

Creativity and Innovation Processes in Complex Sustainable City Environments: „Smart Creative City” Concept

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Abstract - Creativity is an essential „gluing” component for generation and sustainability of the „upgraded” concept of the next generation of citizens' life in the smart city. Creativity enables novel unique ideas. Since every human environment is specific and of very individual nature, with as many differences as possible related to all the characteristics of citizens in one household, or in a village, in an urban quarter, in a city, in a state, in a region or on a continent, power of creativity in all these nano-, pico-, micro- or mega-environments is of a paramount importance for a creation of the smart tailor-made city. The second term in the title, innovation, enables implementation of the given creativity by forming a new idea, solution, process, product, series of products, human-made environment, or, as a final goal, the smart city that will support happy and long life of all citizens. The article describes the creativity phases and innovation types in the complex sustainable and emerging technology environment of the “Smart Creative City”.

Keywords - *creativity; innovation; innovation processes; creativity phases; emerging technology; green environment*

I. INTRODUCTION

The great architect Frank Lloyd Wright said: „To look at the cross-section of any plan of a big city is to look at something like the section of a fibrous tumor” (from Adam John, [1]). The sentence relates a configuration of a city: a carefully planned human made artificial structure or an organically grown structure, without a specific planning.

Eurostat statistics [2] from March 2019 indicated that roughly 75% of European population lives in cities. Thus, the EU has to pay particular attention to a creation of more attractive urban areas that are complying to the newest European energy policies related to reduced consumption and greenhouse gas emissions [3]. The urban areas should be planned in a more attractive and healthier way for the EU population due to their inherent property of being the major driver of the economy meaning that cities open jobs and competitiveness of EU.

The relevant EU policies, proposals and initiatives that take care on urban areas are:

- the energy union strategy [4]; its aim is to transform the European energy system into the most sustainable in the world

- the Urban Agenda for the EU [5]; it is a cohesive force for the Commission, national ministries, city governments and other stakeholders as to provide easier access to funding and more knowledge

- the energy performance of buildings directive (EPBD) [6]; it promotes increase of buildings' energy efficiency by incorporation of smart technologies in the process

- the EU Covenant of mayors for climate & energy [7]; its objective is to realize the committed EU climate and energy objectives by gathering many local governments

- the Strategic Energy Technology Plan (SET Plan) [8]; it supports the most impactful technologies in the EU's low-carbon energy system transformation by powering up and promoting research and innovation efforts

- the Smart Cities Information System (SCIS), [9]; it serves as an exchange knowledge platform

Within the urban agenda for the EU, actions partnerships between the Commission, EU organisations, national governments, local authorities and stakeholders such as non-governmental organisations are developed for plans for passing better laws, improve funding programmes and share all kinds of knowledge.

As of February 2021, there are 14 such developed Partnerships:

1. air quality
2. circular economy
3. climate adaptation
4. culture and heritage
5. digital transition
6. energy transition
7. housing
8. inclusion of migrants and refugees

9. innovative and responsible public procurement
10. jobs and skills in the local economy
11. security in public spaces
12. sustainable use of land and nature-based solutions
13. urban mobility
14. urban poverty

The Green Deal, adopted in December 2019 [10] (COM(2019)640 final) is the most important document of the EU Recovery Plan for the green transition and decarbonisation of energy and transport, especially since the start of the COVID-19 crisis. Its aim is a fair and prosperous EU in the near future, challenged by changes in the climate and limited energy supplies. One of the important parts of the Green Deal is to encourage novel green industries and to fix EU position as a global player in the world competitiveness.

Since buildings are responsible for around 40% of energy consumption and 36% of greenhouse gas emissions in the EU, with the expected use-life of majority of them till 2050, the annual energy renovation rate of residential and non-residential buildings by 2030 with the accent to deep energy renovations is at least doubled, as a EU's goal. The two goals will be achieved by these interventions: energy poverty reduction and increase of citizens' well-being, followed by the third goal, caused by the pandemic COVID-19: increase of construction and renovation ecosystem. The key legislative proposals in that directions will be prepared by June 2021.

