Chapter 5
Higher Education Activities in World Cities: A Spatial Study of Global Leadership and Connectivity

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Abstract Key characteristic of globalization is intensified interconnectedness among different places and individuals, beyond exchanges led by states and governments. However, existing literature on the geographies of higher education under globalization primarily focuses on the interactions at the regional scale and the intercountry level. Little is known about the disaggregate distribution of higher education activities in cities and the manner in which cities are connected in terms of academic linkages. This chapter reveals the spatial distribution of world cities with more higher education activities showing international standings and global connections. A four-indicator system of Globalizing Education Index, which consists of the Place Power and Network Power of cities, is proposed to measure the internationalization and connectivity of places. The spatial distribution of cities performing well in the four areas of prestigious-university standings, influential world scholars, international academic events, and global research networking suggests that decentralization of higher education activities is restricted to certain aspects, although the movement and information flows of the knowledge economy are supposedly more unrestricted under globalization. The geographical distribution of world cities with high Globalizing Education Index remains concentrated in North America with strong historical and cultural backgrounds of world academia and slightly spread to East Asia due to its strength in organizing international events. This chapter supplements existing geographical studies on higher education and proposes further research directions addressing the influence of geography and connectivity in facilitating academic activities with a global reach.

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5.1   Introduction: Intensified and Fragmented Connections in the Knowledge Economy

Globalization has changed the development of higher education, including, but not limited to, the following aspects: national policies for attracting and retaining global talents, interactions among universities, strategies to maintain the competitiveness of universities despite global competition, overseas and offshore schools, and international standardization of the curriculum (Yang 2003; Wang 2008; Lanzendorf and Kehm 2010; Broaden and Crawley 2012; Knight 2012; Ng 2012; Alivernini and Wildova 2013; Postiglione 2013). The focus of these studies varies, but numerous researchers investigated the changes and proposed strategies in response to the challenges brought by globalization. One of the changes realized under the trend of globalization is that different actors in the field of education, including students, scholars, policy makers, universities, research institutions and nations, can readily get in touch with counterparts elsewhere due to the ease of movement and improved telecommunication technology. The increasing role of non-state actors, such as universities, research units and joint research teams, suggests that studies about the internationalization of education should focus more on changes at more disaggregate spatial levels (e.g., city level) instead of the national level. Many academic interactions nowadays are relatively free from the influence of national policies. For instance, universities, even faculties and schools, have signed collaborative memorandums with both local and overseas partners who share common goals. Another example is the popularity of overseas exchanges and the rise of the destination choices of students in the past. Fragmented but interconnected linkages across different localities in a single world is a realization of globalization in higher education activities. These changes suggest that a country or nation may no longer be a sufficient unit of analysis in the field of 'internationalization of education.'

The intensified interconnectedness under globalization rests on the improvements of transport and telecommunication networks over time (Loo 2012). The global economy supported by improving transport and telecommunication networks connects different world cities to the web of commercial exchange (Derudder and Witlox 2010). A global knowledge economy is also strengthened by transport and telecommunication development. Researchers, university management, and students can now travel relatively easily with more affordable airfare and better flight connectivity worldwide. Even when they do not travel physically, they can remain connected to the world. Access to telecommunication and Internet infrastructure allows researchers to generate knowledge flows that bypass national boundaries, perhaps in multi-directions. Students taking online courses can interact with teachers and students elsewhere. A web of invisible links spreads globally and locally in the information age. Any individual studying in the higher education or working in the R&D sector may contribute to the intense interactions in the global

knowledge economy by adding his or her international connections. Subsequently, any city with a mass of individual actors and non-state institutions may become centers of innovations. Thus, 'transnational space' without the traditional sense of boundary may be a more appropriate unit of analysis for studying the global activities of education (Kim 2007). The investigation of higher education can focus on various non-state units, such as universities, regions, cities, or even individuals, which render the multi-faceted nature of the studies on the global geographies of higher education.

