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THE e-FUTURE OF CITIES

BETWEEN TEMPTATIONS OF EXPONENTIAL TECHNOLOGY GROWTH AND THE CONCEPT OF HUMAN CITY

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IMPACT OF CLIMATE CHANGE AND NEW TECHNOLOGIES ON DEVELOPMENT OF CITIES IN THE FUTURE - THREATS OR OPPORTUNITIES

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Abrstract: *Climate change on Earth and global warming of the atmosphere, with changes taking place in its physical and chemical composition, are a consequence of the overuse of fossil fuels and inefficient technologies. The impact of fossil fuels on the environment is considerable, and it is manifested in the increasing concentration of carbon-dioxide (CO_2) in the atmosphere. Fossil fuel use for heating and cooling buildings, transportation, and industry as a whole, influence the increase of CO_2 in the atmosphere. The population growth, sudden expansion of cities and over-consumption of resources, scarcity of water and energy sources are becoming global and planetary problems. Research aimed at reducing or minimizing the negative impacts of climate change is funded by the United Nations, countries, governments and NGOs around the world as well as some cities. Armies of scientists, experts of various profiles, politicians, journalists, and even artists are engaged on this task. However, mankind faced with a sudden climate change is responding inadequately and inefficiently. Enormous funds are spent in different ways; the profit received by some countries, banks and individuals is excessive, and the results achieved at the global level are not impressive. Still, many steps have been taken, and in the fields of architecture and urban planning new knowledge is being developed together with the concept of a sustainable, green, environmentally-friendly, smart city, in which the negative effects of climate change could slow down, if not even stop. The development of new technologies has contributed to the great progress of cities around the world. Digital technologies, the Internet, software, 3D animation, numerical interaction of buildings performances have been developed, which are necessary tools, but are often a kind of illusion. The so-called "virtual reality" is replaced by an actual one and the distinction borders are not always clear. Economic power, consumerism and profit have become the new ideologies in architecture. The position of the investors and politicians, in sharp competition for prestige, becomes strategically more important in the politics of many developed countries. It seems that climate change and new technologies further increase the gap between the rich and poor. The technological revolution has brought big changes in creating a new concept of city planning. New technologies are the answer to the new challenges, which span from natural phenomena, demands of the profession, investors and the influence of big capital, to social and ecological requirements. Economic and technological development should offer solutions for the growing problems on the global scale. Is this always possible, or is it too late; are the provided options and development concepts really sustainable or are they just formally promoted as such? How to curb the negative trend that follows new technologies and make them a part of sustainable development is certainly one of the most important tasks of our profession and the society as a whole today.*

Keywords: *future of cities; climate change, new technologies, sustainable development*

1. INTRODUCTION

Ever since the earliest civilizations cities have been synonyms for development and progress representing, at the same time, the differences and inequalities between communities and countries in which they were founded. This is still the case today. The development of civilizations, cultures, customs and religions throughout the centuries, as well as technological progress, has changed urban structures. However, never until now have the doctrines and theories about future urban development, which seems to be uncertain more than ever, changed so quickly.

Climate change, population increase, and sudden urban expansion, over-consumerism of resources, scarcity of water and energy sources, an increase in greenhouse gas (GHG) emissions have all become global issues. In addition to these are social inequalities, uncertainty, international migrations, economic and environmental threats, uncertainty related to new technologies as well as other unfamiliar phenomena that impact on the changes in concepts and planning paradigms, urban management and financing in the 21st century.

Climate change is mainly due to anthropogenic factors that directly impact on the development of human communities on the planet. These factors have led to an increase in the average temperatures on the planet, at a much faster rate than predicted. Mankind, faced with sudden climate change, is responding inadequately and inefficiently. Cities all over the world are particularly sensitive to climate change and are facing the consequences in the form of more frequent and intensive extreme weather conditions, such as floods, droughts, storms etc. The frequency of flash floods and thunderstorms is greater in big, densely populated cities, such as slums. Sea level rise is threatening coastal cities, delta regions and small island countries. In the next 50 years, 40% of the global population will be facing very serious problems with water scarcity. On the other hand, cities play a key role in solving global climate change issues.

The second important topic is the ***demographic issue***, which occurs in big cities and megapolises[1], especially in undeveloped regions and countries, where the population has increased significantly in the last two decades. In 1995, there were 22 big cities and 14 megapolises, while by 2015 the population in both of these categories doubled. The data show that 44 big cities and 29 megapolises were registered in the world in 2015. Most of the megapolises are in developing countries. This trend will continue, because it is predicted that big cities in Asia, Africa and Latin America will become megapolises (WCR Ch-1, 2016)

Globally, more people live in urban areas than in rural ones. In 2007, for the first time in history, urban population exceeded rural population, and since then the world population has remained predominantly urban. The planet has gone through a process of rapid urbanization over the past six decades. In 1950, more than two-thirds (70%) of people worldwide lived in rural settlements and less than one-third (30 percent) in urban settlements. Based on the data published in 2016 by UN Habitat, 54% of the global population lives in urban settlements (UN Habitat, 2016). The urban population is expected to continue to grow, so that by 2050, the world will be one-third rural (34%) and two-thirds urban (66%), roughly the reverse of the global rural-urban population distribution of the mid-twentieth century. The greatest absolute growth of population will take place in Asia, although it is estimated that developing countries outside Asia will over time have a more significant and greater population growth in cities (CCC_PP, 2014). Only the following three countries - India, China and Nigeria - are expected to account for 37% of the projected growth of the global urban population between 2014 and 2050. India is projected to add 404 million urban dwellers, China 292 million and Nigeria 212 million (WUP, 2014).

Social inequality The trend of rapid urban growth from the mid-20th century till the present has led to

1 Based on their definitions, big cities have between 5 and 10 million inhabitants and megapolises 10 million or more inhabitants (WCR Ch-1, 2016)

increased economic and social wealth in some places, but also to continuing poverty in others.

A fifth of the world population that has 60 % of the global GDP lives in the first 600 big cities and megapolises mainly in developing countries, and they have a significant impact on global economy. It is expected that by 2025, the 600 most influential cities in the world will remain the same, but most of the urban development will take place in developing countries, especially in south-east Asia (McKinsey Global Institute, 2011). Big and very big cities do not grow the fastest, and the bulk of the urban population does not live in them. Research has shown that the fastest growing urban centres are small and medium-sized cities with less than a million inhabitants, who make 59% of the global urban population (United Nations, 2014a; United Nations,2014b). Therefore, it is important that developing countries recognize their potential and focus on developing small and medium-sized cities.

Environmental issues are becoming a global priority. Cities are complex systems and big consumers of energy. The consumption of large amounts of energy, water, materials and all natural and man-made resources has had a powerful effect on the environment. According to the Intergovernmental Panel on Climate Change (IPCC) Report, cities consume somewhere between two-thirds and three-quarters of total global energy and generate 75% of global carbon emissions (Mitigation of Climate Change, 2014).

