



## INNOVATION DIMENSION IN THE CONCEPT OF A SMART CITY: IS THE INNOVATIVENESS THE MAIN ATTRIBUTE OF BEING SMART?

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**Abstract.** The dimension of innovation in regard to the concept of a smart city is presented in this article. The analysis of scientific literature revealed that innovativeness, although it is called the main tool to compete successfully in changing circumstances, cannot be always the expression of smartness, which is nowadays understood as a desired state of contemporary cities. Innovativeness is an attribute of smartness just in the case, if it is based on intelligence, learning, knowledge, agility, and networking and seeks sustainability, while digitality, which can be seen as one of the outcomes of innovativeness, plays a role of the facilitator of these processes. Otherwise, innovativeness may even have harmful effects to the city.

**Keywords:** innovativeness, smartness, smart cities, innovative cities.

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### 1. Introduction

Because of growing complexity and uncertainty in the world, single organizations, cities and regions, despite their long-term innovativeness, which is understood as the main tool for the success, face huge challenges that even lead to the downfall. The hardening conditions of competition encourage scientists and practitioners to search for new ways to enhance competitiveness of various social systems, such as business organizations, cities, regions, states, and define factors for successful activity.

Smartness is one of popular contemporary concepts that are presented and analysed in the scientific and popular literature and governmental documents as a reason of successful development of cities and regions. However, there is still no universally accepted definition of smartness. Also, it's not clear how smartness is related to innovativeness that is called the main tool to reach the competitiveness. Is the smartness of cities equal to innovativeness and vice versa?

The aim of this article is to reveal the relationship between innovativeness and smartness in the case of a city by explaining the concepts of smartness and innovativeness and by analysing the relationship of innovation dimension and other dimensions of smartness, such as networking, intelligence, knowledge management, sustainability, digitality, agility, and learning.

### 2. The concept of innovativeness

Innovativeness as a feature is associated with the creation and adaptation of new and useful products. This process is characterized by different intensity in regard to time and newness: the number of new products and their improvements in a particular period of time (Laforet, Tann 2006) and radicalism (related to pure newness) or incrementalism (that is understood as continuous improvements) of innovations (DeGraff, Lawrence 2002; Duhamel, Santi 2012) are evaluated in various research of innovative social systems. The extent of innovations is also different and depends on the objects (e.g., particular firms, entire cities, regions, countries, societies, etc.) they are applied (Rogers 2003; Shearmur 2012). Hodges (2012, cit. by Mineikaitė 2013) argues that innovation isn't just an economical but also a social phenomenon, where individuals express their needs and creativity. Although creativity, novelty or innovativeness are used as synonyms in the scientific literature (Almonaitienė 2008), those concepts aren't equal to each other. While creativity is the first stage of the process of innovation, in which new ideas are generated (Roffe 1999; MacLeod 2010), innovation can be defined as a *commercially successful* (Zheng, Wang 2012; Wright 2007) development of creative ideas to useful results (MacLeod 2010).

According to Darvish and Nazari (2013), innovativeness consists of innovations and innovative culture. It can be argued that the basis for

innovativeness is an environment that supports creative individuals by providing opportunities to develop creativity, actively share knowledge with others, create new knowledge and innovate (Ng 2004; Zhang, Fu 2013; Darvish, Nazari 2013).

The definitions of innovativeness reveal the characteristics of the subjects that create innovations. They are explained by *creativity* and *activities of knowledge creation* (Šajeva, Jucevičius 2008; Jucevičius 2010; MacLeod 2010), *effectiveness while creating innovations* (Šajeva, Jucevičius 2008), *continuous learning on individual and collective levels* (Šajeva, Jucevičius 2008; Jucevičius 2010), *networking* (Pechlaner, Bachinger 2010), *cooperation* (Ng 2004; Darvish, Nazari 2013; Pechlaner, Bachinger 2010), based on *trust* (Jucevičius 2008; Pechlaner, Bachinger 2010), *tolerance of risk* and *complexity* (Jucevičius 2010), *flexibility to changes* and *mobility* (Šajeva, Jucevičius 2008; Jucevičius 2010), *insightfulness to forecast future tendencies* (Šajeva, Jucevičius 2008). According to Menguc and Auh (2006), innovativeness demonstrates *proactiveness* or an ability to explore new opportunities instead of only concentrating on current strengths.

