Social Economic Debates
Volume 7, Issue 2, 2018
ISSN 2360-1973; ISSN-L 2248-3837

SUSTAINABLE SMART CITIES

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ABSTRACT: Information society allows the expansion of the global information and communication technologies, generating, through deep restructuring in all areas of human activity, structural and institutional mutations at the level of economic reality. In the knowledge based society, we can talk about knowledge as a fundamental resource, information and communication technologies representing both a result of the use of new types of resources and an infrastructure that enables the global dissemination of new knowledge. The challenges of the information society have determined important changes of paradigm and recreation of knowledge terms, information and data. The information society can accept the existence of valid knowledge outside of human cognitive faculties, in introducing the epistemic equation the smart artifacts capable of knowledge, which fundamentally changes the classic theory of knowledge. Artificial intelligence becomes substantial to both the subject and the object of knowledge.

Key words: Smart city, sustainable data, natural resources.

JEL Classification: O32, O44, Q01

Introduction

Many of the patterns of economic development are essentially driven by a paradigm that draws and organises economic phenomena considered relevant. A holistic approach can propose a synthesis of complex issues facing humanity at the global scale with the main solutions which can be predicted, in the interests of sustainable development. The way in which we approach our economic resources of which humanity owns, at a certain moment, it depends on their valuation, depending on their rarity and usefulness, but also on the level of technological development. In the knowledge based society there are increasingly high-performance tools both for the investigation of economic phenomena, as well as new opportunities to intervene in their implementation,

in terms of an advanced vision over economic development. In this approach, considered to be operational, are the concepts of smart economy which can synthesize both the paradigm of sustainable development and the increase of economic productivity and smart city that configures a model of organizing and functioning of the community by means of a top digital infrastructure.

Scenarios of evolution in Economics

To preview the economic evolution on the medium and long term, a global approach is needed in order to interact with the problem of natural resources: their conceptualization, their rarity and distribution issues, their sustainable use. The future availability of natural resources-defined here as food, water, energy, and minerals- is critically important. All individuals and nations require them to sustain current standards of living, as well as to increase economic activity. Current and future resource availability is therefore a political, economic, social and environmental issue that can impact all stakeholder groups, often with disproportionate and indirect consequences. Given that resource-related supply chains are often global in nature, these consequences may easily be underestimated in both scale and scope (The Future Availability of Natural Resources, p. 7).

Thus, problems that seem to be solely economic, such as natural management resource, involves not only multidimensional approaches and between institutions, but also to adopt an integrative vision that defines the terms of economic growth and sustainable development, as well as the way in which a transition cost is distributed towards a new kind of Economics. In this economy, governments, consumers and companies realize and accept the full costs of their transition to a low-carbon, durable and sustainably sourced economy. They suffer through what they perceive as a change in their use of natural resources – one that is essential for social and environmental sustainability (The Future Availability of Natural Resources, A New Paradigm for Global Resource Availability, p. 9). In this context, it becomes relevant when the realization of several scenarios of natural resource management.

The first scenario, the alarming abundance (The Future Availability of Natural Resources, p. 57) - tackles the consequences of the use of abundant natural resources, both fossil and renewable energy resources. Behind the seeming benefits of increased profits on the entire economic chain, from the energy producer to the seller of finished products, you must issue the resource consumption, but vital, such as water, as well as the involved, social and economic implications. We need new instruments to assess the efficiency and competitiveness of economic activities that include forecasting and environmental protection costs, the impact on weather phenomena and other types of rare and non-renewable resources whose consumption increases as a complementary effect.

A second scenario, the challenge of transition (The Future Availability of Natural Resources, p. 63), involves a new paradigm of economy transformation approach by the entire society and by all types of decision-makers. In this world, governments, consumers and companies realize and accept the full costs of their transition to a low-carbon, durable and sustainably sourced economy. They suffer through what they perceive as a change in their use of natural resources – one that is essential for social and environmental sustainability (The Future Availability of Natural Resources, p. 71). Natural resource consumption costs are becoming a very effective tool in making the transition to a new sustainable economy, integrated specialization (The Future Availability of Natural Resources, p. 71) to a resource management solution. A repeated and obvious finding of this project was the need for better ways of thinking about interconnections between resources, the drivers of resource availability, and the environment for resolving resource dilemmas in ways that benefit all stakeholders.