Between 1990 and 2000, a global sample of 120 cities was observed. It showed that with the increase of urban population at a rate of 17% there was increased construction on land at a rate of 28% (NYU, 2015). In a study by Lincoln Institute, it is estimated that urban population will have doubled in developing countries by 2030, while land under construction will have tripled. (Angel et al., 2011).[2] Such an irresponsible expansion of cities and occupation of arable land at the same time affects energy consumption and GHG emissions, which has changed the ecosystems in many cities during the last two decades (UNEP 2007).

New technologies The development of new technologies has seen great progress, and the influence on urban building can be characterized as a new movement in architecture and urban planning. On the one hand, this progress is due to the ongoing development of digital technologies, including the Internet, as well as new software programs (3D animation, numeric modelling packages etc.) On the other hand, new materials and systems offer great possibilities, provided they are available and economically justified (Pucar, Lojanica, 2014).

Cities are hubs of economic, political and cultural activities and centres of knowledge and innovations. With their means and capacities, they have the leading role in the development and implementation of measures for increasing energy efficiency (EE) and for the use of renewable energy sources (RES). Given the data that buildings use about 40% of global energy, of which heating and cooling account for 90% of that energy, the concept of a smart city cannot be imagined without the use of RES and EE principles at urban planning and building design levels. Advocating for smart cities, which also implies new technologies and infrastructure, has a deep foundation in science and practice (Pucar, 2016).

Cities and city dwellers generate a large amount of data that can be used smartly to achieve strategically important goals. The innovative use of information and communications technologies (ICTs) enables progress in the fight against climate change and an improved quality of life. It is also a fact that the development of new technologies positively affects the performances of buildings, especially rational energy consumption and RES implementation. Energy efficient buildings contribute to the reduction of CO_2 emissions, which has important implications for climate change.

As a result, city authorities throughout the world and numerous professionals who recognize the

2 A study about land policies determined that the global urban population grew from 1.8 to 2.7 billion between 1985 and 2000, which is a 50% increase, while the surface of urban land grew on average from 13.000 to 33.000 hectares per city, which is a 153% increase.

importance of the concept of smart sustainable cities increasingly advocate for the use of high technologies for solving the existing problems. Solving them requires a close cooperation between experts, city dwellers, companies, organizations and the national and city authorities. New knowledge is being developed, and the concept of sustainable, green, ecological and energy efficient construction, which could slow down, if not even stop the negative processes and phenomena, is being promoted (Pucar et al., 2016).

However, the potential consequences of implementing ICTs are not perceived in their totality. Selective implementation of these technologies in cities, or in the same city, can lead to social, economic, energy and economic inequalities and even further widen the gap between the rich and the poor.

The next problem is ***cyber insecurity***. Over the past few decades, the advancement of digital technologies and the development of internet have created a new risk. Cyber insecurity, which goes beyond physical boundaries, has become extremely prevalent in today's digital world. Digital technology is being deployed in many aspects of a city's infrastructure and service delivery systems. Over-reliance on technologies and electronic service delivery has made cities more vulnerable to hacking and cyber attacks, which are reported to be occurring as frequently as every thirty seconds (The Economist Intelligence Unit, 2015). Lloyd's of London estimates that cyber attacks cost businesses as much as US$400 billion a year (Fortune, 2015) This in part explains why global spending on cyber security is projected to increase by 8.2 per cent, from US$77 billion in 2015 to US$101 billion in 2018 and reach US$170 billion in 2020 (Cybersecurity Ventures, 2015).

Sociological and ethical problems are also potential threats that city dwellers are facing in case of uncontrollable implementation of information and biotechnologies. In addition to social inequality, controlling data, behaviour and opinions, and loss of jobs, there are other numerous unknown issues potentially facing mankind in the future.

The market intelligence organization International Data Corp. (IDC) estimates that by 2020, about 30 billion embedded devices - the Internet of Everything - will monitor and manage countless activities in our lives, from the moment we awake to the moment we fall asleep, from catching the bus to filling the refrigerator, walking the dog, and watering the garden (Weller, 2017). Threats and possibilities studied by practically all professional and scientific fields concerning the future of cities range from big expectations to big apprehensions for the global future of mankind, and thereby, cities. It can be concluded that individual national countries are not the ones to solve either the problems of climate change or the risks that new technologies can bring together with numerous advantages. The problem of implementing the results of technological innovations must be under international supervision, at least as much as it is the case with nuclear energy. Rich countries are capable of allocating great financial means for the development of artificial intelligence, information and biotechnologies, which involves great risks, but also great profits and advantages. The race has already begun, the objective is uncertain. To prevent abuse of new technologies, it is necessary to establish ethical guidelines at global level as well as operative, implementation and control rules of these technologies.

2. CLIMATE CHANGE

Climate change and global warming of the atmosphere, with changes taking place in its physical and chemical composition, are a consequence of the overuse of fossil fuels and inefficient technologies. Global warming will lead to the rise of the average global temperatures, to more frequent heat waves, droughts, and forest fires, to distribution of precipitation, floods, the melting of ice poles, increased ocean acidity and the rise of the average ocean level. Because of increased humidity in the atmosphere, there will be more rain and snow, which will cause flooding, soil erosion and other changes. Extreme cold and hot waves will become more frequent and dangerous. This will endanger a greater part of the population and significantly reduce

the surface of land.

The impact of fossil fuels on the environment is great, and it is manifested in the increasing concentration of carbon-dioxide (CO_2) in the atmosphere. Fossil fuel use (oil, natural gas and coal) for heating and cooling buildings, transportation, and industry as a whole, cause an increase of CO_2 in the atmosphere. To reduce the negative impact of building, it is necessary to accept new management techniques and technologies and adopt different strategies that promote greater EE and the use of RES (Maksin et al., 2011).

Research results of possible climate changes in Europe indicate significant differences between North and South Europe in view of the changes in temperature regime, as well as other climate elements. In the latest reports by the Intergovernmental Panel on Climate Change devoted to the issues of regional climate change, it is emphasized that the southern part of Europe is more sensitive to climate change than the other parts. In some parts of South-Eastern Europe precipitation will drop even up to 20%.

In 2013, the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report concluded, "It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century." The largest human influence has been the emission of GHGs such as carbon dioxide, methane, and nitrous oxide. Climate model projections summarized in the report indicated that during the 21st century, the global surface temperature is likely to rise a further 0.3 to 1.7 °C in a moderate scenario, or as much as 2.6 to 4.8 °C in an extreme scenario, depending on the rate of future GHG emissions and on climate feedback effects. These findings have been recognized by the national science academies of the major industrialized nations and they have not been disputed by any scientific body of national or international standing.

The rise in temperatures is becoming prevalent due to an increase in concentrations of gas in the air and the greenhouse gas effect. Since the beginning of organized measuring of temperatures, the warmest years globally have been 2014, then 2015, and in 2019 the month of June has been the warmest so far.

