Manifesting sustainability: The Triple Ripple Effect

-The contribution of sustainable cities-

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This thesis is dedicated to:

My parents, for keep encouraging my talents and interests, and letting me become the person I shall truly be…

To Petya and Steliana, for keeping me safe when I am flying fearlessly towards my dreams…

To Phoenix, for planting a seed inspiring for endless manifestation…

Abstract

Sustainability is the hot topic of the century. Realizing the dangers of climate change upon the planet and human kind, have put sustainable development in the center of many academic and practical researches. The thesis is dedicated to investigating the contribution of cities in sustainable development through presenting the entanglement among their perspectives and the theoretical discoveries in sustainability.

The cities of Copenhagen and Rotterdam have been the leaders in sustainable development, based on a research which contemplates sustainability in a rather new approach, presented in Chapter 4. Based on the report from Arcadis (2015), and the theory background of John Elkington (1994), it has now become possible to measure sustainability in a more effective way. What makes this approach better is its interaction with three different dimension; or as they were referred to in the thesis – "three pillars of sustainability". Of course, there are many different angles through which sustainability has to be investigated in order to be measured and defined as precisely as possible. However, the finesse of the "Planet, People, Profit" framing is coming from its focus on the three fundamental perspectives of human existence, and their strong entanglement among each other.

It is important to understand that those three sides of existence represent the most efficient grouping of needs and goals, in the aspect of society and society's relation with the external natural and artificial environment. The cities of investigation have been put in this "box", while also considering climate change effects. Therefore, it is interesting to observe how the strategies and mechanisms they have chosen are always affecting all the pillars. This founding became particularly intriguing through the process of investigation in this thesis. The result of the chosen strategies is that progress has to be made in all of those dimensions. Which is a conclusion that adds even more value to the importance of the chosen framework for investigating sustainability in this thesis.

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Chapter 1: Introduction: Moments of revelation

Where is the world heading to?

History shows that we have been striving for economic development for centuries. Growth consumption has become the focus of all satisfaction, as a source of mental and physical fulfilment. Or at least, that was the common perception of reality, till not so long ago. Then a shift of understandings occurred and material possessions were not quite enough anymore, nor were they able to produce as much added value as before.

Fulfilment can be approached from two sides. For decades, the economic development has been broadly defined as […efforts that seek to improve the economic well-being and quality of life for a community by creating and/or retaining jobs and supporting or growing incomes and the tax base] (Salmon Valley Business and Innovation Center, 2011). Fortunately for the corporations which benefited from this kind of economic development, that was a magnificent way for the world to be perceived by society in general, and has stayed as a main point of view since the start of the Industrial Revolution in 19th century. Unfortunately for these corporations, in the last decade, the concept of society of consumption started reaching its peak, which led to a sense of expected saturation. This trend entered the lives of members of communities, as well as whole corporations.

That brings us to the emergence of the second principle of human fulfilment; which is more fundamental. It, indeed, puts the philosophical side of existence of humans in the spot light. We, as human beings, have become more aware of the outcomes of our actions – both negative and positive.

This awareness has allowed us to renew our connection with the world around us, in a planetary sense. Through acknowledgement of old mistakes and evaluation of present actions, we have become more informed on the impact we have on our planet. Considering the more recent global state of mind, which prevented us from seeing the connection between actions and outcomes, this new perception of the world is revolutionary. In fact, it is not revolutionary only as a causality between actions and outcomes. Opening our eyes to the realization of human impact on environmental level, and increased empathy for the human race in general, has become the source of many innovations and ground breaking discoveries, which would have not been possible to manifest in the conditions of the old paradigm, or as referred to above – the society of consumption. Excellent examples for outstanding discoveries, which have changed the course of development, are the boom of new technologies for utilizing renewable resources and technologies which help us understand the world around us better, and beyond; philosophical ideas resulting in initiatives for increasing awareness among various communities; extraordinary collaborations between nations, etc. Therefore, the "step taken back" to assimilation of the fundamental perceptions of existence and symbiosis with the surrounding natural environment, is in fact a step forward for humanity (as a species and origin of civilization).

