Systemic Modeling and Advance Reengineering of Territory (SMART) as a Path to the Smart Basic Entity (SBE)

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***Abstract*—Smart cities (SC) became, for a few years, a regular topic in the scientific literature, and both political and economic agendas. Indeed, the connection between urban development and Information and Communication Technologies (ICT) represents a large market. It is presented as a multi-dimension tool to face the challenges of the 21st century. We intend here to demonstrate that developing such a concept only on cities may reinforce the already existing fracture between rural and urban territories. The opportunity exists to bring smart technologies to a lower level, that we call the Smart Basic Entity (SBE). We advocate that, to do so, it could be wise, to experiment a Digital Clone Approach.**

Keywords—Territorial Intelligence; Smart City; Smart Basic Entity; Digital Clone; Rural Territories; Ariège; Angola

I. INTRODUCTION

Smart cities (SC) became, for a few years, a regular topic in the scientific literature, and both political and economic agendas. Former President Bill Clinton is often considered as the father of the concept. Telecommunications and Information Technology (IT) giants, SISCO and IBM, having played the role of initiators. Indeed, the connection between urban development and Information and Communication Technologies (ICT) represents a large market. It is presented as a multi-dimension tool to face the challenges of the 21st century [1].

Between the possible denominations - Eco City, Smart City, Knowledge City, Sustainable City, Resilient City, Low Carbon City, Green City, Ubiquitous City, Intelligent City, Digital City, Information City, Liveable City - Smart City is the most commonly used. More recently, Smart Sustainable City (SSC) and Linking City joined the race.

In 2009, the number of people in urban areas surpassed the number of people living in rural areas. Although, we shall keep in mind that national definition of what is urban is not uniform across the World. For the World Bank, rural population registered a sharp decline during the 1960-2018 period, from 66.4% to 44.7%. Such a figure hides huge disparities between regions and continents. In France, the rural population amounts only at 19.56% in 2018 (divided by 2 since 1960 (38.12%)) whereas it remains at 34.49% in Angola (from 89.56% 58 years earlier) and at 44.68% in Indonesia (85.41% in 1960) [2]. The interpretation of such a worldwide trend shall take into accounts local and regional specificities.

Cities offer multiple advantages: access to electricity, sanitation, water, health and education. Incomes are also higher even they shall be related to living costs. Supported by infrastructures of transportation and communication, high density of individuals and businesses, the city is a territory for serendipity. Urban areas also tempt individuals fleeing war or environment disasters. The attractivity of towns, urban centres or urban clusters, do also impact the structure of employment as there is a shift from agriculture towards manufacturing or services.

Therefore, showing disinterest for the rural population may, on the medium-long term, result in dramatic social, economic and political consequences. At the same time, an opportunity exists, by customizing SC concepts, to create a smart rural development model. We will illustrate the issues and solutions, we currently work at, by taking the examples of France, China and Angola. The interpretation of such a worldwide trend shall take into accounts local and regional specificities. Data related to population, population growth, but also human settlements variations shall be combined. We must consider at the same time the analysis of Cities, and the ones of urban Centres and Urban Clusters.

The change in urbanization ratios varies a lot from one continent to another. Africa (+7.3%) is the fastest urbanizing continent for the period 1990-2015, followed by Northern America (6.4%), Oceania (4.4%), Latin America and the Caribbean (3.3%). The growth is only 1.8% in Asia whereas Europe decreases (-0.8%). Most of all, the surface of urban clusters has nearly doubled in 40 years. From 4% of the global landmass in 1975, they represented 7.6% in 2015. Angola is one of 31 countries for which urban areas have more than double during the period. In some states, often small ones, cities cover more than half of the surface. In 58 others (Russia and Australia, for example) less than 1% [3].

Java, Indonesia hosts two of the 10th most populated urban clusters. In Jakarta, the area of 13 000 square kilometres is home of about 50 million people. The one of Semarang, with a more substantial area (around 19 000 sq/km), shelters 22 million people.

