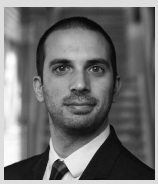
Smart Cities in Asia and the Challenges to the Emergence of a Smart Continent



Gabriele De Luca[1]
1 Researcher, Department for e-Governance and Administration, Danube University Krems, Krems, Austria

アジアでも各地にスマートシティが登場している。これらをつないでスマート国家へ、さらにスマート大陸に発展させることは可能か。バルト3国の先進的な例を参照しつつ探った。

Abstract

With the emergence of Smart Cities in several urban areas in Asia, the problem arises on how to create networks of independent intelligent cities that favour development and innovation, as opposed to inter-city competition. One idea is to create Smart Nations in Asia first, and then connect them to one another in order to favour the emergence of a more complex smart system; say, a Smart Continent. This is however unlikely to happen, because unity between smart systems at a national level cannot be extended to the supranational level unless two factors are present simultaneously: political will of the humans towards globalisation, and a unified technological infrastructure that allows communication between autonomous smart systems. In this paper, we analyse whether these two factors are present in Asia today. With regards to the human demand for political unity, it appears that politics in Asian continues to be played under a game-theoretic perspective, which is based on the assumption that the relevant unit of analysis for politics is the State and that gains and losses are to be measured in relation to it. Concerning technology, the development of networks of innovation continues to take place under a state-centred perspective, as opposed to the continental approach that is followed in Europe. We therefore argue that the next step in the increase in complexity of the smart systems will not follow continental boundaries, but rather political and technological.

Keywords Smart Cities, networks of innovation, knowledge management, globalisation.

How do we make transition from smart cities to larger smart societies

We can today observe the spread of smart cities across all geographical regions of the planet, and the growing complexity of the telecommunication network on which their information channels are based. The same kind of enlargement for smart cities takes place regardless of the continent, and it has been reported both in Europe (Paskaleva, 2009), North America (Martin, Evans, & Karvonen, 2018), Latin America (Macke, Casagrande, Sarate, & Silva, 2018), and Asia (Niculescu & Wadhwa, 2015). This expansion can refer to the number of interconnected ICT devices (Cai, Cvetkovic, & Page, 2020), but it can also concern the number and classes of digital services for e-governance (Morandi, Rolando, & Di Vita, 2016), educational facilities and policies (Leorke, Wyatt, & McQuire, 2018), and also economic and urban development (Bronstein, 2009; Kunzmann, 2014).

The observed expansion of smart cities, both in geographical terms and in terms of competences and services, is leading to the idea of a "scale-up" of the smart city systems into larger systems (van Winden & van den Buuse, 2017). Because the politico-administrative unit that corresponds to the smart city is, of course, the city itself, the literature discusses the transition from a smart city to a larger smart unit in a manner analogous to that of vertical transitions in hierarchies of the public

administration. This is to say, certain authors discuss the transition from smart city to smart regions (Morandi et al., 2016), while others consider the transition to smart nations (Hoe, 2016). The term smart region is somehow fuzzy, though, and may refer to either the regional innovation clusters (Markkula & Kune, 2015), or to the regions as administrative units larger than the cities and smaller than the state (Garau, 2015). The idea of a possible smart continent is also emerging, though it relates for now to specific sectors such as the distribution of electric power over smart grids (Markovic, Zivkovic, Branovic, Popovic, & Cvetkovic, 2013). Its extension to cover political units larger than the nation is not well covered by the literature on smart cities; however, we can find discussions on the policies that larger politico-administrative bodies, such as the European Union, have had in regards to policies that favour the cohesion of smart systems (McCann, 2015).

This discussion relates primarily to the scaling-up of smart cities in terms of their geographical boundaries. In terms of the administrative body that manages it, the scaling-up would concern instead the municipal administration and the national government (Mellouli, Luna-Reyes, & Zhang, 2014). There is some discussion within the context of regulatory theory on what would the smart regulation aspects of globalization be (Gunningham & Sinclair, 2017), but this area of inquiry is still largely unexplored.