The system for satellite recording of meteorological data "Copernicus ECMWF", the Agency for Satellite Monitoring of the European Union recorded alarming results during June 2019: the average temperatures in Europe are 2°C higher, which means that this month has been officially the warmest June ever since temperature started to be recorded on the territory of Europe. (n1info.com, July, 2019). During the presentation of new data by the World Meteorological Organization and the Climate Change Program Copernicus, the Secretary General of the United Nations Antonio Guterres warned that temperatures in July 2019 were equal to the warmest, if not even warmer than the highest recorded temperature since the beginning of measurement, which was preceded by the warmest ever recorded June. "Leading world scientists are stressing the need to limit the temperature rise to 1.5 °C, to reduce greenhouse gas emissions by 45% by 2030, and achieve carbon neutrality by 2050, if we wish to avoid the worst consequences of climate change," stated the UN Secretary-General. He stressed that all decisions made by governments and the industry must include climate risks so as to encourage climate resilient growth, reduce vulnerability caused by climate change and avoid investments that could cause even greater damage (n1info.com, August, 2019).

Climatologists all over the world are warning against the forthcoming dangers from heat waves, which are becoming more frequent, especially on the entire north hemisphere from Japan to California. They state that climate change has contributed to a potentially five times more frequent occurrence of heat waves in Europe.

The impact of climate change on cities is undeniable. These changes are manifested in different ways, depending on the city's position and size. Cities and their dwellers have already begun to experience the effects of climate change. Cities, for their part, greatly influence climate change on the planet. Urban and

architectural solutions, population density, traffic solutions, the paving of public areas, green and water surfaces, airing, type of energy sources used for heating and cooling of buildings, public lighting, heat island effects etc. all have a great impact on climate change on a local as well as global level.

The international climate research community has concluded that human activities are changing the Earth's climate in ways that increase risks to cities. This conclusion is based on many different types of evidence, including the Earth's climate history, observations of changes in the recent historical climate record, emerging new patterns of climate extremes, and global climate models. While projections for future climate change are most often defined globally, it is becoming increasingly important to assess how the changing climate will impact cities. The risks are not the same everywhere. For example, sea level rise will affect the massive zones of urbanization clustered along the world's tidal coastlines and, most significantly, those cities in places where the land is already subsiding (ARC3.2, 2015).

2.1. Cities and climate change

When speaking of the impact of the changing climate on cities, four key terms, which are also equally important at global level, are usually mentioned. These are: adaptation, mitigation, resilience and vulnerability. The climate change impact on cities is recognized all over the world; cities are trying to tackle this problem in different ways depending on numerous factors. Climate change has become a pressing international development agenda simultaneously with urbanization, offering many opportunities for climate change adaptation, mitigation and disaster risk reduction.

Many countries, governments and cities have launched a number of measures for adapting to and mitigating global threats that are especially dominant in this century. A number of countries refuse to face the problems of climate change, because their solutions require great financial means and impact a country's economic policy. Many countries have only declaratively accepted international recommendations, but there are no really visible concrete results. It can be said that mankind faced with a sudden climate change is responding inadequately and inefficiently. Enormous funds are spent in different ways; the profit received by some countries, banks and individuals is excessive, and the results achieved at global level are not impressive.

In numerous UN documents, climate change takes a priority and is characterized as one of the key problems that cities must face. They are described as one of the greatest challenges of our time, with adverse impacts capable of undermining the ability of all countries to achieve sustainable development (United Nations, 2015a).

The vulnerability of cities to climate change is dependent on factors such as patterns of urbanization, economic development, physical exposure, urban planning and disaster preparedness. Within cities, gender, age, race, income and location also have implications for the vulnerability of individuals and groups. Low-income groups are being pushed into locations that are prone to natural hazards and four out of every ten non-permanent houses in the developing world are now located in areas threatened by floods, landslides and other natural disasters, especially in slums and informal settlements (UN-Habitat, 2009; Sheuya, 2008).

Heavy precipitation and extreme weather events can disrupt the basic fabric and functioning of cities with widespread implications for the economy, infrastructure and inhabitants. In 2014, 87% of disasters were climate-related — thus, continuing the 20-year long trend of climate-related disasters outnumbering geophysical disasters in the 10 most disaster-prone countries in the world (International Federation of Red Cross and Red Crescent Societies, 2015) Often, cities in developing countries are particularly vulnerable, both from new extreme weather events and the exacerbation of existing poverty and environmental stresses.

Natural disasters, floods, droughts One of the unwanted side-effects of the process of fast urbanization is the increased risk of floods. Due to climate change a large number of cities are threatened by floods and water scarcity. Those are usually overpopulated cities on the coasts of oceans, seas and cities on river banks, with several million inhabitants. Big floods in the past century led to a change in policies, technologies and the understanding of this phenomenon, as well as to a concept for the protection against floods, especially when technologically developed countries are concerned. However, unfavourable scenarios describe big risks and perils to urban zones. Solutions are put forward that often involve, on one hand, expensive technologies, and on the other practical solutions related to urban risk management, which are very different to how these kinds of problems are approached today. The rise of sea level as well as long periods of drought will threaten not only urban settlements, but arable land as well, which will cause food shortages. Data from Brussels show that just in the Mediterranean there is around 300.000 km² of endangered land, on which 16 million people live. Global warming will cause water scarcity problems for 14 to 38% of inhabitants in the Mediterranean.

An increasing number of settlements and cities are vanishing because of floods that primarily effect poorer populations. Such a destiny is often shared by the inhabitants of technologically developed countries. A striking example is one that happened in Great Britain in 2007, when in a matter of 17 days 350.000 people were left without water (Flood Probe, 2007).

Effects of urbanization on climate change In the UN-Habitat document, in Chapter 5 *"Just" Environmental Sustainabilities* it is noted that while climate change is a profound global issue, it is also a local issue, as urban areas have a crucial role in the climate change arena. Urban areas concentrate economic activities, households, industries and infrastructures, which are hotspots for energy consumption as well as key sources of GHGs. It is now widely accepted that urbanization brings about fundamental changes in production and consumption patterns, which when associated with dysfunctional urban forms and structures of cities contribute to higher levels of energy consumption and GHG emissions (WCR Ch-5,2016). Between 1950 and 2005, the level of urbanization increased from 29 to 49 %, while global carbon emissions from fossil-fuel burning increased by almost 500 %(UNEP, 2011).

Increased temperatures in cities due to climate change and effects of urban heat islands In cities throughout the world temperatures are rising due to climate change and the effects of urban heat islands. Data in the document provided by Earth Institute, Columbia University (ARC3.2, 2015) show that temperatures are already rising in cities around the world due to both climate change and the urban heat island effect: Mean annual temperatures in 39 ARC3.2 cities have increased at a rate of 0.12 to 0.45°C per decade over the 1961 to 2010 time period[3]; Mean annual temperatures in the 100 ARC3.2 cities around the world are projected to increase by 0.7 to 1.5°C by the 2020s, 1.3 to 3.0°C by the 2050s, and 1.7 to 4.9°C by the 2080s[4]; Mean annual precipitation in the 100 ARC3.2 cities around the world is projected to change by -7 to +10% by the 2020s, -9 to +15% by the 2050s, and -11 to +21% by the 2080s.; Sea level in the 52 ARC3.2 coastal cities is projected to rise 4 to 19 cm by the 2020s; 15 to 60 cm by the 2050s, and 22 to 124 cm by the 2080s[5].

