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Public Libraries in the Knowledge Society: Core Services of Libraries in Informational World Cities

Abstract: Informational Cities are the prototypical spaces of the knowledge society. Public libraries play an important role as parts of the digital, smart, knowledge and creative infrastructures of these Informational Cities. Libraries have economic value as location factors in the two spaces of Informational Cities, the physical and the digital. For this reason, we divided the library services into two main groups, namely the digital library and the physical library. For 31 specified Informational World Cities, we empirically analyzed the core services of their public libraries via content analysis of the libraries' Web pages. Additionally, we studied these libraries' social media activities. Many libraries provide free e-resources (above all, e-books, e-journals and bibliographical databases) to their customers. Libraries offer digital reference services, mainly via e-mail and Web forms. Their presence in social media is dominated by posts on Facebook and Twitter. Nearly all public libraries we analyzed represent attractive architectural landmarks in their region. Besides offering spaces for children, the libraries provide rooms for learning and getting together and, to a lesser degree, modular working spaces. Most libraries provide Wi-Fi inside their buildings; more than half of those we investigated work with RFID technology. The prototypical public library in the knowledge society has two core services: (1) to support citizens, companies and administrations in their city and region with digital services, namely e-resources as well as reference services, and to communicate with their customers via social media; and (2) to provide physical spaces for meeting, learning and working, as well as areas for children and other groups, in a building that is a landmark of the city.

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Introduction

Researchers have posited that the typical city in knowledge societies is the so-called Informational City, where flows of information, capital, and power are as or more important than physical spaces (Castells 1989; Stock 2011a). What roles do public libraries play in such cities of the knowledge era? What are the core services of those libraries? In an empirical investigation, we analyzed libraries from 31 Informational World Cities.

Besides our theoretical considerations on prototypical cities of the knowledge society (Stock 2011a, 2011b, 2011c; Khveshchanka and Mainka 2011; Linde and Stock 2011; Mainka, Khveshchanka, and Stock 2011), empirical results are available concerning the nature of Informational Cities, e.g. on measuring Informational World Cities' degree of 'cityness' (Nowag, Perez, and Stuckmann 2011), on job polarization in Informational Cities (Dornstädter, Finkelmeyer, and Shanmuganathan 2011), about Singapore as a prototype of an Informational City (Khveshchanka, Mainka, and Peters 2011), on digital libraries in selected Informational Cities (Mainka and Khveshchanka 2012) and on the role of physical and digital libraries in Informational World Cities (Mainka, Stallmann, and Orszullok 2012; Orszullok *et al.* 2012).

In our theoretical framework (Mainka, Khveshchanka, and Stock 2011), we use six groups of indicators to determine an Informational World City. These indicators are interlinked:
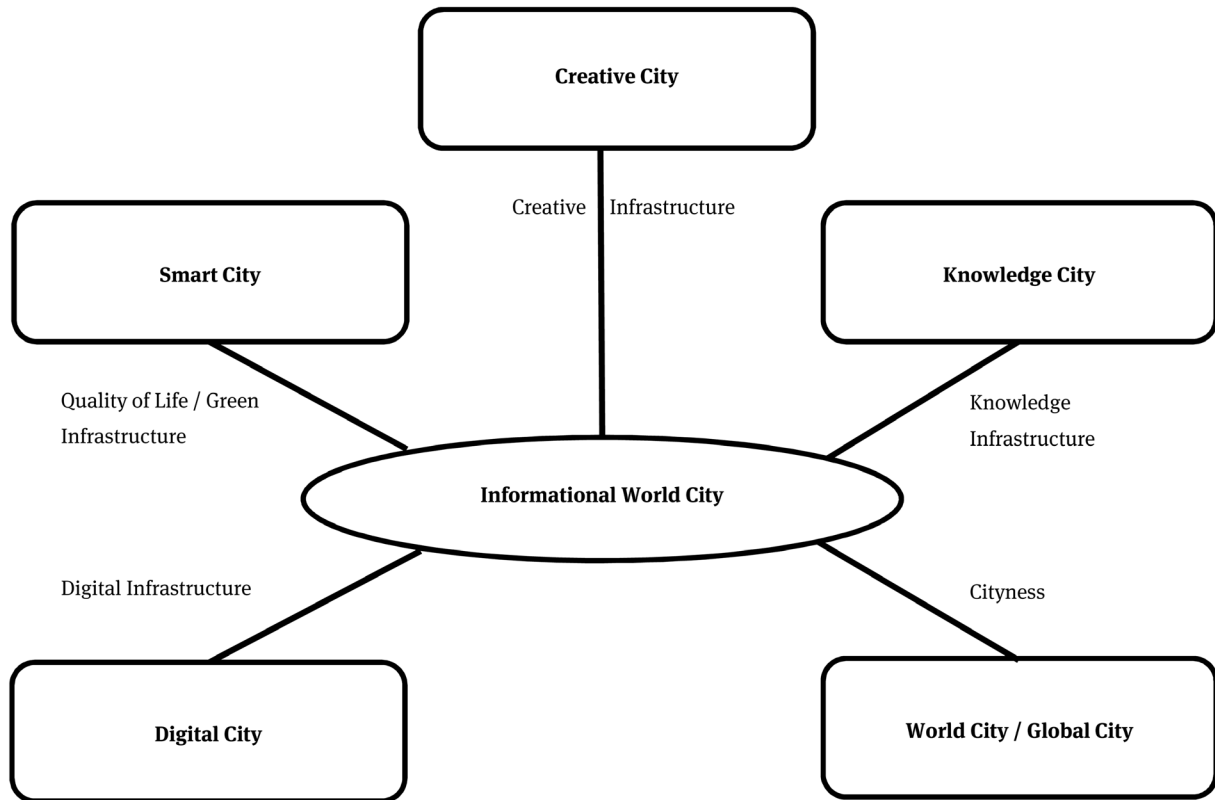
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                          ┌─────────────────┐
                          │  Creative City  │
                          └─────────────────┘
                                  │
                        Creative │ Infrastructure
┌─────────────┐                                      ┌──────────────────┐
│  Smart City  │                                      │  Knowledge City  │
└─────────────┘                                      └──────────────────┘
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Figure 1: Infrastructures of an Informational World City

- Infrastructures (groundwork for digital cities, knowledge cities, creative cities and smart cities) (see Figure 1),
- Cityness: Position in the World City hierarchy,
- Structure of the labour market (including job polarization and share of information professionals on the overall labour market),
- Mix of companies,
- Political willingness to establish an Informational City (including the maturity of e-government),
- Soft location factors (e.g., leisure facilities, shopping malls, "architainment").

In this paper, we concentrate mainly on the aspects of "Infrastructures" and "Soft Location Factors." The research literature emphasizes the idea that "the public library is a community resource in most major cities" (Robertson 2000, 246). In line with this statement, we try to answer the following research question: Which core library services are provided in typical cities of the knowledge society?

Informational World Cities

At the beginning of our Informational City research, we were obliged to identify potential Informational World Cities. An Informational World City links different aspects of modern cities in the knowledge society (Figure 1). First of all, an Informational World City has to be a World City as described by the framework of Friedmann (1995), Sassen (2001), or Taylor (2004), where it is defined by its degree of 'cityness.' Population numbers by themselves do not make a World City. Next, World Cities have to provide important infrastructures for information and communication technology (ICT) as they are given in a digital city (Yigitcanlar and Han 2010), also called a "ubiquitous city" (Hwang 2009). A smart city (Shapiro 2006; Hollands 2008) refers to a "green" city with a high quality of life. A knowledge city (Ergazakis, Metaxiotis, and Psarras 2004) consists of diverse knowledge institutions such as universities and science parks. A creative city (Landry 2000; Florida 2005) offers infrastructures for the creative class. Moreover, the economic success of a World City correlates positively with an enhanced human capital (Glaeser, Scheinkman, and Shleifer 1995). Accordingly, a city must meet

Table 1: Informational World Cities. (Note : applicable ✔, not applicable ✖)

	World / Global City	Knowledge City	Creative City	Digital City	Smart City
1. Amsterdam (The Netherlands)	✔	✔	✔	✔	✔
2. Barcelona (Spain)	✔	✔	✔	✔	✔
3. Beijing (China)	✔	✔	✔	✔	✔
4. Berlin (Germany)	✔	✔	✔	✖	✔
5. Boston (U.S.A.)	✔	✔	✔	✔	✔
6. Chicago (U.S.A.)	✔	✔	✔	✔	✖
7. Dubai (U.A.E.)	✔	✔	✔	✔	✔
8. Frankfurt (Germany)	✔	✔	✖	✖	✔
9. Helsinki (Finland)	✔	✔	✔	✔	✔
10. Hong Kong (China, SAR)	✔	✔	✔	✔	✔
11. Kuala Lumpur (Malaysia)	✔	✔	✔	✖	✖
12. London (United Kingdom)	✔	✔	✔	✔	✖
13. Los Angeles (U.S.A.)	✔	✔	✔	✔	✖
14. Melbourne (Australia)	✔	✔	✔	✔	✔
15. Milan (Italy)	✔	✔	✔	✔	✖
16. Montreal (Canada)	✔	✔	✔	✔	✔
17. Munich (Germany)	✔	✔	✔	✖	✖
18. New York (U.S.A.)	✔	✔	✔	✔	✖
19. Paris (France)	✔	✔	✔	✖	✖
20. San Francisco (U.S.A.)	✔	✔	✔	✖	✔
21. Sao Paulo (Brazil)	✔	✔	✔	✖	✖
22. Seoul (South Korea)	✔	✔	✔	✔	✔
23. Shanghai (China)	✔	✔	✔	✔	✔
24. Shenzhen (China)	✔	✔	✖	✔	✖
25. Singapore	✔	✔	✔	✔	✔
26. Stockholm (Sweden)	✔	✔	✔	✖	✔
27. Sydney (Australia)	✔	✔	✔	✔	✔
28. Tokyo (Japan)	✔	✔	✖	✔	✖
29. Toronto (Canada)	✔	✖	✔	✔	✔
30. Vancouver (Canada)	✔	✔	✔	✖	✔
31. Vienna (Austria)	✔	✔	✔	✔	✔

the needs of the knowledge society and build important infrastructures in order to be able to compete with other World Cities.