However, as mentioned above, the expansion of smart cities across geographical space and the space of competences is an empirical observation, which requires a theoretical explanation. We can then ask ourselves the preliminary question, as to what could come out of the continued observed expansion of smart cities, if this process is extended for long enough. Further, because we know that in a given geographical region, such as Asia, multiple smart cities are present, it is worth exploring the possible dynamics that could characterize the interaction between different smart cities in the process of their expansion. Political history suggests that the expansion of political units is not necessary pleasant and that it is often accompanied by violence (Siegel, 2011; Taagepera, 1997; Woollacott, 2009). This is not a necessity though, as forms of political expansions that are deprived of violence are also possible; the example of the European Union and its enlargement is the first one that comes to mind (Chandler, 2007).

As a consequence, if we are expecting a certain type of political systems to expand in the future, it is worth investigating what type of expansion will it take. Notably, we would like to know whether the expansion will follow primarily competitive or cooperative lines with other analogous political systems that coexist with it.

A common term in the literature on political science to refer to political systems such as cities or states is the word "polity", which we can use here as a synonym for "political system" or "political communities". It has been noted in the literature on globalization that the individual polities are merging into a larger global polity (Ougaard & Higgott, 2002). Smart cities, as a special class of polities that is characterized by a strong technological component, may or may not follow the same dynamic trajectory. Instead, if any aggregation between smart cities happened, this aggregation may end up following technological rather than political lines. If that were to happen, we would need to discuss the implications of a technological, and not politically driven, expansion of a polity. This is important, especially in considerations of the relationship between political expansion and violence that we introduced earlier. In this paper, we therefore study the process of enlargement of the smart city polities in Asia, and analyse whether it follows primarily technological or primarily political directions.

How would a smart Asia look like: cooperation versus competition in socio-technical systems

The choice of studying political and technological expansion of smart cities in the Asian continent is particularly useful in comparison to, say, Europe, because of the large disunity of the polities of the former continent. A study of smart city expansion in Europe would see that the technological and the political directions for the expansion of polities is one and the same, because the topology of the telecommunication network (Capone & Usman, 2015) and the topology of the polity (Celata &

Coletti, 2012) largely overlap. In Asia this is less the case, and the regional forms of political aggregations, such as the Shanghai Cooperation Organisation, tend to be thematic rather than all-encompassing (Boland, 2011). Further, the topology of the telecommunication networks in Asia is far less dense than that of the European Union, as we will discuss later. These two differences may make the study of vertical integration of smart cities in Asia an interesting case, to think about how smart cities would aggregate "in the wild"; i.e., without a political system that encompasses all the other smart cities living the same geographical area.

It has been argued that the process of transition from a given Asian smart city to a larger smart system, in an environment where many autonomous smart cities exist, may take place along the lines of either cooperation or competition between those cities (Niculescu & Wadhwa, 2015). The dynamics of inter-city cooperation and competition are phenomena that are well studied when we refer to the traditional, analogic versions of the smart cities (Taylor, 2011). They are however are less researched when we refer to their digital counterparts. In relation to traditional cities, it has been argued that the dynamics of inter-city relations must necessarily involve some measure of cooperation and some measure of competition (Begg, 1999; Taylor & Derudder, 2004). Notice here that, if we think of cooperation and competition as two opposite poles of a spectrum of relational strategies, the concrete observation of both cooperation and competition could be deducted aprioristically. This is because, if one of the two strategies were never observed in practice at least in some cases, the two polarized concepts may have never appeared in the mind of the human scientists that study the topic. This is in fact a common argument in the literature on epistemology and philosophy of science (Barrotta & Dascal, 2005). Regardless of these epistemological considerations, we can however still assume that, if both cooperative and competitive strategies are possible for inter-smart city interaction, a bit of both will be observed in practice as we argued earlier. The reasons for this are theoretically grounded in the literature on complex adaptive systems; so we now have to take a step back, and look at a smart city as a socio-technical system comprising both a social and a technical component (Carvalho, 2015; Kopackova & Libalova, 2017). These components have autonomous rules that dictate how they cooperate and adapt with other analogous systems, so we here analyse them separately and then merge them together again.

