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Smarter cities' attractiveness. Testing new criteria or facets: "data scientists" and "data platforms".*

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Introduction.

Krugman (1998) and Florida (2002, 2005) have focused on the factors of cities' attractiveness. The usual competition between town centers and cities has been illustrated with methods surveyed by OECD (OECD 2006). In accordance with the teachings of the theories and of the methodologies, cities were until 2010 usually rated and ranked on a large variety of factors (see for example, ranking of French cities for the creation of new enterprises, magazine l'Express Entreprise; ranking of European cities by l'Express; ranking of European cities for living).

This has given rise to the usual promotion of cities by means of dashboards of "attractiveness' indicators". Alongside the internal and external attractiveness factors, the indicators were, for example, quality of the infrastructures, the individual "talent" and the local collective resources in education and health, ease of access to commercial markets in the country, the presence of qualified staff, efficiency of telecommunication networks and transport connectivity with other foreign cities. All criteria that have been modeled and tested as crucial factors of territorial attractiveness in the literature (Poirot J., Gérardin H., 2010).

Because of the emergence of the digital society, we could observe a transition towards a new transactions and sharing economy (Nguyen Dang, Dejean S. (2014), UNESCO, 2013). This structural and technological change has structural effects on employment and productivity so on general attractiveness. The article insists that there should be one condition sine qua non for signal the new attractiveness: having the ability to extract value from public and private territorial data through organizing the data activity by different channels: collecting data from multiple sources, developing platforms of interoperable data, promoting data analysis and activities involving the use of public data on public services.

The article proposes the following proposition: the presence of these activities of valuing data will constitute an evidence for a new strategy for location of a firm or for a family: investors must have a look on the location of populations and skills which are most likely to be comfortable with data sciences (the data scientists), and used to be familiar of data-platforms etc.

So the article will expose that the question of cities' attractiveness is becoming a question of location of the places of the new process of valuation of a shared knowledge by the Territorial Data processing. We will explain why, as the new economy emerged with new internet users, with a lot of new Internet platforms of distance selling (Evans D.S. 2011), cities must begin a new promotion campaign: e-administration services' places and new public data-based services (transportation for example), data-scientist capacities and the use of data platforms of territorial data could now enhance local productivity and welfare. Two new criteria of attractiveness should be tested: Does the local quality of the process of extracting and of using the value extracted from big territorial mix of public and private data is a new asset for attractiveness?

If confirmed in the future by some empirical evidence of economic impact, the announcement of a bigger capacity to learn and decide by the use and processing of territorial data collected in different areas of local public services (transports, education, and quality of environment…) will be a new factor of cities' attractiveness: cities that organize the mixing and processing of data on interoperable platforms equipped with tools for extracting value from data (for example extracting the value from predictive data regarding the actions performed by the Fire Services in a city such as New York) will be viewed as minimizing social costs and being more productive and reliable. They will not usurp their title and "smarter cities" and will have a greater attractiveness. If the testing is positive, nowadays, an attractive city will definitively be a city that has really adopted a new way of organizing the Data valuing process through the use of public-private platforms of interoperable data ("Datathèque platforms") and with the aid of data sciences and data scientists. So, in a near future, the label "smart city", if correctly awarded, will signify the "use of data sciences for producing local public utilities". The two new criteria for attractiveness will be the number of data scientists involved and the number of partnerships involved in exploiting Datathèque platforms.

In the first section, we will cover the traditional indicators of the attractiveness of the cities. In the second section, we will examine the possibility of a new facet to be shown for the attractiveness of a city after the digital revolution and, finally, in the third section, we will present our two new indicators of cities' attractiveness for complex and smart cities in a digital society (Datathèques-services platforms and data scientists' location). Finally, the purpose of the article is to reveal and to propose to researchers to check that, in our digital word, attractiveness of the cities is now founded on new criteria.

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1. Traditional indicators of the attractiveness of a city and the multi-dimensional ranking of cities in the pre-digital society.