How can we define an Informational World City? It must meet two conditions. Firstly, a city has to be referred to as a World City in the literature, and secondly, it must be referred to as a digital, smart, knowledge, or creative city (at least one precondition must be fulfilled). To find candidate cities, we analyzed literature in Web of Sci-ence®, Scopus, Google Scholar, and Wiley Online Library. As listed in Table 1, we found 126 references to a total of 31 cities described as Informational World Cities. These cities reflect global centres distributed all over the world (Figure 2).
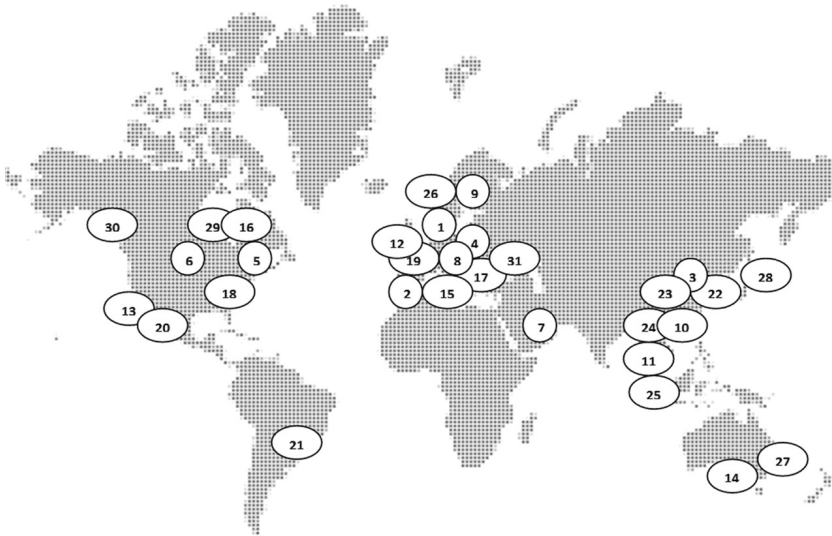
Figure 2: Informational World Cities on the World Map. (Note: cf. numbers in Table 1)

The Economic Value of Public Libraries in the Knowledge Society

There are many studies on the economic value of libraries in general (e.g., Poll 2003; McCallum and Quinn 2004; Missingham 2005) and of public libraries in particular (e.g., Koontz 1992; Morris, Sumsion, and Hawkins 2002; Aabø 2005; Ferreira dos Santos 2009; Ko *et al.* 2012; Saxena and McDougall 2012). Public libraries satisfy "the needs of citizens, small businesses, entrepreneurs and the community's organisations and institutions" (Ferreira dos Santos 2009, 1). In contrast to large companies with their own libraries and information centres, small and medium-sized companies are dependent on the services of the local public library. One of the roles of public libraries in communal economic development is in helping businesses (Bleiweis 1997). Yimin and Zhong (2008) describe strategic partnerships between the library and private companies, relating, for instance, to document supply, market intelligence, technical intelligence or strategic intelligence (e.g. searches regarding mergers and acquisitions).

Empirical studies concerning the economic value of libraries in terms of willingness to pay (which represents the maximum amount of money that a customer is willing to pay for a service or a good) and willingness to accept (the value of the expected compensation for the money) clearly show that people think that public libraries are worth their price (e.g., Aabø 2005; Ko *et al.* 2012).

In the past, public libraries were often described as soft location factors of a city. In contrast to "hard" location factors (such as infrastructures, wage structures, land price, transport connections, etc.), soft location factors play a role in attracting and binding companies (e.g. economic climate, city image, innovative milieu) and for enticing people to live and work in the city (e.g. accommodation, schools, leisure facilities, culture) (Umlauf 2008, 10). Libraries were regarded as part of the soft location factor of culture. Additionally, (physical) libraries acted as traffic generators for retail (and vice versa) (Umlauf 2008) – but only if they had an attractive location. For some economists, culture does not have the same importance as hard location factors. But since empirical investigations into location factors were conducted in the 1980s, it has become clear that deficient cultural institutions lower a city's location value (Hummel 1990). If there *is* a library in the city, it will (more or less) not explicitly be recognized. But if there is *no* library, or the library is shut down, people will perceive this fact to be a disadvantage.

What is the economic role of public libraries in the knowledge society? The "Internet age" has changed the habits of libraries' stakeholders (Kaiser 2008). In cities of the knowledge society new industries and markets are emerging, based on knowledge and creativity. According to Johnson (2012, 31), in such cities it is essential to attract knowledge workers, i.e. people who are "well educated, open to new ideas, creative, and expect to be well informed." In Johnson's terms, "smart people" (knowledge workers and other creative people) are in need of "smart librarians" working in "smart libraries" (Johnson 2012, 33). Such libraries should be spelled in a new way (Cheng 2012, 452):

L: Literacy (the role of the library in literary education and – in the knowledge society – in information literacy instruction),

I: Information Network (the library as a hub in the city's information and communication network, and as a link to global knowledge, i.e. to public and commercial information services),

B: Business Partnership (cooperation of the library with companies in the city),

R: Repository and Archives (development and maintenance of digital information services for and about the city),

A: Access Gateway (the library as a gateway between the information needs of citizens, administrations and companies and global information resources),

R: Recreation and Re-Creation (the library as a space for recreation and for re-creation in the sense of education or meetings),

Y: You (the close relation between the library and the people: "of the people, by the people and for the people" as stated by Lincoln (Cheng 2012, 451), including user-generated content and content generated for users).

Libraries in the Digital City

A digital city (or ubiquitous city) is defined by the integration of (1) advanced ICT-based infrastructures and (2) city-specific information services into the urban space (Leem and Kim 2013). In a perfect ubiquitous city, Internet access is possible everywhere (via free Wi-Fi) – but only for those who possess smartphones or other devices. Today, not all Informational World Cities are perfectly ubiquitous, as there are gaps in citywide Internet provision. Firstly, libraries offer Internet access in their rooms and can lend smartphones or laptops to people who are unable to buy such devices. Secondly, libraries produce specific information services for distribution on the citywide networks (e.g. digitized images of the city, access to their catalogue and to full-text collections, digital reference services).

Libraries in the Smart City

"Smart city" is a rather fuzzy concept (Hollands 2008). We use the term in the sense of a city being more "green" ("smart environment," "smart mobility," "smart energy") and more "livable" ("smart health," "smart living and working") than other cities (Mechant *et al.* 2012, 85). The role of the library in a smart city is to keep people and companies informed on all aspects of "smart" developments and to educate their users in information literacy

(to turn them into "smart" users). This includes developing people's ability to retrieve, evaluate and use information as well as to create, upload and index their own (Gust von Loh and Stock, 2013). Saxena and McDougall (2012, 367) stress that there are "environmental savings offered by the multiple use and reuse of library materials." Hence libraries also form specific parts of the smart city infrastructure (Mackenzie 2000).

Libraries in the Knowledge City

For Dehua and Beijun (2012, 147), Informational Cities "build the Internet of Knowledge (IoK) as a strategic step." Similarly to conceptions like *infrastructure as a service* or *software as a service*, Informational Cities implement "knowledge as a service" (Dehua and Beijun 2012, 149). Access to knowledge is ubiquitous: anytime, anywhere, anything, in any way and at any pace (Dehua and Beijun 2012, 149). Public libraries play important roles in Informational Cities' knowledge infrastructure as soon as they acquire knowledge-containing documents, manage knowledge, and provide documents to all citizens, companies and administrations in the city. Additionally, they offer spaces for working, meeting people, and learning. Informational Cities leverage knowledge outside of their educational infrastructures, their government, and the businesses established in them; "by developing physical and digital public spaces that provide resources and opportunities for learning and interaction, they enhance community development and innovative collaboration" (Merrick 2009). Libraries serve as important knowledge hubs and main components of the infrastructure of a knowledge city (Ergazakis *et al.* 2009; Merrick 2009).

Libraries in the Creative City

For Skot-Hansen, Rasmussen, and Jochumsen (2013), public libraries play important roles in the creative infrastructure of a city, e.g. supporting urban development and culture-led regeneration. The library building is part of the city's architainment (Stock 2011a, 977) and of its experience shapes (O'Dell 2005). It is "an icon" (Skot-Hansen, Rasmussen, and Jochumsen 2013, 10) because it is unique, famous, of aesthetic quality and part of the urban brand. The public library acts as a "placemaker" (Skot-Hansen, Rasmussen, and Jochumsen 2013, 12). It is an active part of urban planning (e.g. for the revitalization of city centres or former industrial areas), it contributes to urban diversity

in cultural districts and creates public domain and new stages for experience. The public library provides for community consolidation (Department of Culture, Media and Sport 2004, 3) and community vitalization (Skot-Hansen, Rasmussen, and Jochumsen 2013, 13) insofar as it boosts local identity and cohesion and involves users and other local citizens in its activities (e.g. by publishing user-based content). Libraries are non-circumventable institutions within the creative infrastructure of an Informational City (Landry 2000; Florida 2005; Stock 2011a).

Spaces in the Library of the Knowledge Society

Public libraries in cities of the knowledge society are not only soft location factors (as before), but form essential parts of the city's (digital, knowledge, creative, and smart) infrastructure.

Thorhauge (2010) has three "visions" for public libraries in the knowledge society. The first vision focuses on the physical library space. The key issue here is not – or not only – the borrowing of materials, but the provision of spaces for learning, for having experiences (e.g. films or meetings with writers), for meeting people and for staging performances. Thorhauge's second vision is the establishment of the digital library. The digital library includes commercial digital information services and Web 2.0 services. The licenses for fee-based databases may vary from municipality to municipality, depending on each library's financial framework. The third vision is partnership, in the sense of "from collection to connection" (Thorhauge 2010, 7). Connections can be found with cultural, educational and knowledge institutions, with companies and with single individuals (e.g. for voluntary services).