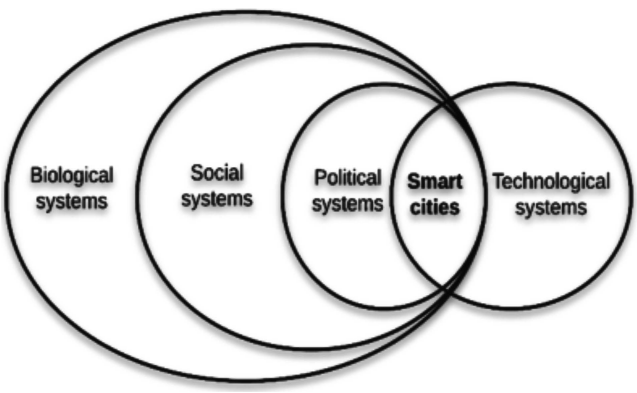


Fig. 1. A smart city as a socio-technical system.

The political constraints, or "how does a political city expand"

Because a smart city comprises also a politico-administrative unit, we could think that the process of its expansion also follows the typical lines of growth of political systems. That is to say, we could think that the expansion of a smart city takes place in a manner analogous to that of a city-state in Ancient Greece or Medieval Europe, or in a manner similar to those of nation states at a later time. If we do so, we are operating under the assumption that a smart city, for being a polity, also expands according to the same principles that drive the enlargement of (non-smart) cities into larger political aggregates.

If this is the case, we can start by investigating the way in which a citadel in ancient history expands and then transforms itself into a larger city-state (Thomas & Conant, 2003). This process begins with a stronger, fortified citadel within which the political, cultural, and religious rites of the community take place (De Polignac, 1995). The citadel receives the resources for its

sustenance from the surrounding villages in the countryside. These resources include water, food, and personnel; and in exchange for them, the citadel provides military protection and safeguards the trade of commodities such as oil and wine (Pratt, 2014). The expansion of the citadel into a city-state then takes place by means of military or cultural assimilation of the neighbouring citadels, which led to the formation of politico-military alliances. The prime example of this phenomenon is the Delian League which was under the political control of Athens. The original purpose of the League was to fight against the Persian empire (Larsen, 1940), and was thus finalized at military conquest (Jackson, 1969). Athens with its Delian League then engaged its historical rival, Sparta, which led its own military alliance, the Peloponnesian League. This led to a military confrontation that takes the name of (the first) Peloponnesian War (Holladay, 1985). Eventually the war ended with the surrender of Athens, and Sparta came to lead the former Athenian empire as well as its own.

For our purposes, we can say that the city-states in ancient Greece have engaged in a cooperative process that consisted in the formation of political alliances between autonomous cities, where the one with superior political strength would dominate the alliance's policies. This process was conditioned by the lack of competition between a weaker city and a stronger one, which led to the formation of military alliances led by the latter. We can see that there is a competitive dynamic that takes place in the behavior of this system. When two political systems meet, such as cities or alliances, if they have approximately equal strength then they clash, and out of their conflict emerges a victor that engulfs the loser.

Because we are studying smart cities as political systems centred around the city, we can imagine that the lines of their political expansion will follow the lines of the political boundaries set by the larger political systems to which they belong. Then, autonomous political systems will either decide to merge into larger political systems, which constitutes cooperation, or will clash with other political systems, which constitutes competition.

It appears that politics in Asia continues to be played under a game-theoretic perspective, which is based on the assumption that the relevant unit of analysis for politics is the State and that gains and losses are to be measured in relation to it (Rauf, 2017). As a consequence, it makes sense to consider the graph along which an hypothetical smart city would expand, as the network comprising the political and territorial boundaries between Asian states. The image below represents the layout of the network of Asian states, where the edges represent a shared border between countries.