3 Of the 100 ARC3.2 cities, 45 had temperature data available for the 1961 to 2010 period. For each of these 45 cities, the trend was computed over the given period. For the trends, 39 cities saw significant (at the 99% significance level) warming. Data are from the NASA GISS GISTEMP dataset.

4 .Temperature and precipitation projections are based on 35 global climate models and 2 representative concentration pathways (RCP4.5 and RCP 8.5). Time slices are 30-year periods centred around the given decade (e.g. the 2050s is the period from 2040 to 2069). Projections are relative to the 1971 to 2000 base period. For each of the 100 cities, the low estimate (10th percentile) and high estimate (90th percentile) was calculated. The range of values presented is the average across all 100 cities.

5 Sea level rise projections are based on a 4-component approach that includes both global and local factors. The model-based components are from 24 global climate models and 2 representative concentration pathways (RCP 4.5 and RCP 8.5). Timeslices are 10-year periods centred around the given decade (e.g., the 2080s is the period from 2080 to 2089). Projections are relative to the 2000 to 2004 base period. For each of the 52 cities, the low estimate (10th percentile) and high estimate (90th percentile)

Cities on the coast: sea level rise, storms, and flooding Around 90% of the biggest world cities are located on the sea coasts. With climate change, big floods and potential hazards from the sea level rise demand new solutions that rely on new technologies. Mankind has always battled against floods and solved them according to existing knowledge, capacities and available technologies. Flood protection has always been a great challenge for the population of endangered areas and cities located in them. Extreme climate risks that often threaten coastal cities present a challenge for science, professionals and management mechanisms. Urban expansion and intensive land use continue to make even greater pressure on coastal environments.

Especially vulnerable to climate events are low-lying coastal areas where many of the world's largest cities are located. Although low-elevation coastal zones account for just two per cent of the world's total land area, they host approximately 13 per cent of the world's urban population (WCR Ch-1, 2016). A one-metre rise in sea levels would pose a great threat to many coastal megacities such as Rio de Janeiro, New York, Mumbai, Dhaka, Tokyo, Lagos and Cairo.

Potential possibilities are seen in the so-called 'floating islands' which, as a new concept of urban development, are starting to be realized; an idea that is winning over an increasing number of supporters. This concept has been applied in several projects in countries like China, UAE, as well as in some European countries; the first city in which it has been applied is Westland, which is near the Hague in the Netherlands. The project combines welfare housing, parks and other facilities that are on the floating islands. The government of the Maldives, in 2010, also decided to develop a floating city, floating golf fields, floating hotels and a congress centre. The master plan for the Maldives was created as a response to the rapid rising of the sea level, but has also offered the possibilities for social and economic development. The floating islands are particularly interesting for building welfare housing and solving the problems of slums, in which a great number of people throughout the planet live and who are threatened by the rise of the sea level (Green Speak 2012).

Energy and transportation in cities: Solving the problem of energy overconsumption in cities, whether it is a question of energy inefficient buildings, transportation and other infrastructure presents big burdens and challenges with which countries, cities and local governments as well as citizens are faced. The effects are visible and they refer to excessive GHG emissions into the atmosphere, the appearance of heat islands which increases the temperatures in cities compared to non-constructed environments, increases pollution, ruins biodiversity, people's health and numerous other negative effects.

With more than 50 % of the world's population, cities account for between 60 and 80 % of energy consumption, and generate as much as 70 % of the human-induced GHG emissions primarily through the consumption of fossil fuels for energy supply and transportation (UN-Habitat, 2011e). In the document of Earth Institute, Columbia University (ARC3.2, 2015) in the major findings, among other things regarding energy consumption and transportation, the following is written:

Current trends in global urbanization and energy consumption show an increasing use of fossil fuels, including coal, particularly in rapidly urbanizing parts of the world.

Key challenges facing the urban energy supply sector include reducing environmental impacts, such as air pollution, the urban heat island effect, and GHG emissions; providing equal access to energy; and ensuring energy security and resilience in a changing climate.

While numerous examples of energy-related mitigation policies exist across the globe, less attention has been given to adaptation policies. Research suggests that radical changes in the energy supply sector, customer behaviour, and the built environment are needed to meet the key challenges.

was calculated. The range of values presented is the average across all 52 cities

Urban transport systems are major emitters of GHGs and are essential to developing resilience to climate impacts.

Cities account for over 70 % of GHG emissions with a significant proportion due to urban transport choices. The transport sector directly accounted for nearly 30% of total end-use energy-related CO_2 emissions. Of these, direct emissions from urban transport account for 40%.

Urban transport emissions are growing at two to three percent annually. The majority of emissions from urban transport are from higher-income countries. In contrast, 90% of the growth in emissions is from transport systems in lower-income countries.

Urban and spatial planning are therefore extremely important, because with measures of climate change adaptation and mitigation included in the strategies, urban and action plans and other important documents can contribute to increasing people's safety by improving ecological and socio-economic resilience, by improving natural and ecological hazards and risk management and decreasing the vulnerability of urban areas. An important segment in this process is the need for new and improved infrastructure. In this context, global cities must seriously tackle the challenges they are being faced with due to climate change; they must identify their weaknesses that are primarily related to life quality and people's health (housing, urban infrastructure, water resources, green surfaces, services etc), and suggest adaptation and mitigation measures, increase resilience and reduce risks. This requires competent teams of scientists and experts in different fields and quite often large financial means, which is quite a different problem.

Cities are more often losing the ability to adjust to fast climate changes. These changes present new challenges in the fields of urban planning and research, water and natural resources management, air quality. Natural phenomena, like heavy rainfall, do not generally recognize national borders, so emphasis should be placed on trans-boundary cooperation, integral planning, and interaction between different levels of planning (Pucar, Lojanica, 2014).

2.2. Expert and professional response

Scientists and experts who research the different aspects of climate change are faced daily with challenges and are trying to provide answers and solutions that are crucial for the future and survival of mankind. Multidisciplinarity and interdisciplinarity are important determinants of climate change. A great number of experts that research the different aspects of climate change are also involved in finding a solution for them. Problems often occur when incompetent and the so-called experts become involved, who often devalue the real efforts of scientists and professionals that are really dedicated to solving this problem. Climate change is, unfortunately, a platform for many different fraudulent activities, corruption and financial gain for many people, who are not educated or knowledgeable enough about this problem. All of this has led people to have doubt about the real threat and effects of climate change, and this doubt is also supported by insufficiently clear and tangible results and insufficient progress at global level. Scientific research, management and financing, urban planning, technical-technological solutions are branching into several directions, and new and innovative solutions are being proposed every day.