At the same time, the deep expertise in specialized fields that allows for concentrated progress in understanding the world must be maintained (The Future Availability of Natural Resources, p. 71).

From here you can start the construction of a new kind of scenario that would aim at a new vision on the resources and their management in remodeling of the digital era. The world already possesses the vast majority of technical knowledge to serve its resource needs. To ensure that these goals are complements rather than trade-offs, the world needs concerted and collaborative innovation in social, political and economic systems (The Future Availability of Natural Resources, p. 71).

According to the Global Information Technology Report 2014 presented in the framework of the World Economic Forum 2009, every day, there are created over 2.5 quintillion bytes of data, and 90% of the data stored at a global level were carried out in the past three years. Also, in the report quoted, it is estimated that the total volume of digital data will be in 2020, globally, of 40 trillion gigabytes; that is 30 times larger than the existing one in 2005, which means over 5200 gigabytes for every citizen of the planet. In the Cisco Visual Networking Index it is estimated that from 2012 until 2017, the volume of data that will circulate between IPs connected in various digital networks will have an annual growth rate of 23%. From this perspective, we can say that digital economy has *time* as its fundamental element and unit of measurement.

Neelie Kroes, Vice-President of the European Commission for the Digital Agenda says that „Data is a precious thing ” and "…that's why I've called data the new oil. Because it's a fuel for innovation, powering and energizing our economy." (Global Information Technology Report, 2014). In the digital economy data is comparable to the oil or gold for the industrial society. „Data have always had strategic value, but with the magnitude of data available today-and our capability to process them-they have become a new form of asset class. In a very real sense, data are now the equivalent of oil or gold. And today we are seeing a data boom rivaling the Texas oil boom of the 20th century and the San Francisco gold rush of the 1800s" (Global Information Technology Report, 2014).

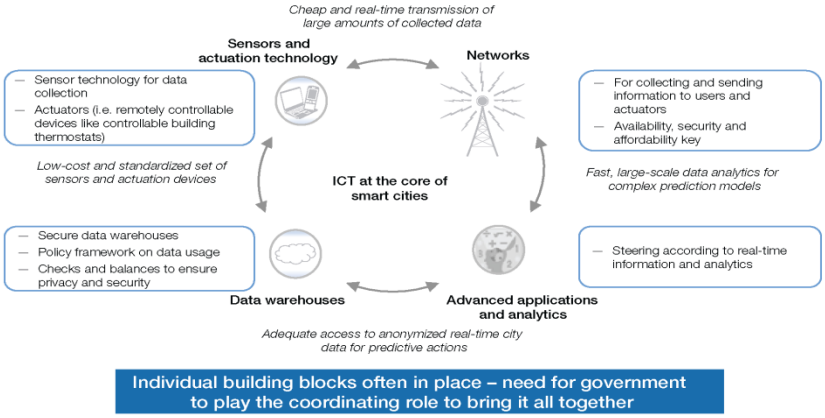
Given that in recent years, globally, we've encountered the effect of an economic and financial crisis, the report's authors identify in what I call the big data, a solution of economic growth, creation of jobs and new opportunities for your business, as well as the raise of the living standard of people in developed countries or emerging economies. For them, the big data is an essential support for global innovation. In the digital economy, the date has a strategic value and is defined by three fundamental features: dynamics, volume and variety. Also, the *data* has a particularly valuable: it is measurable and allows the selection of economic and financial activities. From this, there are some authors whom perspectives set *data* as a new ideology: Indeed, we are now living in a world where anything and everything can be measured. "Data" could become a new ideology. We are just at the beginning of a long journey where, with the proper principles and guidelines, we should be able to collect, measure, and analyze more and more information about everyone and everything in order to make better decisions, individually and collectively. If the big macroeconomic data food sectors generate institutional restructuring, at the organization level, high volume, speed of data accumulation and their great variety, determine new trends. Thus, at the level of organizational management it is being driven for the use of data sources that have not been previously used; so, new automated systems for data management and new calculation methods and trading are born.