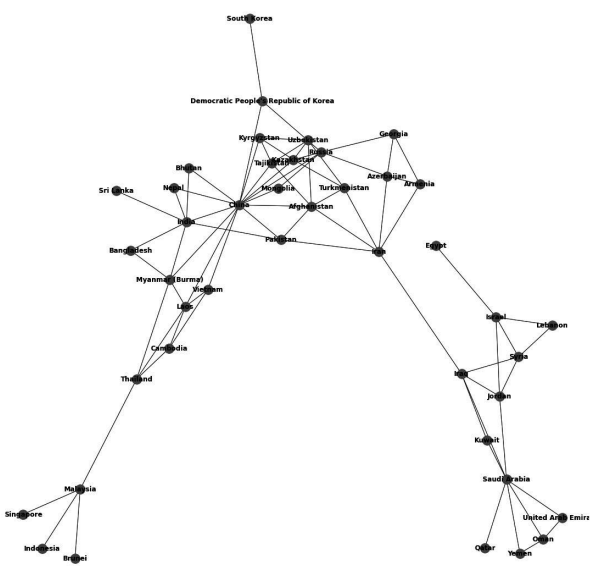


Fig. 2. The topology of the political land borders in Asia.
Graph edges from Wikipedia[1]; Island-states are not represented.

According to the political constraints that we studied in this section, if a process of aggregation of smart cities were to take place in Asia, this would need to happen along the edges of the graph that is represented in the image above.

The technological constraints, or "how does a research and innovation network expand"

The smart city also comprises a technological component, in addition to the political one. The technological component assumes the form of a research and

1 https://en.wikipedia.org/wiki/List_of_political_and_geographic_borders (Accessed 9 March 2021)

innovation network that handles the information and knowledge generation within the smart system (Komninos, 2008). This, in turn, comprises the ICT infrastructure on which data for the IoT systems is transferred (Theodoridis, Mylonas, & Chatzigiannakis, 2013), but also the research and innovation organisations, primarily in the ICT sector, that build and manage the smart city devices and applications (van den Buuse & Kolk, 2019). In Asia, the development of networks of innovation continues to take place under a State-centred perspective, as opposed to the continental approach which is followed in Europe (Tseng, 2009). As a consequence, in order to identify the lines of development of research and innovation networks in Asia it makes sense to use the national research and innovation networks and their linkages. The national research and innovation networks include, of course, universities and their affiliated research organisations (Prokopenko, Holmberg, & Omelyanenko, 2018). Other nodes of the research and innovation network may correspond, if we use the traditional helix model of innovation (Leydesdorff & Etzkowitz, 1998), to the government agencies that manage the smart cities.

These are not the only nodes in an innovation network, though. The literature on knowledge management and innovation typically defines innovation networks as including, among other things, also small and medium enterprises (SMEs) (Mohannak, 2007). This implies that these small and medium enterprises correspond to some of the nodes in an innovation network associated to a smart city.

For the purpose of mapping the research and innovation network around a smart city, however, the presence of the small and medium enterprises in an innovation network makes the network structure so complex that the study of the topology of Asian innovation networks is too complex to be handled by us. This is because small and medium enterprises can choose to delocalize some or all of their activities, and therefore the place of production or registration is not a good indication of the system on which the effects of their activities is produced, nor does it represent their network linkages. The phenomenon of delocalization of small and medium enterprises has been noted in Europe (Mariotti, 2005), but also in Asia (Zhu & Pickles, 2014).

For this reason, we will consider instead the research and innovation network as the network that comprises universities and public administrations connected by preferential telecommunication pathways for the transfer of data. These networks are called "national research and education networks", and ontologies that list and describe them have been compiled (Fryer, 2014).[2] The research and education networks in Asia, together with their topologies and their international linkages, have been subject to previous studies to some extent (Janz & Kutanov, 2012; Shimizu, Nakashima, Okamura, & Tanaka, 2009). Not all research and education networks are connected to one another, not directly at least. Because not all research and education network are directly connected to one another, and because these networks are the ones in which the ICT component of the smart cities is embedded, this has implications for the ability by the latter to expand. This is because, if an expansion of a smart city has to take place, this must follow the links of the network on which the smart city is embedded. If the network is not dense, then the expansion can only occur along the paths that are permissible within that network.

