Sustainable Cities and Sustainable Consumption and Production

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Abstract

This dissertation was written as part of the MSc in Environmental Management and Sustainability at the International Hellenic University. The trend of urbanization is continuing and cities apart from generating wealth are facing sustainability challenges. The urgent necessity to respond to these challenges was addressed by the United Nations in 2015 by setting the Sustainable Development Goals. Cities and societies are recognized as the stepping stones towards sustainability. This paper studies the concept of sustainable cities and describes these city factors with significant impact on sustainability: mobility, energy, disaster risk reduction, water management.

In addition, as cities grow, the consuming demand rises and the products, services and goods are difficult to satisfy all the demand, leading to overconsumption. This paper stresses out the importance of the sustainable production and consumption in urban societies while emphasizing on food waste and waste management. However, apart from a city that establishes new systems and implements new initiatives it is important to understand the behavior of the end users and the sustainable (or non) choices they make. At the last part of the paper the habitual behavior on sustainable choices is analyzed, as by recognizing the origin of the behavior is possible to shift to sustainable choices and maintain long term sustainable behaviors. The review provides a holistic approach of sustainable cities and citizens with sustainable behaviors.

Acknowledgment

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Introduction

The urbanization trend is dominating the 21st century and countries are experiencing profit growth. However, on closer observation it is obvious that the current patterns are unsustainable – socially, environmentally and economically as many cities are trying to maintain their prosperity.

The magnitude of the changes that are our planet is facing has been a surprise and world leaders are forced to take action. Ban Ki- moon, the United Nations Secretary General from 2007 to 2016, has stated than ""We don't have plan B because there is no planet B" and stressed out the urgent situation that has to be handled. In 2015, the 193 countries of United Nations General Assembly agreed on the 2030 Development Agenda, the "Transforming our world: the 2030 Agenda for Sustainable Development". The Agenda lists the 17 Sustainable Development Goals that will act as a compact for countries towards sustainability. The goals are not legally binding however countries are expected to take action and establish a national framework. Civil society, the private sector and all stakeholders are expected to contribute to the realization of the agenda.

Cities play a decisive role and hold the key to a sustainable future. Cities will create the path to solutions related to major problems as climate change, water pollution, overconsumption, vulnerability to natural disasters. Sustainable Development Goal 11 is dedicated to sustainable cities and communities aiming to "make cities inclusive, safe, resilient and sustainable". This paper was inspired by this goal and although literature covers a variety of aspects of the topic this study focuses on five major themes that emerge repeatedly in throughout the literature reviewed. These themes are mobility, energy, disaster risk reduction and water management. In addition, cities are dealing with increased demand for already constrained natural resources. Societies are consuming more that the planet can produce and overconsumption is a challenge as cities can no longer sustain current lifestyles. The same concern was set in Sustainable Development Goal 12, aiming to"ensure sustainable consumption and production patterns". This paper illustrates the importance of food waste in urban societies and explains the zero- waste city concept through effective waste management initiatives. The current literature on these subjects emphasizes on one topic, either sustainable cities or sustainable production and consumption despite the close relation between these two. This paper aims to close this gap by providing as well success stories of cities around the world. Furthermore, apart from establishing knowledge on infrastructures and projects to enhance the quality of life and protect the environment, this paper explores the habitual behaviors and connects the decision making of individuals to sustainable or non sustainable choices.

This paper aims to provide the background information, explore the interconnection between sustainable cities, sustainable production and consumption and sustainable decision making and result as a stepping stone to further individual research and speculation. Academic theoreticians in the environmental management field, professionals or students aiming to broaden their specialization in sustainability, executives of businesses, public organizations and citizens interested in city sustainability will benefit from this paper.

For the conduction of this review, journals, articles, conference publications have been located and extracted through databases including EBSCO (ebscohost.com), Scopus (scopus.com) and in publisher databases including Elsevier (sciencedirect.com), Emerald Insight (emeraldinsight.com) and Springer (springlink.com). Additionally, journal publications, conference proceedings and reports by global organizations like the United Nations have been included in the review. Papers published in English language were included only.

Shaping Cities of Tomorrow

"The road to sustainability runs through our cities and towns." With these words the UN Secretary General Ban Ki Moon pointed out the importance of cities in sustainable development at the ICLEI's Global Town Hall at the Rio+20 Conference in 2012. However is worth understanding why these entities may lead from local to global sustainability.Cities are complex, dynamic systems with many interlinked factors and subsystems that are constantly transforming. A well functioning network of all urban flows as energy, traffic, materials requires a close monitoring of urban factors and a very good understanding of the quality and quantity of these flows. Cites are influenced by all these flows and interconnections and as a result they are constantly struggling to balance in a very dynamic world. This is the reason why the majority of cities need to address many issues and change their conventional state in many categories. While many cities such as Zurich, Stockholm, Seoul, Singapore are writing their own success stories, many other are trying to overcome obstacles and struggle with environmental, economic and social problems. In order to improve their sustainability, cities need to apply a clear assessment of the situation they are today, to address the positive and negative outcomes by its system and set targets towards a better balance between the pillars of sustainability. The main fields that the city has to identify are discussed below.

Urban Development

In recent decades the world is experiencing an unpredictable urban growth. According to the World Urbanization Prospects Report (p.10, 2014), half of humanity – close to 4 billion people- live in the cities, surpassing the rural population , estimated to be around 3,4 billion (United Nations , 2014). The demographic transitions such as health, working conditions, economic growth, public policies, and family structures are also linked to the urban development. The urban population is estimated to increase and reach 5 billion by 2030, bringing to light enormous challenges by the mass urbanization. Inequality, growing number of slum dwellers, increased air pollution, inadequate basic services, water scarcity, sewage treatment, garbage disposal and environmental degradation are just a few.

The necessity for urban planning and management has rise in order to make cities inclusive, resilient, safe and sustainable. Cities occupy only the 3 per cent of the Earth's land, still cities are responsible for 60 to 80 per cent of total energy consumption and 75 per cent of carbon emissions. As estimated by United Nations in 2015, 60 per cent of Earth's population will live in cities by 2030. Moreover, urban resilience is of high importance as cities are more exposed to disasters due to higher people concentration.

Defining Sustainability and sustainable city

The origin of sustainability dates in the 1987 Report on World Commission on Environment and Development (WCED, p.16) , the " Our Common Future" , known as the Brundtland Commission Report. As per the report, sustainable development is defined as *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*. In the years that followed many other definitions of sustainable development arise and all of these have in common the necessity to design communities based on the three sustainability pillars, environmental, economic and social.

As almost half of humanity is living in cities and the 21st century is an urban world, the interest turns over the cities and the relation and impact to sustainability is defined by the term: sustainable cities. According to the International Countries for Local Environmental Policies Organization (2016**)** *"Sustainable cities work towards an environmentally, socially, and economically healthy and resilient habitat for existing populations, without compromising the ability of future generations to experience the same".* Another definition comes by the declaration of the World Ecocity Summit 2008 in San Francisco, which states that an ecocity *"is an ecologically healthy city. Into the deep future, the cities in which we live must enable people to thrive in harmony with nature and achieve sustainable development. People oriented, ecocity development requires the comprehensive understanding of complex interactions between environmental, economic, political and socio-cultural factors based on ecological principles. Cities, towns and villages should be designed to enhance the health and quality of life of their inhabitants and maintain the ecosystems on which they depend.* Both definitions contain the three components of sustainability, the social, the environmental and the economical component.

In the search of sustainable development, the San Francisco Declaration on sustainable development (2008**),** has set a number of requirements that the city has to meet. Firstly, the city must be environmentally secure by providing clear air, solid water supplies, healthy environment and working conditions and resilience towards physical catastrophes. Slums, informal settlements, inadequate housing or homeless

people are not a part of sustainable city. Child labor, social inequity, unhealthy working conditions are not aligned with sustainability. The city should also provide ecological sanitation and efficient waste disposal. The city has to put high among priorities the industrial metabolism that refers to the materials re-use, the life-cycle production renewable efficiency. One more requirement as per the Declaration is the Ecospace – ecological landscape- integrity defining the infrastructure, the building, open spaces, bridges, streets as well as natural features for example ridgelines and waterways, all aiming to maximize biodiversity and efficiency. All of these may have a high impact but still the value is small unless the society develops ecological awareness. It is the individuals that shall understand and be responsible for the cultural identity, for the environment, their consumption and overall impact. These are the elements that complete the image of a sustainable city and cities should work towards this direction in order to be developed.