Scientific research is carried out at universities, institutes, scientific-research centres and laboratories. Every day numerous papers are published, which reveal new research results. Large databases and scientific information necessary for efficient management of urban climate change are available to researchers and experts worldwide.

Urban governance for a changing climate: Cities that are sustainable, resilient and inclusive are dependent upon good governance that encompasses: land-use planning, particularly territorial and spatial strategies have been used across different policy sectors to address climate change risks and build effective mitigation

and adaptation strategies; efficient financing that helps foster urban responses to climate change, through the ability to establish innovative ways to finance sustainable projects. Public private partnerships are one strategy in which governments leverage private sector capital for projects (WCR Ch-1, 2016)..

Urban planning and design have a key role in the global response to climate change. All measures and actions that simultaneously reduce GHG emissions and strengthen the resilience against climate risks should be a priority at all urban levels and documents (strategic, management, expert and operative), starting from the city area, municipality, neighbourhoods, blocks and construction. This needs to be done in ways that are responsive to and appropriate for local conditions. The contemporary approach to urban planning implies new knowledge regarding the implementation of measures that integrate the mitigation of and adaptation to the causes of climate change. Practice has shown that it is not always simple and often compromises that meet different interests and minimize conflicts between competing objectives need to be found.

Measures for mitigation and adaptation often provide new possibilities for developing urban areas. They should be carefully planned and implemented, considering the established aims of sustainable development, the existing resources and technical means of one city as well as the needs of citizens.

This concept requires integrated, holistic planning, systems-based analysis that takes into account the quantitative and qualitative costs and benefits of integration compared to stand-alone adaptation and mitigation policies (Figure 1). Analysis should be explicitly framed within local priorities and provide the foundation for evidence-based decision support tools (ARC3.2, 2015).

Embedding Climate Change in Urban Planning and Design

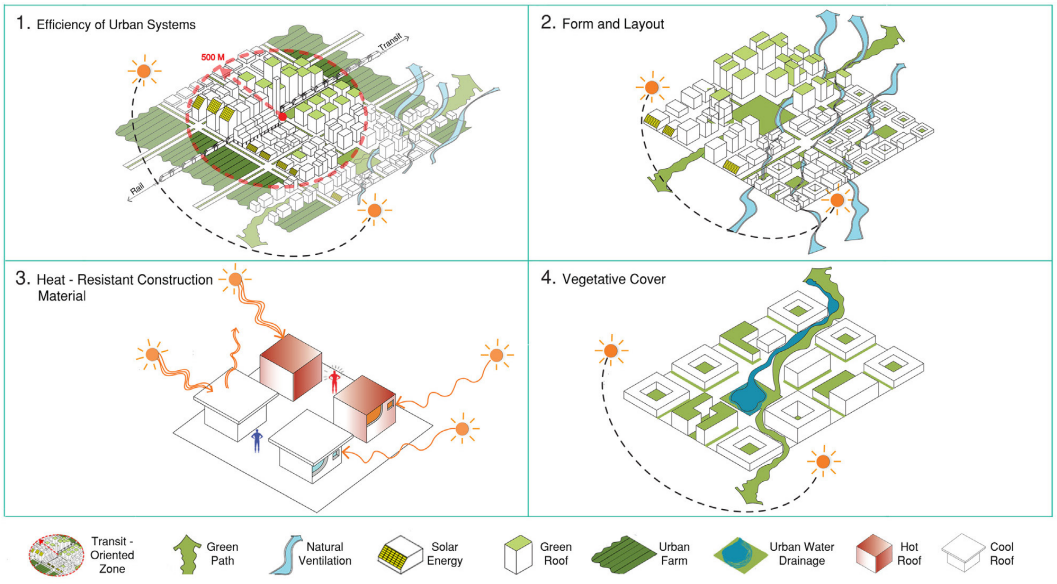

Figure 1: Main strategies used by urban planners and designers to facilitate integrated mitigation and adaptation in cities: (a) reducing waste heat and GHG emissions through energy efficiency, transit access, and walkability; (b) modifying form and layout of buildings and urban districts; (c) use of heat-resistant construction materials and reflective surface coatings; and (d) increasing vegetative cover. (Source:Urban Climate Lab, Graduate Program in Urban

Figure 1 shows how_urban planners and designers have a portfolio of climate change strategies that guide their decisions on urban form and function:

- Urban waste heat and GHG emissions from infrastructure—including buildings, transportation, and industry – can be reduced through improvements in the efficiency of urban systems;
- Modifying the form and layout of buildings and urban districts can provide cooling and ventilation that reduce energy use and allow citizens to cope with higher temperatures and more intense runoff;
- Selecting construction materials and reflective coatings can improve building performance by managing heat exchange at the surface;
- Increasing the vegetative cover in a city can simultaneously lower outdoor temperatures, building cooling demand, runoff, and pollution, while sequestering carbon.

2.3. Climate change - threats and possibilities

Climate change is not only a consequence of anthropogenic factors, but these phenomena are also caused by natural climate variations and seasonal weather patterns. Climatologists and numerous scientists who deal with these problems mainly agree that climate change would have surely occurred, but not in this way and this fast as it has been the case in the previous decades. There are also many sceptics who believe that this global issue is exaggerated due to many different interests and large financial gains. However, the majority of serious scientific-research institutions together with many meteorologists and climatologists perform analyses, measurements, monitoring, collecting and processing of data. All of them publish their results, which show the alarming state our planet is in.

THREATS Climate change threatens cities, and cities are becoming a greater threat to climate change. On the other hand, cities are centres of knowledge and capital, new technologies and synergies, which could lead to the solution of this global problem.

Climate change has a negative impact on socio-economic, ecological and technological systems of cities. Many studies about climate change have analyzed its impact on different sectors and demonstrated the multitude of potential problems in the functioning and capacity of these sectors (Djurdjević, 2015). In the following decades, a higher frequency and intensity of extreme events is predicted to occur in many world cities (torrential rain, floods, droughts, heat waves, windstorms, sea level rise etc.) Extreme weather events combined with climate change are additional threats to cities and urban infrastructure, a growing urban population, economic activities and sustainable development.

Urbanization increases constructed surfaces in relation to natural environments, which causes a rise in air temperatures that are significantly higher than in the areas surrounding the cities. Urban centres and cities often are a few degrees warmer than the surrounding areas because of the presence of materials that absorb heat and the lack of green and water surfaces, which would enable the cooling through evaporation. This leads to the heat island effect. Warmer temperature conditions together with the heat island effect will worsen air pollution in cities.

Urban ecology In most cities around the world there are urban eco-systems, rich in biological diversity, which have a natural potential for climate adaptation and mitigation. Unfortunately, urban eco-systems are already greatly impacted by climate change, which together with rapid urbanization increases the biodiversity and urban species' vulnerability and minimizes their positive role in the future.