We do not have, and could not find, a sufficiently detailed network topology that depicts the links between the research and education networks in Asia. We are however going to make some theoretical considerations regarding the expansion of a smart city over ICT networks, by using as an example the topology of the research and education networks in Europe. In Europe, there exists in fact a pan-European research and education network, called Géant, which connects all the individual research and education networks from each European member states. Its topology is public.[3] By studying its topology, we can learn about what potential

2 See also the relevant page on Wikipedia, at: https://en.wikipedia.org/wiki/National_research_and_education_network (Accessed 9 March 2021)

3 https://www.geant.org/Networks/Pan-European_network/Pages/GEANT_topology_map.aspx (Accessed 9 March 2021)

expansions of a smart city *cannot* happen, because they are not permissible paths within that network's configuration. Let us take a couple of examples, in order to clarify this concept further; the information related to this comes from the documentation associated with the public information campaign of the Géant network (GÉANT, 2018). Estonia, Latvia, and Lithuania, all have their own national research and education networks, which are further connected to one another, as we will see shortly. These networks are: the EENet, SigmaNet, and LITNET, respectively. There is a network link between the Estonian EENet and the Latvian SigmaNet, as well as between the Lithuanian LITNET and the Latvian SigmaNet. There is however not link between the Estonian EENet and the Lithuanian LITNET, which means that the communication through the two networks has to occur through an intermediary node located in Latvia. See the picture below for a clarification on the network structure in the Baltic States.

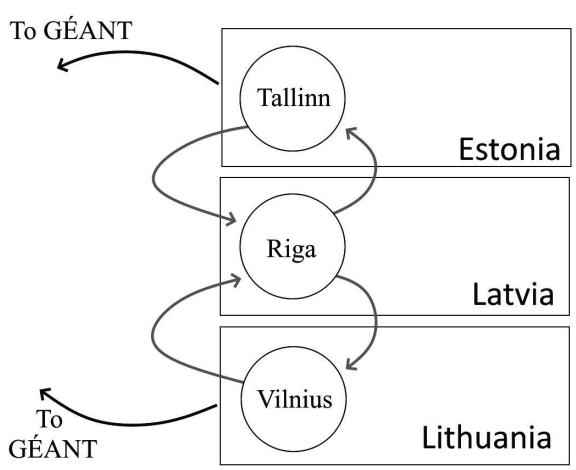


Fig. 3. The topology of research and education networks in the Baltic states and their connections.

Tallinn, the capital of Estonia, and Vilnius, the capital of Lithuania, are both smart cities (Etoke, Kvieskienė, & Goksel, 2018; Julsrud & Krogstad, 2020). Riga, the capital of Latvia, is also a smart city (Aleksandrs, Jurgis, Kristina, & Anatolijs, 2014). If Riga as a smart city were to expand into a larger smart region, this could happen with the inclusion of either Tallinn or Vilnius into its own ICT system. There exists, in fact, a network link that allows the transfer of the data and the delivery of services between the two respective networks. If however Tallinn wanted to expand towards Vilnius, or Vilnius towards Tallinn, this could not immediately happen due to the absence of a network link that connects. The expansion from Tallinn towards Vilnius and from Vilnius towards Tallinn should therefore happen with the inclusion of Riga first, and the other city second.

We can abstract from the previous case study in order to determine the characteristics of an expansion of a smart city in relation to its network topology. More generally, the idea is that, if a network link exists between two smart cities in the ICT network where their data and the services are transferred, it is then in principle possible to create a larger smarter system that encompasses them both. This principle is agnostic to the specific geographical location that is relevant for any given smart city, but it is however geographically bounded by the topology of a network that is present in a given area.

Now, regarding Asia and the topology of the national research and education networks. As we mentioned earlier, there is no unique, continental research and education network, analogous to Géant in Europe or Internet 2 in North America. There are however several dozen research and education networks, each belonging to an individual Asian nation.[4] A comparatively larger research and education network also exists, though, which encompasses China, Russia, Kazakhstan, Kyrgyzstan, and Tajikistan.[5] This network has been studied through social network analysis, and it appears to be centered around China and Russia (Wang & Sun, 2015). This lets us conclude that the expansion of a smart city belonging to one of the member states of the Shanghai Cooperation Organisation could only take place along the link that connects Russia and China.