In the previous non-digital society and non-divided society (before the so-called "fracture numérique"), the campaigns of promotion of the attractiveness used by mayors, councilors and regional governors used to publicize a lot of positive economic and social qualities of their cities. These qualities were, for example, the quality of life, the quality of the local workforce, the lower level of local taxation, the logistical services solutions and the presence of some traditional amenities. Simple indicators were initially used. They were sub-products of the location theories and of empirical tests of these theories: for example, for high-tech manufacturing firms, hard locational factors - especially proximity to universities and supply of skilled workers are indicators of attractiveness (Porter, M. E. 2000). There are different types of firms and different types of populations, so that each type could prefer specific conditions.

So, there is a lot of potential factors of attractiveness. So, dashboard of a lot of indicators have to map out the cities from a panoramic and multi-dimensional perspective. Those indicators used during the period from 1975-2000 were, generally speaking, standard demographic and socio-economic indicators. New enriched composite indicators of local quality of welfare in cities were more and more multi-dimensional (as is seen in the evaluation of public anti-poverty programs using OCDE or World Bank tools). Therefore, the increasing number and greater diversity of cities' indicators of attractiveness have enriched the territorial profiles that could be used in the economic decision process for choosing a new location (Karlsson, C., Johansson, B., Stough, R.R. (2014)). The profiles now in use have integrated new social, environmental and cultural dimensions of attractiveness (Darchen, S. Tremblay, D.G. (2010); Ergazakis, K., Metaxiotis, K. and Psarras, J. (2004)). For example, in Kourtit, Macharis, Nijkamp (2014):

> *For each individual city, 6 main classes of functions were carefully mapped out and numerically assessed, viz. economy, research and development, cultural interaction, livability, environment and accessibility.*

These territorial patterns are really interesting due to the great variety of information contained in the different facets of the observations of a city' system. Each facet within a territorial profile becomes richer and richer in data so that a multidimensional synthesis of indicators is often and now in use to determine a city's attractiveness in a number of categories, facing the city's complex nature.

Interrelations between cities could be taken in account. The analysis of the hierarchy between urban spaces has produced useful data about the combination of location and geographical connections. So, the paradigm of attractiveness of a city has been enriched by the concept of geographically interconnected city. The attractiveness depends on both the attractiveness of an urban system and its relationship with its geographical networks. In France, for example, the concept of Urban systems worked by DATAR (DATAR indicators) has been informed with new systemic facets and new dimensions of interest such as the density of multidimensional relationships within the city and its relationship with other systems leading to the notion of a hierarchy of urban systems (core and peripheral or complex organization).

The example of territorial profiles used in ESPON group's work (https://www.espon.eu/main/) can also illustrate the recent enrichment of territorial profiles which now include a heterogeneous set in order for the qualitative satisfaction indices to be present in a given place including for example the GDP per capita, the infant mortality rates, the high percentage of graduates, the proportion of students leaving school without a degree, and the differences in the average unemployment rate...

These criteria categories applied to a city have been applied to all systems and "living areas" such as universities. The European U-ranking Multirank for Universities for example, is a type of dashboard that could be useful for

students when choosing a university. It can enlighten and expand the area of selection for potential students choosing a location to conduct their higher education before entering professional life (http://www.umultirank.org/). The indicators of "good governance" of the World Bank (indicators that apply to States and Regions) are also multidimensional profiles that indirectly indicate the welfare level of a geographical area and the ranking of a specific place.

A case review immediately shows that cities' territorial profiles have been constructed for various uses. The city's knowledge service receives its data from the territorial profiles and the synthetic index of regional attractiveness. This enables them to compare ("benchmarking") or even classify territories. The utility of such "bouquets de données territoriales", of such composite indicators and of such profile comparisons cannot be denied: more information has been gathered, heterogeneous data sources are amassed and grouped together, and this inform and facilitate decisions regarding the new location of firms or people.

