distribution of Knowledge in the United States. New Jersey, NJ: Princeton University Press.
Martínez, S. D. (2006). A Comparative Framework for Knowledge Cities. In F. J. Carrillo (Ed.), Knowledge cities: approaches, experiences and perspectives (pp. 17–30). Oxford, OX: Butterworth-Heinemann.
Matthiessen, C. W., Schwarz, A. W., & Find, S. (2006). Knowledge Cities. Knowledge Cities. Elsevier.
MIC. (2015). Information and Communications in Japan. Retrieved from http://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2015/2015-index.html
Morris-Suzuki, T. (1988). Beyond Computopia: Infromation, Automation and Democracy in Japan. London and New York, NY: Kegan Paul International.
Nam, T. & Pardo, T. A. (2011). Conceptualizing smart city with dimensions of technology, people, and institutions. In Proceedings of the 12th Annual International Conference on Digital Government Research (pp. 282-291), New York, NY: ACM.
Neirotti, P., De Marco, A., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014). Current trends in smart city initiatives: Some stylised facts. Cities, 38, 25–36.
OECD. (2013). Measuring the Internet Economy: A Contribution to the Research Agenda.
Oliveira, J. A., Doll, C. N. H., Balaban, O., Jiang, P., Dreyfus, M., Suwa, A:, Moreno-Penaranda, R:, Dirgahayani, P. (2013). Green economy and governance in cities: assessing good governance in key urban economic processes. *Journal of Cleaner Production, 52*, 138-153.
Pratt, A. C. (2011). The cultural contradictions of the creative city. City, Culture and Society, 2(3), 123–130.
Sabbagh, K., Friedrich, R., El-Darwiche, B., & Singh, M. (2010). Enabling Sustainable Digital Highways. In The Global Information Technology Report 2009-2010 (pp. 93–106). Geneva: World Economic Forum.
Sassen, S. (2001). The Global City: New York, London, Tokyo. (2nd ed.). Princeton, NJ: Princeton University Press.
Sasaki, M. (2010). Urban regeneration through cultural creativity and social inclusion: Rethinking creative city theory through a Japanese case study. Cities, 27, S3–S9.
Shin, D. H. (2009). Ubiquitous city. Urban technologies, urban infrastructure and urban informatics. Journal of Information Science, 35(5), 515-526.
Siemens AG. (2011). Asian Green City Index. Assessing the environmental performance of Asia's major cities. Munich, Germany: Siemens AG.
Statistics Bureau Japan. (2016). Statistical Handbook of Japan 2016. Retrieved September 15, 2016, from http://www.stat.go.jp/english/data/handbook/c0117.htm#c17

Stock, W. G. (2011). Informational Cities: Analysis and Construction of Cities in the Knowledge Society. *Journal of the American Society for Information Science and Technology, 62*(5), 963–986.
UN. (2008). *Creative Economy Report 2008*.
UN. (2010). *Creative Economy Report 2010*.
UN. (2013). *Creative Economy Report 2013*. New York, NY.
Vanolo, A. (2013). Smartmentality: The Smart City as disciplinary strategy. Urban Studies, 1-16.
Webster, F. (2002). *Theories of the Information Society.* Cambridge: Routledge.
Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough', *Landscape and Urban Planning, 125*, 234-244.
Yigitcanlar, T. (2010). Informational city. In R. Hutchison (Ed.), Encyclopedia of urban studies (pp. 392-395). New York, NY: Sage.
Yigitcanlar, T., Velibeyoglu, K., & Martinez-Fernandez, C. (2008). Rising knowledge cities: the role of urban knowledge precincts. *Journal of Knowledge Management, 12*(5), 8–20.
Zheng, J., & Chan, R. (2014). The impact of "creative industry clusters" on cultural and creative industry development in Shanghai. City, *Culture and Society, 5*(1), 9–22.