In this chapter, higher education activities are investigated at the city level. The transition from a central periphery pattern in the global educational landscape to a multi-center pattern is one of the changes brought by globalization (Chan and Ng 2008: 498). Cities, where universities, research institutions, scholars, and students are located, are perceived as nodes of knowledge concentration in the multi-centered geography of higher education. At the national level, several studies have investigated and interpreted the global geographies of higher education. For example, the illustration of diversifying global knowledge power by Marginson (2010: 6974–6975) was centered on the performance of the state. The National Science Foundation (2012) also studied the expanding global research pool in science and engineering among countries. Nevertheless, these nation-based studies on decentralization patterns only offer one side of the multi-faceted globalized development of higher education. The rise of China as a global knowledge power illustrates this argument. As a new and rapidly growing global knowledge power, China is home to new nodes of knowledge concentration that emerged in some eastern Chinese cities, such as Hong Kong, Beijing, and Shanghai. Hence, the East China Coast may be better described as a rising power than China as a whole. On the one hand, the global geographies of higher education may be less stratified because of the rising importance of non-American units. On the other hand, the spatial distributions remain highly stratified because of the Anglo–American hegemony in research capacity and uneven development within new global knowledge powers, such as China, India, and South Korea. Thus, a subnation (e.g., city level) unit-based investigation may imply different patterns of the development of global higher education.

Against the aforementioned background, this chapter attempts to answer the following questions addressing the internationalization and connectivity of higher education:

1. What are the academic activities that can be quantified to reflect the international standings of a city and the connectivity among cities?
2. What are the performances of different cities in attracting and connecting higher education activities worldwide?
3. What is the spatial distribution of world cities with higher level of internationalization and global connections?

5.2   Identifying World Cities with International Standings and Global Connections

A starting point of this research is to measure the frequency and flows of relevant activities at or between cities to foster a better understanding of the global geographies of higher education. A Globalizing Education Index that reflects the strengths and connections of cities within the global higher education network is formulated. Higher education activities that occur in cities and involve universities, scholars, and students reflect the global education power of the city. Locational strengths can be reflected by the global reputation of universities, number of world-renowned scholars, number of research units and patents granted, number and diversity of overseas students, and frequency of international academic conferences. Networking power among cities can be reflected by interuniversity cooperation, joint programs, international research collaboration, and mobility of students and scholars between cities.

Several academic activities can show the strengths of a city and networking among cities, but measuring the international standings and global connection is challenging. City-level data for a global scale study are always absent for measuring a city's functions (Short et al. 1996; Derudder et al. 2008). Thus, most researchers have used region- or country-based data as proxies for measurement. This methodology has two major deficiencies. First, the proxies may fail to reflect the actual intensity and velocity of a city in global activity networks, as illustrated above with the example of China. Second, the definition of urban agglomeration or region differs among countries, and this difference creates a non-standardized spatial unit of analysis for global comparison. To address this methodological challenge, a Globalizing Education Index based on available city-level data sources is proposed to supplement existing studies on the geographies of higher education.

5.2.1   Globalizing Education Index

A Globalizing Education Index is designed to measure the internationalization and connectivity of a city in the academic world. This index is a modified version of the Globalizing Cities Index (Taylor et al. 2011) and consists of the Place Power and Network Power of a city in contributing to the global network. Taylor et al. (2011) measured the performance of a global city in attracting and connecting commercial activities. Using the headquarter-office structures of different advanced producer services firms, the connectivity among cities is constructed based on the command and control functions of transnational corporations. Similarly, the attraction and connection power of cities are measured by various higher education activities showing their global influence. Figure 5.1 illustrates the four-indicator system of the Globalizing Education Index. This index consists of two subindices, namely, City Place Power and City Network Power. The Place Power (i.e., attraction) of
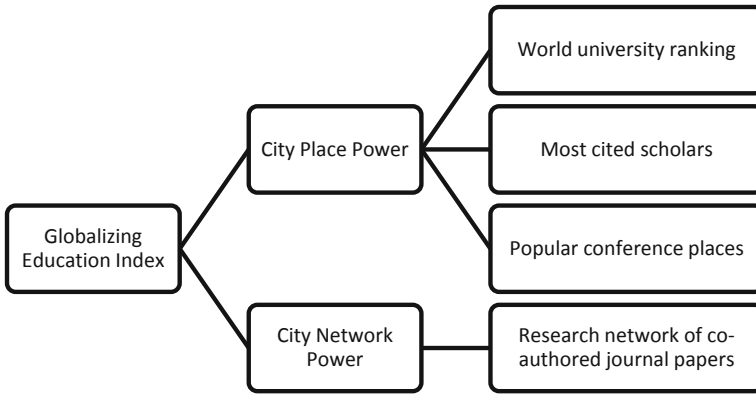
Fig. 5.1 Globalizing Education Index (four-indicator model)

cities covers world university rankings, location of the most cited scholars, and popular conference places, whereas the Network Power (i.e., connectivity) is measured by the co-authorship in published journal papers.