The realization of the benchmarking is not so difficult. It is important to note that when a general index is built as a synthetic arithmetic integration of some specific indicators, the cities could be easily ranked in a cardinal manner. We also know that when the general profile is not designed by the arithmetic synthesis, but by a simple bouquet of local data, we can use the tools of over-classification between profiles ("outranking", "fuzzy integrals") that can rank (in an ordinal manner) cities in terms of several dimensions of irreducible criteria of interest nonobstant the impossibility to get a single grading scale. In fact, new ranking tools have been used for more in depth comparisons (Roy, B. (1991), Baslé, M. Huaulmé, M. (2011)). So, the ranking and outranking are feasible and generally in use. In the communication battle between competing cities, the knowledge and value of these profiles can be demonstrated through correlation between these traditional attractiveness' indicators and the location-relocation of populations, households, governments and businesses (for example: The Global Venture Capital and Private Equity Country Attractiveness Index: see http://blog.iese.edu/vcpeindex/).

The promotion of the traditional cities' multi-dimensional statistical indicators may have had some effects on attractiveness. For example, in France, indicators of new industrial sectors in cities (known as "technopoles", "competitiveness poles", "local productive systems", "French tech labels") are not a description of the local functioning considering the complexity in the functioning of a city (Bretagnolle A., Daudé, E., Pumain, D. (2003), Kourtit, K., Macharis, K., Nijkamp, P. (2014)) and considering that the expected gains in productivity and welfare will be produced in a systemic way. These indicators however are a guarantee and a symptom of productivity and local welfare (Shapiro, J.M. (2006)). This old-type promotion for a city can still be used in publicity for each competing city where everybody search an improvement in productivity and of local welfare. But this article is now interested in the literature on the supplementary criteria of attractiveness of the new specifically smarter cities after the digital revolution.

2. The possibility of a new facet to be shown for the attractiveness of a city after the digital revolution.

The traditional benchmarking is still useful. But, a technological revolution (a new industrial revolution) called digital revolution (Merryl, B. 2016) has changed the whole game. So, the question is how identify the dimensions of cities' attractiveness after this digital revolution. Are the old tools used for promoting a city still sufficient? Must cities continue to consider that the process of promoting a good city image should still be based on the using ancient territorial dashboards and the traditional outranking profiles?

2.1. Observing New Actors in the so-called smarter cities.

In fact, we could observe that, in the new digital economy, a small number of actors in a position of information and telecommunications leadership have become the big actors in the processing of big data (Dirks, S. Gurdgiev, C. Keeling, M. (2010)). These well-known actors are, at the beginning of the 21st century, omnipresent new actors located in a small number of cities in the world, those cities that "*experiment with new approaches to the planning, design, finance, construction, governance, and operation of urban infrastructure and services that are broadly called Smart Cities, some of these approaches are related to emerging roles of information technology*" (Harrison and alii, 2011). (Los Angeles for example, or Dubai, see Cisco, (2005)). IBM is a key-actor in this evolution: following Harrison, "*Recall that IBM's Smarter Cities work began in late 2008 as part of the Smarter Planet initiative*". As followers, more numerous medium-sized cities have had then the chance to be chosen by small and medium firms specializing in data, applications and software.

Based on a lot of observations of the digital divide (Norris, P. 2001), internet accessibility differences signified first of all a new form of infrastructures' open competition with new winners and new loser cities. But we should

add that internet infrastructure differences are not the only specific asset for future productivity in the digital society.

2.2. The necessity of new dashboards for the so-called smarter cities.

If Mayors and Regional governors consider the form of human intelligence, personal and also collective, that is produced by the interaction of brains and new ICTs Tools as a new differential asset and if they create the conditions for the existence of data platforms, in the innovative cities in a digital society, the value of a knowledge service from public-private mix of data will be growing. New crucial local actors can invent and sell periodic service subscriptions that will utilize the value generated by processing the data (Urban systems collaborative USC, 2011). As said Anthopoulos, "*Today, most digital cities focus on ubiquitous computing and on Web 2.0 applications for the delivery of various e-services (e.g. e-tourism, e-security, and e-health and tele-care services) in the city area*" (Anthopoulos et alii, 2011).