After an introduction, we present, in Section II, the Smart cities as a dominant model. The long term debate about urban concentration and growth will follow (Section III). In a fourth step we will consider what makes the cities so unique (Section IV) before identifying the risks associated with abandoning the rural areas (Section V). We will study in Section VI the case of Ariège before exploring government strategies to transform rural areas into attractive territories (Section VII). We will, by presenting our model, indicate how technology could support such a move (Section VIII) and develop further the digital clone approach (Section IX). Before concluding (Section XI), we will illustrate by our Angola and China experiments, the current status of our research (Section X).

II. SMART CITIES: A DOMINANT MODEL

Smart Data, Smart People, Smart Technology and Smart Governance represent the four pillars of the Smart City. SC has become the dominant model of development for towns in the 21st century. Without any restriction related to traditions, culture and religion, almost all aspects of urban inhabitants' life do enter in the SC scope.

All over the world, political leaders need to answer to the combination of significant issues, namely the explosion of demography and the revolt of Earth. By 2025, the level of urbanization will reach 58.20% (4.7 Bn people) from 44.70% (2.57 Bn), twenty years earlier. The projections show that the two-third of humanity will live in an urban environment by 2050, thus prompting the attention of international agencies such as UNESCO or UN HABITAT.

The explosion of demography and the high concentration of human beings into cities may have devastating effects. Pollution, security concerns, mental and health disorders, increased and concentrated needs for energy and resources are the most intensively documented. Such a massive trend always requires more substantial storage capacities and efficient distribution networks. It also increases the vulnerability of human centres to natural (volcanoes, earthquakes, floods, sea elevation, high tide) and health disasters as well as to terrorist and cyber-attacks.

The revolt of Earth takes multiple forms from climate changes to disappearance of fauna and flora species, from freshwater scarcity to pest invasions. It profoundly affects, together with human-generated conflicts, the living conditions worldwide and creates mutations and transformations at many levels as well as migrations and destruction of human settlements. In such a tense environment, Smart City appears as an "easy to sell" political tool. Expandable and flexible, it is a kind of "swiss knife urban concept" able to resolve all issues mentioned above. It is not a surprise then that it be regularly adopted in the Asia-Pacific, a region facing with Africa the fastest rate of urbanization. There, urbanization would reach 70% by 2050, whereas 90% of the increase will take place in Asia and Africa. Six of the 10th most populated cities in the world are in North, East or South East Asia (Tokyo, Delhi, Shanghai, Mumbai, Beijing, Osaka). The score amounts at 32 for the 50 largest cities of which 16 are megacities (over 10 million people). Some of them, Tokyo, Bangkok, Ho Chi Minh, Jakarta, Manila face, on the same way that New Orleans or West Netherlands, both subsidence and sea-level rise. They enter in the group of "Sinking Cities" and shall partially be below sea level by 2025.

Most of the Asian countries are sensitive to the SC rhetoric. They suffer from environmental threats, are often places of significant disparities (gini ratio), face pollution of air and water, unequal access to education, jobs and services, poor infrastructures for energy, telecommunications and transportations. For many people, the anxiety facing an uncertain future dominates. Also, it is no surprise that considering human gregarious instinct, concentration on cities, also supported by job opportunities, higher standards of living and multiple services, may continue to progress.

The political discourse is supported mainly by the revolution of ICT (Information and Communication Technologies), the one of IoT (Internet of Things) and more recently the fast development of AI (Artificial Intelligence). They allow managing ever-increasing volumes of data that shall grow from 33 Zettabytes (ZB) in 2018 to 175 ZB by 2025 [4].

For a large share of the population, those signs of progress are synonym of job destructions and highly tricky adaptation. Political discourses attempt to calm fears. Thanks to technology, the city would become the place where, through monitoring, air and water purity would remain unchallenged, traffic and transports efficiency would be enhanced, garbage would be invisible and immediately recycled. Criminality and terrorist risks would be assessed, and new services would regularly appear. A smart city is also a place where available jobs would be managed and fulfilled. Still, most of all, its development would require a high number of qualified technicians to support every day appearing positions.