### 3. The characteristics of innovative city

It's important to emphasize that first of all, innovative cities are *creators of new knowledge* that are embedded into new goods, services, processes, basically reflecting city's specialization. We know such cities as Manchester, Glasgow, Detroit, San Francisco-Berkeley, Berlin or Tokyo that lived in their golden age at various historical periods: Manchester – as the first industrial city (1760-1890), Glasgow – as metropolis of ship building (1770-1890), Berlin – as “pioneer techno polis” of a new industrial state (1840-1930), Detroit – as the cradle of mass production (1890-1915), San Francisco-Berkeley – as a revolutionary arena of information technology (IT) industry (1950-1990) or Tokyo – as the capital city in the continuously innovating state (1890-1990) (Hall 1999, cited by Jucevičius 2004). However, one should be concluded that innovative cities don't concentrate in technological progress but also pay attention to organizational, institutional, financial, marketing innovations (Duruy 2006, cited by Zhang, Fu 2013). Cities can be called *innovation centers* if they receive global knowledge faster than other cities, towns or other territorial objects and create, develop and apply innovations. Business, other organizations and customers in these cities also have valuable knowledge and can provide them to

other firms acting behind the city boundaries (Isaksen, Aslesen 2001).

Because of continuous innovations, the cities get more *economically vital*, i.e. capable to reach sustainable economic growth. This growth is related to well-being, opportunities for getting job, business profitability, and ability to provide desired social services and usually is evaluated by the growth of GDP (Buultjens *et al.* 1996).

It should be noted that creation and development of innovations depends on their social, technological, economical and cultural context (Jucevičius 2007). As it was mentioned above, the basis of innovative social system is an environment that supports creative individuals by providing necessary resources for creativity and innovations (Ng 2004; Schaffers *et al.* 2012; Zhang, Fu 2013). In other words, innovation is conditioned by a *developed innovation ecosystem* (Schaffers *et al.* 2012). In the cities, whose innovation ecosystems are developed, innovation spirit is supported and all necessary resources are integrated (Xiangdashun, Yangshenghui 2009, cited by Zhang, Fu 2013). The analysis of innovative cities and regions revealed that all of them are characterized by a *critical mass of people and organizations creating and consuming innovations* (Jucevičius 2007), *spreading knowledge* (Manning 2013, cited by Kinnear, Ogden 2014), *defining standards for industries and creating clusters for knowledge recombination* (Moreno, Miguelez 2012, cited by Kinnear, Ogden 2014). Knowledge creation and spreading requires cooperation. Thus close relationships between various actors, as a dimension of innovation ecosystem, is a precondition of the development of innovative cities and regions (Jucevičius 2007; Mineikaitė 2013; Cohendet *et al.* 2010). Such actors are not only business organizations and individuals but also various education institutions, for example, universities (Youtie, Shapira 2008, cited by Kinnear, Ogden 2014), and governmental institutions possessing the characteristics of clarity, enabling initiatives, providing freedom to create and develop business, directing /attracting investments to infrastructure and resources necessary to innovating (The most innovative cities in Asia Pacific 2013). One should be concluded that the most important resource of innovative cities is *human resource* (Zhang, Fu 2013; Bagdzevičienė *et al.* 2002, Melnikas 2008, cited by Mineikaitė 2013). Inhabitants of innovative cities should possess the characteristics of creativity, tolerance to deviations from the norms and failures, openness, continuous learning, qualification and talents (The most innovative cities in Asia Pacific 2013). The existence of *middle class* is

clearly visible in innovative cities. Its main indicators are the percentage of people with high school education, education expenditures per household, average salary and the level of unemployment. Middle class causes the formation of critical mass of innovation creators and consumers (Jucevičius 2007). This formation requires an *egalitarian structure* that is also an index of the existence of middle class. This structure is characterized by relatively small hierarchies, large social mobility, horizontal cooperative relationships, small gap between incomes, bigger part of people with higher education and positive correlation between high educational achievements and economical benefit (Jucevičius 2004).

