Intelligent land use in the perspective of innovative landscape

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Abstract. An intelligently managed territory is a territorial area where through specific and effectively applied urban-territorial policies, competitiveness and attractiveness are increased and where special attention is paid to social cohesion, as an integrated process in the definition of an intelligent territory, through the transmission of information and correlated data, between the urban actors involved in the process. Urban and territorial redevelopment and revitalization through the intelligent use of land must represent a model aimed at increasing the quality of life by promoting green circular economies, restoring disused and/or contaminated sites, and using interstitial spaces as a major potential of the landscape, with the aim of (re)create a smart territory/city. Rather, the intelligent land use of a locality represents a series of integrated processes that work simultaneously to support the introduction of innovative technologies, such as The Internet of Things (IoT), for the benefit of that community. Through accessibility to amenities of local interest, freedom of movement through easy mobility, together with the intelligent use of the environment, the cities can improve the quality of their landscape and enhances the quality of life of their citizens

1 Introduction: Background and definition of key terms

The name "smart city" is assigned to administrative-territorial units that act actively, sustainably, and resiliently, to improve the quality of life for their citizens, and where an intelligently planned territory is identified by valences that fall into three main parameters that define the phrase "smart": sustainable, inclusive and rational. The development of an intelligent territory is strengthened by drawing up a system of territorial networks or clusters through urban actors who play an active role, as well as by developing integrated landscape planning strategies (quasi-/semi-natural, anthropogenic, cultural), through the development and implementation of projects, programs, and processes, used to create competitiveness at the regional level, in terms of local endowments and offers. Also, an important factor is attention to the territorial landscape treated as a highly complex and integrated whole.

Rather, the intelligent land use of a locality represents a series of integrated processes that work simultaneously to support the introduction of innovative technologies for the benefit of that community. The Internet of Things (IoT) allows the introduction of digitization in the physical environment, to provide an increased quality of the urban and territorial space, but also of the life of the citizens who use the respective socio-economic-urban area The use of innovative technologies to increase the quality and attractiveness of a city, to provide services and facilities both to the residents and also to the visitors to improve operational costs, has now become a main trend in defining a territory/landscape/smart city with appropriate usage of the land.

Projects and research into smart cities are widely promoted, claiming to solve a range of contemporary urban-territorial problems, including "air pollution, traffic congestion and assisted living for the elderly". Therefore ensuring that territories/landscapes/cities of the future are, at the same time, cleaner, safer and also more attractive, functional and efficient, in terms of energy, mobility and of use, to provide new jobs and stabilize the population migrations.

The leading principle stated by the Institute of Electrical and Electronics Engineers (IEEE) Smart Cities Initiative presents the situation as follows: an opportunity is created through IEEE to facilitate municipalities in the management of the transition to urbanization. This would include raising awareness of both the benefits and the drawbacks of technology use and would help guide the appropriate usage when it comes to the technology in question.

The Internet of Things (IoT) has received lately a significant amount of attention due to the many potential adjustments and when introduced into the citizen's day-to-day lives, can simplify many of their activities. It is especially present in the fields of smart buildings, health structures, and related devices considered innovative, and also when it comes to the cities that can introduce the technology at a fast pace. The preference given in the field

of smart city, the benefits of the citizen's society and large-scale economy have turned IoT into a major trend, therefore many municipalities are seeking to build their development strategies around it. A starting point in urban-territorial strategy and management is building a fundamental IoT infrastructure, and that can require high costs. As a result, cities should develop applications that will run concurrently with the already consolidated infrastructures and respond to the contemporaneous demands and needs of the citizens. Another important aspect consists of stimulating the citizens to accept, adopt and use IoT technologies. In recent years, the Internet of Things (IoT) has been gradually and actively introduced into city ecosystems, bringing to the fore new challenges and requirements. Some of the difficulties are concerning the introduction of microchip applications in everyday objects, as well as the management and processing of Big Data for providing high-performance IT solutions.