Besides the partnerships between the public library and other institutions, businesses and people, the economic value of the public library in the knowledge society lies in the way it shapes the infrastructure of digital, smart, knowledge and creative cities and serves as a soft location factor in the cities' spaces. Following Castells (1989), there are two spaces in Informational Cities: the space of places (the physical space) and the space of flows (power, money, and information). Public libraries are hardly concerned with power and money, but they are essential with regard to information. It is possible to say that there are three spaces in the library: besides the physical and the digital space there is the space of the services given outside the library, the "space" of outreach services (Boyce and Boyce 1995; Freeman and Hovde 2003; Adkins

and Bala 2004). But this outreach space is either physical ("physical outreach," e.g. bookmobiles) or digital ("virtual outreach," e.g. digital information services in the health sector or library profiles on social networks services) (Yeoman *et al.* 2003; Connell 2009). So it is reasonable to disaggregate the outreach space into the physical and the digital aspects.

Information flows in the knowledge society are organized both face-to-face (in the physical space) and electronically (in the digital space). The library thus functions in both spaces, the physical and the digital.

Method

Our fundamental research question is: *Which core library services are provided in typical cities of the knowledge society?* The increasing importance of the knowledge society also affects public libraries' core services. We investigated the public libraries of 31 Informational World Cities in terms of their status as location factors and parts of the cities' infrastructures. We have to emphasize that there are two spaces in Informational Cities: the physical space and the digital space (Castells 1989; Mainka, Stallmann, and Orszullok 2012; Stock 2011a, 2011b). Accordingly, we had to analyze these two spaces separately in public libraries. This leads to two research questions:

– Which core services of the physical library are provided in typical cities of the knowledge society?
– Which core services of the digital library are provided in typical cities of the knowledge society?

To answer the research questions, we investigated the digital and physical spaces of the identified Informational World Cities' public libraries. Because we were interested in the infrastructure and location factors of those cities, we turned our attention to the services provided by these libraries. We reviewed several aspects of digital and physical library services that are important in an Informational World City. The following services were analyzed (Figure 3):

1. Digital Library
– Website (in the country's official language and in English),
– Web-OPAC (in the country's official language and in English),
– E-resources (e-journals, e-books, digital images, audio books, music, e-magazines, videos, newspapers, bibliographic databases and other e-resources),
– In-library digitized documents and collections,
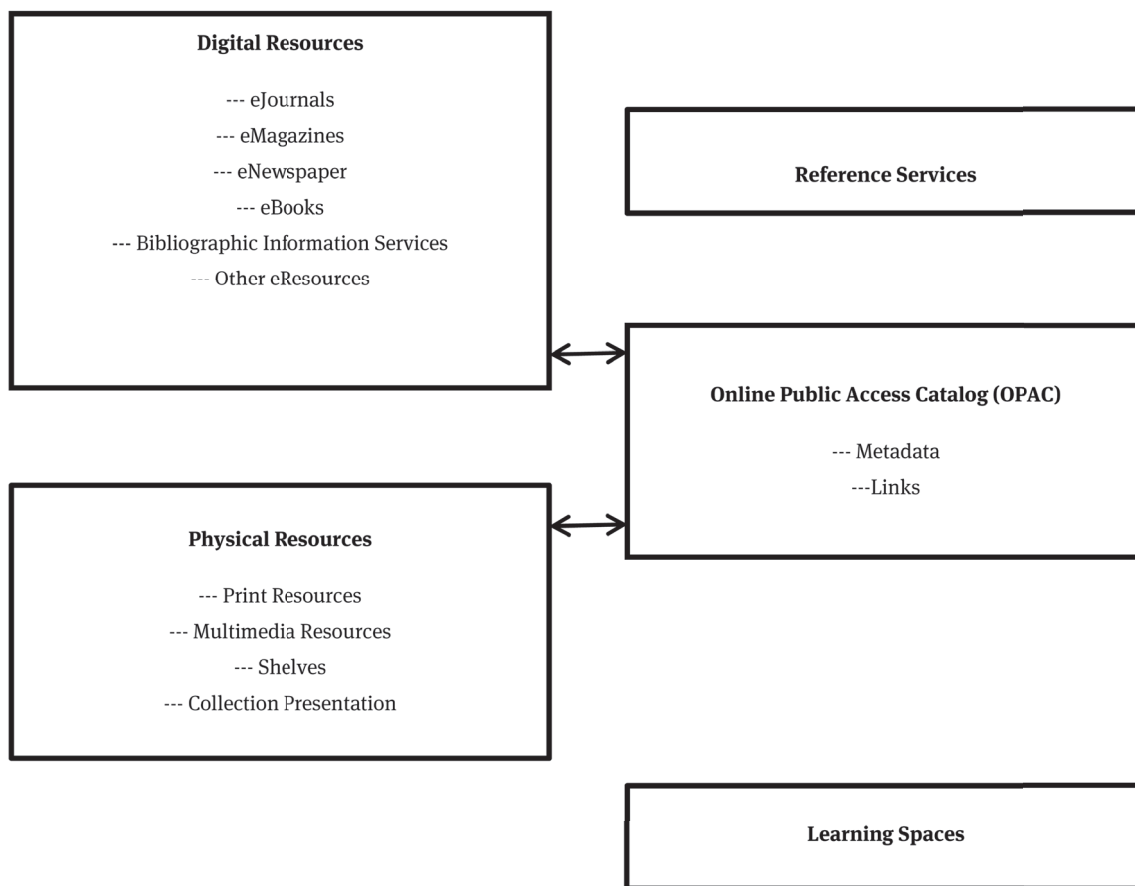
Figure 3: Core Services of Digital and Physical Libraries

– Are all e-resources free of charge for library members?
– Guides to the digital library (video guides, seminars, text documents, FAQs),
– Digital reference services (e-mail, SMS, Web forms, Skype),
– Use of social media (blogs, Facebook, Twitter, Sina Weibo, Flickr, YouTube, and degree of activity on Twitter/Sina Weibo, Facebook and YouTube),
– Apps (applications for mobile devices).

2. Physical Library
– Library as architectural landmark,
– Spaces (for learning, meeting and working, and to provide for children) and their attractiveness,
– Drinks and food in the library,
– RFID,
– Ability to return borrowed media everywhere possible,
– Wi-Fi,
– Library marketing.

We analyzed the content of the libraries' websites in order to glean information about the various criteria. We performed an intellectual content analysis of the websites. We have to mention that this method can only represent a partial aspect of the studied libraries. For a comprehensive picture of a library one has to visit it. We visited some of the libraries, but at the present stage of the project it was not possible to realize visits to all 31 cities. In some cases, if the website did not offer enough information, we contacted the library staff via e-mail. For all aspects, we calculated the percentage of libraries that provide the service in question. So our analysis is binary in general: a library has or has not a specific service (e.g. e-books). We did not count the amount of the service (e.g. the concrete number of e-books offered) and we did not study the services' use (e.g. the number of borrowed e-books per year).

The results show us a prototypical public library in an Informational World City (in a statistical sense). For every main aspect, we chose an exemplary library that performs well in this regard. The analyzed libraries and their websites are listed in Appendix 1.

The second stage in our analysis was to build a ranking concerning all libraries' core services. Identified core services in the digital and in the physical library can score 75 points each. Thus, the most a library can get is 150 points. Points are distributed evenly across all indicator groups (10 points per group). The definition of a group is based on the services listed in Figure 3. In a very few cases the number of points for a group was chosen differently – e.g. the presence of a Web-OPAC is defined as more important than the availability of library apps. A detailed listing of all indicators and weights can be found in Appendix 2.

Digital Libraries

The literature offers many definitions of digital libraries (Borgman 1999; Levy 2000; Meyyappan, Chowdhury, and Foo 2000; Allard 2002). Borgman (1999) and Levy (2000) condense these definitions into two general aspects. On the one hand "[...] researchers focus on digital libraries as content collected on behalf of user communities [...]" (Borgman 1999, 229), whereas on the other hand the digital library is identified as an institution or service run by librarians (Borgman 1999; Levy 2000). According to Oppenheim and Smithson, a digital library is an "information service in which all the information resources are available in computer processable form and the functions of acquisition, storage, preservation, retrieval, access and display are carried out through the use of digital technologies" (Oppenheim and Smithson 1999, 97). Digital libraries are distinguished from databases or information retrieval systems by their extensive content and functionality. They comprise electronic collections and are accessible via the Internet (Thong, Hong, and Tam 2004). These collections can consist of a variety of media in digital form; mainly text, audio, image and video (Meyyappan, Chowdhury, and Foo 2000). In contrast to traditional Web-OPACs, a digital library does not merely include reference information but also features full-text materials (Stock 2011a) and documents in non-text formats (Oppenheim and Smithson 1999). With the emergence of digital libraries, the responsibilities for librarians will change (Lor and Britz 2011); to wit, the content of the e-resources is more unpredictable and uncontrolled in contrast to the controlled acquisition and controlled indexing of physical media.

In addition to Thong, Hong, and Tam (2004), who focused on different types of electronic media in a digital library, we analyzed all e-resources of 31 public libraries. We checked whether a library provides access via Web-OPAC (in the country's language and in English) or links directly to e-journals, e-books, digital images, audio books, music, e-magazines, videos, newspapers and bibliographic databases. Furthermore, since special resources can be digitized by the library itself, this aspect is also explored in our investigation. Why did we insist on an English version of the website and the catalogue, if the population served is not English speaking? All analyzed cities are World Cities. Citizens of World Cities should be able to communicate with other people on a global scale. Today's *lingua franca* is English.

Borgman describes digital libraries as a service and "[...] a set of tools and capabilities to locate, retrieve and utilize the information resources available" (Borgman 1999, 233). For this reason, we analyzed whether a library provides guides or tutorials to support users in working with the digital library. As guides, we defined the aspects of video guides, seminars, text documents and frequently asked questions (FAQs). With the help of these guides the user should be taught to use the digital library interface, because it is vital that the library system should be easy to handle (Thong, Hong, and Tam 2004).

We also investigated digital reference services. "Libraries offer telephone, email, and online chat alternatives" to help their users, especially those who use digital libraries and are not physically present (Lesk 2005, 219). On this account, we decided to investigate the utilization of digital reference services via e-mail, SMS, Web forms and chat or instant messaging. Moreover, to emphasize the digital character we have concentrated on Skype (a service using voice over Internet protocol) as a channel of reference services rather than the traditional telephone lines.