Mobility

One of the greatest environmental challenges we face today lies in sustainable mobility that supports the societies and the economies mainly by cars, busses, trains, trucks and other means of transport.

Transport is responsible for the one quarter energy related green house gas emissions (GHG) worldwide and increasing in a fast rate. The problem to tackle is significant but it is a great opportunity as well for a low carbon society. It is included and discussed in every sustainable development strategy and has captured the attention early enough, since 1992 in the United Nation's Earth Summit in Rio. Agenda 21, the outcome of the Earth's Summit, recognized the importance of the transportation which is mentioned in chapter 7 and in chapter 9, on Atmosphere and on Human Settlements respectively. In 1997, the General Assembly noticed that transportation will be the most important factor behind a growing demand for energy in a twenty rear term. Since then, transportation as a key development issue has been discussed globally many times, as in Millennium Development Goals, in Kyoto Protocol and in Sustainability Development Goals. At the 2012 United Nations Conference on Sustainable Development (Rio +), Ban Ki- moon UN Secretary General, identified transport " as a major component of sustainable development" and emphasized on its

role on setting a vision for sustainable cities. In addition, mobility and transportation is not a standalone goal but is reflected the majority of sustainable targets.

Transportation impacts on sustainability not only on greenhouse gas emissions but also in many ways affecting economics, social and environment. Traffic congestion, facility and infrastructure costs (roads, parkings, terminals) , consumer costs (vehicles, fares), mobility barriers, accident damages represent a high cost not only for individuals but for states as well. At the same time, social factors should be taken under consideration as mobility for disadvantaged people, health impacts, aesthetics, and community livability. Environment is highly impacted due to water and air pollution, noise, habitat loss, depletion of non renewable resources. The decisions on policy making transportation systems, locally and globally, and the impacts of it are long term as it concerns time consuming projects of high budget and usually technologically complex.

The image below depicts this relation between mobility and quality of life, climate change, air quality and includes targets involving expanding public transport, providing access to all, reducing the environmental impact of the cities. By investing in mobility and sustainable transport, cities will witness improvements in many fields. Public transport as metro and rail wails enhances the access of citizens in local markets and increases the opportunities, especially for the one's with low income, to get connected with more job markets. Under this perspective, in the long run GDP growth is possible. By maximizing accessibility is necessary to achieve efficiency in the energy systems and minimize the carbon footprint by using alternative, renewable, safe sources. Still climate responsiveness is a personal task as citizens have to be open to change to alternatives and understand the impact and expansion of their every day small decisions as for example taking their car downtown instead of public transport.
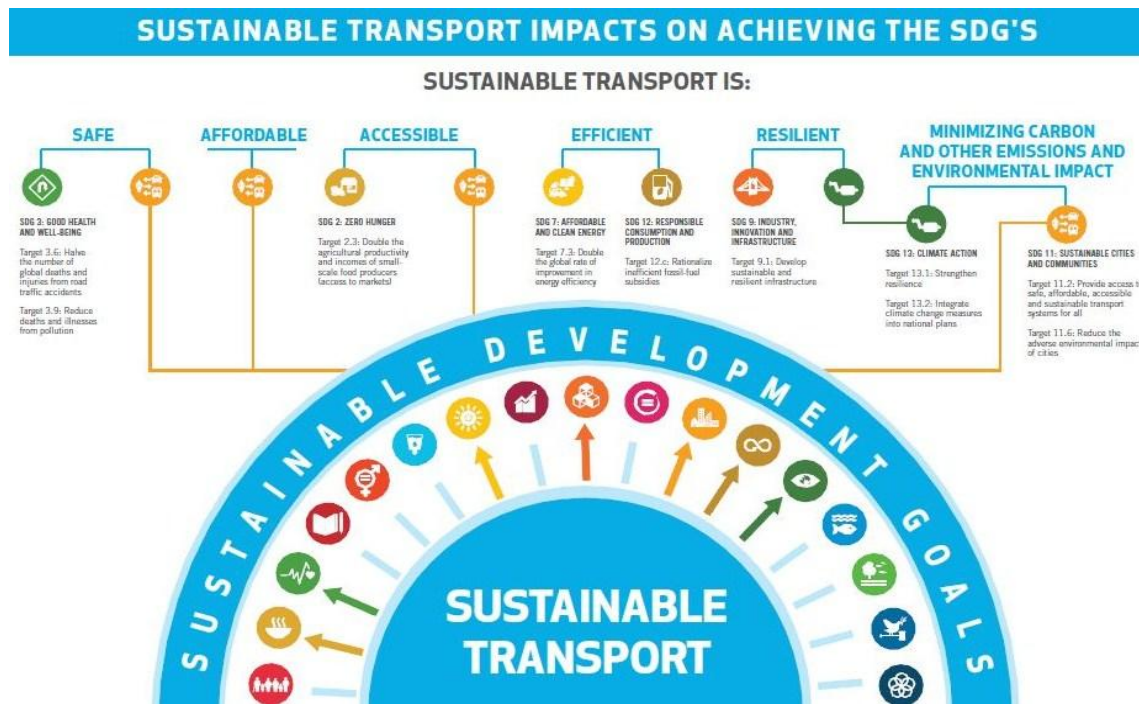
Picture 1 Sustainable Transport Is (Source: Mobilizing Sustainable Transport for Development, p,11, UN 2016)

How to make city transport sustainable

As mentioned in the Mobilizing Sustainable Transport for Development (UN,2016) in order to be oriented towards sustainable transport , advances shall be done in policy development, financing and technological innovation.

To start with, transportation has a wide range of sectors, for example housing, technology, health, business, land use, all to integrate and achieve effective policy making. The Sustainability Urban Mobility Plan, proposed by European Commission in 2009, adopts this holistic approach, emphasizes on vertical and horizontal integration and presents mechanisms for cities to achieve their goals and evaluate them. For example, Copenhagen's long-term vision is that no more than 30 per cent traffic will be by car and the rest will be by bicycle or public transport. It is believed that future transportation will be less depended on cars and more diverse (Mega, p.94, 2010). Instead citizens will use light rail, buses, bicycles as long as are a safe, resilient, clean, fast, flexible mean of transport. In Europe, Zurich has the highest public transport use as it has developed an eco friendly surface system achieving high speed and safety. In addition, technical innovations serve the vision of the city as it's possible to reduce

greenhouse gas emissions (GHG), nitrogen oxides (NOx) and has simplified the transition to very low carbon fuels and electrification of vehicles.

The European project JUPITER II , one of the European Commission initiatives, explores the potential of innovative energy and environmental innovations. It has achieved reductions in energy consumption by 20 per cent and in emissions of harmful air pollutants of up to 25 per cent. Also the ZEUS project led by Stockholm in collaboration with other European cities, focused on the production of vehicles powered by biogas that comes from recycled, liquid , organic waste. In total, 200 vehicles were the outcome of the cooperationn among the municipal sector and enterprises and were used for wastewater management, fuel companies and city infrastructure services (Mega, p,69,2010).