'**World university ranking**' is an indicator that highlights the international ranking of cities in terms of world-renowned universities. It considers the reputation of universities as a measurement of the attractiveness of a world city. The Academic Rankings of World Universities (ARWU), which is conducted by the Center for World-Class Universities and the Graduate School of Education of Shanghai Jiao Tong University, China, is a popular global university ranking that covers institutions all over the world. The chosen global university ranking measures the status and prestige of a university based on research outputs, faculty staff, world-class awards, and number of international students, among other factors, as an aggregate strength index of a university (Shanghai Ranking Consultancy 2013). The top universities announced by ARWU are included as the world university ranking indicator of the Globalizing Education Index.

'**Most cited scholars**' is an indicator that highlights the locations of internationally renowned scholars who contribute intangible knowledge flows in the academic world. It shows the locations of such researchers listed in the Highly Cited Researcher project of Thomson Reuters. Thomson Reuters organizes citation information between 2000 and 2008 and identifies the 250 most cited researchers in each discipline (Thomson Reuters 2013). Cities with a higher number of most cited scholars are considered to have a higher place power because of these researchers' contributions toward knowledge generation with high impact and global influence.

'**Popular conference places**' is an indicator that shows cities selected as the hosting place of international academic conferences or meetings. The information is collected from conference proceedings or journals published in 2012 and listed in the Scopus database to identify the frequency of a particular city as the location of international conferences or meetings. The cities on this list are the places with more face-to-face interactions among researchers.

'**Research network of co-authored journal papers**' is an indicator that considers scholarly networking and as a proxy of intercity connection in transnational research collaboration. This indicator represents the interactions and flows of information and knowledge exchange in the knowledge economy. The networking patterns reflect both face-to-face and intangible transnational knowledge generation and exchange. The locations of co-authors and distance between their hometowns indicate the level of internationalization and connectivity of cities in the knowledge economy. The data for this indicator are collected from the Web of Science database. The sample consists of the last issues of the highest, middle, and lowest ranked journals in each subject category of journal citation reports published in 2012. The locations of the work affiliation of the first and second authors are analyzed to build the intercity research network pattern. The more frequent the cities appear in the net of research network, the stronger networking power they have. The average earth surface distance (measured by the haversine formula) between the first and their second authors in a particular city reflects the spatial extent of this transnational higher education activity:

$$\text{haversine}\left(\frac{d}{R}\right) = \text{haversin}(\varphi_2 - \varphi_1) + \cos(\varphi_1)\cos(\varphi_2)\text{haversin}(\lambda_2 - \lambda_1),$$

where haversine is $\text{haversine}(\theta) = \sin^2\left(\frac{\theta}{2}\right)$; d is the spherical distance between two points (cities of authors); R is the radius of the sphere (the earth); and (φ_1, λ_1) and (φ_2, λ_2) are the latitude and longitude of the two cities, respectively.

Table 5.1 summarizes the data sources, sample sizes, and the relevance of the proposed index system to the studies on the internationalization and connectivity of higher education.

With the formulation of this four-indicator system, this research offers a new set of quantitative measurement and reveals the importance of each local node (i.e., city) in forming the globalizing education network and in leading the globalization of higher education. Most of the previous quantitative measurements with a global coverage have relied on country-based performance. The Globalizing Education Index can demonstrate the strength and connectivity of a city with regard to education activities. At this stage of the study, the four indicators carry equal weight in the aggregate Globalizing Education Index. Cities with more place-based activities (i.e., world universities, most cited scholars and popular conference places) will have higher scores based on the importance or frequency of occurrence. For research collaboration, cities with more occurrences in this network-based activity will have a higher score. The assignment of index scores to cities is proportional to the performance of the highest scoring city.