Whatever is the type of decision process (centralized or decentralized) used to drive the development of the Smart City, all insist on people empowerment. Many suggest the promotion of platforms for bottom-up participatory governance [5]. Then, through the access to data, the contribution by forwarding ideas, the development of software and applications by its inhabitants or local companies, the city of the future may appear as a new place for democracy. At least in the political discourse and notwithstanding the increased pressure and control that smart data and IoT may allow on the citizens. By becoming smart, the city will anticipate and satisfy all needs as defined by the Maslow Pyramid from physiological to self-actualization.

Dr. Joan Clos, Secretary-General of the United Conference on Housing and Sustainable Urban Development (Urban III) perfectly summarizes the commonly shared vision: "In this unprecedented era of increasing urbanization, and in the context of the 2030 Agenda for Sustainable Development, the Paris Agreement, and other global development agreements and frameworks, we have reached a critical point in understanding that cities can be the source of solutions to, rather than the cause of, the challenges that our world is facing today. If well-planned and well-managed, urbanization can be a powerful tool for sustainable

development for both developing and developed countries" [6].

III. Urban Concentration and Growth: A Long-term Debate

Does urban concentration support growth? The question remains a place for fierce debates. Jane Jacobs, the well-known author of The death and life of great American cities, appeared as a pathfinder when she claimed that "the understanding of cities, and also of economic development generally, has been distorted by the "dogma of agricultural primacy." From initially being primary organs of cultural development, cities have become primary economic organs [7] and as such a centre of growth. As places of innovation and industrial production, cities offer to the rurality the services and products required to increase the output, to upgrade raw into transformed goods with added value. Polese [8] studies the pro and cons of such a theory extensively. He identifies the laudators of cities whether considering the relationships between per capita income and urbanization levels, the contribution of urban areas to national income and product, the definite link between productivity and the agglomeration of economic activities in cities. But he rejects a direct causal relationship as scientifically impossible to demonstrate. Tolley and Thomas conclude that "Urbanization as such is neither the source nor the enemy of development" [9]

IV. What Makes Cities So Unique ?

Urbanization mainly concerns the rural-urban shift. The denomination is also used when population growth is predominantly urban. As indicated earlier, agricultural productivity directly impacts urbanization pressure. As indicated earlier, agricultural productivity directly impacts urbanization pressure. Reversely effectiveness of agriculture may lower or slower urban growth. Urbanization, part of the farm workforce becoming free, constitutes an inferred-effect of the agricultural revolution [10]. Castells-Quintana and Royuela [11] edulcorate such a proposal by stressing,that rural population are often expelled from the rural areas.

The populations of major cities scarcely decrease: it is the case for Busan and Nagasaki but also in several European towns submitted to low fertility and emigration.

Before 1850, no country was predominantly urbanized. It was the case only for England by 1900. From then, the rate rose dramatically from 14% after World War II, to 55% in 2018 with projections at 68% by 2050. During the period 2018-2050, three countries, namely India (+416 million urban dwellers), China (+255 million) and Nigeria (+189 million), account for about 35% of the projected increase. Northern America (82%), Latin America and the Caribbean (81%), Europe (74%) and Oceania (68%) are highly urbanized. On the other hand, Asia (50%) and Africa (43%) remain mostly rural, but their rate of population growth will automatically generate, as demonstrated by Tolley both urban and non-urban growth.

The genuine attraction for cities shall be analyzed. Cities are the mothers of human progress [12] and, no development may take place without towns [13]. Often the change in status (from city to capital as it was the case for Jakarta in 1961-1964); the efforts from government or municipality; the development of the hinterland, accelerate the urbanization process. Thanks to the concentration of capital and means, the city offers a place for innovation [14]. "The city promotes the monetization of the economy, facilitates social mobility and the adequacy between offer and demand for qualified manpower, expands the markets for industrial and agricultural productions" [15]. Even a specific size shall be reached to boost technological progress [16], dense and marge populations constitute a fertile ground able to welcome the exchange of ideas [17]. City diversity supports employment growth [18]. By limiting the distance, offering efficient transportation and communication networks, they reduce the cost of transmitting information and increase efficiency and productivity [19] [20]. Unsurprisingly the patterns have changed with time also in the 90's "Cities with high levels of human capital did well, and cities with large numbers of the poor did poorly" [21]. Environmental concerns also require adaptative and innovative means of transportation. Intermodal platforms aim at improving efficiency [22].