On the way to clean, safe and reliable mobility systems, China has introduced more than 200 million electric two wheelers in its cities, over the last 20 years, to cover short distances needs. At the same time, tax incentives are used in cases and seem to have helped cities such as Colombo, Sri Lanka to have more hybrid and electric cars per capita than any other developing country. Also, Norway's newly registered cars are plug in electric cars – by 25 per cent- due to tax incentives and prevalence of charging station. Implementing Information Communication Technology across transport models, both safety and efficiency will be improved, time delays and congestion will be reduced, real time adjustments for routings will provide an overall experience for the users. Dar es Salaam, Tanzania, who won the 2018 Sustainable Transport Award, has achieved a number of transformative improvements in transit, cycling and walking and has developed the Dar es Salaam Bus Rapid Transit (BRT) or DART. The DART System, the first in Africa, has increased transit speed, cut down in half commute time and improved pedestrian access. By mid 2018 will fully operate with more than 300 buses and will carry 400,000 passengers per day.

Niklas Gustavsson, the Chief Sustainability Officer of Volvo Group (WWF Global,2017), admits that the private sector holds a key role in the transmission of the cities to more sustainable policies and it can be to a large extent a part of the solution. Still the government should develop appropriate funding methods, engage with private companies for successful co operations , as the "Crossrail" in London and Autolib – flexible car renting- in Paris, and provide tax incentives to individuals. For

instance, some opportunities would be parking regulations and fees, fuel taxes based on the use, vehicle registration and ownership charges that vary based on road damages, emissions, congestion (Mobilizing Sustainable Transport for Development,p.23-26, UN 2016).

Celia Blauel, the Deputy Major for Environment in Paris, recognizes as biggest challenge in mobility the mind shift that is required (WWF,2017). In particular, the difficulty lies on how people will engage in the actions that the public sector takes, as well how is it possible to get engaged in the transformation of the cities. Walking and cycling, the most sustainable means of transport, have gained ground in most European cities (EEA as cited in Mega, p,66,2010). Policy makings and infrastructures for cyclist are promoted and Amsterdam and Copenhagen are success stories of bike friendly cities.

Going beyond that, cities without car are still an attractive idea, as long as the second option, after car, is still attractive. Many cities have bounded cars from the historic centers and many commercial streets were transformed into pedestrians. It was first the Italian cities, Rome, Bologna, Florence, Milan and Bolzano that implemented park and ride systems, restricted cars and lifted up the beauty of their historic centers. European Mobility Week and A Day without A Car are strong symbols using to raise awareness among the public on the damage that the urban mobility causes to environment and the quality of life (Mega, p. 72,201). Bold actions are required driven by collaborations between the public and the private sector and is high time to move from targets and commitments to actions.

Energy for Sustainable Cities

Various daily activities are responsible for the energy consumption as in residencies, shopping centers, industries, street lighting, water and sanitation services and it is highly dependable on the buildings, the mobility and the urban planning. In particular, the urban areas are responsible for approximately 80% of all carbon dioxide emissions worldwide (Satterthwaite as cited in Han et all, 2012). A step by step approach aiming to carbon neutrality and energy security by increasing the share to renewable energy sources are the targets of a low carbon society. The European Union has set the targets known as 20/20/20 by 2020, that follow three main objectives. The 20 per cent
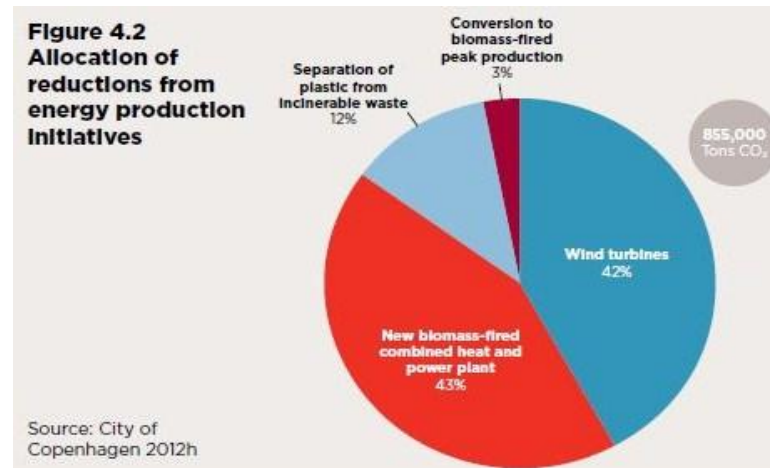
reduction in EU greenhouse emissions (base year is 1990), the 20 per cent energy production from renewable sources and the 20 per cent improvement in EU's energy efficiency. To meet the EU targets of 2020 cities have to consider goals and initiatives in energy consumption, energy production, mobility and city administration. For example, the reduction of energy consumption can be achieved by vehicle electrification or land use infrastructure planning that may influence travel distances (City of Copenhagen 2012h, p.89). Cities shall compare qualitatively the energy resources as petroleum , gas, nuclear, hydro, wind, solar, biomass, ear thermal based on specific attributes as capability, availability, cost, risk, incentives dispatch ability (Nigin, p.339,2006) .

One main challenge that cities have to meet is to provide secure, clean, affordable energy to consumers. Renewable energy sources and distributed energy systems are considered to be key elements in sustainable energy future. Renewable energy sources are indigenous, so it is not possible to be evenly distributed within cities (Mega,p,55, 2010). As Mega notices energy police making depends highly on geopolitics and international trade. For example, European Union is the largest energy importer. This energy dependence affects pricing, provokes supply uncertainty and political instability. All these affect the policy making of the cities energy system and the job opportunities as well affecting the stability of the sustainability triangle.

Green growth and innovation are keys to a city's strategy and were also captured in the CPH 2025 document (2012) that establishes the city's carbon neutrality goal : *"In 2025, Copenhagen will be the world's first carbon-neutral capital and the city 's businesses and universities will be spearheading the development of green solutions generating employment and green growth (City of Copenhagen 2012h)."* Wind turbines and biomass are the main contributors to this initiative as depicted in the figure below. The 2025 initiatives include the increase of 100 land and sea based wind turbines and conversion to biomass at the combined heat and power plant. The target of Copenhagen is not only to create a surplus of low carbon electricity but to export it to the grid. Additionally, district cooling has become a remarkable option as sea water is used to chill industrial and commercial buildings by achieving 70 per cent reduction of CO_2 emissions, compared to traditional cooling ,80 per cent less demand for electricity and at the same time releases room for roof terraces and enhances the aesthetics as

pipelines are buried underground. The below figure demonstrates that wind turbines and biomass are the main initiatives that will contribute to the initiative of potential mitigation of 850,000 tons of CO_2 that the city has set.

Figure 4.2 Allocation of reductions from energy production initiatives

- Conversion to biomass-fired peak production 3%
- Separation of plastic from incinerable waste 12%
- Wind turbines 42%
- New biomass-fired combined heat and power plant 43%
- 855,000 Tons CO_2

Source: City of Copenhagen 2012h

Picture 2 Allocation of reductions from energy production Initiatives (Source: City Of Copenhagen 2012h, p, 46)

All in all, is not only about producing smartly and increasing efficiency while polluting less but it is also about consuming less. Heating, lighting and equipment of households account for 40 per cent of energy consumption (Mega, p.95, 2010). Ecological homes those with double glazing, insulation, heating system, ventilation- are essential and the example of Europe is indicative. In Europe, the lifetime of a building is 50-100 years as they have been built prior to energy performance norms , so the only way to improve the energy efficiency is to intervene in the existing infrastructure. Mega (p.97, 2010) notes that it would be possible to achieve a CO_2 reduction by 31 per cent by 2018 if housing associations started renovations (tearing down old housing, establishing new frameworks, switching electronics etc) and this number would be possible to rise to 37 per cent by 2025 if the effort continued. Ecological homes and districts should not be considered as luxuries but as necessities and a good example to start with would be the public buildings. This necessity is depicted in the 2002 Energy Performance of Buildings Directive(as cited in Mega, p, 96,2010) which suggest energy performance standards to be applied in existing and new buildings.

Disaster Risk Reduction

Disaster risk reduction (DRR) is strongly related to sustainable development as for activities to be developed sustainably is necessary to reduce risks. An increasing number of people are affected by natural hazards over the years. As per UN Office for Disaster Risk Reduction, more than 2,7 billion people were affected and more than 1,3 trillion USD were lost between 2000 and 2011 due to disasters. As per the UNISDR the term "natural" disaster does not exist, but the natural hazards exists. Based on the UISDR definition, Disaster Risk Reduction "*aims to reduce the damage caused by natural hazards like earthquakes, floods, droughts and cyclones, through an ethic of prevention*". The goal is to create a culture of prevention through disaster management, disaster mitigation and disaster preparedness instead of a culture of reaction.