The data sources of the four indicators are primarily from established Anglo–American-based global institutes analyzing scientific research performance. Hence, the potential bias is recognized and addressed. For instance, data collected from

Table 5.1 Data summary of the four-indicator globalizing education index

Indicator	Data source	Sample size	Relevance to internationalization and connectivity of education
World university ranking	Academic Rankings of World University (ARWU)	Top universities reported in ARWU	Cities with world-renowned universities
Most cited scholars	Highly Cited Research, Thomson Reuters	Approximately 3500 scholars on the list	Cities with active knowledge creation that act as key focus points of the global knowledge economy
Popular conference places	Scopus Database	Approximately 700 conferences held in 2012	Cities with frequent international knowledge exchange through face-to-face interactions
Research network of co-authored journal papers	Web of Science	Approximately 1500 co-authored papers from the highest-, middle- and lowest-ranked science and social science journals published in the last quarter of 2012	Cities that generate intangible and sometimes face-to-face knowledge exchange with other places

different journal citation rankings may overrepresent the English-speaking, world-leading, and scientific or technological academic exchanges (Jöns and Hoyler 2013). To address this issue, non-ISI (The Institute for Scientific Information) listed conference proceedings from the Scopus database and journals from social science disciplines are also incorporated into the indicator calculation. At the later stage of the study, other indicators such as scholar and student mobility will be added to diversify the data sources. Nevertheless, the suggested data sources offer a comprehensive coverage for a world city study addressing the internationalization and connectivity of higher education activities.

5.3 Findings of the Four-Indicator Globalizing Education Index

In this section, the results of each indicator and the overall Globalizing Education Index are examined with an emphasis on the spatial distribution of city with outstanding performance.

5.3.1 World University Ranking

Figure 5.2 shows the cities that house more world-renowned universities. The distribution of cities matches the traditional power of education with New York (the only city with four prestigious universities), London and Paris housing more internationally recognized universities. Most of the top 50 universities are located in the United States and Europe; only two are located in Japan. None of these universities are located in South America and Africa. The spatial distribution is highly concentrated in the Northern atmosphere, in particular North America and Europe. In other words, the World University Ranking indicator demonstrates the ongoing Anglo–American academic hegemony of university rankings (Jöns and Hoyler 2013).

5.3.2 Most Cited Scholars

Figure 5.3 presents the world cities with the highest number of most cited scholars. Similar to the distribution of world cities with world-renowned universities, the key global localities of the most influential scholars are concentrated in North America and Europe. Four cities with more than 100 most cited scholars are located in the USA: Cambridge in Massachusetts, New York, Stanford, and Chicago. Only four non-American cities (i.e., London, Cambridge, and Oxford in the UK as well as Tokyo) are on the list. Several Asian countries, such as China, Singapore, and South Korea, are regarded as new global powers of higher education measured by their scholarly outputs (Jarnecic et al. 2008; Mukherjee 2010; National Science Foundation 2012; Shin 2012; Abrizah et al. 2013). Despite the rising importance of Asia in the global knowledge economy, the world's most influential researchers continue to display a highly concentrated spatial pattern (see Fig. 5.3). In Europe, London, Cambridge (in the UK), Oxford, Paris and Copenhagen are the top five cities with more influential world researchers. In the Asia–Pacific and Australasia,

Fig. 5.2 Top 50 universities in world cities [produced by the authors based on data from ARWU (2012)]

Fig. 5.3 Top 30 world cities with the most cited scholars [produced by the authors based on data from Thomson Reuters (2013)]

Tokyo, Kyoto, Canberra, Hong Kong, and Melbourne house a larger number of the most cited scholars. The more powerful Asian–Pacific and Australasian cities with higher global standings remain concentrated in places with mature economic development and strong links with the English-speaking culture.