Smart Territories/Landscapes/Cities are complex environments that, through several applications related to increasing the quality of life or the use of land resources, can support the decision-making parties and lead to the coexistence of different business propositions and value chains for different services and amenities. Such complexity and heterogeneity are also reflected in the technology offering to support large-scale coverage and connectivity in the urban environment, a vast and diverse environment.

It is needed to be taken into account, integrated and related to, today, in the smart technological approach, the theoretical perspective, but also applied in urban-territorial specialist practice, which starts from the idea of the whole Planet seen as a living organism [1], as well as the approach to human settlements seen as living metabolic organisms and complex urban processes in permanent change and metamorphosis [2].

Developing cities as networks and relations between citizens is essential to the success of the locality itself. IoT plays a major role in the development of services and applications to improve quotidian lives. In addition to minimizing the negative effects of urban mobility, to create a cleaner environment, IoT provides additional services such as:

- Noise monitoring: exposure to excessive noise levels can have a negative impact on the quality of life, producing an austere environment, sleep disturbances, anxiety, etc. Information collected from multiple sound sensors dispersed throughout the city can help monitor noise levels.
- Air quality monitoring: with the help of sensors placed in public spaces to monitor air quality and pollution levels, data can be publicly distributed, in real-time, to the concerned citizens
- Automation of public service buildings: IoT actively introduced in this service network can support application developments aimed at monitoring energy, increasing the safety of rooms, digitizing them, and also at streamlining the citizen's route and, implicitly, the request about public administration.

Smart Mobility must be integrated into a process of intelligent structuring of a resilient urban system model, based on the fact that: *Chrono-metabolic urban systems classify people, objects and energy as pieces of information; they articulate these circuits in a flexible vision and they order information grids and reports, as well as space units and time units* [3].

Landscapes are subjects of evolution, being directly influenced by the various processes that take place in an environment; in other words, they are constantly changing, developing and evolving progressively and/or regressively.

Intelligent land use planning is a complex research process that reviews six different functions and uses of soil and/or land, providing material goods and services to both the people and the environment. The introduction of public policies and indicators, can come to the aid of decisions making by explaining the complexity of the many and different land use subsystems.

The term "land use" can be used in several different ways, and oftentimes refers to several concepts: "usage of the land relief or difference in elevation " (land cover) refers to the physical characteristics of the land surface, such as: the type of vegetation or the presence of an anthropization. "Land use" describes the economic and social functions of the land surface to meet the demands for food, shelter and natural resources.

By extending, the term "landscape" to the result of interference with human activities and based on the linguistic origin of the term, the strategic approach of the landscape is considered either as a result of evolution and interaction with the human environment or as a cultural symbolic representation [4].

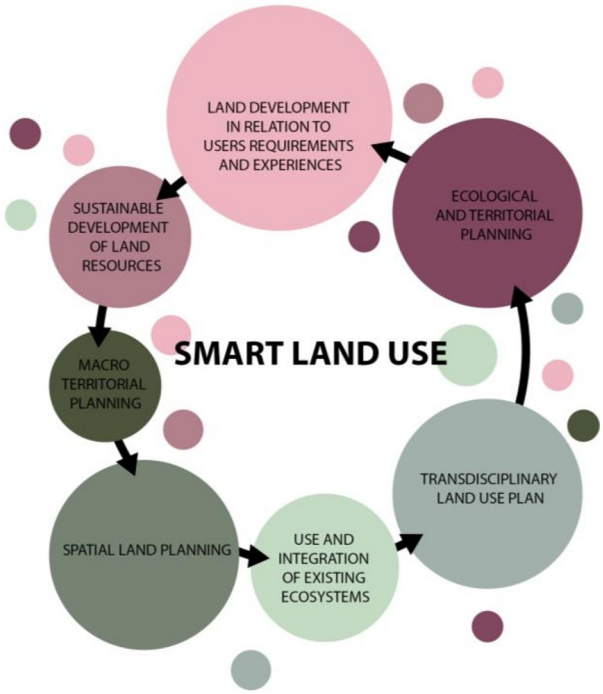

Fig. 1. Main principles of ideal smart land use practices.