The relation between the disaster risk reduction and sustainability was recognized in 2005 in the Hyogo Framework of Action 2005-2015. The Hyogo Framework of Action 2005-2015 emphasized on the importance of prioritizing the risk reduction among the policies and institutional and legislative frameworks. The Sendai Framework for Disaster Risk Reduction 2015-2030 moves from managing losses due to risks, towards risk reductions by proposing seven global targets to reduce the direct economic losses and the number of people affected. As per the Sendai Framework,(2015, p.14-15) there are four priorities to take action in local, national, regional and global level. The first priority is to understand the disaster risk and estimate the vulnerability, the frequency, the intensity, the probability of occurring and evaluate what the consequential losses will be. Geographic information systems, risk maps, risk assessment tools will provide reliable data to strength the disaster risk governance to managing disaster risk. Public and private sector should address the disaster risk, promote incentives to households, communities, businesses, set legal measures and raise public awareness.

The second priority includes the implementation of laws, regulations, standards and establishment of necessary mechanisms to ensure high level compliance to health and safety standards. The third priority is the investment of the public and private sectors to disaster risk reduction and prevention through measures aiming to improve the health, economic and cultural resilience of the community. Infrastructures should

be designed and built efficiently oriented towards the utilities and services such as water supply and distribution, sewage, solid and hazardous waste collection and treatment, transport facilities and energy distribution networks.

In addition, it is of high importance to strengthen the protection of livelihoods and design policies prior, during and after disasters for the protection of sensitive groups. The Sendai Framework sets us the fourth priority to improve the disaster readiness and to "Build Back Better" in recovery and reconstruction. For example, Tokyo, a city with high risk of earthquakes, has developed a fundamental review on its disaster prevention measure in response to potential earthquakes, typhoons, winds and flood damage. The vision of the city of Tokyo is to be "*the world's safest city as through the efforts of its citizens, communities, companies and governments disaster response capabilities are in place".*

The city has also provided plan for every possible scenario and what initiatives should be put in place by the year 2020. These tables may be found in public places, parks, schools, hospitals, hotels and the year 2020 has been chosen as is the year that Tokyo will host the Olympic and Paralympic Games.

In 2014 the city of Thessaloniki was selected as part of the second cohort of cities to join the "100 Resilient Cities Plan" pioneered by the Rockefeller Foundation. In 2017, the city released its plan "Resilient Thessaloniki: A Strategy for 2030" reflecting the visions of the city. Below are the four goals of the city which are broken down in 30 objectives and more than 100 actions. The city of Thessaloniki is exposed to many natural hazards and shocks as urban floods, forest fires, and earthquakes. To tackle these threats, Thessaloniki and its municipalities have to implement and coordinate a plan. A holistic approach is necessary towards the challenges that the city faces as the population shifts, urban economy, open spaces, mobility, and local governance. By addressing the stresses a city becomes more suitable and flexible in responding to these events and delivering basic functions in case of a disaster. The relevant framework of the city is depicted below. Still as a citizen o f Thessaloniki on my own I do recognize that there are many basic infrastructures to be improved in order to avoid common and regular phenomena as floods and earthquakes.
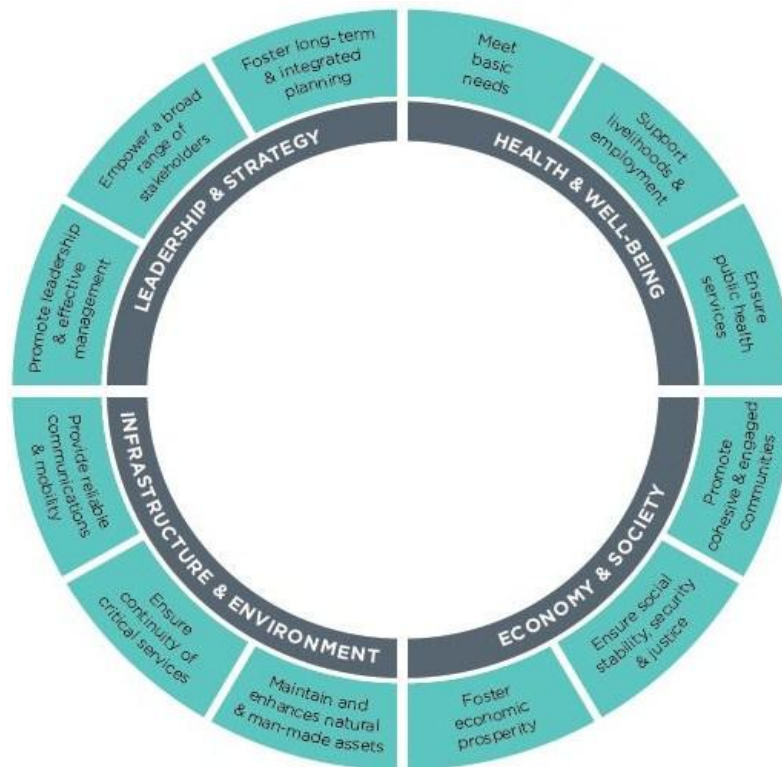
Picture 3 Thessaloniki City resilience framework (Source A strategy for 2030, p. 13)

Water management in the urban environment

As water stress and water scarcity have become global challenges, the cities have to develop the tools and experience in order to design and implement an efficient water system to sustain the urban demand and reduce the water losses. Water withdrawals have tripled the last 50 years and is estimated it may lead to 40 per cent supply shortage of water (Water Resources Group, 2009 as cited in Leeuwen, 2013). The World Water Council, in the 7th World Water Forum (2015), identified and stressed out that necessity and in its report may be found the characteristics of the urban water efficiency. Based on this report, the main characteristics of the urban water efficiency are the considerable difference between the volume of water they treat and distribute and the difficulty to account for all the water used.

The main challenges of the urban water management are listed in the below figure as identified by the SWITCH Project 2006-2011. Changes are on the way due to the increased intensity of rainfall, the rising temperatures and sea level and the floods and droughts that have increased over the years. Furthermore, the infrastructure

systems may be deteriorating (pipe breakage, wastewater leakage) but emerging technologies such as membranes, natural systems, information technology, modular small scale units may respond partly to these problems. Among the best practices is managing storm water for future reuse as for example Los Angeles is reusing the rain water to recharge drinking water aquifers and Melbourne is experimenting on reusing storm water in toilets flushing and lawn watering. Furthermore, the fastest growing alternative in the world is taking saltwater from the ocean and turning into usable water. The main disadvantage is that the cost of equipment is high resulting as an obstacle for acquiring. Of course the more convenient alternative is the water reuse as it is cost effective and safe and the level of treatment depends on its end use (Arcadis, p 35, 2016).