Since the adoption of the European Green Deal, the first energy union report is published on 14 October 2020 [11]. It checks progress made in the five sectors of the energy union - decarbonisation, including renewables, energy efficiency, the internal energy market, security of supply and research, innovation and competitiveness. On the top of it, it supports the implementation of the National Energy and Climate Plans (NECPs), as well as on the relationship between boost of the EU's economy and energy-related investment.

There are some factors that influence the concrete energy transition of a separate city. These are: city's geographic situation that influences the amount of energy required for heating, cooling and lighting; city's demographics with its needed demand for space and services; urban form and density, where it is known that sprawling cities tend to have higher per capita emissions than more compact ones; urban economy with the types of economic activities and their emissions of large quantities of greenhouse gases; wealth and consumption patterns of urban residents.

When sharing data, four key types of insight are required:

- Operational insight; it examines characteristics of things such as buildings, communities and organizations, using data to evidence and improve their value for the city;

- Critical insight; it provides real-time monitoring of incidents and current cases that is important for achievement of the desired response;

- Analytical insight; it determines patterns, correlations and predictions of the explored datasystem. This insight is the most important part for our goal of generation of the „Smart Creative City”, since it allows innovations of systems or services;

- Strategic insight; it examines outcomes related to strategic objectives, decisions and plans.

Only smart cities are solutions that support the European Green Deal.

Futhermore, our vision is that only „Smart Creative City” that grows within it an inherent component of creativity can successfully win a naturally grown chaos (that is only seemingly chaos to human, but otherwise order to nature) and turn it into a „human made synthetic order”.

In relation to the global smart cities with a size of minimum cca 10 millions people, Croatia is a small country with small cities. In [12], Graeme Evans and Jo Foord in the chapter entitled: „Small cities for a small country Sustaining the cultural renaissance?” discuss a new growth theory. The „new growth theory” is based on a „creative economy” that could be an exact match for small cities in a win-win manner. The „creative economy” is based on people's use of their creative imagination to increase an idea's value [13]. It is applied from arts to science, whenever an economic activity depends on a person's individual creativity for its economic value. It is independent of a cultural element content and not limited by finite resources. In an open creative environment with a structured organization, a creative economy can result in an exploitation of unpredictable business ideas for innovative products and services, oriented to environment of small cities, or even to novel concept of free private cities [14].

In order to open novel discussions on introduction of creative sustainable order in new concepts of creative cities in Croatia, the paper presents basic creativity phases and innovation types.

A. *Smart Creative City*

Smart cities rely on integrated and interconnected strategies and systems to effectively provide better services and increase quality of life, ensuring equal opportunities to all, as well as safety and protection of the both: human and environment. They are based on emerging ICT technologies, like 5G. The idea of the smart city is that it relies on gathered information from sensors that are all connected to Internet of Things (IoT) and transmitted in real time to central monitoring location. The network containing huge amounts of connected sensors can be in the full function only by application of the emerging technologies, such as 5G [15], [16]. The network should enable robust flow control, adjustment and fine tuning of the parameters, maintenance of the infrastructure and manufacturing systems, and all in the real time.

A smart city continuously strives to improve social, economic and environmental sustainability outcomes. It responds to challenges like climate change, rapid population growth and political and economic instability by engaging with society, applying collaborative leadership methods, working across disciplines and city systems, and using data information and modern technologies.

International standards are sources of best practices developed with experts from around the world [17]. They are used to monitor technical and functional performance. They ensure that technologies used in cities are safe, efficient and integrated. The standards enable optimal management of resources to reduce environmental impact and improve service delivery to citizens. Standards are an important means to the unification of the world in terms of exchanging knowledge and technology. In that sense, systems are interoperable, which enables standards furthermore to stimulate innovation, especially in the cities [18].

Smart city concept requires development of careful planning strategy. It is important to envisage a specific perspective of the city, meaning that it is important to understand its most valuable properties. Thus, the overall strategic planning process is based on the set of analytical tools, on a series of indicators and on techniques that support creative thinking. As a consequence, creative planning, including taking valuable assets like closeness of research institutes, city history, traditions and values, friendliness of citizens, images and perceptions of a place or presence of companies are also a part of the strategic planning process.