These trends poses new challenges to be answered by the organizational management: improve the human resources required to manage the new models and tools for storage and data processing and question the creation and implementation of systems that ensure data protection. However, organizations confront vast

differences in their ability to utilize big data to good effect, as seen in their stages of big data maturity. These differences range from adopting big data practices for operational improvement in selected functional areas or building or revamping an organization's value proposition to completely transforming their business model based on big data. At the more advanced stages, organizations learn to monetize big data far beyond simply getting better at what they are currently doing; learning this lesson is an accomplishment that can mean a fundamental shift for them. Environment readiness plays a pivotal role in enabling such success, because its effect is far greater than the evolution of individual organizations' internal capabilities and usage levels of big data (Global Information Technology Report 2014). Dynamic data management systems are far ahead the creation of data security systems, as well as the provisions contained in the legislation relating to such matters. In this respect, both the Governments and the private organizations are allowed to recommend a separate data storage, depending on their content, creating separate departments specializing in data protection, use of data management systems that are not joined, so that, if a system is affected/ill, the other is not contaminated, data exchange between systems should be carried out only with the observance of rules to ensure data protection , application of mechanisms that confirm the identity of users (for example, biometric signature). In addition, the legislation must be improved, in particular, in order to ensure ownership of individuals and organizations over data.

As a result, in the digital economy is considered not only the gold or oil the new economy, but also creator of a new revolutionary ideology and philosophy of management. According to The Economist Intelligence Unit, over two-thirds of executives believe that big data helps to identify new business opportunities and better management decisions, almost half of the executives addressed considers that the management of big data contributes to the competitiveness of the company, and a third of the executives think big data has a role in increasing financial performance. At the same time, it mustn't be ignored, a precautionary approach in the management of the databases. Jaron Lanier urges us to be cautious when you need to believe in the results created by what he called "Wisdom of the crowd" and that should increase concern about keeping the privacy of the individual's life. Thus, the creation of large databases raises two problems concerning fundamental human rights: they may be invasive and may suppress certain human freedoms (for example, the right to intimacy), and so, these digital systems have weaknesses. Humanity started to create a digital universe, a virtual reality whose rules of activity are dynamic, in the process of elaboration. However, it is undeniable that the new digital ecosystems are required as factors of economic growth and competitiveness. "First described by Clive Humby as the "new oil," this data growth is fueling knowledge economies, sparking innovation, and unleashing waves of creative destruction. But most of these data are unstructured and underutilized, flowing at a volume and velocity that is often too large and too fast to analyze. If data do, in fact, comprise the new raw material of business, on par with economic inputs such as capital and labor, then deriving insight and added value from this new input will require targeted transmission, processing, and analysis" (Global Information Technology Report 2014). Michael Mandel introduced a significant fundamental conceptual distinction, revealing the fact that, up until the present time economists have divided economic activity results in goods and services, but *the data* is neither. As a result, *the data* can be both resources, as well as a result of the work of a company and requires a new paradigm in economic thinking.

Figure 1: Many Elements of ICT Infrastructure Needed for Smart Cities



Source: Expanding Participation and Boosting Growth: The Infrastructure Needs of the Digital Economy, World Economic Forum, Prepared in collaboration with The Boston Consulting Group, March 2015

Digital infrastructure allows and new forms of social and economic organization, called smart cities (Global Information Technology Report 2014). Many of the ICT-based systems, apps and services that can address urban needs such as energy, transport, water and waste, social services, and building management and services already exist.