With the emphasis put on the outcome of our actions as a species, a new concept emerged and is gaining more attention ever since it has been officially introduces to the world in 1987. Sustainable development is now one of the most important topics on the global scale. It is uniting good intentions, creative solutions and profound breakthroughs, connected with human perceptions of existence and way of life. These are among the factors that make sustainable development an extremely interesting topic of examination by not only challenging the status quo. Moreover, as a field of investigation, it has the power to challenge one's mind by questioning and enriching current knowledge and one's personal paradigm of the world.

Even though there have been many researches and examinations in the topic of sustainable development, it is still hard for us to thoroughly define sustainable development. Moreover, we are still on our way to completely understand the concepts and mechanisms that need to be present in order for sustainable development to be manifested successfully. This is due to the complicated nature of the subject. Sustainable development entangles many different dimensions which are constantly influencing each other, and at the same time cannot be objectively examined nor improved by taken as a single element. Rather, the realization that they are bound together and are influencing each other is the key to getting closer to the true capacity of sustainability and the great positive effect it has on human kind and the planet itself.

Personal motivation

The personal stimuli behind investigating sustainability is dreaming about what the future holds for humanity. Living in a world with balanced usage or resources, compassion and global unity, is something to live for. As futuristic as it may sound, we are closer to it than ever before. But in order to get there dreaming is not enough. There are decisions and actions which have to be made in order for a better future to become a reality. Investigating the present development of society from economic and environmental perspective allows us to form a solid foundation upon which a brighter future can be build.

Projects like One Community Global and Venus Project have ignited a passion in me, increased the hope and enhanced the determination of my personal and professional growth, to be dedicated to direct involvement in sustainable development of human kind.

My personal admiration towards the concept of sustainability and its expected influence on the planet and the development of human civilization, has been triggered by the realization that sustainability by itself represents innovation in a new dimension. This is not just an innovation which expresses itself through separate inventions. This innovation is more powerful, in a sense - it is so rapid that it leads to changes in the paradigm of human perception as a whole, regarding the connection between humans and environment, through emphasizing the relation between human activities, and their influences and outcomes. In other words, my personal paradigm sees sustainability as synergy generated from transition between paradigms, including materialistic and philosophical understandings of the world.

Motivation behind choosing cities as a unit of analysis

With the increased attention given to sustainability and sustainable development the number of researches in the field keeps growing. Thus, allowing for deepening the understanding of complexity of the concept, as well as the precautions and actions humanity has to take in order to achieve fulfillment and improve well-being, living conditions on the planet and creating a better future for generations to come. When we are getting into the topic of sustainable development of human existence, we have to put the emphasis on the global scale. Therefore, it's important to specify that on a global scale the smallest units of analysis are cities, settlements and rural areas. In this thesis, the emphasis will be put on cities. This unit of analysis has been chosen because of the level of importance of cities, revealed through the current trends in demographic dispositions and the expected tendencies of population growth. Cities are the most popular urban areas nowadays, with the tendency to become the most preferred location for personal and professional development of people, from all around the

world. This forecast has been supported by United Nations research (2014), revealing that more than 54% of the world's population is currently living in urban areas, with the expectancy of this share to increase with more than 10% till the year 2050.

The fascination with this tendency have not only inspired many to focus on cities as the unit of analysis, but has also brought up the question of the direction of civilization development. With the increased concern about the future of humanity and its entanglement with climate change, the observations have been enrichened with the acknowledgement of economic, social and environmental dimension. Which, based on statistical reports, theory expansion and concept formulation, have turned into the three pillars of evaluation of sustainable development, and by thus, the "ground zero" for many modifications of perceptions, as well as placing the spot light on the question "What is the meaning of development for human kind, from this moment forward?"

Therefore, the thesis aims to represent the good practices and creative innovation thinking that have contributed successfully to developing sustainability in cities. A process of evaluation has been executed in order for choosing the cities which fit for purpose of investigation here. The result from the evaluation has determined Copenhagen and Rotterdam as most appropriate.