The concept of the „Smart Creative City” encompass many dimensions of creativity and innovations. The most important examples related to engineering is coupling to the arts and looking at an issue (or, what can be called, „unsolved or even unsolvable problem”) from another perspective. This synergy of arts and engineering can definitely enhance view to the complex set of dilemmas and bring the issue out of the darkness, in the same manner as even the smallest hole with a source of light enlightens darkness. This will automatically increase the both: effectiveness and efficiency of the proposed solution.

The idea behind the „Smart Creative City” is to enable and support pilot projects that can open minds of the participants and thus, introduce a new way of thinking, especially in terms of holistic view. Actually, this is the essence of the development of ancient cities and of the human mind: it is people who has skills and creativity and, thus, form the city itself and take care of the urban development. Every city reflects primarily the citizens who live in it.

B. „Smart Creative City” Strategy

It is very clear that a development strategy of a country, of a region or even of a global view strongly relies on innovation that supports more sustainable human activities and more inclusive society, in general. The strategy of the „Smart Creative City” lies on five pillars,

or we can say that it is developing in five phases. The first phase is planning, the second is establishment of indicators, together with assessment of potential and obstacles. The third phase is execution. The fourth is assessment. The fifth phase is the final brick in the feedback loop that reports back. The development phases are depicted in Fig. 1.

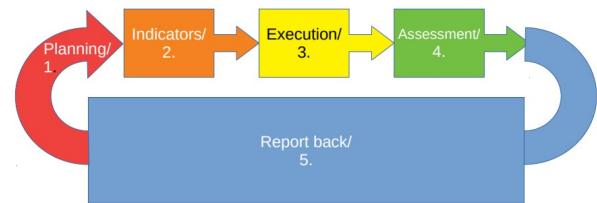


Fig. 1 Development phases of the „Smart Creative City”

The first phase deals with preparation. It can be also taken as a planning phase. In this phase, the stakeholders identify a problem, which results in raising of an awareness of importance of inter- and trans-disciplinarity between all disciplines, but especially between science, technology and arts. One of the good examples is the S+T+ARTS programme of the European Commission [19] that funds collaboration of arts and technology in order to support proliferation of creativity from arts directly into technology, which results in stimulation of innovation across various programmes.

Since ancient times, arts and technology were narrowly coupled (as an example, one can take great Leonardo da Vinci with all his fantastic inventions and not less fantastic arts, as well [20]). In the modern culture, arts are taken as an undoubful catalyst for an efficient conversion of science and technology knowledge into novel products, services and processes. Creative component of arts is an active ingredient in an increase of innovation capacity of high-tech big and small companies. An important part of this creation energy is a focus to the sustainability and social inclusion of the generated products, services and processes.

The second phase of „Smart Creative City” is establishment of indicators. The indicators are meant to support the formulation of the required stakeholders for the future success. It is important that the participants in this part of the scenario for making the „Smart Creative City” strategy successful are partners with broad knowledge and visions. This is important in order to understand a potential for change, how could the creative solutions to existing and/or emerging problems be helpful, and what are the obstacles (are they removable and how?). It would be helpful to have the urban development experts, especially with an experience of „charette” technique, as the participants in building this phase. Of course, it is also possible to build the team with the same quality, but it requires more time. The result of this phase is an assessment of a possibility of generating a creative milieu of a particular city. The „final audit” of an assessment possibility reflects weak, good, strong or no chances for an establishment of the „Smart Creative City”. A strong support embedded in the second phase is a

democracy. Namely, important part of the citizens, when „correctly” and „appropriately” „pushed”, can provide a competent impact in the whole process in the longer term. In this way, today's technology that enables efficient citizens' networking and, thus, visibility, is a fantastic factor that supports all the three main components of this creative process in this second phase: activity-based projects, human development, and, of course, the capital development. The three components are given in Fig. 2.