Recall that three ways are open for creating added value in the local knowledge economy (Lee et ali. 2013): data acquisition and processing systems which assist human intelligence (HI), -creativity public impulse, so awarding inventiveness and artificial intelligence (AI). Facilitating the interoperability on mixing public and private data platforms that will be based on trust and are at the service of collective intelligence (CI). In summary, in this "growing intelligence in the city" model, the three forms of HI-AI-CI intelligence participate in helping to change behavior and in the creation of new services through new public and private data management.

In this context, all real digital cities should potentially be favorable environments for entrepreneurship and propitious to a social participation. The true digital cities, in an innovative context, those which have had - the will to organize new cooperative platforms (here called "datathèques-services") connecting public and private open data, data from a lot of heterogeneous sources - and the will to enter the digital society, have not usurped the title of "smarter cities". Local authorities, business firms and non-profit organizations which created some local industrial organization of data-services could produce some benefic individual or societal applications and deliver more and more new knowledge services (for example, applications facilitating personal transportation in the city and new services for the disabled or handicapped persons) . So, the bet is that smarter cities will be the most attractive in the near future.

The consequence for our dashboard of attractiveness indicators is that new attractiveness of smarter cities can no longer be summarized and promoted by the ancient list or profile of ancient assets.

3. New indicators of cities' attractiveness in a diagram for complex and smart cities in a digital society.

The communication services of the cities are engaged in a competitive process. In a digital society, every complex city could be chosen as a location by global actors. These global actors are not located in each big city, but the cyber-world requires smarter cities in a lot of cities. Therefore, the existence of these factors characterizing the smarter cities could produce a supplementary indication of future local gains in productivity.

3.1. The first proposition of diagram.

A first list could be presented in a hub of dimensions as in the diagram provided by Fast Company (http://www.fastcoexist.com/1680538/ what-exactly-is-a-smart-city) (diagram 1). Each dimension has its specific

metric and scale that are more or less quantitative or qualitative, continuous or discontinuous.