Investigating cities which have already reached a high level of sustainability, was not an easy task. On the contrary, it was challenging for the current perception of relation between economic development, human well-being and social transformation. Copenhagen and Rotterdam have proved to be a great unit of analysis since they are among the core innovators in the global canvas of sustainable development, classified in the top 5 of most sustainable cities in the world. Through implementing innovative solutions in infrastructure, business environment, social involvement, etc., the leaders in sustainable development have been able to unleash their own potential of sustainability. It is interesting to observe that the inspiration and execution of strategies has not been oriented towards materialistic satisfaction. The approaches and taken actions are beautifully justified by the complex relation between the three pillars of sustainability. Which made it possible to see that economic, social and environmental dimension did not simply restrain development in order to achieve sustainability. Moreover, they have proven to be stimulators for revealing and inspiring the sustainable potentials of an urban area, and are actually the gates through which sustainability can be guided in future, by rising fundamental questions which goes beyond the consumption paradigm.

The motivation for choosing Copenhagen and Rotterdam is not only extrinsic. There is a personal justification of the choice made for the subjects of investigation of the thesis. Copenhagen and Rotterdam truly represent a limitless source of inspiration and admiration. Their acknowledgement of the importance of sustainable development is probably what helped them reach the world's top 5. As

subjects of investigation, they show increased focus on the ways to build a better future. As it will be revealed in following chapters, the cities hold many good ideas and practices for overcoming issues that cities are facing, in the current state of planetary environment. Those urban areas set up a great example filled with innovativeness and boldness, by implementing strategies, procedures and realizing initiatives for expanding the awareness of their citizens; and by thus influencing the global canvas of perception of sustainable development.

Research question

My personal observations, over the common paradigm of the world, go beyond the consumption society. When future is being discussed, there is a tendency of breaking away from the present. Humanity has reached a point of development where the craving for better future is growing rapidly. However, the down side of this stimuli would be forgetting the present. Today is the time when the foundations for a better future are being shaped. Guiding the direction of development from now to the future is the right approach to prosperity. Therefore, it is crucial to investigate how the results from human development till the present days are influencing the human development of the present, and the future. By investigating the present we would be able to receive answers to many questions, such as:

- How do human activities affect the environment?
- What is the extent of the negative impact of human development over the planet?
- What are the mistakes and what would the solutions be?
- How important is the entanglement between economic, social and environmental dimension?
- What has to be done, from here on, in order to achieve sustainable development?

These are just some on the questions which have found answers in this thesis through consideration of both material growth and expansion of consciousness. They are also the source of inspiration for the formulated research question. With the complexity of the subject of sustainable development, the research question does not consist of all the questions there are to be answered, and is not meant to give the ultimate answer of how to achieve sustainability. However, the purpose of the research question is to help understand sustainable development, inspire, provide guidance and advice, and thus contribute to sustainable development at a global scale. We live in a world of free exchange of information and knowledge. Therefore, sharing that knowledge is the way to move forward to a goal that is now beyond individualistic existence of humans. Rather, in order for the better future to break out of the dream world and turn into reality, collaboration on a global scale is needed, in a world where the right of equal well-being is a standard measure.

Research question:

What is the role of cities in sustainable development?

Sub-research questions:

1. “What are the cities solutions for sustainable development?”
2. “What is the impact of the sustainable solutions on the dimensions of People, Planet and Profit?”
3. “How can we improve sustainability through the dimensions of People, Planet and Profit?”
4. “Can the sustainable solutions be implemented in other urban areas?”

Chapter 2: Methodology

This chapter will reveal the process behind forming the idea of this thesis. It will proceed with the approach taken for the answer to the research question, stated in the previous section. An explanation will be further presented regarding the five sub-research questions, which helped reaching and justifying the proposed answer in Chapter 6. The analysis of the thesis has been conducted through the research method of case study, therefore this section will have the following structure:

- Why has this research method been chosen for this thesis?
- Design of the case study
- Data collection through case study
- Analysis of the data through a case study

Defining case study as a research method

The formulation of the research question defines it as a descriptive question. According to Shavelson and Towne (2002), the type of the question serves as a proposition of the chosen method for its examination. Accordingly, the research method applied in the thesis is a case study research.

The definition of a case study according to Yin (2009, p.18) is that it represents [an empirical inquiry about a contemporary phenomenon (e.g., a “case”), set within its real-world context—especially when the boundaries between phenomenon and context are not clearly evident].