Source: Author's own conception

The basic principles of ideal smart land use practices are:

- to be integrated into good practice and state strategies, regulated by inclusive laws;
- to be based on holistic approaches and inter and multidisciplinary cooperation;
- to promote the civic response of the population and decisional transparency;
- to consider local strategies and traditional practices in solving problems and possible conflicts;
- to respond to the territorial scales of analysis of the multiscalar territory: macro-mezzo-detail (territory-region-municipality/city/commune -village);
- to relate in time and space to the needs of the present citizens, actively, resiliently and sustainably (without jeopardizing the development of future generations);
- to collaborate with economic development;
- to follow the idea of subsidiarity;
- to be a result of a strategy integrated into the landscape, of intelligent land use;
- to approach a visionary strategy with the integration of possible models and forecasts of the near or distant future;
- to be oriented towards it being implemented, practical and adapted to local conditions

Landscape typologies, depending on the approach criteria, are diverse: rural, urban, rural-urban or peri-urban, quasi/semi-natural, urban anthropic, architectural and cultural, yellow-green-blue, etc.

2 Evolution, approaches, criticisms

People have oriented their settlements, near areas with an increased risk factor due to the existing resources in the same territory, but not always after an adequate assessment aimed at human and urban vulnerability, the risk often compensating the possible advantages. The development of urban areas in such areas, prone to dangers and vulnerabilities, despite these risks, is a clear indication of the permanent choices the social groups concerned have made. The usual means of protecting the risk exposure of human settlements seem to be subject to limited objectives.

Spatial planning and urban planning together with the organization of buildings are difficult to implement in dense and continuously changing areas. Accurately assessing the vulnerability of a settlement after each adverse event and preemptively planning for a new one to occur can greatly reduce the damage and increase the ability to last with technological potential. Depending on the nature of the hazard and the type of society, geological data can convey huge differences when it comes to planning and development.

The first representations of the landscape emerged from the regional-territorial models that depicted the relief using elevations, wetlands and surface waters. If these landforms are protected, they could act as determinants of the macro-shape of the territory, becoming a guide in the future of urban development. By tracing the water, the wetlands, and the steep topography in a coordinate system, we can classify these types of land uses as ecosystems.

Ecosystem typologies could then be used to establish priority areas for further research as means of guidance for urban development.

3 Methodology

The article aims to establish the specific nature of the subject, define the key terms, and develop clear research questions or hypothesis that address the gap in the existing literature and aligns with these research objectives. To better understand intelligent land use policies, the researchers of this article used a thorough examination of the literature at their disposal. The primary and trustworthy sources for the bibliographic information were Google Scholar, Science Direct, Researchgate, and Springer Link. To ensure that only relevant and high-quality papers were considered for this article authors establish inclusion and exclusion criteria. Inclusion criteria specify the characteristics that articles must possess to be included in the study, such as innovation in the field of technologies and their integration into land usage policies. Other inclusion criteria involved in the writing of this article included factors such as publication date (favoring articles) language (English/Romanian/French) study design (such as empirical studies) geographic focus and alignment, with the specific research of this topic.

On the other hand exclusion criteria outline characteristics that would result in an article being rejected from consideration. These criteria play a role in maintaining the relevance and quality of selected papers. Literature that was excluded from this research were those that do not represent policies and guidelines for the rapid rate of change in the urban planning field of analysis. For the case studies that were discussed in this paper, articles and strategic papers were also consulted. Exclusion criteria that lead to the rejection of studies from consideration involved factors such as low-quality methodology, content that's not incorrect study design (such as including reviews instead of primary studies) inadequate data, sources that have not undergone peer review, and articles that focus on a different population or context. The intended scope of the study in defining a intelligent land use in the perspective of innovating landscape.