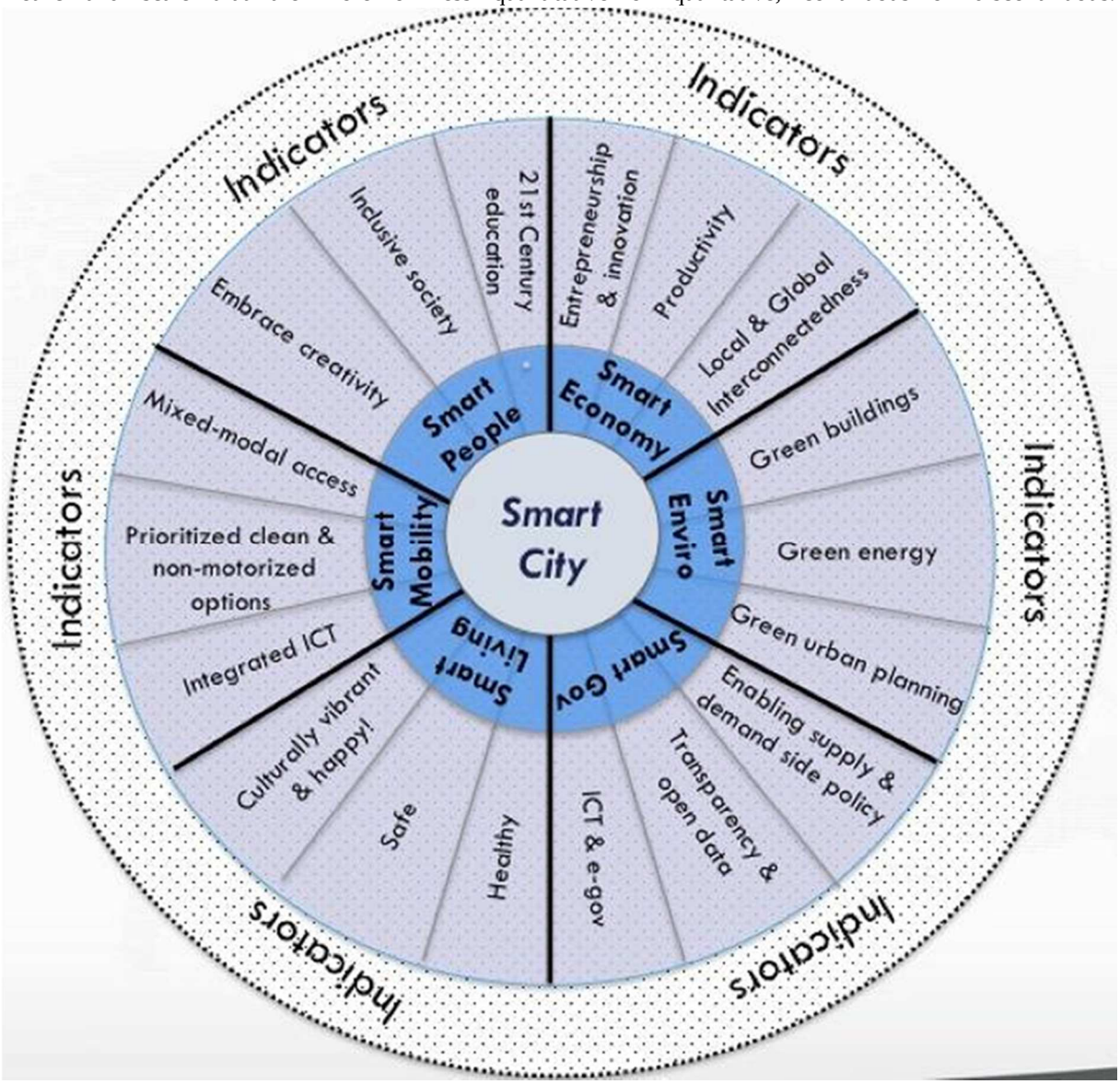


Diagram 1. Sourcing the indicators of a smart and attractive city.

Source : http://www.fastcoexist.com/1680538/what-exactly-is-a-smart-city

In this hub presentation, the “bouquets de données territoriales” provide “a lot of territorial flowers” for promoting a city. ICT and e-Government are facets. And smarter cities should be really pro-active to be well ranked in each array. But, these dimensions of criteria present a lack.

3.2. Our complementary proposition of diagram.

For a complex city using the services from the digital society, we want to add new arrays. Within a knowledge economy, within a smart city producing and using sharing data and big data, with data suppliers, data analysts, data scientists, and data processing, the city could host a new innovative activity which could have its own local industrial organization, the whole of the complex smart city leading to a new profitability center.

So, we propose to widen the diagram to include additional factors: the process of extraction--processing-- valuing data could constitute a new asset which could be seen as a factor of new attractiveness of a smart city (Van Winden, W. and Berg, L. (2004)). This is a not a science-fiction point of view. Smart data used by local industrial organizations permits smart cities’ to advertise themselves (Ovalle María del Rosario González, Marquez José Antonio Alvarado, Salomon Marquez Samuel David Martínez, (2004)). Big actors in the Data industry are preparing for the future and, for example, IBM published the following in the Journal of Research and

Development (http://researchweb.watson.ibm.com/journal/) and in IBM Smarter Cities Creating opportunities through leadership and innovation:

> *Smarter Cities are urban areas that exploit operational data, such as that arising from traffic congestion, power consumption statistics, and public safety events, to optimize the operation of city services. The foundational concepts are instrumented, Interconnected means the integration of those data into an enterprise computing platform and the communication of such information among the various services in a city. Intelligent refers to the inclusion of complex analytics, modeling, optimization, and visualization in the operational business processes to make better operational decisions. This approach enables the adaptation of city services to the behavior of the inhabitants, which permits the optimal use of the available physical infrastructure and resources, for example, in sensing and controlling consumption of energy and water, managing waste processing and transportation systems, and applying optimization to achieve new efficiencies among these resources.*

Leveraging information to make better decisions becomes a crucial asset. The ads, the experiments and case studies of local data gathering for solving territorial intelligence problems has multiplied over the last few years.