This definition represents to a big extend the reason for choosing the approach of a case study for examining the topic of sustainability through sustainable development in urban areas. By presenting the two cases of Copenhagen and Rotterdam, an opportunity has emerged for a clearer inside leading

to understanding the real aspects of sustainability, going beyond the exposed theory. This has really been an advantage because of the access it gives to the real-world context (a concept discussed by Bromley, 1986). Understanding the real-world context is crucial for the attempts of defining and investigating in depth the concept of sustainability. It allows testing the available theory on the matter, and by thus giving the possibility of enriching it. It has to be acknowledged that sustainability is relatively a new topic of observation from scholars and practitioners. Therefore, attempts of obtaining a more realistic perception of sustainability are especially important for the further development and progress in this area, and the research question.

Design of the case study

The motives that set the reason for choosing case studies for the purposes of investigation of the thesis were driven by the main definition of sustainability, proposed by the United Nations Habitat program. United Nations present sustainability as the [development that meets the needs of the present without compromising the ability of future generations to meet their own needs] (Arcadis, 2015).

Based on this definition, few questions emerged. It is true that sustainability is a global initiative. However, by observing global development, it becomes visible that different urban areas have different level of development, in the dimensions of people, planet, and profit. This is a reason for dividing regions on developed and developing urban areas. Both types of regions have an influence of the success of global development. Nonetheless, considering the formulation of the research question *"What is the role of cities in sustainable development?"*, it has come to my notion that investigation of developed urban areas is more important, in a sense that through examining their cases, solutions can be revealed, which can contribute to introducing and implementing sustainability in both types of areas. In other words, I have examined the cases of two developed urban areas in the concept of sustainability. Therefore, the case study design of this thesis is embedded, multiple-case study.

Following this idea, I have made a researched through academic and business sources, performing evaluation and comparison between developed urban areas. The results from this first stage of research ended in using the Triple Bottom Line (Elkingron, 1994), and its more recent form – People, Planet, Profit index (Arcadis, 2015). The detailed examination of Arcadis' report (2015) has resulted in noticing Copenhagen and Rotterdam as leaders in the field of sustainability on a global scale. The framework has been thoroughly explained in Chapter 4.

Another motive, for proceeding with the cases of those two urban areas, is their geographical disposition. On one hand, they are both delta cities, which is a prerequisite for similar climate conditions. This is an important factor since the general "box" in which sustainability has been looked

upon in the thesis is climate change. On the other hand, Denmark and Holland are both countries which are economically well-developed. They have also been making progress in changing the overall approach of country development towards more environmental friendly existence (UNDP, 2012). The third motive, which is highly related to the previous one, is the fact that those cities have already been making steps towards connecting with external influences in the face of businesses abroad (Vonortas, 2009). This gives them one more advantage as being defined as proper case studies, by expanding their role in sustainable development beyond their national borders.

Nonetheless, the choice made for case studies is connected with the theory to the extent of the boundaries which it represents in the formulation of sustainability. In the presentations of the cases, theory has not being included to the real-world examination. Rather, after completing the analysis of Copenhagen and Rotterdam, the collected evidence has been related to the theory in order to prove the entanglement between the so far gained knowledge about sustainability, and it further importance, relevance and role in defining the role of developed urban areas in global sustainable development. Considering the presence of sub-research questions: “What”, “Why”, “How”, “Is it possible”?, the design of this thesis has followed the process of involving literature and real-world data, with the purpose of unfolding a well-developed and justified answer to the research question.

Data collection through case study

The data has been collected by using multiple sources. Through a research for the sustainability approaches of both cities, I have found reports connected with their sustainable solutions, climate adaptation plans and empirical data, based on the implemented strategies in the urban areas. The main sources used in the presentation of the cases of Copenhagen and Rotterdam are mainly produced by their municipalities. However, the information presented from the municipalities have been collected through collaboration with the meteorological institutes, accordingly to the country, as well as government administrations, and third parties involved in examination and prediction of climate changes, and executions of the solutions in question.