When conducting their searches, researchers use terms or phrases called keywords. These keywords are carefully selected and related to the special implications of this research topic. The keywords selected after going through the literature are used to better understand the phenomenon and were selected out of a variety. The keywords are: smart land use, urban environment, smart city, innovative landscape, community, and resilience.

4 Urbanization

The urban population of the planet is growing twice as fast as the total population. This rapid urbanization, especially in urban developments, and the anthropization of some landscapes, will continue to be one of the crucial factors that must be considered in urban planning, landscaping and designing, taking into account the human population in the 21st century.

From recent history, it can be seen how cities in developing countries go through fundamental changes and sometimes with strong repercussions on the lives of the citizens of a locality. Societies are transformed and economic and political systems are being built and rebuilt in a variety of patterns and conditions.

In the past few years, the vast majority of cities around the world have experienced rapid development due to the rapid world population growth and rural-to-urban migration flows. More precisely, in the big cities of the globe, being constantly under development, the population growth rate has been constant so that at present, many of them face spontaneous, unplanned and uncontrolled settlements in peri-urban or rural-urban sub-areas.

Urbanization, as a process of human agglomeration in multifunctional settlements of relatively medium sizes, is a phenomenon that is due to the dispersion of services and facilities throughout the territory of a country.

The peri-urban area went through a marked process of deterioration and the strategy followed was to promote the conservation and restoration of these peri-urban spaces by creating a natural continuum around the city. The main goal was integrating the city's peri-urban parks within the urban layout and connecting them at the same time with the natural environment, encouraging the conservation of natural values and biodiversity [5].

Medium-sized cities have grown since the beginning of the 20th century, from industrial centers with predominantly agricultural services to cities with economic and industrial functions, including in recent decades the application of a strategy and integrated management through national and even international policies. These changes in the initial functionality led to changes in land use and landscape.

The rapid rate of change can be a concern for planners and local governments because, if left unchecked, it can have a profound and acute impact on the landscape, the available water resources, already existing ecosystems, agricultural lands, recreational centers or other types of land uses, bearing in mind the remaining limited space.

The monitoring of the urban expansion, together with the multiple uses of the surfaces of a locality, represents a fundamental source of information in understanding the patterns regarding the circulation and the changes in the habits of using the urban land, evaluating the impact that the urban growth has on the landscape, trying to constantly respond to the demands that the population imposes on them.

Therefore, monitoring in time and space with the help of emerging technologies (including Google Earth) has already demonstrated its great potential as a tool for several fields of research, especially regarding the multiplicity of natural landscapes, in detecting the occurring changes in land use and landforms, in the mapping of urban-territorial morpho-structural typologies and city landscapes, as well as in the monitoring of ecosystems.

The development of future sub-areas must be based on a general plan with a directive character that includes innovative land uses, drawn up for the entire metropolitan region of which it is a part, with the purpose that future generations are not subject to ineffective land use planning, intended in the spirit of the principles of sustainability and urban-territorial resilience.

5 Identifying the types of smart cities

Fig. 2. Standard signs to recognize a smart landscape within cities
Source: Author's own conception.

6 Urban biodiversity and innovative landscape

Most European countries have a long history of soil research and land classification. These pieces of information are very useful in identifying opportunities and risks of land use or overuse and can help direct public policies toward sustainable and profitable use of land resources.

A challenge for a public administration is to filter and use the multitude of information to develop an appropriate land management and soil policy at a possible regional or national level. To be successful, this process must involve the government, research academia, the private sector and the community.

Soil composition plays a crucial role in addressing present key issues, such as food security and climate change, providing an essential natural resource that supports sustainable development.

Until recent history, this role has been, for the most part, ignored in political debate. At the current time, this situation is changing at an international level, because the importance of the land and its valorization in the context of supporting the prosperity of the present generation, as well as the future one, is becoming a field of research with an acute need and possibility for regulation.