4 See footnote 3, above.

5 This is the website of the University of Shanghai Cooperation Organisation, which acts as the organizational and legal framework for the exchanges in the research and educational sector between its member states: http://www.uni-sco.ru/ (Accessed 9 March 2021).

Another form of cooperation between Asian research and education networks is the SERENE program (World Bank, 2010). In its original formulation, it was supposed to establish the network connections between some 17 research and education centers; Around 7 of them were located in the United States, United Kingdom, Australia, and Ireland, while the remaining ones were properly South Asian. The recent reports seem to indicate that knowledge exchanges along that network are taking place with increasingly higher frequency (World Bank, 2019); it is not clear, however, whether the infrastructure for data transfer and service delivery that is needed for a smart city is present or not. For this paper, we will simply assume that, if the infrastructure for large bandwidth communication will be developed in the SERENE countries in the future, then that one, too, could be a path along which the development of large smart systems could take place.

If more studies on the topology of the connections between research and education networks in Asia will be conducted in the future, then the consideration made above might in principle be extended to countries other than those that comprise the Shanghai Cooperation Organisation or the SERENE network. The general rule that we learn by the considerations we performed in this paragraph is that another constrain on the emergence of a smart Asia exists, in addition to the political layout of the continent. This comprises the topology of the Asian research and education networks and, more specifically, the existence of links that allow communication between any two of them.

The political and technological constraints to the emergence of a Smart Asia

In the previous sections we have identified two partially overlapping sets of constraints that determine the possibility by a smart continent in Asia to emerge, out of several independent smart cities. These are laid on the political and on the technological network in which the smart cities are embedded. After these considerations, we can now define what competitive and cooperative forces would look like, on the political and technological layers on which the emergence of a Smart Asia can take place.

On the political layer, cooperation corresponds to the creation of regional organisations that possess the characteristics of statehood that are now held by the Asian nation-states; *à-la* European Union. In network terms, this is represented by the replacement of a group of nodes or vertices of the political network, with a single node that takes on the political functions of the previous ones. We do not consider possible network effects that lead to the creation of new links or edges between existing member states, because this can happen only with modifications to the territorial composition of the states themselves. If that were to happen, the most likely scenario is that of catastrophic collapse of the political system (Kuecker, 2007), which could hardly be considered a form of cooperation.

On the technological layer, instead, cooperation may as well be manifested by the establishment of new links. This is because, while the political state is characterized by a certain rigidity of its territorial boundaries, the technological boundaries of a research and education network are more flexible. Concretely, the forms of cooperation on that layer would correspond to the creation of dedicated nodes for the connection and the transmission of data and services between two previously disconnected research and education networks.

The desirable continuation of this research is the mapping of the network links existing between Asian research and education networks, because that would allow the identification of the structure of the network along which a larger smart system could be built. The policy implication for this paper consists in the idea that the promotion of agreements for data and information sharing among national research and education networks could be beneficial. This type of measure would not only improve the output of the scientific production of the countries involved, but also create the conditions according to which the aggregation of smart cities into larger systems could take place later.

References

GÉANT. (2018). GÉANT topology map: https://www.geant.org/Networks/Pan-European_network/Pages/GEANT_topology_map.aspx

Aleksandrs, Z., Jurgis, Z., Kristina, T., & Anatolijs, B. (2014). Concept of smart city: first experience from city of Riga. *Journal of sustainable architecture and civil engineering, 7*(2), 54-59.

Barrotta, P., & Dascal, M. (2005). *Controversies and subjectivity* (Vol. 1): John Benjamins Publishing.

Begg, I. (1999). Cities and competitiveness. *Urban Studies, 36*(5-6), 795-809.

Boland, J. (2011). Ten Years of the Shanghai Cooperation Organization. *21st Century Defense Initiative*.

Bronstein, Z. (2009). Industry and the smart city. *Dissent, 56*(3), 27-34.

Cai, Z., Cvetkovic, V., & Page, J. (2020). How Does ICT Expansion Drive "Smart" Urban Growth? A Case Study of Nanjing, China. *Urban Planning, 5*(1), 129-139.

Capone, V., & Usman, M. (2015). *The GÉANT network: addressing current and future needs of the HEP community*. Paper presented at the Journal of Physics: Conference Series.