In conclusion, it can be stated that innovative city is an economically vital complex system, characterized by its egalitarian structure, creating new knowledge that are developed to new and useful products. This process is supported by the existing innovation ecosystem based on socially and culturally embedded relationships between a critical mass of actors creating and consuming innovations. However, it remains unclear, is innovative city equal to a smart city, whose initiatives are gaining more and more popularity both in scientific and political literature?

#### 4. The concept of smartness

The concept of smartness is analyzed in the cases of various phenomena, actions, persons, both artificial and social systems. In the scientific literature, smartness is closely associated to *the ability to choose the most appropriate action plan depending on a particular situation*. For example, a smart seller plans selling processes and chooses the best selling ways depending on situations as opposed to the trials to spend all his time to fulfill selling tasks (Rapp *et al.* 2006). Smart players of computer games are able to choose game platforms and technologies, game genres and game communities, and combine games for fun and games for more serious reasons (Moshini 2006). Smart enemies are very flexible and adapting to various situations quickly (Williams 2002). Smartness is also characterized by *participating in network structures and cooperation* (Williams 2002; Moshini 2006; Caragliu *et al.* 2011), *continuous learning, learning from mistakes* (Matheson, Matheson 2001), *tolerance of uncertainty* (Williams 2002; Matheson, Matheson 2001) and *ability to recover even after experiencing decline* (Williams 2002). Also, according to the concept of smartness, possessing all special knowledge by ourselves is not of extreme importance; it's a necessity to be able to know the sources of them

(Moshini 2006; Matheson Matheson, 2001), and to apply existing tools and opportunities. The strategy of smart specialization is based exactly on this statement. Cities, which apply this strategy, are concentrated on their strengths (Foray, Goenaga 2013; Mccann, Ortega-Argilés 2013; Sandu 2012) and oriented not just to a concrete sector or sectors in general, but to new activities that encourage the development of these sectors (Foray, Goenaga 2013).

These smart characteristics, such as flexibility, adaptivity, resilience, continuous learning, tolerance of uncertainty, reflect the features of complex adaptive systems (Plowman *et al.* 2007; Johnson 2009; Murthy, Krishnamurthy 2003). Complex adaptive systems are also characterized by an intensive creativity and innovativeness (Uhl-Bien *et al.* 2007; Mason 2007). Does it mean that innovative city is a smart city and an innovation is in such case the main dimension of the city?

#### 5. The characteristics of smart city

The analysis of smart cities is still on its infant stage. Very often, smart cities are understood as equal to *digital* cities, i.e. those cities that employ novel (smart) information-communication technologies (ICT) in various areas of life (Hollands 2008; Toppeta 2010; Lombardi *et al.* 2012). Much emphasis in the literature of smart cities is done also on *innovations* (e.g., Mishra 2013; Toppeta 2010), *learning* (Hollands 2008; Winters 2011), *knowledge management* (Mishra 2013), *human and social capital* (Giffinger 2011; Caragliu *et al.* 2009).

Smart cities are defined as innovation ecosystems (Schaffers *et al.* 2012), territories with a high capacity for learning and innovation, conditioned by creativity and knowledge production (Hollands 2008), cities characterized by high technologies, creative industries and social and economic sustainability (Caragliu *et al.* 2011).

One of the most popular model of a smart city proposed by Giffinger (2011), presents the six following characteristics: smart economy, smart governance, smart people, smart mobility, smart environment, smart living, based on “the ‘smart’ combination of endowments and activities of self-decisive, independent and aware citizens” (in other words, that is a middle class explained in the chapter 3).