Furthermore, the cases have been enrichened by information conducted by external sources, such as media coverage of the progress of the urban areas through the years, private organizations’ reports, as well as official brochures for attracting multinational business involvement in the areas. On the other side of the picture, the theory collection is also important since it has set a big part of the framework in which the investigation has been developed. The theory has been conducted through examination of multiple literature sources from many academics, covering the progression of sustainability concept and implications, from the early 90s to nowadays. The theory selection in the

data collection reflects different parts of sustainability and sustainable development, which has helped establishing the right direction for answering the question of investigation.

Analysis of the data through a case study

The way the case studies of the urban areas has been shaped is meant to expose in more depth the sustainable solutions that are being integrated in the cities. The analysis of the data has been based on a qualitative data, rather than quantitative, even though both of them are present in the thesis. The approach chosen for analyzing the data has been following the steps of explaining the solutions implemented in both cities, separately. The motive behind this attempt has been the purpose of presenting the solutions in a way that allows comparing them later on. The comparison has been performed in the discussion part of this thesis, as part of the answers needed for the research question.

In other words, it can be said that the analysis of the real-world data has been unfolded in two ways in the thesis. First, by presenting thoroughly the collected information of sustainable solutions of Copenhagen and Rotterdam. However, that was not enough to formulate an answer to the research question. Therefore, the second part of analyzing the data has been performed in summarizing the results, by entangling them with the involved theory of the thesis, and the set framework of sustainability. This has been a crucial moment in the process of answering the research question.

Limitations

It is true that the cases were formulated in a way meant to enrich the perspectives of sustainability in the real world. However, they were not enough by their own to unfold the whole picture of sustainable development. Therefore, entangling with the other two dimensions of the thesis – theory and framework was necessary. In order to answer, as precisely as possible, the research question, sub-research questions have been formulated. The answers to those questions have been reached by making further connections between reality, theory and framework. Thus, the achieved result represents an answer which has been reached through the limitations three different angles used in this thesis – real-world, theory, framework limitations.

Chapter 3: Theory

Sustainability

History of sustainability: How did we get here?

We live in a time when a lot of people, organizations and institutions start recognizing the importance of the future. To be more precise, it is not just a general idea of a future that has been developed and growing through the past years. Rather it is the idea of having a sustainable future through building sustainable present. Through the years there has been an evolution in the way of perceiving the surrounding environment in regards of society itself and nature. It is important to remember that the path that has been walked till nowadays, where there is a global awareness of the threats human race is facing, is a long one. Therefore, it is important to acknowledge the main milestones in history of mankind that laid the base for the "modern craving" for sustainability.

The history of sustainability emerged with the development of the earliest civilizations and goes all the way till modern times. It is very much connected with the impact human race have had on the Earth. Kramer (1988) summarized that among the first civilizations were the ones that has emerged in India, Peru, and China and in parts of Eastern Europe. If we go all the way back to human history, there are evidences pointing that with the depletion of local resources, the communities started developing different tools and strategies with which to enrich their stock of resources for food and shelter. This

huge step for mankind may have had an impact of the natural diversity of plants and animals in certain areas. (Kramer, 1988)

Based on archeological evidences presented by Kramer (1988) we now know that the first civilizations were situated in Sumer, Mesopotamia and Egypt, around 3000 B.C.E. All those old cultures have set the beginning of agricultural development. This set of events have given the certainty of early people to settle down at one place and form a bigger community by helping each other and improving chances for survival, in present and future. The agricultural development required forming of an irrigation system, which resulted in bureaucracy, political hierarchy, along with religious sanction and forming armies to protect the early forming civilization. Unfortunately, evidences also prove that with the development of the agriculture and providing a higher degree of safety for the community, there was an exponential population increase which have led to rapid growth. Because the young civilizations had not yet developed systems that could handle efficiently the growth of the agricultural demand, the result was increase of floods and deforestation. These events were followed by decrease in the population and decline of the young civilization. The conclusion of many researches in economy, history and archeology (History of Sustainability, 5 April 2016) are presenting the idea that the poor management of resources led to diminishing whole civilizations.