In addition, the SWITCH report has identified that the changes in public priorities, the basic economics needs, and the lack of long term policies by the political regimes impact the efficiency of the water system (Van der Steen et al. 2011 as cited in SWITCH Report 2011).
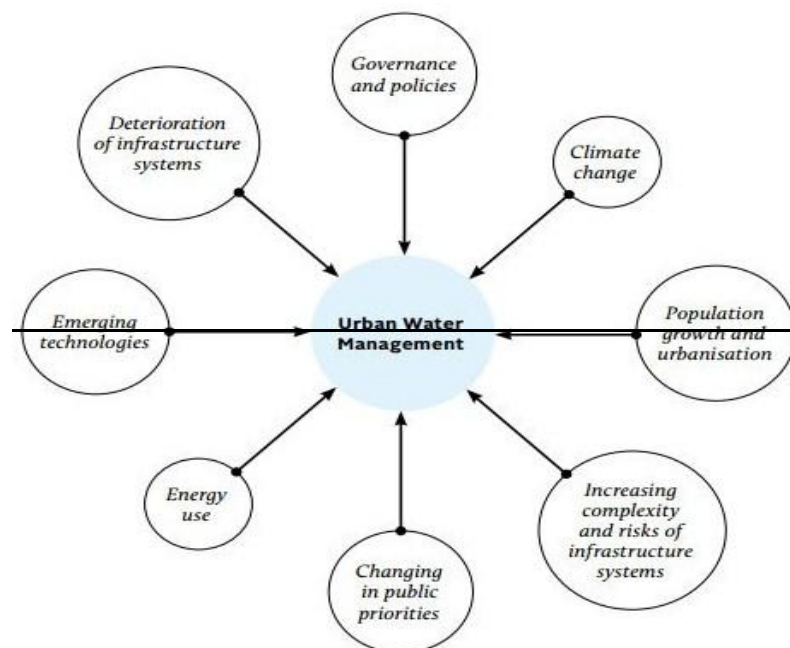

Picture 4 Future Challenges in Urban Water Management, (Source: Switch p.29, 2011)

The consulting company Arcadis in collaboration with the Centre for Economics and Business Research (CEBR) has developed an Index to be applied by cities in for

future improvements towards a sustainable water future. This Index is divided in three sub indices: resiliency, efficiency and quality. By resiliency, cities shall consider water related disaster risks e.g. floods, vulnerabilities, water resources, green spaces. Apart from this, cities have to implement metering systems to achieve service continuity, control leakages and water charges as well as waste water reuse. The quality sub index includes sanitation, monitoring the quality of drinking water and analyzes water related diseases (p, 5, 2016).

A more sustainable approach is still based on the same components as the conventional system is. The below figure by the SWITCH report (p.77,2011) presents the elements that should be added in the conventional approach in order to improve services, provide greater resilience and gain in economic savings through more efficient treatments.
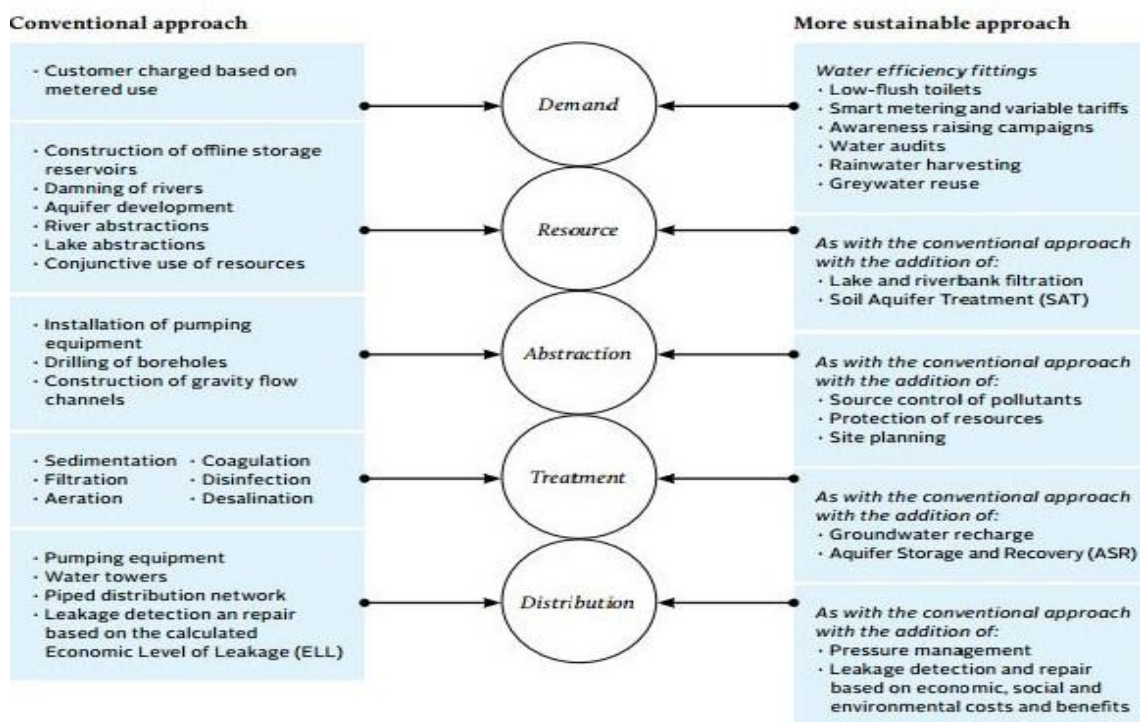
Picture 5 Water supply Management Components (Source: Switch, p. 77, 2011)

In order to reduce losses innovative technologies shall be applied. For example, smart pipes that contain multiple sensors are able to sense and measure temperature, monitor the flows and enable real time data of potential leakages. A vast variety of applications can achieve better management in water resource allocation (ITU, 2014 as

cited in World Water Forum, p, 49, 2015). Smart meters, as well, that contain sensors and wireless transmitter providing two way communication allowing the detection of leaks, illegal connections and tamper alerts (ITU,2014 as cited in World Water Forum,p,50,2015). Furthermore, smart management can be applied for the efficient use of storm water developing green infrastructure that includes soil, trees, open spaces to mitigate and treat what is produced through storage, reuse or infiltrated of rainwater.

Worldwide European cities seem to lead the way as the top five more water sustainable cities are Rotterdam, Copenhagen, Amsterdam, Berlin and Brussels. These cities have high water quality, organized sanitation and wastewater treatment systems and world leader committed to sustainable water practices. In addition, they have developed multifunctional flood protection systems against water natural hazards (Arcadis, p 10, 2016). As more and more cities have to optimize urban water use, it will be necessary to measure their blueprint and set the goals they want to achieve. ISO 55000, that was performed by individuals until recently, may be applied by large cities as well and revise their progress (Arcadis, p. 34, 2016).

Responsible Production and Consumption

Earth Overshoot day, or as previously known Earth Debtor Day is the day that human's resource consumption for the year exceeds the Earth's capacity to generate the resources that year. It marks the day that humanity's demand on nature exceeds what Earth can generate that year. In 2000 this day was in late September and in 2017 it was in August 2, far earlier than even before, meaning that we consume more than the Earth can generate. In particular 1,7 planets are needed by the end of 2017." Our planet is finite, but human possibilities are not. Living within the means of one planet is technologically possible, financially beneficial, and our only chance for a prosperous future," said Mathis Wackernagel, CEO of Global Footprint Network and co-creator of the Ecological Footprint. Economic growth and sustainable development requires urgent reduction of the ecological footprint by changing the production and consumption of goods and services as well.

According to the Report of the Secretary-General, "Progress towards the Sustainable Development Goals" (p.13, 2017), domestic material consumption increased from 1,2 kg per unit of GDP from 2000 to 2010 and the total domestic material consumption increased from 48.7 billion tons to 71.0 billion tons and this may be explained by the rising natural resource use worldwide, in particular in Eastern Asia. Countries are facing main challenges in air, solid and water pollution as well as chemical and toxic waste exposure. Global solutions can speed up through the actions of cities aiming to sustainable production and consumption.

Sustainable Production and Consumption: why is it important

It was in 1992 in Agenda 21 (Chapter 4, p18, 1992) the first time that the unsustainable patterns of production and consumption were addressed as well as the necessity of changing it. According to the Oslo Symposium in 1994, sustainable consumption and production refers to "the use of services and related products, which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the needs of further generations". In 2002 the concept gained attention in the Johannesburg Plan of Implementation as it

was recognized as an "overarching objective" and a 10-year framework of programs is established to support relative initiatives. In 2012, Member Sates of the United Nations recognize that "the way societies consume and produce are indispensable for achieving global sustainable development" and invite others "to consider rationalizing inefficient fossil fuel subsidies" (p.43, Future We Want). The 2030 Agenda dedicates goal 12 to sustainable production and consumption patterns targeting its focus on a 10-year framework of program. The rising attention to this subject derives from the increasing demand for already constrained natural resources as most people globally are expected to join the middle class over the next two decades. If the population reaches 9, 6 billion by 2050, as expected, it will be required three planets to sustain current lifestyles.