Energy systems in cities and the environment Cities spend a large amount of energy for heating, cooling, lighting, transportation, industry etc. and they produce waste heat, emit GHGs that pollute the atmosphere and impact on people's health. Current trends of global urbanization and energy consumption show an increasing consumption of fossil fuels, especially in parts of the world that are rapidly becoming urbanized. The main problems are the following: how to secure a growing need for energy in buildings, transportation and other urban systems; how to provide energy security and equal access to energy; how to reduce

the consumption of fossil fuels including the reduction of GHG emissions, and how to build resilient urban energy systems that can endure and recover after the effects of ever more extreme climate events. Scientific estimations indicate that the average temperature on the planet will rise for more than 2°C in the following decades. This will cause the expansion of deserts, the melting of polar ice caps, ocean level rise and more frequent weather phenomena, such as hurricanes and typhoons. These changes will disrupt agriculture, flood cities, transform the greater part of the planet into uninhabitable areas and disperse hundreds of millions of refugees (Jianping et al., 2016). The available data tell about a further increase of CO_2 concentration into the atmosphere. Speaking of forecasts, there are two scenarios: in the first one, the average global temperatures will rise for 4.5°C till the end of the century, and the second one is more optimistic because a reduction of harmful gas emissions is being calculated into the picture. In the Paris Climate Agreement, adopted on 12th December 2015, world countries have pledged to limit the average global temperature rise to below 2°C compared to pre-industrial levels, and to make an effort to reduce it to 1.5 °C, as well as to reduce GHG emissions to the levels from the second half of the past century.

Transport Transport in cities increasingly impacts the changing climate. The greatest number of vehicles in cities worldwide, especially in less developed countries, still consumes fossil fuels, often of poor quality. Interdependence of transport and other urban systems means that disruption in transport can have immense consequences on the functioning of a city. A special threat for the environment is air transportation.

Managing threats to human health Climate change and extreme events are increasing risks of disease and injury in many cities. Every year, in urban environments, an increased number of illnesses and mortalities are recorded due to a greater frequency of weather extremes. The urban population groups that are particularly threatened are children, the elderly, the sick and poor. It is predicted that the number of chronic and contagious diseases will rise due to climate change.

Migrations Scientists predict that in the following years migrations will be greater due to climate change, and that millions of people will have to flee their regions that will become uninhabitable. Weather extremes with more frequent and intensive heat waves, floods and droughts threaten big populated areas and cities.

POSSIBILITIES Knowing, understanding and forecasting climate change will help cities to prepare for a more sustainable future. Cities can become more resilient against natural disasters and they can control climate risks. Whether climate change is caused by anthropogenic or natural factors, they all require permanent attention of governments and city authorities, science and professionals to improve urban resilience.

Urban planning Climate change adaptation should be a key element of urban planning. In designing plans, experts from different fields such as climatologists, scientists and programmers should be consulted, because they can provide information about climate risks at urban scales, from current risks to projections of future extreme events, while taking into consideration local conditions. Urban planning has long-term effects that impact on the city's capacity to reduce GHG emissions and to respond to the climate hazards that threaten the life quality of its citizens. They should also involve long-term strategies that face the problems of a changing climate. Urban planning provides cities with a spatial framework for the protection and management of natural and man-made environments, including their biological diversity, land and natural resources, and sustainable development.

When it comes to adapting cities to climate change, the principles of green building have become one of the most important premises in both urban planning and building design. Different methodologies set by cities or states, which are primarily focused on the reduction of carbon dioxide consumption, have achieved ambitious goals in contemporary practice. Such goals are stimulated by significant financial resources in order to encourage "Green programs"[6] (Pucar et al., 2018).

6 The concept of a smart city (also known as or similar to other concepts such as "digital city", "intelligent city" or "knowledge-

Cities on the coast An adaptive strategy requires monitoring changing conditions and refining measures as more up-to-date information becomes available. Simple, less costly measures can be implemented in the short term, while assessing future projects. Land-use planning for sustainable infrastructure development in low-lying coastal areas should be an important priority (ARC3.2, 2015).

Urban ecology Investing into urban ecosystems and green infrastructure can offer economical solutions, based on a city's natural resources and potentials. Improving the ecosystem in cities is an important measure for climate change adaptation, while at the same time it creates opportunities for increasing social justice, green economy and sustainable urban development. Strengthening urban ecosystems and investing into green infrastructure have multiple common benefits, including improving quality of life, people's health and social welfare.

Energy systems in cities Extensive research published in the Climate Change Assessment Report by Columbia University advises city authorities to make radical changes in the energy supply sector, consumer habits and building in order to face the key challenges of climate change. One of the important activities of city heads is the initiative to form an urban register with data on energy use according to entities and building typology, transportation, infrastructure and GHGs. This database has already been formed in many cities, and apart from the fact that it directly benefits professionals and citizens, it can also help in exchanging experiences and information as well as in comparing results with other cities, in better understanding of problems and discovering potentials for climate change mitigation. In these activities, open communication, exchange of experiences and knowledge via internet are priceless.

Transportation as a climate challenge and solutions Providing safe affordable transportation, with a low carbon footprint should be one of the paradigms of urban sustainable development. In this context, the importance of supporting public-private investments is stressed. ICTs have an increasing importance. There is a need for innovating the standards and rules and stimulating users with different measures (financial, socio-economic, ecological, healthcare) to reduce their use of vehicles.

Management Given that the majority of the world population lives in urban settlements, cities must project the measures for limiting risks and increasing resilience. Integrating measures for adaptation to climate change into the measures for limiting risks from disasters means overcoming a set of barriers related to increasing resilience; understanding hazards, vulnerability and risk monitoring; coordination between different administrative and sector management levels; implementation and strategy development, and harmonization of financial capacity.

Managing threats to human health Urban health systems have an important role to play in preparing for these exacerbated risks. Climate risk information and early warning systems for adverse health outcomes are needed to enable interventions. An increasing number of cities are engaging with health adaptation planning, but health departments of all cities need to be prepared (ARC3.2, 2015) Improving urban infrastructure, smart e-management of city systems (traffic, public lighting, energy, waste waters, sanitary protection, water management, environmental protection) will have a direct impact on the city dwellers' health. Measures taken to limit GHG emissions and air pollution in cities and to increase green and water surfaces are environmentally-friendly public transport; good connectedness of pedestrian and cycling paths can also influence the health of urban inhabitants. In this context, the application of new technologies is very important and can aid in collecting information and predicting events, in implementing an early warning system; in training citizens for extreme weather conditions, recovery after a natural disaster,

based city") has often been used in different and inconsistent ways, resulting in some confusion about its added value. A common understanding, as articulated in recent studies of the OECD Green Cities Programme, is that smart cities use ICTs or digital technologies to make the critical infrastructure components and services of a city more interconnected and efficient. There are many applications and potential objectives of using such digital technologies, and not only for improving the cities' environmental performances.

measures of mitigation, adaptation and resilience etc.