Taking a leap further in history, the next important milestone is the transition to **industrial societies.** Mastering different technologies and tools for centuries gave the opportunity for humanity to have more control over the environment. However, the seeds for the emergence of industrial societies were planted in the 18th and 19th century with the industrial revolution (Rostow, 1960). With the industrial revolution the potential of fossil fuel energy came on focus. Coal became the source or powering different engines and later on was used to generate electricity. According to Hilgenkamp (2005), the mastering of energy also reflected on areas such as medicine, technological and scientific growth and industrialization. For only 200 years the human population on the planet doubled. As history repeats itself, names as *Thomas Malthus, John Stuart Mill* and *Eugenius Warming*, among others, started foreseeing a disaster coming, considering the risks of “overpopulation”, the importance of “ecological economics”, and “ecology” itself; also reflected upon by Martinez-Alier (1987), Schumacher (1987) and Daly (2004).

By the beginning of 20th century the increase of human population started effecting the rates of consumption. Even though the increase in health and wealth was considered as a sign of progress, the increased levels of resource consumption required an action. In the 1930s, models for **managing non-renewable resources** started to emerge for developing a sustainability of the economy using non-renewable resources. Different disciplines has been added to the scientific pool and various concepts

influencing sustainability came on focus. Worster (1994) considered that three aspects are particularly important:

- the interconnectedness of all living systems in a single living planetary system, the biosphere;
- the importance of natural cycles (of water, nutrients and other chemicals, materials, waste);
- the passage of energy through trophic levels of living systems.

After the Great Depression and the World War II, during the 1950s the world entered the next period of growth, described as [great acceleration ... a surge in the human enterprise that has emphatically stamped humanity as a global geophysical force] (Robin, 2008, p.2). This was **the beginning of environmentalism**. Different environmental gatherings started to form and pointed out that there is an environmental cost of the usage of the planet's resources in the way that they have been consumed thus far. These were also the times when innovations in plastics, nuclear energy and synthetic chemicals took place. These innovations combined with the increasing usage of fossil fuels had a great impact on the transformation of society. The American geoscientist M. King Hubbert predicted a peak in oil production, originating in the United States and then making its way around the world by leaving a huge impact (Grove, 1974). During that time, concerns about pollution, consumerism, population increase and the uncontrolled exploitation of the limited resources of the planed started to emerge, finding their expression in books such as "Small is Beautiful" by E.F. Schumacher in 1973, and "The Limits to Growth" by the Club of Rome, in 1975.

Few years later, 1973-79, the energy crises occurred. This revealed how dependent on non-renewable energy resources the global community was, and environmental problems became global. While the developed countries were considering the threats of uncontrolled development, the developing countries considered development itself as essential for solving their poverty problems and increasing the living standards (History of Sustainability, 5 April 2016). Later, the United Nation's World Commission on Environment and Development (1987) admitted that **development has to be sustainable**. This was essential with its means to meet the needs of the poor without having a negative impact on the environment. In 1961 almost all countries around the globe had the potential to meet their own needs based on their own resources. However, World Wide Fund for Nature (2008) presented that the population growth played its role, and in 2005 many countries were able to meet their demand only by importing resources from other areas. One of the taken strategies was increasing public awareness and introducing recycling, as well as discovering renewable energies. The first step towards renewables was taken in 1970s-1980s, mainly represented by wind turbines, photovoltaics and hydroelectricity. The next stage of empowering through renewable resources occurred in 1980s-

1990s through the development of the first solar and power plants. (Southface Energy and Environmental Resource and TelosNet, 2016).

Followed by all the history events of learning how to manage our limited planetary resources, we are now in the stage of **global awareness**. [The climate system is already moving beyond the patterns of natural variability within which our society and economy have developed and thrived. These parameters include global mean surface temperature, sea-level rise, ocean and ice sheet dynamics, ocean acidification, and extreme climatic events. There is a significant risk that many of the trends will accelerate, leading to an increasing risk of abrupt or irreversible climatic shifts]. (Copenhagen Climate Council, Congress, 2009)

Importance of sustainability

If we look at the past and the present we will notice a drastic change in the development of humanity, as well as a major change in the conditions of our environment. The era in which we are today has been defined by Paul Crutzen and Eugene Stoermer as the *"Anthropocene".* This term defines modern times […as being human-influenced, or anthropogenic, based on overwhelming global evidence that atmospheric, geologic, hydrologic, biosphere and other earth system processes are now altered by humans]. (Anthropocene, April 2016)