Cities are intricated into a complex system: the system of cities. For Pumain, cities also have an intrinsic quality to transform themselves: an evolutive capacity or (re)organization. Remembering the "General systems of cities" conceptualized by J.Reynaud in 1841; the works of Berry and its famous "cities as systems within systems of cities" [23] and the ones of Pred ; using analogies with physical systems and synergetics [24]; Pumain compares cities systems to dynamic systems governed by an auto-regulation. She goes even further by defining an evolutional theory centred on the notion of "*system of cities*"; thus, ending the supremacy of a static vision of cities [25].

V. The Risk of Abandoning Rural Areas and "The Catastrophe Scenario"

Could any government decently abandon 60 to 20% of its population? The "yellow vest" movement in France, initiated in October 2018 and still active as of March 2020 in some rural areas, constitutes, for any government, a fierce reminder. The images of violence in Champs Elysees, the groups of rioters spreading in the capital and main cities, made people forget that many Yellow Vest were leaving in rural areas and were protesting against decisions taken by the central government that directly impacted their living conditions.

France is presented regularly as an heir of Jacobinism. Despite some tentative of decentralization, regionalism is refrained, and decisions centres are often far from the countryside. Strong disconnection exists between elites, budget and environmentally oriented, unknowledgeable about local realities, and the rurality. To fight against deficits, dramatic cuts were done, during the last thirty years, in public services. They are now doubled by the disappearing of private services, in particular in the field of finance and communications. An untrained and unprepared population faces a new "virtual world", as well as non-efficient networks.

Conscious that a balance shall exist across the entire national territory, President Charles de Gaulle created in 1963

the Délégation à l'Aménagement du Territoire et à l'Action Régionale (DATAR). Under the Prime Minister, such a structure had to impulse, coordinate, reequilibrate the actions of the state whereas in developing rural areas, reinforcing transportation networks, meshing the country. By using DATAR, the state aimed at organizing and modernizing France; at preserving cohesion, at making territories more attractive.

On 2014, DATAR merged with the Comité Interministériel des Villes and l'Agence Nationale pour la Cohesion Sociale et l'Egalité des Chances into CGET, le Commissariat à l'Egalité des Territoires. Such a combination of agencies was lately replaced by the Agence Nationale pour la Cohésion des Territoires (ANCT) under the ministry of Cohesion of Territories and Relationships with Territorial Collectivities.

Terminology matters here: cohesion, equality constitute the fertile soil of a territory that any disorder may spoil forever.

In the 1970s, DATAR prepared a prospective study forecasting what will be France by the end of the 20th century. One of the output, referred to as the "Catastrophe scenario", concentrating all developments into large metropoles and consequently creating desertification of rural areas had to be avoided. Dou and Fournié [30] have shown that, notwithstanding expert's advices, France has been developed under such a configuration. The sizeable interstitial space created suffers from insufficient means, infrastructures and is dramatically abandoned by its population.

The state agency France Strategy proposed that national investments be channeled to the 15 largest French cities through metropolitan pacts of innovation. Such a policy, justified by a lack of resources, may lead in territories located at the fringe, to the reinforcement of inequalities as regards as public services, access to medical services, connectivity between others.

France suffers from a triple fracture: a Territorial Fracture, a Technological Fracture and "Data-consciousness" fracture.

France is not the sole country to face problems with its rurality. The phenomena concerns almost all countries of the continent. The European Union, now aware of the situation, initiated some action process with the Cork declaration, Ireland, 2016; the UE Action Plan for Smart Villages (11/04/2017) that aims at « investing in the viability and vitality of rural areas »; the Bled declaration, Slovenia, 2018.