5.3.3   Popular Conference Locations

Figure 5.4 shows the spatial distribution of world cities hosting more international academic conferences. The result reveals a more decentralized pattern of globalizing higher education activities. More Asian cities are on the list, including Beijing, Shanghai, Kuala Lumpur, Singapore, Hong Kong, Seoul, and Taipei. The spatial distribution also shows a weaker connection to the traditionally powerful academic cities, such as those along the northeast coast of the USA. Cities with established tourism development, such as Las Vegas, Xian, Jeju Island, and Bali, are key hosting locations of face-to-face academic interactions as well. This factor induces a more dispersed spatial distribution of powerful world cities measured by conference organizations.

Fig. 5.4 Top 30 popular conference cities [produced by the authors based on data from Scopus (2013)]

5.3.4 Research Network of Co-authored Journal Papers

The previous indicators of Globalizing Education Index signify a city's place power in the globalization of higher education in terms of the world-renowned universities, citations of scientific outputs, and international academic events. They indicate the visibility of a particular city in the global academic world measured by the tangible movement (flows of researchers) and intangible interactions (knowledge creation and exchange). Another characteristic of globalizing higher education is the transnational research collaboration; joining this transnational activity is now easier for researchers. To illustrate the connections among the world research collaborators, the study has extracted 1500 co-author papers published in 2012 for this part of the research. Figure 5.5 shows the spatial extent of the global research connections. Cities in North America and Europe as well as a few in Asia and Australia have participated in the global knowledge economy with active networking. Meanwhile, cities in South America and Africa are not fully engaged in

Average distance between the first two authors (in order of the top 20 cities with most research networking):

1. London (2,663 km)	11. Madrid (1,655 km)
2. New York (1,018 km)	12. San Francisco (1,036 km)
3. Montreal (1,029 km)	13. Atlanta (938 km)
4. Sydney (2,109 km)	14. Melbourne (446 km)
5. Beijing (1,434 km)	15. New Haven (1,536 km)
6. Cambridge, MA (1,077 km)	16. Seattle (1,124 km)
7. Ann Arbor (740 km)	17. Seoul (0 km, all are intra-city networking)
8. Hong Kong (4,758 km)	18. Vancouver (198 km)
9. Chicago (191 km)	19. Baltimore (653 km)
10. Iowa City (582 km)	20. Boston (3,246 km)

Fig. 5.5 Connectivity of global research networks [produced by the authors based on data from the Web of Science database (2013)]

the global networking of research activities, although this activity is more individual-based compared with attaining a prestigious-university status and hosting international conferences.

Among the top 20 cities with the highest number of global connections, no obvious relationship exists between the frequency of engaging in global research networking and the spatial extent of collaboration. Cities with higher standings of global academic reputation do not necessarily entail long networking distance (e.g., Ann Arbor, Chicago, and Baltimore). Numerous research collaborations found in North America are confined to the continent. Meanwhile, research collaboration found in Asia–Pacific and Australasia is of relatively long distance (e.g., Sydney, Beijing, and Hong Kong). The Hong Kong research network shows the largest spatial extent with the longest research networking distance of 4758 km. By contrast, the research collaboration network recorded in Seoul, another rising academic power in Asia, indicates no degree of internationalization and is primarily limited to domestic collaboration.

5.3.5   *Geographical Distribution of Cities with High Globalizing Education Index*

Figure 5.6 illustrates the locations of the leading 30 cities based on the four-indicator Globalizing Education Index system. The top two cities, New York and London, are almost tied in leading the globalizing academic activities (with the indices of 1.000 and 0.996, respectively). The top five cities are either located in North America (New York, Cambridge, Montreal and Chicago) or Europe (London). Beijing and Shanghai also rank high in the Globalizing Education Index (6th and 10th, respectively). A number of American cities are on the top 30 list, such as Chicago, Pittsburgh, Los Angeles, San Francisco, Philadelphia, Berkeley and Princeton. They form a network of strong clusters of higher education activities. Although European cities have a longer history of education and R&D with global recognition, this regional cluster has been challenged by an Asian one