3. NEW TECHNOLOGIES

Apart from climate change, another global challenge with which our civilization is being faced is the new technological revolution. We are witnesses to fast changes at all levels of life, not only for individuals but for the entire human population. Only a few protected, isolated groups have not been confronted with one of the modern technologies on offer. How to manage, control, shape and use the advantages of new technological solutions, which represent a turning-point in most aspects of our lives, and also how to protect ourselves from their adverse affects, are questions that people worldwide ask every day.

The third or digital revolution started in the late 60s of the last century with the development of technology, from analogue electronics and mechanical devices to digital technologies. The post-industrial "fourth industrial revolution" or "new technological revolution" is completely changing the world. The switch from agriculture to industrial production lasted two centuries, while the switch from industrial to post-industrial phase was very rapid, lasting only several decades. The fourth industrial revolution has brought many new inventions regarding artificial intelligence, robotics, internet, automobile industry (self-driving cars), quantum computers, nanotechnology and biotechnology.

New scientific-technological revolution represents a qualitative change in production, based on turning science into a driving force of socio-economic development. Every developed country of the modern world aims to become a technological leader of the 21st century. New industries, electronics, automation, biotechnology, new materials take up 50 to 60% of the total industrial production of the most developed countries. Today, the latest technologies employ top experts in micro-electronics, the production of computer equipment, robotics, production of tools and gear, atomic and space production, creating in that way "humanless technologies", where the production is mainly based on automated, robotized production (geotesla.wordpress.com, 2016). High technologies are pushing out production with classic technologies. Industrial society was based on social and technical work division, which is gradually disappearing. The structure of workers is changing, which is causing intensive restructuring of global production, even though the industry is still the driving force of a society's development.

Given the aforementioned fact that in less than 35 years two-thirds of the world population will live in urban settlements, with an additional 2.5 billion inhabitants, the importance of new technologies will be even more unquestioned. Many studies predict a time when cities that rely on high technology and create possibilities for their citizens to develop new solutions will achieve the greatest development.

A very illustrative example that supports this thesis is in the document Structured Data Approach from 2017. To gain insight into which cities do this best, Business Insider has consulted with 2think, a research firm specialized in analyzing innovative cities and assessing global cities with the latest applied technology based on carefully selected factors (SDA, 2017).

The firm chose 10 factors related to technological advancement - including the number of patents filed per capita, start-ups, tech venture capitalists, ranking in other innovation datasets, and level of smart phone use - weighted them, and ranked a list of 85 cities accordingly.

3.1. Impact of new technologies on urban development

The implementation of ICTs in the last two decades has caused a revolution in the transformation of cities into the so-called smart cities. This has led to the internetworking of cities and their inhabitants at local and global levels. To inform city authorities and other interested parties, including city dwellers, new technologies increase the quality of life, management and access to a wide spectre of data and provides solutions to different functions and issues of a modern city, such as: more efficient mobility and reduction of traffic jams;

creating a healthier environment by reducing different forms of pollution; optimization of resources, above all energy and infrastructure systems; preparedness for emergency situations etc. An important segment in the implementation of new technologies is the building of a strong telecommunications infrastructure that will enable the transfer of a large amount of data allowing communication between different services and users (e.g. smart measuring devices for water or energy consumption) and a smart transportation infrastructure.

The use of data allows cities to measure their performance and to re-inform investments in city infrastructure. Cities are increasingly relying on metrics and globally comparable city data to guide more effective and smarter city decision-making that build efficiencies in city budgets (WCR Ch-2, 2016).

ICTs are much more complex than one-way implementations of technological solutions and include sociological concepts like maximum social inclusion and transparent decision-making systems (Pucar et al., 2016).

Models of cities in 2D and 3D format and the use of GIS technologies, software and tools, which have key roles in the development of cities, would be used for collecting data on the building stock and its physical parameters. In the domain of energy efficiency, the geo-information technologies provide an integration of spatial data and their analysis, the exploration of development scenarios and, finally, the selection of optimum solutions (Pucar, 2016).

The technological innovations related to the elements of energy efficiency, modelling, simulation, measurement, etc., are becoming a part of the urban planning practice. They have led to great changes in city planning and changed the way of thinking and understanding the role of urban planners, architects, and the profession as a whole. Technological solutions implemented in urban planning can, to a greater extent, provide answers to all the current urban issues caused by climate change (Pucar, 2015).

The new technologies enable the mapping of RES at city level. This includes, for example, vacant and neglected spaces in a city, roofs or facades of the buildings suitable for the installation of solar collectors for water heating and PV power supply systems. Such procedures would enable both the users and local community or private sector to make decisions on the most optimum locations for the use of RES based on detailed analyses of climatic parameters, different policies and technical limitations that exist in a city. New technologies are increasingly adopted and recognized by participants in different professions in the complex process of urban planning. Solving the problems of GHG emissions, infrastructure systems, energy efficiency, transportation, municipal solid waste, etc., is based on available technologies and mutual connections between the complex information, communications and regulations systems. In addition, the possibilities of reducing energy consumption include the introduction of smart street lighting technologies through the control and energy efficient lighting systems, energy efficient city transportation, the use of bioclimatic parameters in planning and design, the introduction of traffic monitoring and signal control systems across the city, etc.

Urban plans represent an efficient way of improving energy efficiency, while different tools are used depending on the size and position of a city, street geometry, vehicle movement, height of buildings, position of green and blue areas, industrial complexes and air pollution dispersion (Pucar et al., 2016).

3.2. New technology - threats and possibilities

As mentioned in the introduction, new technologies have opened a new chapter in the history of mankind and have already changed the world in a way that was inconceivable only several decades ago. There are numerous positive and negative effects on global development, with completely new objectives and methods of realization. What will happen next and how much the world will change in the next few

decades is difficult to answer. The fact that it is difficult to control this development at global level presents a problem. As the 20th century was marked by an arms race, which is still ongoing, the 21st century will be marked by a race in digital technologies, which is as dangerous, if not even more dangerous than the arms race. The threat of atomic weapons and their development have paradoxically put armament under control. However, the race in new technologies, especially when bioengineering and artificial intelligence are in question, sets objectives that are uncertain, and in achieving them we can lose control. What will be the role of cities and their dwellers in the future? No single country has monopoly over new technologies; they are not controlled or guided even within the same country. Governments and governing structures (from state to city), science, universities, academies, experts, investors, civil society organizations etc. must realize what kind of responsibility they have and try together to find the answers to the problems that are looming in the future.

The changes are so radical from the perspective of human history (because we see the reforming of the economic, social and cultural contexts in which we are living). Never has there been such a disbalance between possible prosperity and potential perils. The appearance of new technological discoveries, which cover many fields, such as artificial intelligence, robotics, internet, self-driving cars, 3D printers, nanotechnologies, biotechnology, scientific materials, energy storage and quantum computing will not only change the ways we work, but also the ways we live and how we interact. Although many of these technologies are still in their early phase of development, some have reached their curve point, where technologies complement each other in a fusion that will impact not only physical, but also biological and digital domains (Živanović, 2018). There is a change in paradigms in basic, social, humanistic and technical-technological fields, sciences, education, healthcare, culture and business. Behavioural ways and value systems are changing.