A soil management strategy, implicitly a land management strategy, is useful because it provides a clear purpose, and direction, for the development of urban policies and a framework for coordinating the activities is vital. It is necessary to propose political visions and sets of guiding principles to face these challenges, to demonstrate the value of information that lies at the core of land resources and how it can be efficiently used in the landscape.

7 The impact of smart land use on humans and the importance of sub-zoning a city's landscape

Spatial planning that is aimed at sustainable use of land and soil must harmoniously combine various practices in a manner to avoid overusing, with the six main functions of soil still being the starting point.

Spatial policy instruments must permanently protect all valuable areas, especially those from the environmental and landscape point of view [6].

This must not represent a rigid and mandatory scientific design and planning perspective, but a strategic and political one, in agreement with the needs of the community, which means that the people who live in a certain area must decide what land functions can be used at a given time or in a certain landscape/territory/area/sub-area, in a temporal approach. In this context, urban-territorial planners have the only possibility to develop scenarios, to explain the causes and what is the possible impact that can occur on the community,and the citizens, when different options are implemented.

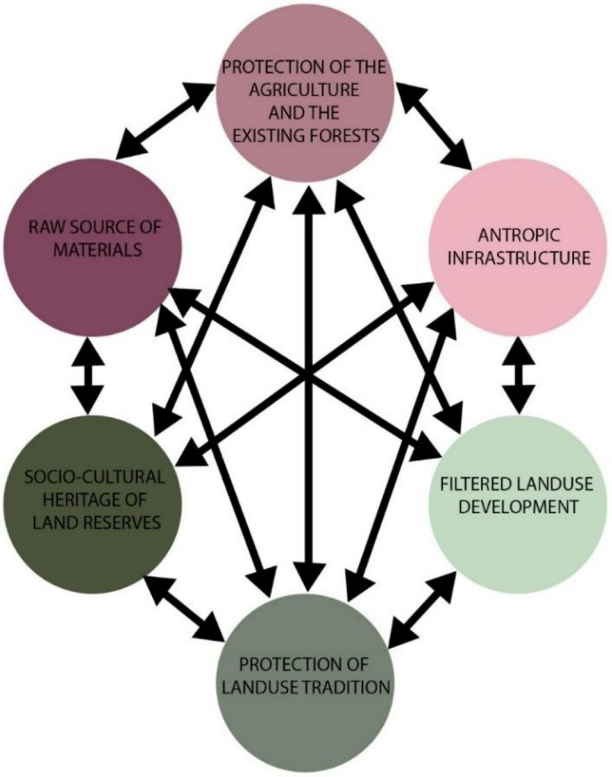

Fig. 3. Relations and competitions between the types of land uses
Source: Author's own conception.

For example, politicians and decision-making factors in a local public administration, as well as stakeholders, need real, accurate, information from the sites. This information can be statistical data, databases, indices and indicators, cultural, social, economic, ecological or technical information.

Scenarios based on such indicators can help politicians and decision-making factors, as well as planners, to understand the complexity of the land use system, and to choose the right options.

These optimal planning solutions must be based on an integrated multi- and trans-disciplinary analysis, and when the conservation and valorization of the natural environment are subject to pressure, there is even the possibility of generating spatial conflicts, difficult to be mediated, but inevitable, and which can bring particularization to scenarios and the final planning solution addressed [7]. Territorial land use planning should be grounded on solid scientific scenarios and contain clear criteria, correlated indices and indicators, prognoses and possible statistics of the near and more distant future.

The DPSIR (Driver-Pressure-State-Impact-Response) approach enables the understanding and management of complex ecological and technical systems by developing such scenarios. To define the indicators, new concepts are needed, including interdisciplinary and multidisciplinary approaches, which bring together, in conjunction with the regional, territorial, urban, architectural and landscape

fields, related sciences such as: technical, ecological, cultural, social and economic sciences. Indicators based on this approach can bridge the gap between science and technology, on the one hand, and stakeholders, decision-making and politics, on the other hand, thus sharing the knowledge between those who have it and those who need it.