Importantly, different levels of "smartness" exist; tools ranging from those that perform basic monitoring to advanced systems enabling predictive, analytics-based applications can all have a significant impact on improving citizens' well-being and the efficiency of daily life. Singapore, for example, uses sophisticated traffic control systems to maximize the efficiency of 164 kilometres of expressways and road tunnels. Rio de Janeiro uses an advanced weather-forecasting system and mathematical models that take in data such as topography and historical rainfall to predict heavy rains and possible flash floods at highly localized levels (World Economic Forum 2015, p. 49).

The digital economy's support to develop Smart Economy.

The debate on new economy revolves around ICT (Information and communication technology), as well as prerequisite for economy by increasing emphasis on labor productivity and a new approach to human capital looked at from the angle of computerisation process digitalization. Thus, ICT shall be presumed to have the most growth, which would attract reducing unemployment and inflation, the effect or a cyclic response of a positive impact the bid (with a drop in prices for food, energy, insurance and technology).

The new economy is different from the old one, because of the difference between investment and productivity/technological advance that specifies a concept (neoclasic) built-in technology, as well as between the forms of intangible capital, knowledge and/or innovation; the type of difference specific to a unincorporated technology concept, and technological change. By reference to the smart economy, economic growth is supported and driven by the ICT boom in the services sector, by the increase of the share of knowledge-based activities and innovation in the economic instruments, by the developing policies to social inclusion as a support for an increase your inclusive, dynamic, fair and sustainable economies at EU level.

Smart economy is based on concepts of productivity growth in the services sector, based in particular on re-allocation of factors and more efficient use of ICT (Sharpe 2002; Bosworth and Triplett 2007; Basu and Fernald 2008), suggesting a deep impact of ICT at the level of the production function. The transition from old economy to new economy is taking shape more and more comfortable on the smart economy, both by reforming economical policies in order to incorporate the technology at the level of all sectors of the economy, as well as at the level of principle policies production within the meaning of the phrase: *faster, better, cheaper* (Jorgenson 2004).

In general, the economic growth *boom* overlaps with the investment in ICT, and high rates of growth of investment reflects the full nature of technological new economy; ICT presents itself as type of input at rates of efficiency or marginal products large, with low costs and huge potential for additional applications (organizational) type GPT (General Purpose Technology). Thus, the new economy is based on the ICT technology, showing low costs and high marginal products; main difference from conventional types of capital is that it indicates high rates of depreciation. In these circumstances, the investment *boom* reflect both rapid decline of high prices and the rates of the efficiency of ICT, supported by technological progress in top levels of high-tech, as well as the fact that entrepreneurs have chosen to change their patern and replacing ICT with other types of input.

We admit the advantages and disadvantages of this position. A number of economists have sought to suggest that the difference between investment and technological advance, on which a neo-classical conception indicates that an investor can internalise yields return on investment without benefit, in exchange of spillovers benefits, external benefits which are produced elsewhere, without satisfying the entire concept of technology and outputs (increasing), highly associated with ICT at a microeconomical level. Thus, ICT reflects a huge potential for techno-human complementarity, emphasized by the organizational literature and/or the skill based technical change Theory, and historical analogies with General Purpose technology, which marked, past irreversible, the growth of the industrial trend. Economy reflects a major shift toward intangible forms of system inputs and outputs. Thus, to each 1 dollar investment in computers or information technology equipment, managers invest $10 to reorganise their social systems of information and production to use this new technology as efficient as possible (Zysman and Weber 2000, p. 9). We support the concept of the new economy based on information and communication technologies in particular and we try to provide a domestic and international perspective on growth and the role of ICT in this increase, taking into account a wider range of topics subsumed under the new economy, such as the smart economy. The current society focuses on a development model based on innovation and creativity to provide population welfare through rationalising economic resources and especially time. In truth, we are talking about the fact that the economic world expands and time, as a resource, shrinks. This makes the approach on economy to be in line with the reduction in the use of time in productive work units, at an economy's level, in the sense in which the value of resulting products through work doesn't lessen the time of an individual, as the main vector towards the future. Humanity wants to connect in real time to any event from any point on the globe, to reduce or eliminate any borders, obstacles, limits that could obstruct communication, viewing, linking with facts and actions that could make an immediate or subsequent impact on the individual and society.