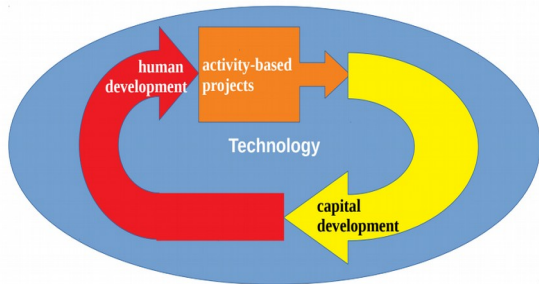


Fig. 2. Technology as the pillar of the three main components of the creative process

The third phase is execution. This phase is a natural continuation of the planning phase and assessment of potential and obstacles, as well as noting indicators. The most important carrier of this phase is a concept with pilot projects. As in all other areas, like arts, the creation requires experimentation, in order to perform perfectly, once when the final project will take place. In this case with a smart city, this is quite crucial, since it could be fatal to make some serious, or even small mistakes in the final creation of the „Smart Creative City”. Also, pilot projects are crucial pillars of the innovation, since it is built exactly in them.

The fourth phase is an assessment that lies on monitoring of the chosen indicators, measuring achievement, registering problems and understanding failures. It is depicted on Fig. 3.

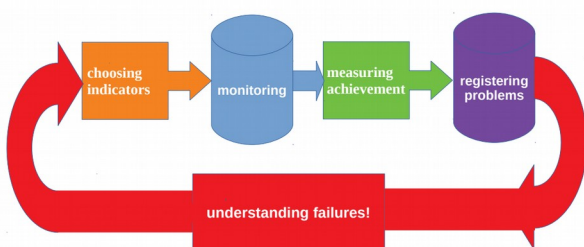


Fig. 3. The fourth, assessment phase of the „Smart Creative City”

The fifth and the final phase deals with communication of the whole process to the others, meaning that it is a democratic process that includes academic studies, public events and exhibitions, open fora and other forms that support the discussion of the future of the city and provide a creative and constructive feedback to the „strategy development group” of the Smart Creative City.

C. „Smart Creative City” Innovation

The four basic types of innovations that are built upon the creativity, especially in the pilot projects of the smart city are [21]:

- sustaining or incremental
- disruptive or creative destruction
- technology transferable
- transformation or radical

The sustaining or incremental innovation is the most common innovation type in engineering in general, but also in the ICT. It is based on an evolutionary change of a certain product and it is quite relevant in the deployment of the „Smart Creative City” strategy.

The disruptive innovation, based on the „creative destruction”, is expected in the pilot projects of the „Smart Creative City”.

The technology transfer-based innovation is based on the existing technology applied suddenly in another sector. This is also a kind of innovation that could be expected in the lifetime of the „Smart Creative City” pilot projects.

The transformational or radical innovation open new paradigms in the technology, economy and society. Therefore, it is expected in the strategically oriented „Smart Creative City” pilot projects, which will be based on the forming of the core creative/innovation group with a careful election of the technology and artistic participants.

The four innovation types are depicted in the innovation-technology-smart city volume on Fig. 4.

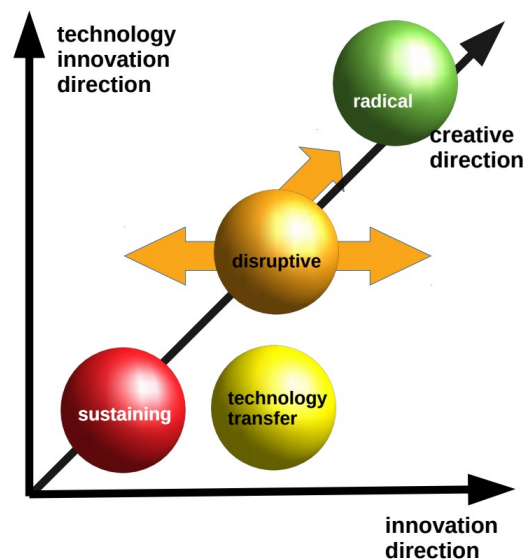


Fig. 4. „Smart Creative City” innovation types

II. SUSTAINABILITY

What is sustainability? Entropy, evolution: we cannot escape their laws; the entropic and evolutionary processes have only one direction that cannot be changed. Time cannot turn. But we can change our influence on the speed of these processes (that is, on their derivation over time). Our way of life, consumption, behavior are decided by the speed of entropy decay, the speed at which useful energy is wasted and, according to the latest analyzes, the period of survival of the human species.