In the literature, smartness, so as innovativeness, is related to the ability to create additional value (Matheson, Matheson 2001), maximize national, regional and global competence and enhance life quality (Hughes, Spray 2001). Based on scientific literature, it can be noted that both innovativeness and smartness of the social systems are

characterized by networking, continuous learning, uncertainty tolerance, flexibility and adaptability. Such congruity of these characteristics is understandable, if smartness is defined as the basement of innovativeness. However, is innovative social system smart in all cases? Such questions arise, when we look at the downfall of business organizations, cities and regions, once called innovative (for example, Detroit city in USA) and revival of social systems that were seen as problematic and unsuccessful (for example, the case of Medellin that received an award in 2012 as the most innovative city in the world, after long decades of violence and political instability (Maz 2013)). What are the reasons of these inclines and declines?

### 6. The coherence between smartness and innovativeness

One of the main characteristics of smartness is adaptability, or an ability to adapt to the environment quickly. All innovative social systems, at least in the start of their innovativeness possessed the latter characteristic because they were capable to foresee the market needs and develop innovations successfully, by using environmental resources. However, since experiencing the downfall they demonstrate the loss of smartness because they aren't capable to remain resilient and adaptive to current situations (Williams 2002).

In the scientific literature (especially in the area of smart artificial systems) smartness can be of various levels. For example, Schwartz *et al.* (2010), while analyzing smart textile systems, define *active* and *very active* smartness. Active smartness is understood as an ability to feel stimuli from the environment and act depending on them (reactiveness). A very active smartness manifests as an ability to foresee the future and to act according to it (proactiveness). The lower level smartness reflects the type of creative innovators, defined by Jin *et al.* (2004). Such organizations generate ideas themselves and create innovations whose purpose is to satisfy the needs of current customers. The other type of innovativeness is characterized by an orientation to so called "soft" innovations that are related to innovative changes in business models, strategies etc. (Jin *et al.*, 2004). Such organizations are able to change the rules of game, even if they don't create radical innovations. They re-position their business or orient to those segments that are ignored by competitors. Thus, these organizations get many ideas from outside. It correlated to the characteristic of smartness that there is no extreme need to possess special knowledge, it's more important to choose sources appropriately that lead to

success. Jin *et al.* (2004) use the concept of *acumen* that means intelligence, speed of understanding and coping with business situations in such a way that causes good outcomes. According to Reilly and Reilly (2009), this concept includes a clear perception of business problems, an understanding of complexity and unpredicted future, giving attention to all interested sides, determination and flexibility.

This analysis demonstrates that innovating can be reactive and proactive. Although in artificial systems reactivity is also related to smartness, in social systems proactiveness is required that such systems would be characterized by smartness or acumen. It means that innovativeness should be based on other dimensions and it isn't the main attribute of being smart in all cases. This idea is emphasized in the model of smart development, proposed in the article of Jucevicius and Liugailaite-Radzvickiene (2013) (Fig. 1).

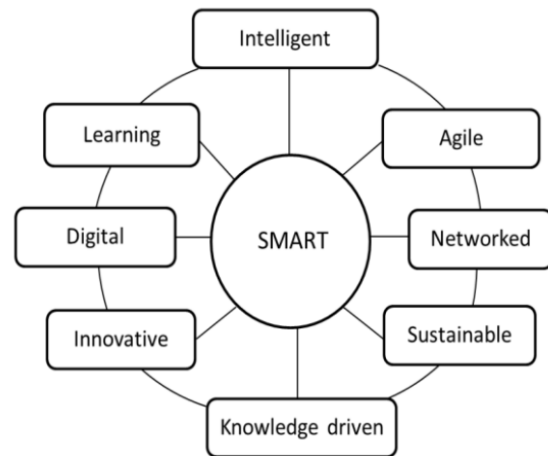


Fig 1. Theoretical framework of the concept of smart social systems and smart development (Jucevičius, Liugailaitė-Radvickienė 2013)

In this model, the concept of smartness is comprised from the following dimensions: intelligence, learning, innovativeness, digitality, knowledge, networking, agility and sustainability. This model represents innovation dimension as one of the other characteristics of smartness. It can be argued that:

- *Innovativeness should be based on learning.* Because of a lack of learning processes, innovation processes slow down. It can be stated that innovative city is also a learning city (Jucevičius 2007).
- *Innovation is a result of knowledge creation, sharing and spreading* (Jucevičius 2004, 2007; Shearmur 2012; The most innovative cities in Asia Pacific 2013). Because of out-of-date knowledge or a lack of knowledge innovation processes slow down