Current Web technologies and social media enable personalization and portability. Using elements of Web 2.0, libraries have the opportunity to communicate and interact with their users (Harris and Lessick, 2007; Anttiroiko and Savolainen 2011). News, events or general information, e.g. opening hours, can be published straightforwardly via social media (Parkes and Walton, 2010). We analyzed library services on blogs, Facebook, Twitter, Sina Weibo, Flickr and YouTube.

"To stay relevant, libraries have to adapt changes such as the broad access to mobile phones" (Dresel and Kaur 2010). Some libraries already provide reference services via SMS; mobile technologies, including mobile applications, are ever developing (Murphy 2010). Mobile applications (apps) offer an opportunity for communicating and interacting with the user. There are several ways to deploy apps for libraries, e.g. as search and retrieval systems or for document viewing (Greenall 2010). To what extent are apps already in use in the 31 public libraries?

Physical Libraries

To analyze the physical library, we investigated aspects like library buildings' architecture, different kinds of spaces, as well as their attractiveness. Furthermore, we took a closer look at the events and programs taking place at the library, in particular seminars on information literacy, and at the libraries' marketing strategies.

Referring to qualities of good library spaces, McDonald (2006) points out, amongst other aspects, that a library space should be functional, work well, and look good. In the same vein he suggests that the space should motivate and inspire people (quality to be conducive) and have a 'wow' effect. Concerning the 'wow' effect, the building should captivate and fascinate the person looking at it. The relevance of the library building and of its architecture is influenced by the development of social life and should create a public sphere for urban residents (Dahlkild 2011). As part of the city's "architainment," the library building becomes an event in itself. On account of this we theorized that the architecture of the library building is one core element for the physical library in Informational World Cities.

Not only the exterior view of the building is relevant, but we also have to focus on the interior design and the functionality in itself. Many researchers, students and other people look for a convenient place to study and work. The lighting and big desks at the library (Cannell 2007) are of importance, but there are also other aspects that improve the attractiveness of the spaces (McDonald 2006). Moreover, the library should be a place where, for instance, students not only search for information but also "engage in a collaborative learning process" (Freemann 2005, 5). McDonald (2006) expresses the view that a variety of study environments should be offered due to the variety of users' preferences for study – such as the quiet reader who studies independently, as well as teams that collaborate on a project. The role of the library as a provider of learning and studying places should be boosted (Mittrowann 2011). Also, modular working spaces are important in catering to the different needs of the libraries' users. Via the adaptability of spaces the library can further respond flexibly to changes in room size (McDonald 2006). Of crucial importance here is the flexibility of the working rooms, so that one can adapt the spaces according to the number of participants or to the technical equipment that is required. The users also need technical support. For instance, Wi-Fi should be accessible within the library (McDonald 2006). The users should have the option of returning their borrowed media anywhere in the city. In this context, it is also important to mention RFID (radio frequency identification) (Singh, Brar, and Fong 2006).

Corresponding to the idea of the library as a social space, the library is also a meeting place where communication between groups of people with different or similar interests or takes place (Cannell 2007; Aabø, Audunson, and Varheim 2010; Audunson 2005; Audunson, Essmat, and Aabø 2011). For instance, such meeting spaces can be used as offices for co-working (Corsini 2013). Thus a place for eating and drinking, like a café, can be a centrepiece of the library and optimize the quality of one's stay (Cannell 2007; Franz 2011; Mittrowann 2011), but it may also serve as a place for knowledge management and face-to-face communication in the library (Cannell 2007). We should also keep in mind the children, i.e. whether there is a place especially for them (Mittrowann 2011), and for the elderly (consider the reading clubs for Singapore's elderly (Luyt *et al.* 2011)) in the library. Similarly, there must be places for specific groups of people.

Apart from this, many libraries operate as teaching libraries. Here the holding of seminars on information literacy is relevant and represents a core service of the physical library (Homann 2003). Other factors that must be taken in account are marketing strategies. We thus investigated the libraries' publicly available marketing strategies, e.g. special programs and events.

Results

Digital Library

Generally it can be stated that 81% of the analyzed public libraries have a website available in English. Figure 4 shows the percentages of the different e-resources in use. Note that only 30 libraries are integrated in these results, because data for one library was unavailable. It is noteworthy that almost all e-resources are used by 50% of public libraries. Only videos and digital images are not as popular as e-books or other e-resources. Particular emphasis must be placed on the Capital Library Beijing and the Boston Public Library, which offer all e-resources analyzed in this study in their digital libraries. 80% of the public libraries analyzed provide their patrons with access to the databases free of charge.

As seen in Figure 4, a Web-OPAC is a must for a public library in an Informational World City. Here it also appears to be important to have an English version of the Web-OPAC. Where there are special sources or collections in the city, some libraries conduct their own digitization
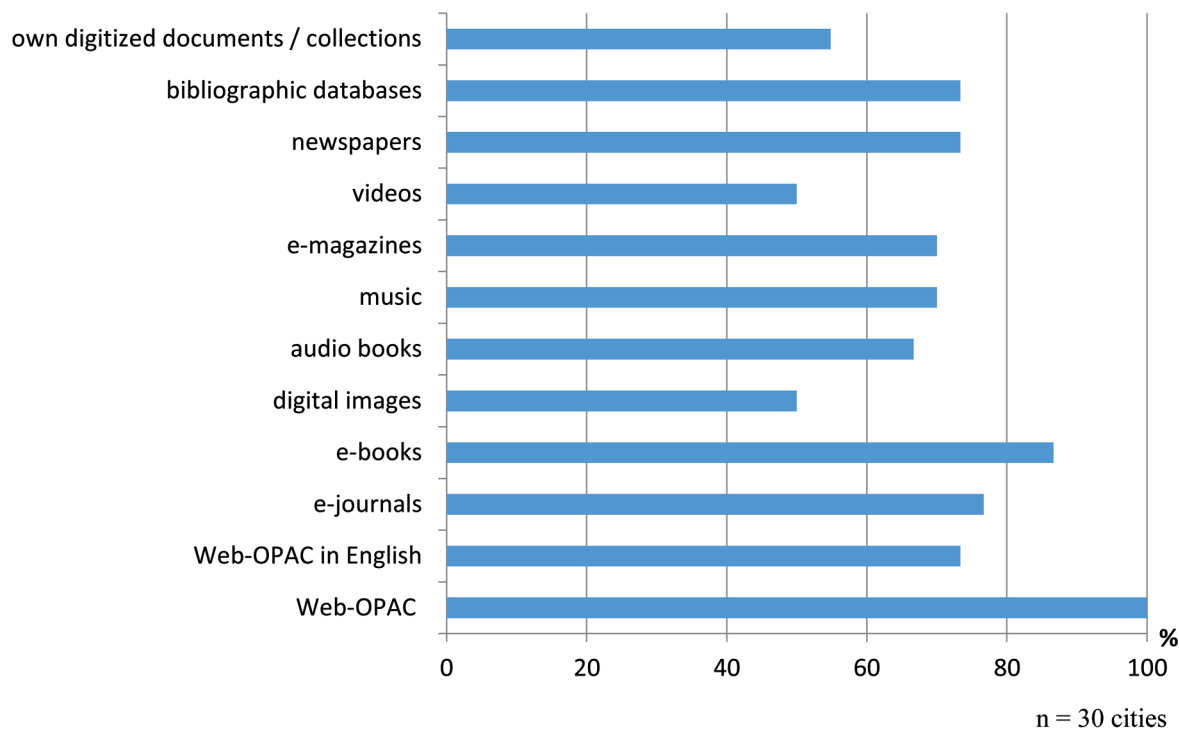
Figure 4: E-Resources in Informational World Cities' Public Libraries

projects. 17 public libraries indicate that they digitize documents on their own.

Despite the high number of e-resources, Figure 5 indicates that guides explaining how to use the digital library are not offered as extensively. The Toronto Public Library provides their users with a variety of guides: video guides, text documents with screen shots, FAQ lists and seminars. Although only a few guides are used by the 30 analyzed public libraries, the Toronto Public Library provides them all.

When pursuing requests for documents or for special pieces of knowledge, it is helpful to have the option of contacting reference librarians without visiting the library in person. Figure 6 describes the provision of digital reference services via e-mail, chat or instant messaging, SMS, Web forms and Skype.

Skype is not available in public libraries. Instead, other forms of reference services are used including e-mail (81%), Web forms (65%), SMS (16%) and chat or instant messaging (29%). For instance, the New York Public Library supports all of the mentioned digital reference services. The other libraries use e-mail and Web forms predominantly. In the case of a library not giving their e-mail address, Web forms are mostly supported.

Interaction between the library and its users can be enhanced via the use of social media. Figure 7 presents

the adoption rates for the five applications focused on in our analysis. Particularly YouTube (32%), Flickr (29%) and blogs (29%) are used by several libraries. Furthermore, microblogging services like Twitter and Sina Weibo (65%) and Facebook (74%) enjoy great popularity among public libraries of Informational World Cities. An impressive example is the Openbare Bibliotheek Amsterdam, which actively uses (amongst others) YouTube, Flickr, Twitter, Facebook and blogs.

In addition to social media, the focus is now directed toward mobile applications. 14 of the 31 analyzed public libraries offer mobile apps. These mobile services are primarily used to access the Web-OPAC, e-resources and one's user account. General information about the library can also be retrieved via apps. The Los Angeles Public Library is a particularly strong user of mobile applications..