Carvalho, L. (2015). Smart cities from scratch? A socio-technical perspective. *Cambridge Journal of Regions, Economy and Society, 8*(1), 43-60.

Celata, F., & Coletti, R. (2012). Soft, mobile or networked? Cross-border cooperation and the topology of the European Union external frontier. *EU Border Regions, Working Paper Series, 2*.

Chandler, D. (2007). EU statebuilding: Securing the liberal peace through EU enlargement. *Global Society, 21*(4), 593-607.

De Polignac, F. (1995). *Cults, territory, and the origins of the Greek city-state*: University of Chicago Press.

Etoke, M. T., Kvieskienė, G., & Goksel, G. U. (2018). A Comparative analysis of the smart city communication in the Buea (Cameroon) and Vilnius (Lithuania). *Socialinis ugdymas: mokslo darbai. Vilnius: Lietuvos edukologijos universitetas, 2018, T. 49, nr. 2*.

Fryer, T. (2014). Research and Education Networks around the World and their Use.

Garau, C. (2015). Perspectives on cultural and sustainable rural tourism in a smart region: The case study of Marmilla in Sardinia (Italy). *Sustainability, 7*(6), 6412-6434.

Gunningham, N., & Sinclair, D. (2017). Smart regulation. *Regulatory theory: Foundations and applications*, 133-148.

Hoe, S. L. (2016). Defining a smart nation: The case of Singapore. *Journal of information, Communication and Ethics in Society*.

Holladay, A. (1985). Sparta and the first Peloponnesian War. *The Journal of Hellenic Studies, 105*, 161-162.

Jackson, A. (1969). The original purpose of the Delian League. *Historia: Zeitschrift für Alte Geschichte*(H. 1), 12-16.

Janz, R. F., & Kutanov, A. (2012). The case of nrens in central asia. *Central Asian journal of global health, 1*(1).

Julsrud, T. E., & Krogstad, J. R. (2020). Is there enough trust for the smart city? exploring acceptance for use of mobile phone data in oslo and tallinn. *Technological Forecasting and Social Change, 161*, 120314.

Komninos, N. (2008). *Intelligent cities and globalisation of innovation networks*: Routledge.

Kopackova, H., & Libalova, P. (2017). *Smart city concept as socio-technical system*. Paper presented at the 2017 International Conference on Information and Digital Technologies (IDT).

Kuecker, G. (2007). The perfect storm: Catastrophic collapse in the 21st century.

Kunzmann, K. R. (2014). Smart cities: a new paradigm of urban development. *Crios, 4*(1), 9-20.

Larsen, J. A. O. (1940). The constitution and original purpose of the Delian League. *Harvard studies in classical philology, 51*, 175-213.

Leorke, D., Wyatt, D., & McQuire, S. (2018). More than just a library": Public libraries in the 'smart city. *City, culture and society, 15*, 37-44.

Leydesdorff, L., & Etzkowitz, H. (1998). Triple Helix of innovation: introduction. *Science and Public Policy, 25*(6), 358-364.

Macke, J., Casagrande, R. M., Sarate, J. A. R., & Silva, K. A. (2018). Smart city and quality of life: Citizens' perception in a Brazilian case study. *Journal of Cleaner Production, 182*, 717-726.

Mariotti, I. (2005). The internationalisation strategies of Italian district SMEs. *Borders and economic behaviour in Europe*, 25-42.

Markkula, M., & Kune, H. (2015). Making smart regions smarter: smart specialization and the role of universities in regional innovation ecosystems. *Technology Innovation Management Review, 5*(10).

Markovic, D. S., Zivkovic, D., Branovic, I., Popovic, R., & Cvetkovic, D. (2013). Smart power grid and cloud computing. *Renewable and Sustainable Energy Reviews, 24*, 566-577.

Martin, C. J., Evans, J., & Karvonen, A. (2018). Smart and sustainable? Five tensions in the visions and practices of the smart-sustainable city in Europe and North America. *Technological Forecasting and Social Change, 133*, 269-278.