- or new products that don't fit contemporary realia are developed.
- *The cohesion between networking and innovation is dual*: innovativeness is based on networks (for example, Jucevičius 2007; Mineikaitė 2013; Cohendent *et al.*, 2010); on the other hand, innovations (especially in the area of ICT) encourage networking and knowledge sharing and creating processes (Alwinkle, Cruickschank 2011).
  - *Innovation should be based on intelligence*. Intelligence that can be defined as “an art of monitoring weak signals which tell us whether the social system is on the right track or not” (Jucevicius, Liugailaite-Radzickiene 2013) conditions the long-term successful innovativeness. Innovative city based on intelligence is able to understand its position among other cities and choose adequate innovative solutions. If an innovative city lacks of this ability, it will create innovations that don't enhance city's competitiveness because they may be not adequate to market needs or it will concentrate on current innovations although environment requires for radical changes. Also, a city may orient only to innovations of some kinds, for example, technological innovations, forgetting about social innovations.
  - *Agility* is an ability to respond quickly to the environment because of flexibility, proactiveness, tolerance of uncertainty, adaptability and ability to create value (Preiss *et al.* 1996). It is also a precondition of innovation together with learning and knowledge management.
  - *Innovation and digitality are closely inter-related to each other*. Digital technologies can facilitate innovation processes, for example, by uniting remote human beings and their organizations and encouraging the creation of networks (Alwinkle, Cruickschank 2011), involving customers in creative processes (Roth *et al.* 2013), facilitating learning and information / knowledge management. As Hollands (2008) argues, digital infrastructure is the main element of innovation development because it enables social, cultural, economical and environmental development. Also, new digital innovations implemented by a city demonstrate city's innovativeness.
  - Although the characteristic of socioeconomic and ecological *sustainability*, as the characteristic of smartness (Tregoning *et al.* 2002; Grant 2009; Giffinger 2011; Caragliu

*et al.* 2009) is emphasized in the research of contemporary innovative cities (for example, see The most innovative cities in Asia Pacific 2013), however, many innovative cities weren't sustainable in regard to social or ecological environment. For example, although very innovative, Detroit city experienced huge social problems related to racial conflicts and it was one of the reasons that led to city's downfall. One should be concluded that studies of innovative cities, first of all, emphasize innovations, their types and intensity as the main characteristic of innovativeness and don't analyze the sustainability dimension at all. It can be argued that innovation should be based on sustainability and also work as a tool for a better sustainability.

These statements explain the paradox that is underlying in the relationship of innovativeness and smartness. Although innovativeness and emergence, as one of the most important features of complex adaptive system (Mason 2007) or smart system (Murthy, Krishnamurthy 2003), are related to the creation of new properties, not every emergence of innovations can be defined as the attribute of smartness, if it is not based on the features discussed above.

## 7. Conclusions

It can be argued that innovation dimension is a significant attribute of a city if it's based on the complex of other attributes of smartness, such as intelligence, agility, learning, knowledge management, networking, digitality and sustainability. In other words, city's innovativeness, manifesting as emergence of new and useful products, causes a long-term competitiveness and a good quality of life just in the case if it is based on the following abilities: monitoring weak signals from the environment and understanding city's position compared to other cities (intelligence), acquisition of new knowledge (learning), creating networks and working in them, managing knowledge, responding quickly to the environment (agility) and seeking social, economical, ecological and cultural harmony (sustainability). Digitality plays a role of both facilitator and outcome of city's innovativeness. It promotes, facilitates and encourages networking, learning, knowledge acquiring, sharing and spreading, also reaching for sustainability.

If an innovative city lacks of intelligence, agility, learning or knowledge, its innovativeness will be temporal, not adequate or will be oriented only to economical development forgetting about social, ecological or cultural environment.

Innovativeness is an expression of smartness in such case, if the development of innovations is not only a reactive, but also a proactive response to the complexity of an environment and encourages the emergence of new activity's models that enhance social, economical and ecological sustainability and helps a city remain resilient.

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