VI. The Case of Ariege

Separated from Spain by the Pyrenees mountains, Ariège is one of the 13 departments composing the Occitanie region, second largest province in France (72 724 sq/km). With 5.8 million inhabitants, organized around 18 urban poles, two large metropoles (Toulouse and Montpellier), the region shelters a strong industry recognized at international level (aeronautics, spatial, in-vehicle systems, agro-industries, biotech) supported by 15 poles of competitivity and several large universities.

Ariège is a department limited in size, home of 152 724 inhabitants of which 46.04% are over 50 years old compared to 33.08 % in the neighbour department of Haute Garonne (central city: Toulouse). Largest cities in 2017 were Pamiers (15675 habs), Foix (9 532 habs), Saint Girons (6 383 habs) and Lavelanet (6 137 habs). Only 31.1% of Ariege's inhabitants have a graduate-level, far from the 50.8% of Haute Garonne and 97% of the companies have less than 50 employees.

The territory, called in some media the anti-startup nation [26], has suffered from the closure of few large factories (in particular of paper, an industry-supported by hydroelectric capacities and forests) and mines in the 90's, of "green tourism" being impacted by fierce competition with other regions and international destinations since the year 2000, and more recently of "white tourism" being affected by climatic change.

Still, Ariège benefits of several assets. A vast cultural and historical heritage (between others Cathar castles), an immaculate nature with 55 000 ha of regional Natura 2000 park that welcomes bears and wolves, high peaks over 3000 m, thermalism are only parts of them.

In this French department the disappearing of state presence, mass transportations and private services alter the living conditions and destroy the efforts to promote tourism On the long term, they might be the synonym of exode and increased poverty. A feeling of exclusion may prevail that could be transformed into social unrest and affect social and national cohesion. State presence disappearance takes multiple forms: the closing of taxation and perception offices, of classes in schools and colleges, of tribunals and legal offices, the reorganization of beds in hospitals or health services. In parallel, traditional shops are impacted by slow local and touristic activities. Low traffic and profitability condemn branches of banks and post offices. Bank Automated Distributors are suppressed. As in many rural regions, people have to drive 20 to 40 km to access essential services. Not the least, doctors and specialists abandon those areas, and there is a lack of professionals in both private sector (-26% between 2014 and 2018) and hospitals (-16% for the same period).

Moreover, new regulations made possible the absence of controllers in the trains creating tense situations as regards as security and law enforcement in transports. On many lines, tickets cannot be sold into trains whereas at the same time commercial offices are being suppressed or opened during a short period of the day. Automatic machines are destroyed if located outside of the station and remain not accessible out of office hours or during weekends. The law referred to as LOM (Loi d'Organisation des Mobilités) signed December 24th, 2019, creates a right to mobility. It may also, despite allowing through open data the access to information on transports and reinforcing the role of region, broadly impact rural territories.

As regards as communication networks, 48.3% of housing have access to a high-speed network whereas over 10% still have connection problems. At the same time, only 22.6% are eligible to optic fiber [27].

Thus, at the same time authorities are pushing for more eco-friendly means of transportation and numeric transformation, an ageing population, suffering from a lack of knowledge and adaptative capacities, has difficulties in adapting to tools not fully available and to which it has not been trained. Besides the rupture of equality between

territories, such a situation may endanger - this a guess that shall be assessed on the field - on a large scale, mental health, create deep feelings of exclusion and increase the vulnerability of rural populations. The social patterns that have been prevailing for over a century are destroyed by decisions coming from Paris or regional levels, neither understandable to the majority nor understood.

VII. Could Rural Areas Become Attractive Again?

Could rural areas become attractive again? Or in other words could we, create in those regions, at a time environmental concerns become a priority, the conditions to make the soil fertile again for living, to invert the rural-urban shift, to attract capital and means, to transform rural areas into places of innovation and serendipity.