The integrated cooperation of the different participants in the land use planning process is a permanent necessity for adapting the spatial and territorial tools for resilient urban (re)development [8].

Regarding land areas, it is necessary that they be managed in such a way that the needs of the current population are satisfied and to ensure the transmission of information and good practices to future generations to meet their needs in the long term, sustainable and constantly. Urbanization uses rules, which are not based upon local conditions alone and may influence changes in remote areas from the city or town center [9].

A vision for a locality, based on the principles that could project the existing landscapes preserved in such a way as to value and collaborate the health of the soil, the system of sustainable production and create a quality of life for the inhabitants of the area. In this scenario, the soil is only one component of an integrated natural resource system and becomes complementary to innovative land use.

It is necessary to be avoided the process of *transforming landscapes formed by the rural lifestyles into urban-like ones* [9] and to preserve the particular and unique morpho-typology of the place where the territorial, spatial planning or design process takes place.

8 Conclusions

For the peripheral metropolitan or rural-urban areas, strategies and operative urbanism and landscape plans must be drawn up for the optimal use of land and to ensure its coherent development and integration into the quasi-/semi-natural, anthropogenic and cultural landscape. These strategic plans must be intelligent and based on indices, indications and new technologies, being necessary to rely on an extended integrated multicriteria analysis, which also takes into account the social, economic, political and landscape indices and indicators that affect the intelligent use of the land, to result in an optimal management of the land in the planning area.

The integration of indices from different fields can only be done after a complex synthesis, following a general approach methodology, but with certain elements adapted directly to the territory/region/zone/location/place/site and the special context of the anthropic and cultural natural landscape.

This planning process does not have to ignore a sensitive approach to the landscape as a fragile resource, but also the unique and particular characteristics of a place with strong and unique *genius loci* and a determining value from the past to the future [10].

Urban integrated landscape planners, need to evaluate the urban form, under the conditions that *The urbanists we need must imagine urban forms that can satisfy the sensibility of the urban world (...). They must find a geometry more complex and truer than that of the nest and the straight, a geometry of life* [11].

Withal, the role of protection and conservation or development, revitalization and transformation into a sensitive and resilient urban and territorial form of the natural anthropic and cultural landscape is a priority, with deep involvement and implications in social-community, but also in the legislative and administrative processes [12].

The physical characteristics of the land are important environmental factors in the definition of the landscape, a fact for which we consider it necessary to address the issue of a possible appropriate evaluation model of intelligent land use, to help evaluate the physical characteristics of a territory/area in the future areas proposed for development and planning. Sustainable land use assessments are based primarily on the topography, soil pedology, drainage and depth to bedrock characteristics of the sub-areas. The presented system for assessing the sustainability of land use needs to be modified, where necessary and correlated with the specificity and particularity of local conditions.

Thus, the use of contemporary innovative technologies, including the use of AI, to increase the quality and attractiveness of a city, it is necessary to focus on providing services and facilities to both residents and visitors to improve operational costs. These have now become a main trend in defining a smart territory/landscape/city with appropriate land use.

The intelligent use of land must be planned sustainably, but also prospectively resilient, to face possible future challenges in the perspective of the innovative landscape, through integrated systemic, technical and technological correlation, but also aesthetical, with the preservation of the specific and characteristic elements of the respective territory/place, including the preservation and conservation of the quasi-/semi-natural heritage values, anthropic urban-architectural and cultural landscape, as well as with the integration of community needs.

Current planning processes are concerned with answering very general "what if" or hypothetical questions. By changing the hypotheses and filtering the results in order to reach the urban development’s recommendations, a strategy for intelligent land use at the territorial scale of the landscape can be outlined. Thus, the procedures for drawing up a general urban plan should aim for a vision to substantially improve its ability to use the information systems. This approach is based on the concept of information feedback regarding the evaluation of the plans and the plan development process, a transdisciplinary approach. A political vision and a set of guiding principles to meet these challenges is demonstrated by harnessing the positive impact information that underlies the existing field resources.

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