Public Libraries' Use of Social Media Platforms for Information Dissemination

Our study focuses on the existence of libraries' core services in physical as well as in digital environments. The factual use of these services by library patrons was not examined, since access to this kind of data is either restricted to library staff or impossible because the data has not been collected (e.g. use of cafeterias in physical libraries). We see a different state of affairs on social media platforms, where statistics are openly published and reflect
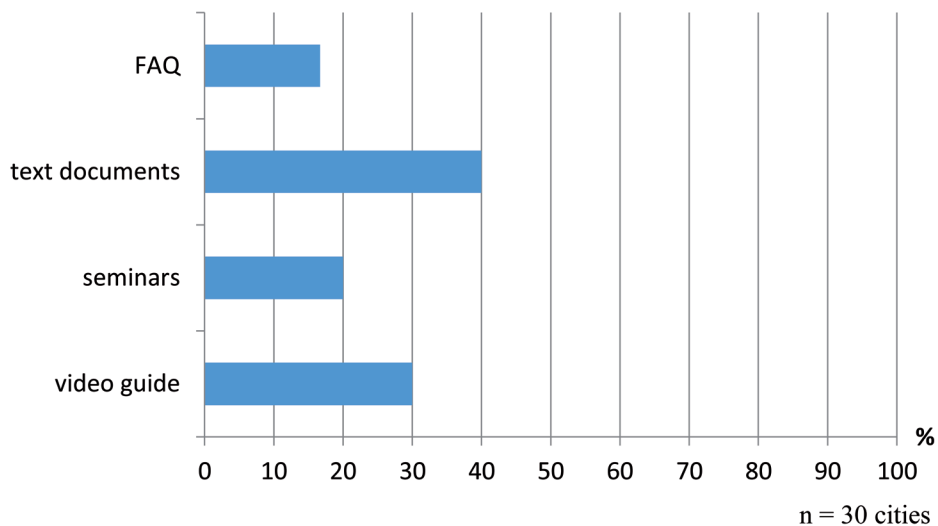
Figure 5: Guides in Informational World Cities' Public Libraries
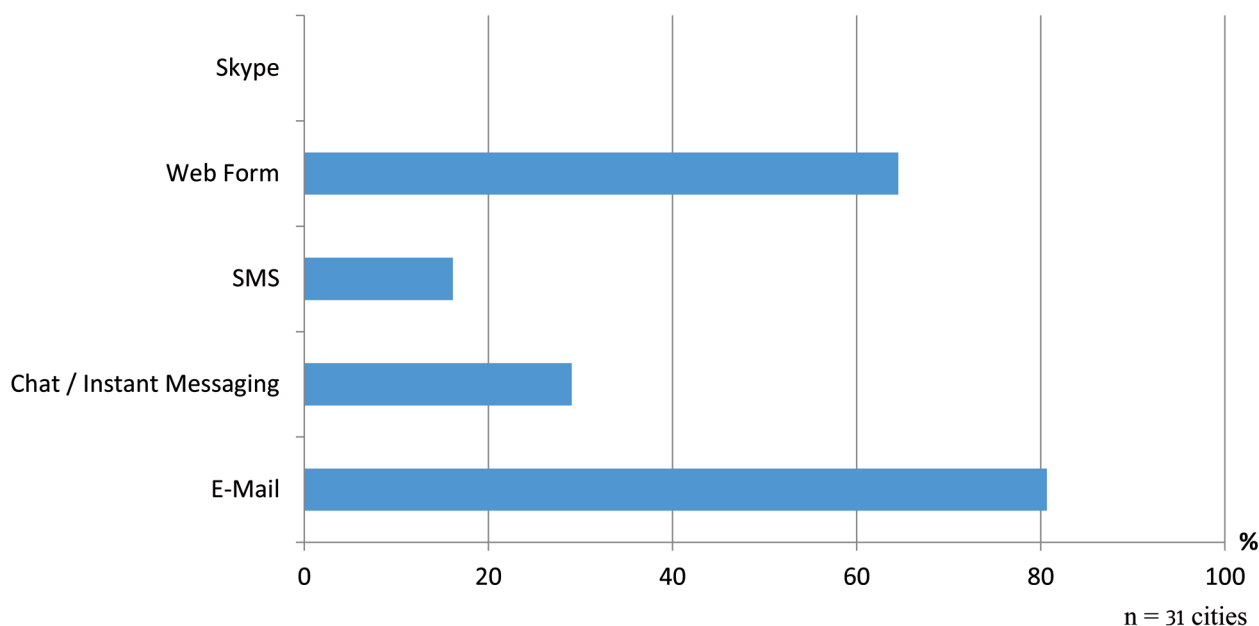
Figure 6: Digital Reference Services in Informational World Cities' Public Libraries

the library's activity (e.g. number of tweets). By now there exist several studies researching libraries and their social media activities, but they are often focused on academic libraries, libraries in certain geographical regions, or on particular universities (amongst others: Chua and Goh 2010; Anttiroiko and Savolainen 2011; Gerolimos and Konsta 2011; Pendse 2012). Walia and Gupta (2012) analyzed the national libraries of 66 different countries regarding their social media use. In contrast to the aforementioned studies, we will focus on public libraries spread around the world and show to what extent they use social media platforms to disseminate information in Informational World Cities. The social media platforms we will take into account are Facebook, Twitter, Sina Weibo and YouTube, since they are the most popular prototypes in their area of social media functionalities, i.e. social networking, microblogging, and video sharing.

As shown in Figure 7, most researched public libraries have at least one account on Facebook, Twitter, or Sina Weibo. YouTube, Flickr, and Blogs are less popular but
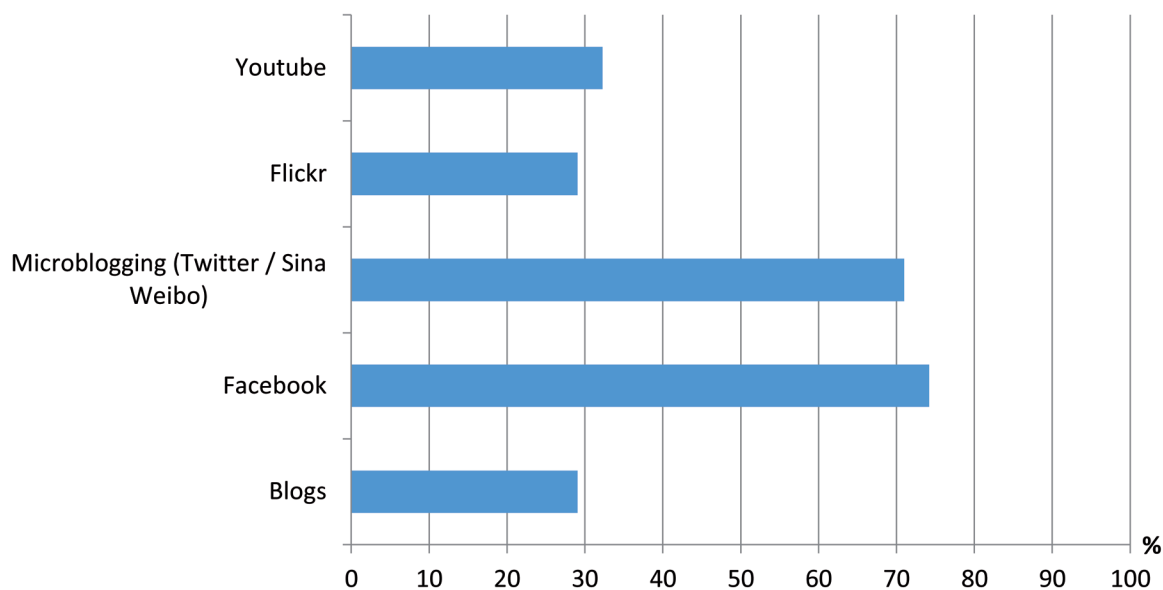
Figure 7: Applications of Social Media in Informational World Cities' Public Libraries

also being used (see Pendse (2012) for similar results on Ivy League university libraries). From October 17 to December 13, 2012 we visited each social media account and gathered available statistics. Libraries in China do not use Facebook or Twitter because of access restrictions. Thus, Chinese social media equivalents were investigated (i.e. Sina Weibo). Because Sina Weibo offers extended microblogging functionalities (e.g. enhanced linking procedures) and as such can be regarded as a Twitter substitute, only those indicators were considered which also find equivalents in Twitter (e.g. posts vs. tweets) and which were available on the website. Since we could access Twitter via its API (Application Programming Interface) we found more information on libraries' Twitter accounts than on Sina Weibo accounts (e.g. creation dates of library profiles are not publicly available on Sina Weibo). Therefore, such statistics for Sina Weibo are only included in the following figures where possible. For a detailed analysis of microblogging on Sina Weibo for a Chinese library, see Jingchi and Huang (2012).

22 out of 31 libraries (71%) are active on Twitter or on Sina Weibo. This number forms a strong contrast to the results of Walia and Gupta (2012), who found that only 57% of national libraries are using Twitter. Figure 8 displays how active libraries are on both microblogging platforms. The New York Public Library is the most active library in terms of total number of tweets. Since this number depends, among other factors, on the time that a library has already been using Twitter or Sina Weibo, we also calculated average tweet numbers per day. For this, we counted the days

from the user creation date (assuming that this is the day of their first tweet) to the day of data download. According to this calculation, the National Library Board Singapore is the most active library, sending an average of 12 tweets every day, while every library sends an average of 3.4 tweets per day. The results that show Singapore to be the most active twitterer might be misleading since Singapore is a young twitterer with an immense output. Second place in terms of tweeting activity is occupied by the New York Public Library, which has constantly published a lot of tweets since 2008. The oldest Twitter user is the Toronto Public Library, which started its account in April 2008. The year with the most Twitter account creations is 2010, which is also the year in which more than half of all libraries became Twitter users. The Bibliothèques Publiques de Montréal follow the most Twitter users and as such consume the most information (see "followings"). This leads to an increased probability of producing retweets of other users' content and, alongside, to more tweets sent by the library.