Sustainable Production and Consumption requires a "life cycle thinking" emphasizing in resource and energy efficiency and shifting challenges to business opportunities. This change needs commitment and involves different stakeholders, consumers, policy makers, businesses, researchers. This paper searches the initiatives and instruments to be used in a local level within a city by businesses and civil society organizations. Many businesses have begun sustainability reporting and /or implementing ISO's standards and Civil Society Organizations are promoting sustainable consumption and production.

A holistic approach

The McKinsey Global Institute has conducted a research in 2016 highlighting the characteristics of the consumption in the urban world within the following years. In this particular research is being pointed out the importance of the cities as by 2030, the consumers in large cities will account for 81 per cent of global consumption. Global consumption is unevenly distributed as 32 cities are likely to generate one quarter of 23USD trillion in urban consumption growth, as estimated between 2015 and 2030, and on the other hand a 100 cities will be responsible for 45 per cent of that growth. Between 2015 and 2030, it is estimated that the 20 metropolitan areas with the most consumption growth will include seven in the United States, six in China and only 1 in Europe, London. The urban population has to face a double threat, the population is

aging and urbanization is plateauing in many countries. As a result, the consumption patterns are highly dynamic and constantly shifting.

The concept of sustainable production and consumption is considered a holistic approach as it involves life cycle perspective (McKinsey, p, 15,2016). For example, when it comes to a production of a good there are many fields to be considered, as the resources used, the resulting emissions and waste, the efficiency of all stages in the value chain. The main objective is to decouple economic growth from environmental degradation (UNEP, 2012, p.19). The tool of life cycle assessment is very commonly used to assess the value chain from an environmental and social perspective. Life cycle assessment can identify the impact on the community, access to resources (energy, air, solid, water), considering the safety, cultural heritage, social impacts. According to the UNEP and the Society of Environmental Toxicology and Chemistry (as cited in UNEP, 2012, p.20), this tool may be used to enhance the environmental performance of the goods, decrease costs of production, consider the social impact, create an environmental base.

Food waste in urban societies

According to Food and Agriculture Organization of the United Nations (FAO, 2011), one third of the annual production of edible food worldwide gets lost or wasted, resulting to 1,3 billion tons of food waste. Food loss refers to the decrease of food for human consumption throughout the supply chain. Food waste is related to the retailer's or tp the consumer's behavior at the end of the supply chain (Parfitt et all,2010 as cited in FAO, p.2011).

The numbers of food loss and waste are highly dependent on specific conditions that apply in each country. In most developed societies, it is a combination of consumer behavior and lack of communication in policies and regulations. In particular, food safety and standards often exempt edible food out of consumption. Additionally, inadequate planning of purchases and wrong use of expiry date lead to food waste (FAO,2013, p.15). It is not only the food waste measured by food thrown away, it is the water, the land, the energy and all the resources used that are included in the food waste.

FOOD WASTE: DIMENSIONS AND IMPACT ON THE ENVIRONMENT

Every year each person WASTES			
in North America	1,334 kcal a day	42 m³ of water	498 m² of arable land
+	+	+	+
in Europe	720 kcal a day	18 m³ of water	334 m² of arable land
=	=	=	=
TOTAL	2,054 kcal a day	60 m³ of water	832 m² of arable land
	Average food requirement for 1 person	40,000 1.5 liter bottles	2 basketball courts

Picture 6 (Source : Kummu et al. (2012) as cited in FAO 2011)

The table above depicts the dimensions and impact on the environment measured in a person's consumption yearly. In particular, the consumption is measured in North America and in Europe and includes information on food, water and land. This information is summed up and translated into equivalent amounts in average food requirement, bottles of water and basketball court in order to stress out the impact.

The Barilla Center for Food & Nutrition (BCFN) collaborated with the Global Footprint Network in 2017 to calculate the food contribution in the Ecological Footprint. One of conclusions is that the food is the responsible for the 26 per cent of humanity's ecological footprint.

These negative environmental impacts have repercussions on hunger, poverty, nutritional status, food availability, income, social equality and economic growth. All these are causing imbalance in a sustainable city model and it is necessary to be confronted despite the magnitude and the complexity of the problems. The Food Sustainability Index (BCFN, 2017) proposes the education of consumers and the shifting towards a rich diet. The increased urbanization, the changing working conditions, the expansion of large supermarket chains has many consequences on people's lifestyle and the healthcare system. The percentage of obese and overweight people has risen, as well as coronary diseases, type 2 diabetes have respectively. Additionally, the current diet choices have micronutrient deficiencies such as lower intake in vitamins .Based on BCFN' report developed by the Economist (2017) these

issues may be addressed by imposing taxes on sugar – sweetened beverages and restricting advertisements of unhealthy food especially to children. Also cities may educate their citizens in workplaces, schools or in food retailer's nutrition. FAO emphasizes on the necessity of partnerships with regional or international organizations and between farmers and fisher with global companies.

Apart from these measures, it is possible to make an impact even on a more local level of partnerships and collaborations. For example, in California , where 40 per cent of all food is thrown away or plowed over in farms, has been developed a web-based "market place ", named WasteNoFood, where donors (eg grocery stores, restaurants) are connected directly in few seconds with recipients in need . Also, in Copenhagen, a charity has opened the first food surplus supermarket, called WeFood, aiming to reduce the 700,000 tones of the country's food waste (Matt Payton, 2016).

Waste management

The currently consumption driven society produces enormous amounts of waste, estimating 11 billion tons of solid waste every year. Cities are responsible for the majority of it and as urbanization growths it seems that a strategic waste management system would be required. Waste management includes all the activities necessary to manage waste from the start to its final destination. The term waste is related to waste generated to all phases of the production line, for example the extraction, the process into final goods, the consumption. Below will be examined the concept of a zero waste city emphasizing on the disposal of goods after their consumption.

Zaman and Lehmann (p.3,2011) define the zero waste city as the city that recycles the 100 per cent of municipal solid waste and recovers 100 per cent of all resources from waste materials. However, designing sustainable cities is more than challenging. Large amounts of paper waste, over packaging, plastic bags, e-waste, chemicals not only affect the environment but also affect the health and aesthetics as well. Several handling and treatment processes of waste management also emit greenhouse gases, contributing to climate change (Song et al., 2015 as cited in Holgersson, p.9 ,2017).

The zero waste city concept includes different aspects that have been developed over the years as reduce, reuse, redesign, regenerate, remanufacture,

repair, resell (Zaman and Lehmann, p.4, 2011). According to the same study (p.84, 2011) , the authors propose five principles to be applied in order to transform a city into a zero waste city as seen below in the table :

Picture 7 Five Principles in Order to Transform a City into a Zero Waste City (Source : Zaman and Lehmann, p. 4, 2011)

These five principles have to be applied simultaneously and were developed based on the waste hierarchy of "avoid-minimize-recovery". Firstly, behavior change, shifts in lifestyle choices and sustainable consumption will avoid the unnecessary waste. Also, extended producer and consumer responsibility will lead to sustainable choices and ensure ownership of personal waste generation. By just achieving these two steps the environmental impacts minimize and the future generations will benefit by shifting to viable consumption. Total recycling of waste, legislation of zero landfill and a 100 per cent resource recovery from waste define a zero waste city aiming to minimum depletion of natural resources. Each of these principles is analyzed below based on the holistic model proposed by Zaman and Lehmann (p. 85-88,2011) :

Education on Behavior Changes
Societies provide limited education regarding the importance of sustainable consumption so as individuals and social groups to be driven towards sustainability.

However, education is a key element towards sustainable consumption and more funds should be invested in research and innovation in key areas as education and training in order to fight hyper- consumption which has met extremely high levels. Training centers, universities, schools, city campaigns, research centers may contribute to this transition towards a sustainable lifestyle.