The report of Cour des Comptes dated March 2019 and entitled "Accessing public services in rural territories" concludes that, despite multiple initiatives, rural areas have required a long-term effort and remain a permanent failure of the central state. Multiplication of policies, overlapping of competences, and lousy coordination represent only few aspects of the problem. Several laws have been voted with little positive impact: the legislation « Montagne » (Mountain) of 1985; the law for the Orientation and Development of Territories dated 04/02/1995; the bill for the Development of Rural Territories (23/02/2005). Circular letters addressed to the prefects by the Prime Minister and inter-ministerial committees for rurality took place between 2015 and 2016 defining a set of 104 measures to promote rural areas and ensure local development. Were considered as priorities: the access to health and the fight against « medical desert »; the access to services through Maisons de Services Publics (MSP) (Public Services Office); « Nomade » Public; and « mobile » Postmen Services; the fight against school weaknesses; the numeric coverage and implementation of networks in rural areas; the execution of « Contracts of Rurality ». Those committees were replaced by CGET soon to merge into ANCT as mentioned earlier.

The strategy of President Macron government for rurality should be read in the continuation of previous initiatives. As an example, Maisons France Services - a system presented as a new device - offers substantial similarities to MSP. In Ariège, 4 units are operational, all located in major cities (Saint Girons, Mirepoix, Tarascon sur Ariège, Ax Les Thermes) but none in remote villages. Most of already existing financial, social and fiscal tools are maintained and strengthened through the continuation of ZRR (Zones de Revitalisation Rurales), of rurality contracts, of reciprocity contracts. Innovation and cooperation shall take place in Territory Workshops (Atelier des Territoires) and Industrial Territories.

Still 18% of the total French population live in medical deserts [28], a figure to compare to the 19.56% representing the total rural population. The same remedies have been proposed over the years without success. Rural territories continue to see their young population disappearing, the closure of public and private services and the constant degradation of their images in a never-ending vicious circle.

VIII. A New Strategy Supported by Technology

Boosting the attractivity of rural territories is related to both a change in image, the development of light infrastructures of utilities and communications, the development of inner innovation capacities and value, the acceptation of the challenge by local people. Technology could be a fantastic chance to invert such an ineluctable destiny. Whatever we call it "Smart Village" or "Smart Basic Entity" (SBE), we advocate that a new frame of organization and development shall be studied. It may become a potential area of growth and allow the inversion of the concentration process into cities. The SBE model shall, of course, and provided customization, benefit of the technical innovations and successful realizations that would be implemented in Smart Cities. SBE and SC models shall not be competing with each other, but live side by side, completing each other through exchanges on data, technologies and experiences, through existing or to be developed networks.

What we foresee today is nothing else than a downsizing process; to go from mainframe (the state or the region) to a connected smart unit, the SBE. Such a reorganization of the territory underpins, on the medium term, a global rethinking of administrative and political organization. The SBE could be defined as an evolutive and complex system, without exact physical limit but characterized by a logic of flows (persons, assets and information) always looking for efficiency improvement. By analogy to the system of cities; SBE will be connected through them as a network: the system of SBEs. Flows exchanges will exist within the SBE and with the exterior.

A way to define Smart Cities is by using a tangible (Hard)/ intangible (Soft) domains approach [29]. By customizing such an approach, we may consider two axes:

- Tangible/Hard: Water, Energy, Land and Environment Resources (Forests, Mines, Parks…), Transportation, Buildings (including health care and education) infrastructures, Security systems
- Intangible/Soft: Governance, Education, Health, Economy, Culture systems and data

And seven related applications: Utility management, Land and Environment Ressources management, Mobility, Buildings, Economy, Security, People (Cultural, social, education and health)

New technology facilitates communication, remote financial operations, distance learning, online medicine. As a consequence, cities are on the way to lose most of their competitive advantages.

IX. The Smart Digital Clone Approach

By collecting data related to the 2 axes, we shall be able to create a digital clone of the SBE. It shall represent its tangible and intangible assets and allow to analyse flows within the SBE as well as exchanges with outside, mainly, within the system of SBE. Such an approach that we call SMART (for Systemic Modeling and Advance Reengineering of Territory) shall facilitate improvements, reinforce governance efficiency

The digital clone would allow, by simulating any structural or logical change, to evaluate it. It shall promote, as

well, the definition and implementation of contingency plans; and make possible dynamic stress tests on all tangible and intangible dimensions. It appears mandatory to respect when implementing such an approach, several rules that we summarized as the HAWKS principles. H: Holistic: the digital clone covers all aspects and enlightens even shadow areas A: Accepted: by the population W: Wise K: Creative S: Secured

The digital clone terminology is used by analogy with recent development in medical technology. If a digital clone can be created to save or cure a human patient, why not applying the same to study, monitor, optimize the living conditions in a rural SBE?