74% of libraries have a Facebook account. Chinese social networks like Douban or Sina Weibo are not taken into account in this analysis. Here again, Walia and Gupta (2012) found fewer national libraries participating in social networks, although the authors did not limit their analysis to Facebook. Organizations and companies have to build up sites on Facebook instead of profiles, but they can also publish posts on these sites (Sekyere 2009). Users who become fans of a site (instead of becoming friends with other human users) by clicking the "like" button on the library site receive these posts on their timeline. The
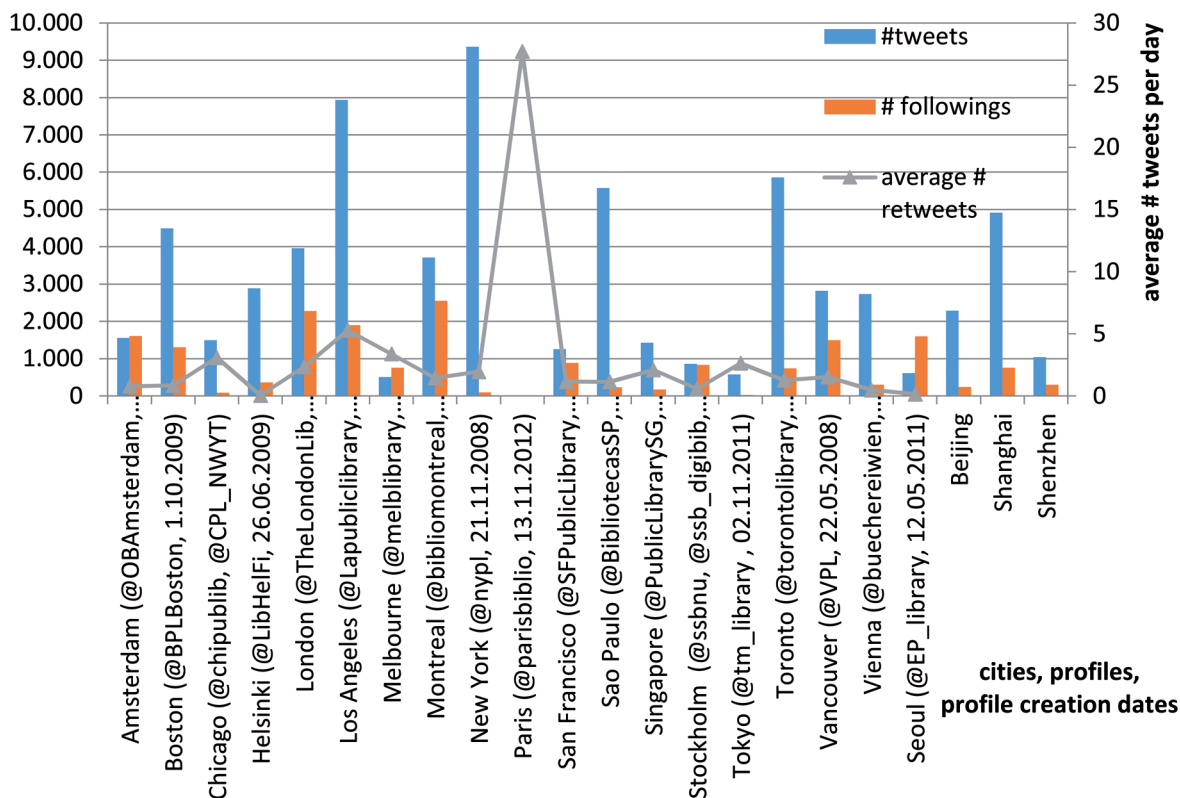
Figure 8: Microblogging Activity (i.e. Number of Posts and Number of Followings) of Public Libraries (n=22)

Facebook posting behaviour of libraries cannot be tracked that easily since Facebook does not publish an accumulated number of posts or events on the site, in contrast to Twitter. However, the number of posts could be generated by using the Facebook API. Four different types of posts reflect activity on Facebook: status posts, which are text posts only; photo posts; video posts; and URL posts to events organized by the library. All types of posts can contain text messages as well. Figure 9 shows the total number of posts in contrast to the average number of posts per day. Since we face the same problem of different account creation dates on Facebook as on Twitter, we had to normalize the posting activity by dividing by the respective days of activity. Sao Paulo, Seoul, and Stockholm are the most active public libraries on average, with over two posts per day. Seoul is a young Facebook user (active since September 2012) and therefore shows a low number of total posts. The libraries of New York and Sao Paulo are the most active ones in terms of total numbers. The San Francisco Public Library is the most experienced Facebook user, having set up its account in February 2008. On average, each library account was created in October 2009. The most frequently used post types are URL and event, respectively, followed by photos. This reveals that

public libraries in Informational World Cities predominantly share real-world activities (i.e. events in the physical library) and library content with their patrons.

45% of libraries publish videos on their own YouTube channels (as shown in Figure 10), which is a similar result to Walia and Gupta (2012). Library activity can be analyzed via the total number of videos. In our data set, the New York Public Library is the most active library with 3,000 videos, which is an average of almost two published videos per day or 60 videos per month. The average number of published videos per month across all libraries is 7, although this number might be misleading because of the immense amount of videos published by the New York Public Library. The median for videos per month is 1. The calculation of normalized values for each library takes into account only 11 libraries, since profile generation dates were not available for both the Sao Paulo Public Libraries and San Francisco Public Library.

Physical Library

We investigated different core services in the context of physical libraries. Starting with the architecture of the
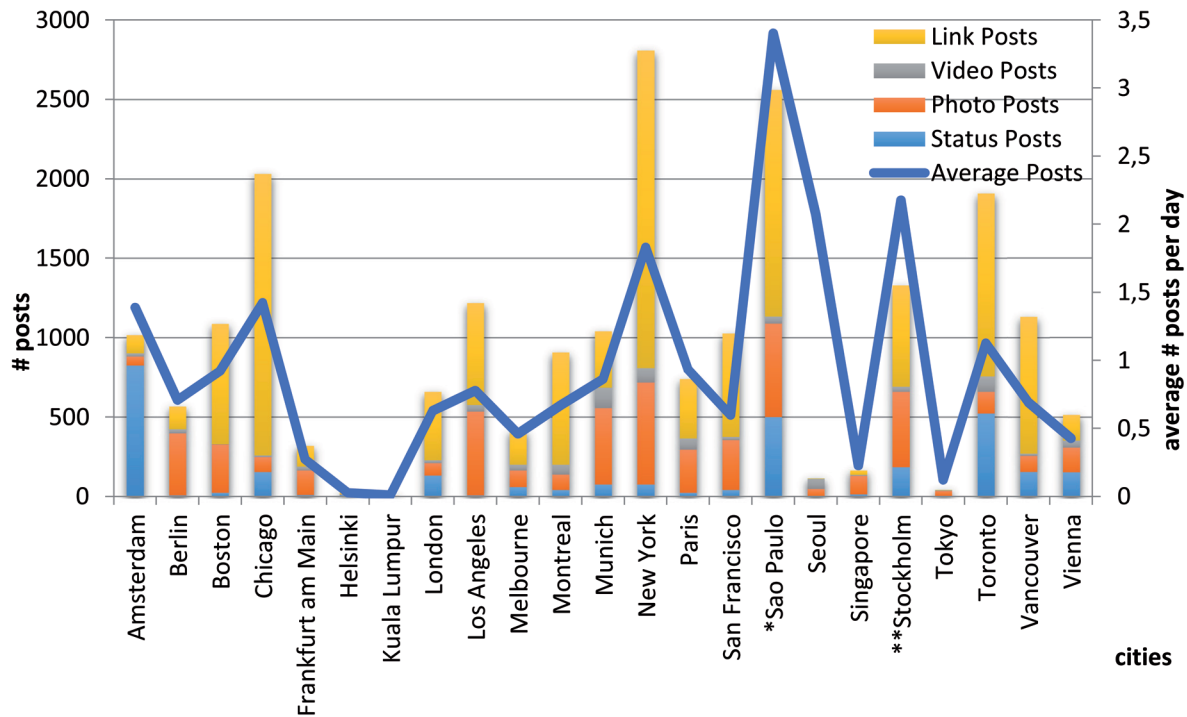
*BibliotecasSP, Biblioteca de São Paulo

**Stockholms stadsbibliotek - 40 folkbibliotek, Internationella biblioteket, Internationella biblioteket

Figure 9: Facebook Activity (i.e. Number and Type of Posts) of Public Libraries (n=23)

public library buildings, it can be seen that almost every library of the Informational World City is an architectural landmark. Statistically speaking, more than 9 out of 10 library buildings can be considered as an attraction of their city. A good example for such a building with a 'wow' effect is the National Library of Singapore (Figure 11).

Other important aspects of the physical library are its interior spaces (Figure 12) and its attractiveness. Therefore, we investigated libraries' different uses, e.g. providing spaces to learn, meet and work as well as special places for children. According to the statistics, the majority of libraries have meeting (77%) and learning spaces (81%) for their users. This is only exceeded by spaces for children – the majority (97%) of libraries offer special rooms for them or, like Shenzhen, a whole library aimed at children's needs. Modular working spaces that can be adapted to the requirements of meeting groups are not that popular. Fewer than one in two libraries have these kinds of rooms. The same value was reached by places in the library for eating and drinking, such as cafeterias. In total, only 45% of libraries offer the possibility of having a snack inside the library building. Regarding spaces, we would like to single out the National Library of Singapore, which combines most of the presented core physical library services.

Furthermore, in many cases we came upon measures that improve the attraction of the spaces, e.g. designer furniture or reading lounges. Two good examples are the libraries of the Openbare Bibliotheek Amsterdam and the Biblioteca de Sao Paulo. The public library in Amsterdam is equipped with designer furniture, a roof terrace, and a piano in the lobby where visitors can practice. Sao Paulo stands out through its comfortable reading area with a lot of armchairs and cushions, and the green space in its immediate vicinity.

In addition, there are also technologies that attract the user to the library. In every investigated library, wireless Internet is available – only one exception must be named, which is Singapore. There, the whole city has access to Wi-Fi, so the library need not provide its own Internet access. To address users' mobility, another core service is the chance to return the borrowed media anywhere in the city. In total, more than 70% of libraries provide their users with this option. Only slightly fewer libraries have already installed RFID in their collections (ca. 58%).