Extended producer and consumer responsibilities

Alternatively known as product stewardship, extended producer responsibility is a very important tool to be used for innovational design of a product aiming to avoid and reduce the volume of waste that it generates during the production process. Also, when consumers purchase goods will be responsible for their irresponsible consumptions and extended responsibility is applied for consumers. In addition to this, take back mechanisms can be implemented especially for e- waste (such as mobile devices) in order to ensure that collection and recycling systems are as effective as possible. Furthermore, tax reliefs or bill reductions can be established for those households that achieve a standard percentage of recycling.

100% Recycling Waste

Many high consuming cities are working towards achieving 100 per cent recycling of municipal solid waste as San Francisco. San Francisco aims to completely eliminate trash that sends to fill by 2020 with its innovative legislation that includes construction debris recycling, banning plastic checkout bags in retail and grocery stores and making businesses and residents separate recyclables and food waste from their trash (Katz, 2014).

On the other hand the electronic industry is seeking solutions for the disposal of e-waste which increases constantly and so do the precious metals than can be found copper, rhodium, lithium, gold, aluminum, iron, silver and other in the printed circuit boards, computers, copy machines, and monitors (Zaman and Lehmann , p.86, 2011). The International Telecommunication Union (ITU) has estimated that in 2016 were discarded minerals of total worth of $65 billion. Mining waste can regain materials and reduce the demand of raw materials (Vision 2050,p.24,2010) . There are approximately 20 types of metals that e- waste recyclers can extract (Zaman and Lehmann, p. 85,

2011) and as new materials are becoming scarce and environmentally costly the recovery of landfill waste and by products as methane gas and aluminum is being encouraged (Vision 2050, p.86,2011). The potential for recycling e-waste is estimated to be enormous and still largely unexploited. Still 100 per cent recycling is highly promoted but extremely challenging as well. By designing products with 100 per cent recyclable materials the goal is much more achievable.

Legislate Zero Landfill and Incineration

Zero landfill is considered an important key element of sustainable zero waste cities and many cities are working on 100 per cent diversion of disposal of waste from landfill. Singapore's population has reached 5,5 million people in 700 square kilometers of land surrounded by water. In order to extend the landfill life, Singapore incinerates approximately 8,200 tons of garbage every day, reducing garbage by 90 per cent and the incineration plants produce over 25,00MWh that supports around 900 houses every day (Singhal,2015). Waste incineration is still on rising and it accounted for a fifth of total municipal waste treated in 2009 in 27 EU countries (Zaman and Lehmann, p.87.2011).

100% Recovery of Resources from Waste

Resource recovery from consumption products that were previously thrown away is concerned as a valuable aspect. While hyper consumption has become a common element of developed countries, e- waste, as referred above, and landfill are currently transforming to a hidden treasure. German studies have estimated that the household garbage may contain rare metals enough to cover the whole demand of the country yearly (Zaman and Lehmann , p. 88,2011) .

Green cities around the globe have implemented their systems in order to strategically handle the waste. For example, the city of Songdo, in South Korea, has an automated collection waste that uses underground pipes. Once the trash reaches the facility it gets automatically recycled, burned for energy or buried underground. However the facility is not fully operational yet (Singhal ,2015). San Francisco, the first US zero waste example has developed a comprehensive source program for all sectors. As per Jack Macy, the senior commercial Zero Waste Coordinator at SF Environment in

City and County of San Francisco, the system encourages consumers to take responsibility for what they buy and where they dispose it. Consumers have been trained in order to dispose their garbage to the correct bin (compostable, trash, recyclable), businesses get economic benefits on the rates on their services by recycling and composting, otherwise compliance mechanisms as letters and fines follow.

Behavioral Science Insights on Sustainable Consumption

It is estimated that 91 per cent of global consumption growth will be generated by people living in cities from 2015 to 2030 and 1 billion new consumers in emerging cities will be added by 2025 (McKinsey, 2016). Small, every day choices and actions taken by individuals, impact, as a whole, the planet's natural resources.

Understanding human behavior is necessary in order to recognize the barriers and the challenges towards achieving sustainable consumption. Policymakers around the world are incorporating behavioral science into the design of programs in order to maximize its efficiency and effectiveness. Behavioral science assists in understanding the complexities of consumption decision making, the intentions, the social, physical, mental factors that may influence the action taken (UNEP,2017). In the case of sustainability it is necessary to understand why people are not willing to act in a sustainable way despite their good intentions or despite understanding that their actions have significant impact on the environment, for example people are very resistant on using reusable bags instead of plastic bags. The UNEP's publication (2017) on behavioral science outlines five behavioral barriers to sustainable consumption which are analyzed below:

Choices are lead by habitual behavior

Habitual behavior is not about values, they do not involve mental effort. In order to change these behaviors is necessary to "disrupt the environmental factors that cue habit performance". A real example linked to this was applied in San Jose, California, in order to increase recycling. The city government has replaced the trash desk bins of its 8000 employees with 6 time's smaller bins in order to discourage the disposal of paper and encourage recycling. As a result, the trash service decreased by 50 per cent, recycling increased by 6.3 per cent monthly and trash got much smaller as people got more conscious about their choices.

Consequences of Consumption are not always obvious

The consequences of the use of the resources are not often visible to the households, leading to over consumption. In addition to this, individuals do not understand the

consumption at first place as there is no immediate cost. For example, excessive water or energy use will increase the amount of the next bill but this will not be linked directly to this specific action as consumers will probably receive the bill many months afterwards. The invisible impacts leads the individuals to procrastinate their "good actions" by pushing their good behavior into the future, e.g. next time I will recycle.

Sustainable Consumption is not taken personally

Individuals are experiencing cognitive dissonance as they are aware of the existence and the implications of a problem but at the same time fail to realize that the implications are significant or personally affect them directly. For example, a 2007 US survey to individuals about how serious is climate change, forty per cent of respondents replied that climate change was a threat for "people in other countries". By using personalized information and feedback, it might be possible to address and affect the consumption choices. The more personal and customized the information will be the more likely is for the individual to respond.

Social Groups and Associates Affect Behavior

The consumption patterns are influenced by the social norms, especially in times of uncertainty. When the individual is not aware of what is right or wrong he will possible take his behavior from other sources e.g his associates and override his beliefs. This example shows just how difficult is to act on reverse and opposite to the social norm. For example, in car owned societies where cars are defined as key elements of success is too easy for an individual to abandon his noble intention. Another factor is identity, the way individuals see themselves, which can be affective any time by the surroundings and the experiences one may have.

Sustainable decisions are difficult to take

This principle is based on the choice architecture, how consumers get the sustainable option (purposefully or not). A German study showed (as cited in UNEP, p.15, 2017) that when customers were asked to choose between renewable energy and conventional, the majority opted for the renewable despite the higher costs. In the

case where the conventional was presented as the default option the rate dropped. This example points out the importance of the default option that is being set and highlights the potential benefits of making the sustainable option the default one.

In order to seek solutions to a problem it is necessary to identify the situation and the context that the problem exists. Datta and Mullainathan (as cited in UNEP,2017) describe the approach that must be taken during the resolution procedure. The first step is the definition of the problem and the development of an adequate understanding of its characteristics. Once achieved, it is necessary to diagnose the barriers to action and at this step is required to use the behavioral science in order to understand and estimate the barriers that hold back from decision making. Based on the conclusions of the previous steps one can proceed to designing the appropriate solutions, test capable interventions and evaluate its effectiveness.

Conclusions

Today's cities are facing difficulties thriving economically and at the same time securing the benefits of its environment and citizens. Global challenges will be confronted by local actions as cities have to respond to their challenges.

The analysis of the literature revealed a significant body of information in the fields to be redesigned sustainably within the city, as mobility, energy, waste and water management and disaster risk reduction. The literature provides a significant amount of scattered information on metrics, systems, innovative technologies that can be applied in order to move from the conventional approach that cities are currently on towards a more sustainable approach.