McCann, P. (2015). *The regional and urban policy of the European Union: Cohesion, results-orientation and smart specialisation*: Edward Elgar Publishing.

Mellouli, S., Luna-Reyes, L. F., & Zhang, J. (2014). Smart government, citizen participation and open data. *Information Polity, 19*(1, 2), 1-4.

Mohannak, K. (2007). Innovation networks and capability building in the Australian high-technology SMEs. *European Journal of Innovation Management*.

Morandi, C., Rolando, A., & Di Vita, S. (2016). *From smart city to smart region: Digital services for an Internet of Places*: Springer.

Niculescu, A. I., & Wadhwa, B. (2015). *Smart cities in South East Asia: Singapore concepts-an HCI4D perspective*. Paper presented at the Proceedings of the ASEAN CHI Symposium'15.

Ougaard, M., & Higgott, R. (2002). *Towards a global polity*: Routledge.

Paskaleva, K. A. (2009). Enabling the smart city: The progress of city e-governance in Europe. *International Journal of Innovation and*

regional development, 1(4), 405-422.

Pratt, C. E. (2014). *Critical Commodities: Tracing Greek Trade in Oil and Wine from the Late Bronze Age to the Archaic Period*. UCLA,

Prokopenko, O., Holmberg, R., & Omelyanenko, V. (2018). Information and communication technologies support for the participation of universities in innovation networks (comparative study). *Innovative Marketing, 14*(3), 17-29.

Rauf, S. (2017). Changing Geopolitical Dynamics in Central Asia. *Strategic Studies, 37*(4), 149-165.

Shimizu, S., Nakashima, N., Okamura, K., & Tanaka, M. (2009). One hundred case studies of Asia-Pacific telemedicine using a digital video transport system over a research and education network. *Telemedicine and e-Health, 15*(1), 112-117.

Siegel, P. E. (2011). Competitive polities and territorial expansion in the Caribbean. *Islands at the crossroads: migration, seafaring, and interaction in the Caribbean*, 193-218.

Taagepera, R. (1997). Expansion and contraction patterns of large polities: Context for Russia. *International Studies Quarterly, 41*(3), 475-504.

Taylor, P. J. (2011). On city cooperation and city competition. In *International handbook of globalization and world cities*: Edward Elgar Publishing.

Taylor, P. J., & Derudder, B. (2004). *World city network: a global urban analysis*: Psychology Press.

Theodoridis, E., Mylonas, G., & Chatzigiannakis, I. (2013). *Developing an iot smart city framework*. Paper presented at the IISA 2013.

Thomas, C. G., & Conant, C. (2003). *Citadel to city-state: the transformation of Greece, 1200-700 BCE*: Indiana University Press.

Tseng, C.-Y. (2009). Technological innovation and knowledge network in Asia: Evidence from comparison of information and communication technologies among six countries. *Technological Forecasting and Social Change, 76*(5), 654-663.

van den Buuse, D., & Kolk, A. (2019). An exploration of smart city approaches by international ICT firms. *Technological Forecasting and Social Change, 142*, 220-234.

van Winden, W., & van den Buuse, D. (2017). Smart city pilot projects: Exploring the dimensions and conditions of scaling up. *Journal of urban technology, 24*(4), 51-72.

Wang, K., & Sun, D. (2015). *Research on the Shanghai Cooperation Organization network architecture from the big data perspective*. Paper presented at the 2015 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM).

Woollacott, A. (2009). Frontier violence and settler manhood. *History Australia, 6*(1), 11.11-11.15.

World Bank. (2010). A Program of the South-South Experience Exchange Facility. Retrieved from https://openknowledge.worldbank.org/handle/10986/12367

World Bank. (2019). *The South-South Experience Exchange Facility: Implementation Progress Report 2019*. Retrieved from Washington, DC: https://www.southsouthfacility.org/sites/ssf/files/inline-files/Implementation-Progress-Report-2019-Mar23-lowRes-singles.pdf

Zhu, S., & Pickles, J. (2014). Bring in, go up, go west, go out: Upgrading, regionalisation and delocalisation in China's apparel production networks. *Journal of Contemporary Asia, 44*(1), 36-63.