X. Angola and China Cases

In Southern Africa and more specifically in Angola, the question of the economic development based on a systemic (system and system of systems) approach is crucial. The problem is multidimensional from two different points of view. Multidimensional, according to the aspects which constitute the domains where solutions must be designed, developed, implemented and evaluated: production and consumption of energy, wastes treatments, water control (drinking and wastewater), forest preservation and agriculture development, artisanal (handmade) and industrial activities, mobility … . Multidimensional, because at the same time, cultural, societal, technological, collective and individual.

Under the umbrella of the DNDTI (National Direction for the Development of Technology and Innovation) of the MESCTI (Ministry for Higher Education, Sciences, Technology and Innovation) of Angola a "SMART Villages" project is close to being launched. The question is how new technologies can be used for assuring a real, sustainable development of a small city (village)? How could a global approach be defined and implemented? As we noticed at the beginning, the project aims to consider each field of challenge (energy, wastes, water …) as a system and to consider the global interactions between all these systems. The objective is not only to solve problems; it is more the optimization of different solutions under a set of balanced criteria (economic development, alphabetization rate, safety and security …).

This pilot project will consist of two main parallel parts. The first will be focused on scientific and technological studies to propose and implement selected solutions, for example, about production and consumption of energy. But the most original part could be the second one. This part will consist of developing a "digital ghost" (or digital clone) of the small city (village) based on the capture of data concerning all the aspects to take into account even the feelings and the opinions of the citizens, visitors tourists…. Also, if at the origin the "digital ghost" will be more a database than a real digital representation of the city, each development will be the occasion to reinforce the amount of data (information) creating step by step a new digital structure able to facilitate original representations of the city based on the selection of data according to specific criteria (as mobility by example).

On the other hand, to be able to assess the project itself and its results, a model of excellence, as the EFQM model used for evaluating the efficiency of enterprises or public organizations will be used. This approach will allow to assure or to analyze the results for different stakeholders. According to this last point, it will be interesting to compare the evolutions (transformations) of the "digital ghost" of the city with variations of the stakeholder's opinions reinforcing by this way the capacity to understand better how a SMART integrated development impacts positively or negatively the citizens' lives.

Another exploratory work was carried out in the city of Shanghai (China). In partnership with the company Mobike (free bicycle), students worked on the development of an onboard pollution capture system (integrated into the bike frame). The aim was to transmit this information to a platform in order to advise cyclists on "greener" alternative routes. The recording of pollution data, combined with travel data and other information (the digital ghost), resulted in a city (quarter) map of statistically green routes. But this digital ghost (big data) also made possible to study the behavior of the cyclist (deciding whether or not to follow the green route), depending on the level of pollution, distance, time of day, weather conditions, etc. In such a way, it was helpful in supporting the definition of urban policies. The analysis of data made it possible to identify clusters (e.g., long journeys) for which specific actions could be established (fare reduction linked to the use of the green route, longer trip, etc.).

XI. Conclusion

There is no inevitable future for rural territories. We firmly believe that the rural-urban shift is not a fatality and could be inverted provided rural areas modify their image and become land of innovation and investment. Thanks to technology, distance is no more a concern as regards as accessing information, finance and education. Environmental and security issues could reinforce the position of territories towards cities that have lost part of their competitive advantages. Such a revolution could take place at the SBE level and that the development of SMART Digital Clones constitutes a significant leap into the future for rural territories. Its application has no frontier from China to Angola, from rural territories of France to the ones of Indonesia. And the current ongoing pandemic of Corona virus, that constitutes a real stress test for the economy and states structures at the international level may question the future of megapoles. Isn't it time to invest in rural territories, therefore keeping in mind that their specificities and environment shall be preserved ?

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