Urbanization in the digital era

Digital infrastructure allows not only the reshaping of economic activities, but also the forms of organization of human communities. If, at present, about 50% of the planet's population lives in urban areas

(http://www.romaniasmartcities.ro), it is estimated that, by 2050, it will be both a phenomenon of demographic growth, the number of inhabitants will reach 9.3 billion people, and one of intense urbanization. Thus, it's predicted that, in three decades and a half, 70% of the world's population will live in cities, the urban population will reach 6.3 billion people. In this context, the current urban organization models are proving to be outdated and we need a new vision of the future of the human community.

Overcrowding of urban centers will generate accelerating consumption of resources, will raise new problems in the governance and management of waste. Currently, cities produce 70% of global greenhouse gas emissions at a global level (http://www.romaniasmartcities.ro) and the bulk of total waste. Considering that, in over 10 years, it is estimated that waste will have reached a total volume of 2.2 tones and their processing will involve a cost of $ 375 billion, reorganizing urban communities based on new principles is not only a priority in governance, but a matter of survival and development of the human race. The concept of smart city expresses a new vision of urban organization, based on the principles of sustainable consumption and an integrating digital infrastructure allowing synergistic operation of transportation systems, power distribution, citizen safety, as well as health and education systems.

Thus, the compatibility of a water supply system with the supply of electricity by means of intelligent networks, can achieve a significant reduction in resource consumption while increasing the quality of life. Also, the new architectural concepts must respond not only to aesthetic choice or cost, but a philosophy of urban organization aimed at the efficient functioning of all services needed by citizens (public transport, hospitals, fire departments, police, schools etc.). Smart solutions for urban organization are already out of the planning phase and are becoming reality in cities in Europe, USA and Asia.

For example, in Amsterdam intelligent integrated solutions are being used for both energy consumption and water management, as well as infrastructure and urban management. To illustrate the concept of Smart City, the Experience Lab – Marineterrein (http://amsterdamsmartcity.com) project was launched in Amsterdam. Basically, the purpose of the experiment is to present and test innovative architectural solutions that bring the Dutch concept of kijkdoos' in construction to an urban scale, but also to use an integrated digital infrastructure at a city level.

From Smart City to Smart Citizen there is also a conceptual step. The human being reshapes itself on the threshold of a new era, the digital one. In this context, we can say that the future looks smart as we face another challenge: to give new meanings to the relationship between human and artificial intelligence. It is obvious that the environment in which man evolves is becoming more intelligent, as intelligence, becomes more artificial.

Conclusions

In the smart economy, the technological-social innovation manifestation has a driving effect through which the transfer of knowledge, resources and tools, from the researcher, promoter or generator of information, towards the individual, society, as a receiver and beneficiary in order to increase social welfare and the rational use of economic resources. Thus, innovation can be considered the foundation of cognitive entrepreneurship (Drucker, 1993) leading to the deliberate search of changes and systematic analysis of economic and social opportunities. Discipline in innovation is based on diagnosis, namely the systematic examination ability of the contexts or areas that give entrepreneurial opportunities.

A measure by which the current boundaries become irrelevant for the virtual user and the time resource is rationally used, is implementing the concept of smart economy in the global economy. By implementing the smart economy concept, time gains an economic value in its own right, its rational use is an advantage to the producer or user, its value consisting of the smart products they create or are likely to be achieved. And so, creativity and innovation are essential "smart economy" attributes through which the economy gains due to the advance of science, the value of skills and performance of each individual in the work process, the achievement of a function between competence and performance by reporting on science and technology. Transferring knowledge from concept to reality is achieved through creating smart city that services the development need of the modern individual, knowledge user, conceptual and thinking freedom, rational, advocate of the sustainability and durability principles.

Smart City is not only a powerful information system, catalyst of energies and intelligent solutions, but a projection of what the future designates over the individual in relation to resources and knowledge economy.

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