In addition, the majority of the bibliography discussed in the paper provided extensive information on the evolution and progress of each field in the last decades. On one hand, these overviews, found in journals and publications are necessary to understand the importance and have a holistic view but it does not provide material for a fruitful research. Indeed, there is a significant gap on how cities are going to achieve sustainable targets. In particular, there is limited literature providing complete information on how cities are supposed to take action to achieve significant results. The literature mainly emphasizes on the steps to be taken prior to action, for example identifying the current situation, the challenges, the strengths and the weaknesses, setting the targets and less information is available on the methodology to undertake to actually achieve this and have as well a smooth transition based on the characteristics of the city. The sustainability reports and the city leaders discussed in the paper may be used as a handbook and as an example of other cities to follow but still the city's individual characteristics and "DNA" has to be taken under consideration.

However, based on the descriptive analysis of habitual behavior it is proved that decision making, environmental awareness, social groups and knowledge may have a significant impact on sustainable actions and lifestyle. As a result, it is not only what amenities cities provide to citizens, for example recycling bins or upgrading building programs but is also how people respond to consumerism. As described in the paper, despite the fact that people understand that their actions might not be "correct", compared to a sustainable lifestyle, e.g. buying plastic bags in markets, still

this understanding is not enough to change their decision. There is a relationship between cities and citizens that requires actions from both sides in order to reach remarkable and long lasting results and it could be that citizens have a role and a power far more important that is widely considered.

For future research, a topic to be explored could be the mind shift of urban societies towards sustainable options and the possibility of setting sustainable decisions as default options instead of alternatives. Also, there is a significant work remaining in sustainability transformation and in the development of action plans by engaging all stakeholders, developing programs, regulations, tools and financing sources. Also, it is necessary to provide solutions on collaborations between the city and all the sectors of the societies for example NGOs, private sector, and the government and between cities as well.

Cities have to focus on several aspects and need to develop a stable policy in a very dynamic environment. City leaders have already marked the road and were discussed in the paper, however it is high time for other cities to initiate their journey towards becoming sustainable, economically thriving, inclusive, resilient and responsive.

Bibliography

Agenda 21. (1992). Rio de Janerio: United Nations Conference on Environment & Development, pp.18-22.

Arcadis Global (2016). *Sustainable Cities Index 2016*. [online] Arcadis Global, pp.10, 34-35.
Available at: https://www.arcadis.com/media/0/6/6/%7B06687980-3179-47AD-89FD-F6AFA76EBB73%7DSustainable%20Cities%20Index%202016%20Global%20Web.pdf [Accessed 18 Jan. 2018]

C.A. Howe, K. Vairavamoorthy and N.P. van der Steen (2012). *SWITCH Sustainable Water Management in the City of the Future*. The Netherlands: SWITCH Project UNESCO-IHE, pp.29,35-55,66-79.

Cities Today - Connecting the world's urban leaders. (2017). *Dar es Salaam wins 2018 Sustainable Transport Award*. [online] Available at: https://cities-today.com/dar-es-salaam-wins-2018-sustainable-transport-award/ [Accessed 8 Dec. 2017].

Climate Neutral Cities. (2011). New York and Geneva: United Nations UN, pp.37-68.
Copenhagen, Green Economy Leader Report. (2014). London School of Economics and Political Science, pp.15,45-89.

Digitaljournal.com. (2017). *Minerals in e-waste discarded in 2016 were worth $65 billion*. [online] Available at: http://www.digitaljournal.com/tech-and-science/technology/the-minerals-in-e-waste-discarded-in-2016-was-worth-65-billion/article/509936 [Accessed 18 Jan. 2018].

Food wastage footprint : Impact on Natural Resources. (2013). Food and Agriculture Organization of the United Nations FAO, pp.40-65.

G.H. Brundtland, Our Common Future, 1987 (Report of the World Commission on Environment and Develepoment, Oslo).

Gino Van Begin, Monika Zimmermann (2015). *ICLEI Seoul Strategic Plan 2015-2021*. [online] Bonn: ICLEI - Local Governments for Sustainability e.V. Available at: http://www.iclei.org/seoul-strategic-plan [Accessed 19 Dec. 2017].

Han, J., Fontanos, P., Fukushi, K., Herath, S., Heeren, N., Naso, V., Cecchi, C., Edwards, P. and Takeuchi, K. (2012). Innovation for sustainability: toward a sustainable urban future in industrialized cities. *Sustainability Science*, 7(S1), pp.91-100.

Kelly, R. (2016). *Food losses and waste: a challenge to sustainable development*. [online] Earth Overshoot Day. Available at: https://www.overshootday.org/food-losses-and-waste-a-challenge-to-sustainable-development/ [Accessed 18 Dec. 2017].

McKinsey Global Institute (2016). *Urban World : The Global Consumers to Watch*. McKinsey&Company, pp.10, 15, 20-25.

Mega, V. (2010). *Sustainable cities for the third millennium*. New York NY: Springer.
Payton, M. (2016). *The world's first food waste supermarket has opened*. [online] The Independent. Available at: http://www.independent.co.uk/news/world/europe/denmark-food-waste-supermarket-we-food-copenhagen-surplus-produce-a6890621.html [Accessed 18 Nov. 2017].

Petit-Boix, A., Llorach-Massana, P., Sanjuan-Delmás, D., Sierra-Pérez, J., Vinyes, E., Gabarrell, X., Rieradevall, J. and Sanyé-Mengual, E. (2017). Application of life cycle thinking towards sustainable cities: A review. *Journal of Cleaner Production*, 166, pp.939-951.

Resilient Thessaloniki : A strategy for 2030. (2017). Thessaloniki: Municipality of Thessaloniki, Pioneered by The Rockefeller Foundation 100 Resilient Cities, pp.17, 80-120.

Sendai Framework for Disaster Risk Reduction 2015-2030. (2015). Sendai: United Nations, UN, pp.5,14-16.

Singhal, A. (2015). *Friday Fun: How to create tomorrow's green cities with today's garbage | TheCityFix*. [online] TheCityFix. Available at: http://thecityfix.com/blog/friday-fun-green-cities-garbage-trash-waste-management-sustainability-aaryaman-singhal/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+thecityfix%2Fposts+%28TheCityFix%29 [Accessed 18 Jan. 2018].

The 7th World Water Forum (2015). *The White Paper*. Republic of Korea: The 7th World Water Forum, pp.15, 20-25.

Tokyo Disaster Prevention Plan : Becoming the World's Safest , Most Secure City. (2014). Tokyo: Tokyo Metropolitan Government, pp.20-29.

Un.org. (2012). *United Nations Official Document, The Future We Want*. [online] Available at: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/66/288&Lang=E [Accessed 5 Jan. 2018].

Unisdr.org. (n.d) *What is Disaster Risk Reduction? - UNISDR*. [online] Available at: https://www.unisdr.org/who-we-are/what-is-drr [Accessed 9 Jan. 2018].

United Nations Environment Programme, UNEP (2017). *Consuming Differently, Consuming Sustainably: Behavioural Insights for Policymaking*. United Nations Environment Programme, pp.9-39.

van Leeuwen, C. (2013). City Blueprints: Baseline Assessments of Sustainable Water Management in 11 Cities of the Future. *Water Resources Management*, 27(15), pp.5191-5206.

World Business Council f or Sustainable Development , Vision 2050. (2010). World Business Council f or Sustainable Development, pp.24,86.
Wwf.panda.org. (n.d.). *Sustainable mobility*. [online] Available at: http://wwf.panda.org/what_we_do/footprint/one_planet_cities/sustainable_mobility/ [Accessed 18 Jan. 2018].

Yale E360. (2014). *Putting San Francisco On the Road to Zero Waste*. [online] Available at:
http://e360.yale.edu/features/interview_jack_macy_putting_san_francisco_on_the_road_to_zero_waste [Accessed 18 Dec. 2017].

Zaman, A. and Lehmann, S. (2011). Challenges and Opportunities in Transforming a City into a "Zero Waste City". *Challenges*, 2(4), pp.73-93.