Finally, we focused on marketing strategies and on seminars on information literacy. Most of the libraries take their role as teaching libraries seriously. Two thirds of the libraries provide information literacy programs in the
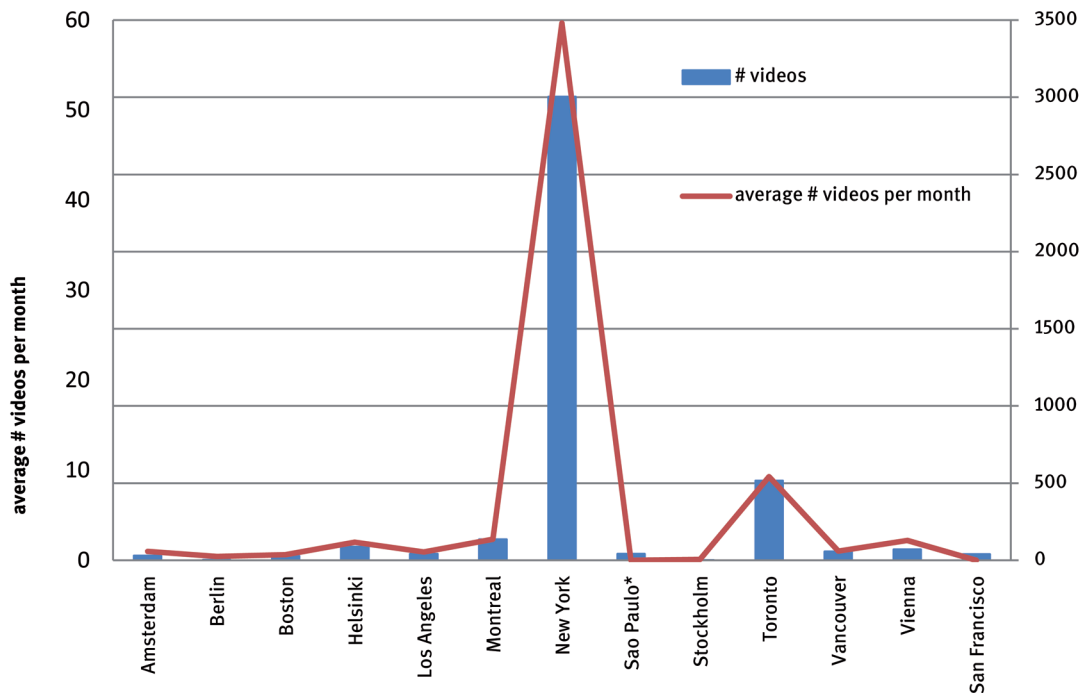
	Amsterdam	Berlin	Boston	Helsinki	Los Angeles	Montreal	New York	Sao Paulo*	Stockholm	Toronto	Vancouver	Vienna	San Francisco
# videos	31	3	29	88	42	137	3.004	42	2	516	58	71	40
average # videos per month	0,98	0,43	0,64	2,01	0,92	2,34	59,68	0,00	0,10	9,28	1,03	2,19	0,00

*bibliotecas SP, Biblioteca de São Paulo

Figure 10: Libraries' YouTube Activity (i.e. Number of Published Videos, n=13)

form of seminars where users learn, for example, how to read up on information, or how to use computers and online services reflectively. Taking the marketing strategies into account, one notices a great diversity. Services range from online marketing, e.g. special sites for children, teenagers, or immigrants, via offers for the elderly and the disabled (library buses or delivery services), to events and attractions on location, such as guided tours, exhibitions, or book and gift shops.

Ranking of Informational World Cities' Public Libraries

In our cumulative ranking regarding digital and physical aspects of public libraries in Informational World Cities, it is clear that there are two winners: Vancouver and Montréal (see Figure 14). Both of them gained 129 out of 150 points on our rating scale. Montréal even fulfilled all requirements concerning the physical library. Having a

closer look at this aspect, one can assert that most of the libraries score points with their multi-functional building and on-site offers. Only in a few cases does the evaluation of the digital library overmatch that of the physical library.

Surprisingly, it should be noted that Dubai takes up the last place. In our visit to the United Arab Emirates in February 2013, we visited the central library of Dubai's public library system. We found a book-to-borrow oriented library, supported by an OPAC and some bibliographic databases. Besides the dominating book shelves there is a reading room for newspapers and there are ca. ten PCs with Internet access. This old-fashioned public library is in stark contrast to the glittering face of Dubai with many information-oriented clusters such as Academic City, Internet City, Media City, and Knowledge Village. To stick strictly to our research method of the investigation of websites these findings did not flow into the dataset. Nevertheless the visit of the public library in Dubai clearly approves the surface impression and the last position in the ranking.

Figure 11: The Library as an Architectural Landmark of an Informational World City: The National Library of Singapore as a Paradigm. Photo: W.G. Stock

Discussion

We opened this paper by asking which core services are needed in a public library of an Informational City. At this point we can sum up which services are given in an average Informational World City's library. The average library has a digital library consisting of the following e-resources: e-journals, e-books, audiobooks, music, e-magazines, videos, and newspaper and bibliographic databases. Additionally, the library digitizes its own specialized collections and publishes them. The cardholders can access databases free of charge. Furthermore, there are various guides for the digital library whose forms are diversified. To use the reference services in a typical library of an Informational World

City, one can write an e-mail or use the Web form. Concerning its online presence, the library has a website in English next to its national-language version. This also applies to the Web-OPAC. Moreover, the lion's share of public libraries use social media products to promote their resources, with Facebook and Twitter being the most actively used of these media. The study by Walia and Gupta (2012), which focused on national libraries, showed that only 28 of 66 analyzed libraries (i.e. 42%) use social media, whereas almost 71% of public libraries in our analysis have at least one social media account. This discrepancy may be rooted in the different roles and aims of national vs. public libraries. One may assume that public libraries are forced to communicate with their patrons and to become visible in the city's community

Figure 12: Spaces in Informational World Cities' Public Libraries: The Shanghai Library as a Paradigm. Photo: W.G. Stock
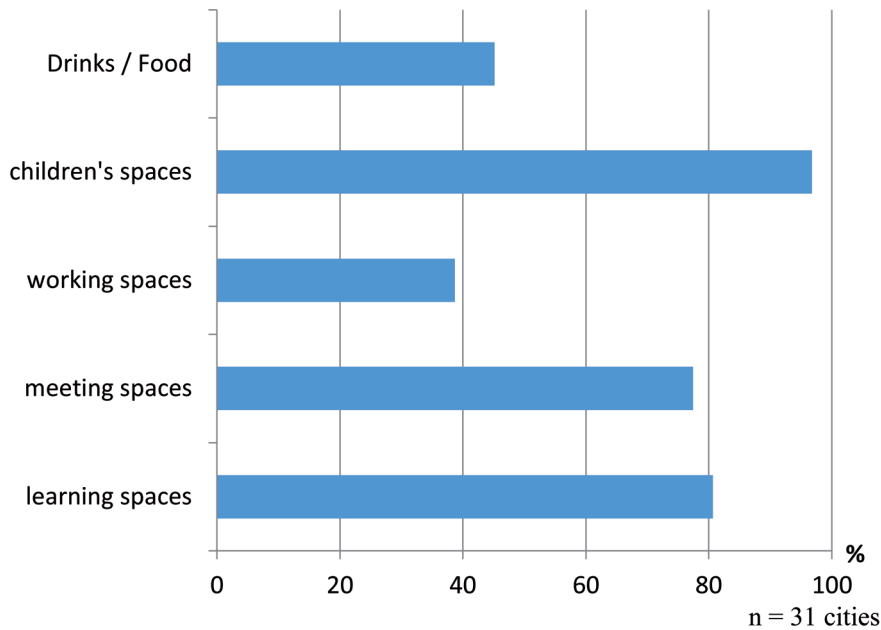
Figure 13: Physical Spaces in Informational World Cities' Public Libraries

to a greater degree, so that public libraries are more willing to use Social Media for this purpose.

Focusing on the library as a place, the building represents an architectural landmark and offers learning and meeting rooms as well as spaces especially for children. The average library offers Wi-Fi Internet access to its visi-tors and allows patrons to return their borrowed media anywhere in the city – in the same context, the library also has RFID. Last of all, seminars on information literacy are organized at the library.

To sum up: We believe that there are two core services of the prototypical library in the knowledge society:
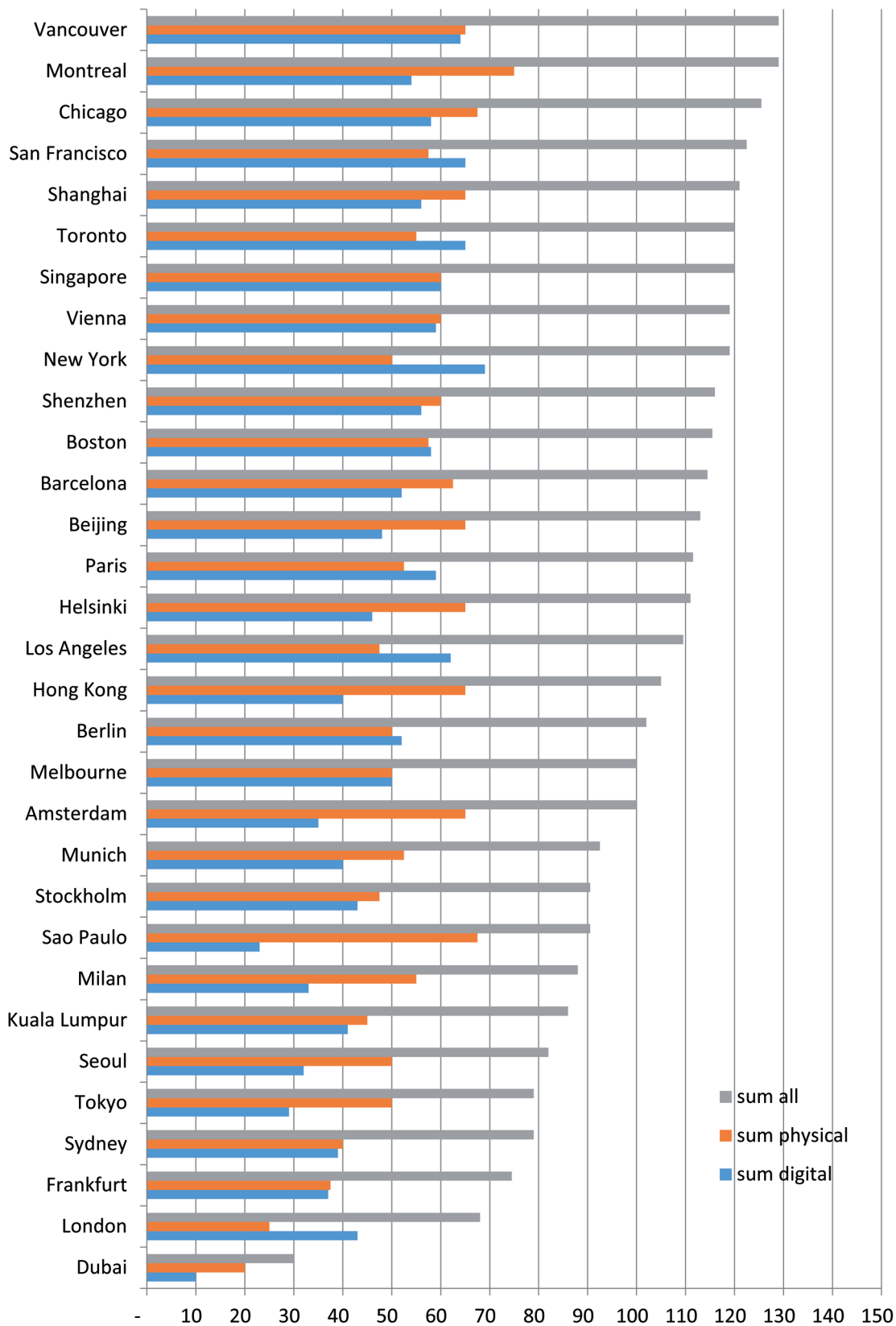
Figure 14: Ranking of Informational World Cities' Public Libraries