Fig. 5.6   Spatial distribution of cities with high globalizing education index
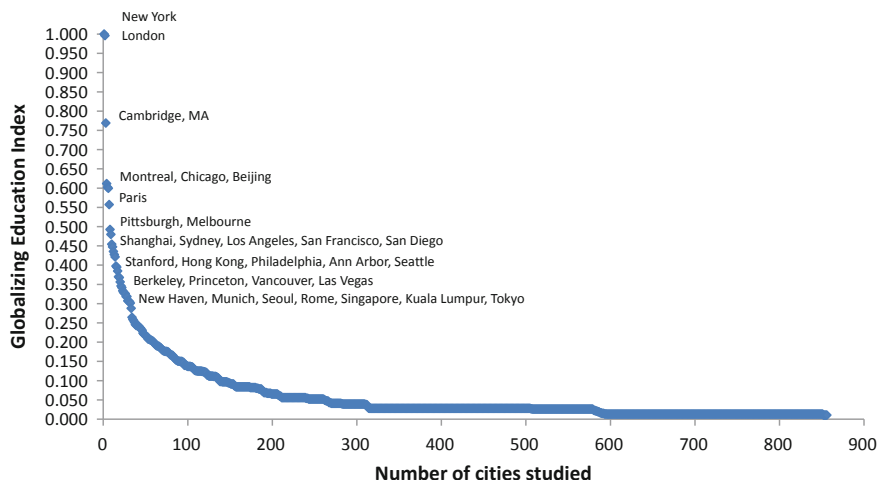
Fig. 5.7 Globalizing Education Index for all cities

(Fig. 5.6). In particular, several Asian cities with economic strengths also perform quite well in the academic world (e.g., Hong Kong, Singapore, Seoul, Beijing and Shanghai). In other words, the city-level analysis of internationalization and connectivity of higher education activities indicates a very strong concentration in North America. Cities along the East Coast and West Coast exhibit a well-rounded performance in the four indicators. Another cluster of cities with more globalizing higher education activities is located in East Asia. Their importance in the global academic community is primarily demonstrated by frequent international academic events. In addition, this global study covering more than 800 cities worldwide indicates that the internationalization of higher education remains concentrated at the top cities—only two cities have a Globalizing Education Index that is equal to or very close to 1, and roughly 770 cities have a Globalizing Education Index below 0.3 (see Fig. 5.7).

5.4 Discussion and Conclusion: Toward a New Research Agenda

In this chapter, the Globalizing Education Index, which consists of four indicators of knowledge production and circulation, reveals the internationalization and connectivity of different higher education activities. The results indicate the global geographies of higher education activities at the city scale. These empirical findings suggest future research directions for the field on geographies of higher education. Activities and people movement are supposed to be more unrestricted under globalization in the knowledge economy. However, the spatial distribution of world

cities with intense globalization remains concentrated in certain parts of the world. Different factors have influenced the performance of world cities measured by the Globalizing Education Index, namely, the historical and cultural background of cities, local and national education policies, increasing demand of higher education due to structural, and population changes of cities. Aside from these socioeconomic factors, the manner in which 'geography' and 'connectivity' affect the landscape of globalizing higher education activities would be interesting to investigate. First, Beijing, Shanghai, Singapore, Hong Kong, and London, which are on the list of top cities with globalizing education activities, have excellent air transport connectivity. Second, numerous cities on the same list are popular tourist spots with cultural and nature attractions, such as Beijing, Las Vegas, Istanbul, Xian, Jeju Island, and Bali. Third, Hong Kong shows an extremely long networking distance of research collaboration. In addition to socioeconomic and education factors that facilitate the internationalization of the Hong Kong education sector, the city's connectivity with the outside world, including the convenient flight connections and high-quality telecommunication and Internet infrastructure, may lead to the global reach of Hong Kong. In summary, little is known about how different geographical or network characteristics, such as flight connectivity, Internet access and inherent geographical locations, are related to the spatial distribution of global academic activities, and whether these characteristics have slowed down or fostered more and faster interconnectedness of higher education activities under globalization. Thus, a further spatial analysis on globalizing higher education activities, taking into consideration socioeconomic factors, education policy influence, and geographical factors, is required.

Note: A longer version of this chapter with themes on the geographical embeddedness in a city's global reach strategies and a comparison of city rankings measured by academic and economic activities was published in the *Higher Education Policy*. Based upon the previous article, the present chapter is revised and adapted to this volume. This research was supported by the Education University of Hong Kong [Dean's Research Grant FLASS/ECR-17].

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