While a nuclear war and climate change threaten only the physical existence of mankind, radical new technologies could change its very essence; therefore, they are intertwined with the deepest human, ethical and religious beliefs. While everyone agrees that a nuclear war and environmental disasters must be avoided, the opinions on bioengineering and artificial intelligence as tools for upgrading human beings and creating new forms of life are much divided. (Harari, 2019).

THREATS Regarding the adverse effects of new technologies, intellectuals worldwide, who deal with different fields of human activity, have written volumes and published many alarming results. Humanistic thinkers, sociologists, historians, economists, scientists, engineers are sending messages in which they question the future of humanity: What will happen when computers start surpassing humans in more and more tasks and replacing them in more and more jobs? Will the number of unemployed people grow (based on some estimation 47% of jobs in the world will disappear due to automation)? What does overload of information that cannot be controlled or filtered mean, and how does it affect people, especially the young? How to solve problems of social isolation and alienation, which is becoming especially more present in families, greater privacy invasion such as recording and applications for filtering information? How to protect the population from daily control and automated surveillance and monitoring of personal information organized by centralized structures of power at global and local levels? The development of genetic and biotechnical research, as well as artificial intelligence opens up a series of moral and ethical questions, and how can they be solved? How to solve the problems of equal opportunities for accessing ICTs and *digital divide* (a term that defines the gulf between those that are digitally-rich and those that are digitally-poor in the world)? How to reduce the ever growing gap between the rich and poor cities and inhabitants? Can these complex questions regarding the future of mankind be answered?

POSSIBILITIES ICT implementation in cities has revolutionized communications, budget management and infrastructure systems, innovations, investments, networking of firms and small and medium enterprises. There are numerous examples of significant reductions in business costs, of greater productivity, more

efficient healthcare and traffic, energy saving, reduced GHG emissions and environmental protection.

Further, ICT implementation in cities supports innovations and promotes efficiency in urban infrastructure, which results in cheaper city services. An increasing use of geographic information systems (GIS) allows the connecting of the spatial referential data from different sources, offering a clear picture of what takes place in the cities (WCR Ch-1, 2016).

With Big Data and the Internet of Things, city leaders are gaining a more detailed, real-time picture of what is happening within their city. The Internet of Things is reaching a tipping point. As more people and new types of information are connected, Internet of Things becomes an Internet of Everything— a network of networks where billions of connections can create unprecedented opportunity for cities. Notably, the volume of digital data is almost doubling every two years (Turner, 2014.; Oudenhoven, Pontika, 2017)

The concept of smart cities, which advocates sustainability, innovation and management of important urban systems ties in with ICT and supports the collaboration between city authorities, inhabitants and enterprises. The International Telecommunication Union defines a smart sustainable city as "an innovative city that uses information and communication technologies and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs economic, social, environmental as well as cultural aspects." (ITU, 2015). A smart city can guide better decision-making with respect to prosperity, sustainability, resilience, emergency management, or effective and equitable service delivery. Technology solutions and the effective use of data are providing city leadership with new tools and opportunities for effective change.

There are many advantages resulting from new technologies, if attention is paid to socio-economic, humanistic and ecological contexts. They can trigger innovations, creativity and productivity; help economic prosperity and the quality of life of most inhabitants by preventing poverty; social involvedness especially directed towards children and young adults, and contribute to urban development. A special advantage is certainly cheaper access to knowledge and information for a great number of people. By investing in education in the field of new technologies, even less developed countries could be equal to the developed ones.

In order to realize the potential of ICT towards sustainable development, an enabling environment has to be created, with participatory governance models, the right infrastructure and technical platforms, including capacity building, ensuring inclusion and bridging the digital divide. (UN-Habitat, 2014)

4. CONCLUSIONS

Climate change and new technologies have brought big changes to cities all over the world. Individual effects of these events and their interconnectedness have changed the cultural, demographic and economic characteristics of cities, institutional capacities of local governments, man-made environments, ecosystems and the natural environment. Due to the importance and comprehensiveness of all these changes, roles and responsibilities of the key players must be defined in city planning. Interactions between them must be coordinated during each phase in the process of planning and implementation.

The shaping of cities under the influence of *climate change* and threats regarding climate disasters, irrational consumption of resources (primarily energy and water), pollution, heat island effect have all impacted on the creation of new strategies for improving resilience and managing risks and reducing the vulnerability of cities. Innovative urban planning, land use, financial instruments and the strengthening of public-private partnerships; the building of strong institutions, managing and improving the ecosystems are only some of the objectives towards which cities will strive in the future. City authorities should connect with national legislature and programs. When speaking of cities with a small budget, good connectedness to international

programs and donors is crucial in order to secure financial support. Networks of cities that are dealing with this issue, especially some successful cities, play a key role in accelerating the spreading of good ideas and the best of practices at international level. Often, it is not only a question of finances, but good ideas, exchange of information and knowledge is also important. Strategies and action plans of cities in relation to climate change can be adapted to local urban contexts.

In addition, the more frequent extreme climate events are a good opportunity to examine the vulnerability of a settlement, as well as to analyze the possible models for the existing and newly-designed building stock to resist such challenges. In this domain, a multidisciplinary approach to solving problems is necessary. In this approach, it is expected from planners and designers to take a more active partner role, for which the broadening of existing knowledge is needed together with a more intensive exchange of specific information at local and global levels (Pucar, Devetaković, 2011)

The development and application of new *technologies* has changed and greatly improved the living conditions of city dwellers, while announcing at the same time global existential threats, which no single nation can tackle on its own. The way of building has changed, new materials with high performances have been discovered that meet the complex, constructive, environmental and energy demands. Development and application of internet, computer tools, software, AutoCAD, 3D animations, numeric modelling of building performances have created new possibilities in design, while at the same time triggering a series of questions to which there are still no right answers.

Now we need a new global identity, because national institutions are not capable of tackling the unseen before global issues. We have a global ecology, global economy and global science - but we are all still stuck in our national politics. Globalized politics means that the political dynamics within states, and even within cities, should pay much more attention to global issues and global interest. (Harari, 2019). The best opportunity for jobs growth and the economic development of cities comes from a focus on the quality and efficiency of infrastructure and services, strengthening education and health services, improving the quality and adaptability of human capital, and on reducing where possible the costs of doing business, such as through cutting unnecessary "red tape" and non-tariff barriers (WCR Ch-8, 2016).

Social inclusion and the raising of awareness of not only the citizens, but also the local governments and experts, play one of the key roles in this process. For this to be possible, the issues of new programs and models of educating engineers, the scientific and professional profiles, should be in the focus of state and local politics. Without this, it is very unlikely to expect a sustainable economic and social development. Institutional connectedness and adaptation is needed in the domain of city management.

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