1) good libraries support citizens, companies and administrations in their city and their region with digital services, namely e-resources as well as reference services, and communicate with their customers via Social Media; and 2) good libraries offer physical spaces for meeting, learning and working, as well as for children and other groups in a building which is a landmark of the city.

Outlook

Finally, we concentrate on prospective perceptions of the digital and physical libraries. The offers of e-resources in the digital library are very expensive. To deal with huge numbers of subscriptions to e-books, e-journals, etc., all libraries in a city should cooperate, of course facing the problem of potentially higher licences for the information products in order to serve a larger clientele. Pursuing this thought further, it seems that not only public libraries but also academic, special and national libraries could convene and offer their stock in unison (this idea is inspired by the "franchised model" of Wah and Choh (2008)). The digital library does not have any physical spaces and the user does not care which library serves him the document – he is just interested in getting the information. This leads us to the conclusion that the cooperation between different kinds of libraries would support the user's information needs. Furthermore, the accruing costs could be divided between the participating libraries.

Focusing on physical libraries, it must be noted that with the growth of the digital library the library as a building and as a place has to find new ways to attract users to leave their computers at home and use the physical library. This aspect is reinforced by the fact that there are now fewer shelves with books and journals (compared to emerging amounts of digital resources). Maybe it is not the print versions of media that should convince users but the spaces and the events taking place at the library. We already suggested some examples for these attractions, such as spaces to meet, to learn together or to compare notes. Possibly the future of the physical library is as a place of exchange that entices users via the attraction of its spaces and activities, e.g. expositions and author readings as well as helpful seminars. Open questions are, however, how to attract the "creative" users and the knowledge elites to the library, how to sustainably bind children and young adults, especially the generation of Google, Wikipedia and Facebook users, to the library spaces, and how to successfully argue that knowledge management (Hayes 2004) must take place at the city level.

In terms of information dissemination and outreach via social media activities, Facebook's API automatically records which types of posts libraries publish on their pages. The posts or videos from Twitter, Sina Weibo, and YouTube would have to be analyzed manually to determine their content type. Since Jingchi and Huang (2012) found out in their study that tweets written by librarians are more likely to be retweeted than automatically generated posts, and Pendse (2012) showed that most YouTube videos are about faculty activities, student conferences, or software training, we postpone the detailed content analysis of posts to our further studies in order to gain a deeper understanding of libraries' posting behaviour. Further steps in our research include expanding analyses to university libraries and their use of social media as well as to the reactions of users to produced content (e.g. retweets or likes).

This study has limitations. The content analysis of the libraries' websites is a very rough approximation of the libraries' "real" services. The study should be extended to visits to all public libraries of the 31 Informational Cities. Our analysis is dichotomic: there is a specific service or not. To be more precise one should study the concrete scope of every service. We concentrated on the supplier side of the services and neglected the user side. Here it would be very helpful to study the concrete use of the services. All these aspects should be topics of further research.

To sum up, our study tries to understand the digital and physical library spaces as infrastructures and as soft location factors in Informational World Cities, and how libraries might improve those core services. Informational Cities are often called "ubiquitous cities." Do libraries in the knowledge society emerge as ubiquitous libraries (Kaske 2004), libraries that are "mobile" (Barnhart and Pierce 2011), available anytime and anywhere (O'Donnell 2011), and acting as "dynamic engine[s] for the knowledge and information society" (Li 2006)? Our answer is, "yes;" in most of the analyzed Informational World Cities, libraries do indeed form an essential part of the city's digital, smart, knowledge, and creative infrastructures and play a major role as a soft location factor.

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Appendix 1: Analyzed Libraries (Websites)

Amsterdam   Openbare Bibliotheek Amsterdam
                     http://www.oba.nl/
Barcelona   Biblioteca General Barcelona
                     http://w110.bcn.cat/portal/site/BibliotecaGeneral
Beijing   Capital Library Beijing
                     http://www.clcn.net.cn
                     Beijing Public Library Information Sharing Network
                     http://www.bplisn.net.cn/
Berlin   Central and Regional Library Berlin
                     http://www.zlb.de/
Boston   Boston Public Library
                     http:// www.bpl.org/
Chicago   Chicago Public Library
                     http://www.chipublib.org/
Dubai   Dubai Public Library
                     http://www.dubaipubliclibrary.ae/Default.aspx
Frankfurt/M.   Frankfurt City Library
                     http://www.stadtbuecherei.frankfurt.de
Helsinki   Helsinki City Library
                     http://www.lib.hel.fi/
Hong Kong   Hong Kong Public Libraries
                     http://www.hkpl.gov.hk/eindex.html
Kuala Lumpur   Kuala Lumpur Library
                     http://kllibrary.dbkl.gov.my/client/pkl
London   London Library
                     http://www.londonlibrary.co.uk/
Los Angeles   Los Angeles Public Library
                     http:// www.lapl.org/
Melbourne   Melbourne Library Service
                     http://www.melbourne.vic.gov.au/MelbourneLibraryService/
Milan   Biblioteche Milano
                     http://www.comune.milano.it/dseserver/webcity/Documenti.nsf/
                     webHomePage?OpenFormandsettore=SVIY-5HNG9W_HP
                     http://www.aboutmilan.com/libraries-in-Milan.html
Montreal   Bibliothèques publiques de Montréal
                     http://ville.montreal.qc.ca/portal/page?_pageid=
                     4397,6375618and_dad=portaland_schema=PORTAL
Munich   Munich City Library
                     http://www.muenchner-stadtbibliothek.de/stadtbibliothek/
                     http://stadtbib-home.html
New York   New York Public Library
                     http:// www.nypl.org/
Paris   Bibliothèques
                     http://www.paris.fr/bibliotheques
San Francisco   San Francisco Public Library
                     http://www.sflp.org

Sao Paulo	Biblioteca Mário de Andrade
	http://www.prefeitura.sp.gov.br/mariodeandrade
	Sistema Municipal de Bibliotecas
	http://www.bibliotecas.sp.gov.br/
	Biblioteca de Sao Paulo
	http://bibliotecadesaopaulo.org.br/
Singapore	National Library Board Singapore
	http://www.nlb.gov.sg/
Seoul	Namsan Library
	http://211.61.24.74/english/index.aspx
	Gangnam-Gu Library
	http://library.gangnam.go.kr/
	Eunpyeong Public Library
	http://www.eplib.or.kr/action/index.php
Shanghai	Shanghai Library
	http://www.library.sh.cn/
Shenzhen	Shenzhen Library
	http://www.szlib.gov.cn
	http://www.szreader.org/portal.php?mod=topicandtopicid=34
Stockholm	Stockholm City Library
	https://biblioteket.stockholm.se/
Sydney	City of Sydney Library Network
	http://www.cityofsydney.nsw.gov.au/library/
Tokyo	Tokyo Metropolitan Library
	http://www.library.metro.tokyo.jp/
Toronto	Toronto Public Library
	http://www.torontopubliclibrary.ca/
Vancouver	Vancouver Public Library
	http://www.vpl.ca/
Wien	Büchereien Wien
	http://www.buechereien.wien.at/

Appendix 2: Library Core Service Index

	Group	Indicator	Weight (Indicator)	Weight (Group)
DIGITAL LIBRARY	**Web-OPAC**	Web-OPAC	8	13
		Web-OPAC in English	5	
	e-documents	e-journals	1	10
		e-books	1	
		digital images	1	
		audio books	1	
		music	1	
		e-magazines	1	
		videos	1	
		newspapers	1	
		bibliographic databases	1	
		other e-resources (explain)	1	
	databases with access to full papers	databases with access to full papers - free of charge?	10	10
	guides	video guide	1	6
		podcast guide	1	
		seminars	1	
		text documents	1	
		FAQ	1	
		other guides (explain)	1	
	international access	website in English	10	10
	digital reference services	e-mail	2	10
		chat / instant messaging	2	
		sms	2	
		web form	2	
		skype	2	
	social media	blogs	1	6
		facebook	1	
		twitter	1	
		flickr	1	
		youtube	1	
		other social media	1	
	apps	apps	5	5
	own digitizations	own digitized documents / collections	5	5
PHYSICAL LIBRARY	**spaces**	learning spaces		10
		meeting spaces		10
		working spaces		10
		children's spaces		10
	use of technology	RFID	25	10
		interlibrary loans (borrow anywhere and return anywhere)	25	
		wifi	5	
	architectural landmark	architectural landmark		10
	attraction of spaces	drinks/food	5	10
		attraction of spaces	5	
	information technology	seminars on information literacy		5
		SUM DIGITAL LIBRARY		75
		SUM PHYSICAL LIBRARY		75
		SUM ALL		150