This period has already been recognized as a crucial moment in human development, progress and preservation. Chapter 3 revealed many ways in which human kind have tried to manage progress and to survive, through the ages. Unfortunately, history also shows that after some time all the methods have proven not to be good enough to meet the end goal – roughly said, long term preservation of human civilization. Returning back to the present, if we want to manifest [improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities] (UNEP, France, 2011). It is important to notice that there are specific steps that have to be taken in order to overcome possible negative future outcomes. Along with the formulation of these steps, their execution, however, requires a new approach. It is humble to say that this is a great challenge for the perception of existence society have had thus far. Our world is changing every day. Therefore, the focus needs to be not just on sustainability, as a tool to create a better future, but also on adaptation – as a big part of the methods for achieving sustainability.

In order to be able to develop successfully sustainability there are some factors that need to be recognized and respected: Planetary boundaries; Human well-being on social relations and fairness; Growth not based on material consumption. (United Nations, Rio+20 Conference, 2012)

Creating a better future: Shift of perceptions.

It is clear that the path we were on till now was the wrong one, in long term. However, we do have the possibility to choose to change it. And instead of keep developing and maintaining a society that is led by consumption, we now have the capacity to choose a different goal. Manifesting sustainability will allow us to protect and restore nature, to achieve fairness on social and intergenerational levels, stabilizing population (United Nations, Rio+20 Conference, 2012), and therefore improving the well-being of humans of today and the future generations.

"Contrary to the conventional wisdom, it is business as usual that is the utopian fantasy; forging a new vision is the pragmatic necessity."

Paul Raskin et al. 2002

A change of perception in our view of human impact on nature has to be made. The rules that we have had thus far are not effective anymore. Sustainability is a concept that is relatively new, and it completely changes and challenges the status-quo. Nonetheless, it is far from impossible. The time we are now in is the first time in documented human history, where we have enabled ourselves to communicate without borders; have reached a tremendous peak in science and innovation (Wong et al., 2005); technological progress is flourishing by the day (Giplin, 2000); constant exchange and expansion of knowledge; etc. All those achievements, occurring through the development of our civilization, are making global awareness possible, thus it sets the start for manifesting sustainability, developing sustainable ideas and implementing sustainable strategies.

According to Report to the United Nations for the 2012 Rio+20 Conference (2012, p.12), there are certain requirements that have to be met in order to make a transition from the current state of economy and development to sustainable world. It is important to acknowledge that:

- We live in a finite world with limited resources;
- Developing well-being requires more than just material consumption;
- Change of growth goals – shifting from the desire of limitless growth to goals for material sufficiency and equitable distribution;
- Redesigning the world economy for preservation of well-being and creating balance between natural, social, human and built assets.

Table 1 The basic characteristics of the current economic model, the green economy model and the ecological economics model. Source: "Building a sustainable and desirable Economy-in-Society-in-Nature". Source: United Nations, Rio+20 Conference, 2012, p. 2-3

	Current Economic Model	Green Economy Model	Ecological Economics Model
Primary Policy Goal	**More**: Economic growth in the conventional sense, as measured by GDP. The assumption is that growth will ultimately allow the solution of all other problems. More is always better.	**More but with lower environmental impact**: GDP growth decoupled from carbon and from other material and energy impacts.	**Better**: Focus must shift from merely growth to "development" in the real sense of improvement in sustainable human well-being, recognizing that growth has significant negative by-products. More is not always better.
Primary Measure of Progress	GDP	Still GDP, but recognizing impacts on natural capital.	Index of sustainable economic welfare (ISEW), Genuine progress indicator (GPI), or other improved measures of real welfare.
Scale/carrying capacity/role of environment	Not an issue, since markets are assumed to be able to overcome any resource limits via new technology, and substitutes for resources are always available.	Recognized, but assumed to be solvable via decoupling.	A primary concern as a determinant of ecological sustainability. Natural capital and ecosystems services are not infinitely sustainable and real limits exist.
Distribution/poverty	Given lip service, but relegated to "politics" and a "trickle-down" policy: a rising tide lifts all boats.	Recognized as important, assumes greening the economy will reduce poverty via enhanced agriculture and employment in green sectors.	A primary concern, since it directly affects the quality of life and social capital and is often exacerbated by growth: a too rapidly rising tide only lifts