> *Cities today face significant challenges including growing populations, aging infrastructure, and shrinking budgets. Forward-thinking cities are thesis addressing challenges by leveraging information to make better decisions. - Anticipating and resolving problems proactively. - Coordinating resources to operate more efficiently. In doing so, they are able to make confident, informed decisions that reduce costs and improve citywide living conditions.*

So, what is the new information system in a smart city? Essentially, the urban system can be observed by sensors and spectators. As a dynamic complex system, the city's functioning is increasingly well-captured and more manageable (Batty, M. (2013), Yigitcanlar, T. (2011)). De facto, the information system could be an effective factor of public and private productivity. So, with new forms of growth and well-being in the 21st century, such as the digital economy and society, the conditions of attractiveness will be tied to industrial production and the use of data value (Townsend, A.M. (2013)).

The consequence is immediately perceptible: the attractiveness' indicators must take account of this new factor. This has a corollary: indicators regarding the local industrial organization of the process of Data valuations in the city will better describe the "smart" character of the city. (Stock, W. G. (2011)). So, in the new age, new comparisons between cities and between regions will be operated through a new enrichment of the dashboard of indicators presented in the diagram 1.

Conclusion. Testing two new criteria of attractiveness of the cities in the digital society.

In fact, the new digital society is a new place for growing competition between real smarter cities. Each city develops its own publicity ("*we have these socio-economic profiles, we have a competitiveness pole, and we have the characteristics of a smart city*") and everybody expects a growth in productivity and an improvement in local welfare if the city is selected as anchor location.

In the digital age, traditional information dashboards and territorial profiles could be still in use by new entrepreneurs looking for a location. But, we have explained that, in a digital economy and society, new location decisions are increasingly interested in the existence of the characteristics of a smarter city with Data scientists and with actors of the public and private industrial organization of the Data uses. Having capacities for extracting societal value from data rendered interoperable and close together is the facet to be tested to-day. Cities with a large capacity for Data processing and Data Valuing should be considered as more productive so their Data capacities will be a new factor of attractiveness. The industrial organization divides the profitability producing tasks between firms, non-profit organization and local authorities and their services. Smart cities are created through the creation of interoperable data platforms which mix the different sources of thematic data (for example, in transportation). Their platforms are compatible with other platforms in other towns and eventually will become part of the international network of smart cities. And their platforms (or Datathèque-services points) are not only a technological tool. They more and more become the sign of internal collective intelligence, internal trust sharing, the ability to produce a new collective good and therefore the sign of a better "ambiance" for future productivity and local welfare in the digital society and the cyberspace global organization.

So, we have asserted that the future dimensions of attractiveness are becoming the differential asset in the competition between digital services. Now, this hypothesis has to be tested: could we confirm that some indicators of the existence of a smart city (like a capacity of platforms based on data sciences and data scientists) are now better indicators of future gains in productivity and of local welfare (as suggested by Shapiro, J.M. (2006))? Nowadays, real smart cities communicate more and more with their specific asset: being an active actor in the Digital economy and society through their local organization of the data industry, the use of data sciences and the

physical presence of local data scientists. We need empirical works that prove that a new mode of organization of Data valuing and publications is correlated to global productivity and local welfare. We do not still see in the statistics the economic and social outcomes of a policy which has enhanced the smarter character of the cities: so test are necessary before concluding with a general recommendation for cities wishing to prove that they became smart cities. For us, the test has to be focused on two visible components that are specifically the sign of a partnership in data sharing and valuing: the existence and vitality of local clusters around interoperable data platforms (in French "Datathèques-services") and the number of data scientists, these components which will probably be at the heart of the city competitiveness and of local welfare in the future.

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