Thus, we come to the concept by which we mean the commonality of the relationship of human activities and their dynamics with the biosphere and its mostly somewhat slower dynamics. These relationships must be such that it allow people's lives to continue, that each individual can meet their needs and that different human cultures can evolve, but in such a way that changes caused to nature by human activities are within certain limits so as not to destroy global biophysical connectivity.

Energy-consuming and dissipative cities

Though the study of systems far from equilibrium, thermodynamics proves capable of representing the relationships that exist between dynamic structures, such as living systems, whose evolution is inexorably limited by physical constraints, and the environment. The definition of general behaviors, within the logical schemes of evolutionary thermodynamics, offers a rigorous reading key for the study of natural systems, living organisms, and their dynamics over time.

These relationships must be such as to enable people's lives to continue, that each individual can meet their needs and that different human cultures can develop, but in such a way as to change the inflicted natures by human activities to be within certain limits so as not to destroy global biophysical connectivity. One should definitely introduce a city platform, as described in [22].

III. CONCLUSIONS

The basic creativity phases and innovation types are presented in the paper, as the basis for opening discussions for development of small cities in the direction of „Smart Creative City”.

REFERENCES

- [1] J. Adam, „X and the City: Modeling Aspects of Urban life, 2012, Princeton University Press
- [2] EUROSTAT, <https://ec.europa.eu/eurostat>, Retrieved: 8.2.2021
- [3] European Parliament, European policies on climate and energy towards 2020, 2030 and 2050 (2019), [https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/631047/IPOL_BRI\(2019\)631047_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/631047/IPOL_BRI(2019)631047_EN.pdf), Retrieved: 7.2.2021
- [4] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank (2015), A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy, COM(2015) 80 final
- [5] <https://futurium.ec.europa.eu/en/urban-agenda>, Retrieved: 6.2.2021
- [6] Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings, OJ L 153, 18.6.2010, p. 13–35
- [7] <https://www.covenantofmayors.eu/en/>, Retrieved: 4.2.2021
- [8] https://ec.europa.eu/energy/topics/technology-and-innovation/strategic-energy-technology-plan_en, Retrieved: 3.2.2021
- [9] <https://smartcities-infosystem.eu/>, Retrieved: 1.2.2021
- [10] Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, The European Green Deal (2019), COM/2019/640 final
- [11] Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 2020 report on the State of the Energy Union pursuant to Regulation (EU) 2018/1999 on Governance of the Energy Union and Climate Action, 2020, COM(2020) 950 final
- [12] D. Bell and M. Jayne (Eds), Small Cities Urban experience beyond the metropolis, Routledge, 2006
- [13] J. Howkins, The Creative Economy: How People Make Money from Ideas, Penguin Business Series, 2nd edition, 2013
- [14] <https://www.freeprivatecities.com/en/>
- [15] 5G smart cities whitepaper (2020), Deloitte
- [16] Ericsson, A better 5G network, https://www.ericsson.com/en/5g/5g-networks?gclid=EA1aIqobChMI6fK-k_P_7gIVgRkGAB3fpgCbEAAAYASAAEgLPafD_BwE&gclid=aw.ds, Retrieved: 21.2.2021
- [17] <https://www.iso.org/home.html>, Retrieved: 30.1.2021
- [18] CEN-CENELEC, <https://www.cencenelec.eu/standards/Sectorsold/SmartLiving/smartcities/Pages/default.aspx>, Retrieved: 1.2.2021
- [19] S+T+ARTS, <https://www.starts.eu/>, Retrieved: 8.2.2021
- [20] <https://www.britannica.com/biography/Leonardo-da-Vinci>
- [21] D. Simunic and I. Pavic, Standards and Innovations in Information Technology and Communications, Springer Nature Switzerland AG 2020
- [22] A. Višković, D. Šimunić, and V. Franki, “Innovation platform - A novel energy service utility,” 2020 43rd International Convention on Information, Communication and Electronic Technology, MIPRO 2020 - Proceedings 2020, 425–430, 2020.