			yachts, while swamping small boats.
Economic efficiency/allocation	The primary concern, but generally including only marketed goods and services (GDP) and market institutions.	Recognized to include natural capital and the need to incorporate the value of natural capital into market incentives.	A primary concern, but including both market and non-market goods and services, and effects. Emphasis on the need to incorporate the value of natural and social capital to achieve true allocative efficiency.
Property rights	Emphasis on private property and conventional markets.	Recognition for the need of instruments beyond the market.	Emphasis on the balance of property rights regimes appropriate to the nature and the scale of the system, and a linking of rights with responsibilities. Includes larger role for common-property institutions in addition to private and state property.
Role of government	Government intervention to be minimized and replaced with private and market institutions.	Recognition of the need for government intervention to internalize natural capital.	Government plays a central role, including new functions as referee, facilitator, and broker in a new suite of common-asset instructions.
Principles of governance	Laissez-faire market capitalism.	Recognition of the need for government	Lisbon principles for sustainable governance.

Table (1) expresses the differences between models of economy, society have come up with through time. There are supporters and opponents for each of the models. However, it has to be considered

that there is no model that is perfect, or finds the ultimate solutions for solving problems that our civilization faces today. Nonetheless, it can be seen that there is progress in the way of thinking and perceiving obstacles along the way for sustainable existence. This is due to the fact of realizing that sustainability is needed, and at this time and point of being it might be referred to as a necessity. As introduced in previous pages, the notion that society strive towards the understanding of the omissions of the current model is playing a huge role in changing and improving the current strategies.

In order to notice how big are the differences between the Current Economy Model (CEM) and the Ecological Economics Model (EEM) the omissions have to be discussed further. CEM is strictly focused on economic growth, without including all the factors of the external environment for this particular economic state. It might also be referred to as a "material economy". The downside of that material focus is the ignorance towards the connection between materialism and the actual provider of materials – which is our ecological life-support system (Walmsley and Lewis, 2014). The key concept for escaping the trap of "society of consumption" is shifting the direction of our economy through understanding the interconnected system that we are just a part of. Furthermore, a distinction between growth and development has to be made. The definition of development has changed with the necessity of sustainability. Now, development is defined in terms of creating a sustainable well-being, which is a definition that goes beyond the material side of human life (Dasgupta, 2001). Of course, the most efficient choice at this point is not choosing one or the other, but rather finding the balance between the two sides and executing them in the new form of economic model – EEM.

Fundamentals of sustainable development

Sustainability and location.

The common understanding of sustainability is utilizing the current resources without jeopardizing the possibilities future generations have in front of them relying on the resources they would have access to (Arcadis, 2015). Using that as a starting point, we have to take under consideration the truth that the geological distribution of resources is not equal in every geographic location. Logically, this leads to the conclusion that certain regions have specific type of resources to utilize in order to satisfy the basic needs of survival, such as the need of water, energy and adaptation to climate conditions (Dasgupta, 2001). Here, the lifestyle and way of living and co-existing of the community should also be noted.

Based on that, different geographic locations not only have a different set of resources to operate with, but also the location predispose to separation in the problems that have been faced to survive, keep maintaining the community, and of course develop and maintain sustainability. A very good illustration

of this correlation has been presented by Arcadis (2015) in one of their reports, which measures the sustainability levels in different cities that strive for sustainable development.

The result from their investigation reflects upon the similarities and differences cities are facing. This allows building groups and establishing connections among “fellow” cities. This kind of grouping is very helpful because it allows separating different sustainable cities in clusters, instead of observing them only all together at a global scale. The separation is also effective because of the numerous positive options it gives to observers to identify and examine more closely the strategies and processes that have been executed in specific cities in order to achieve sustainable development. In other words, this kind of classification of cities represents the different macro environments which are a home to the “micro unit” participating in sustainable global development – the city.

At last but not least, these type of classifications are not playing a positive role only in the process of observation for parties which study and examine the sustainability levels, ways and progresses. It is also plausible that it gives the opportunity for the cities themselves to explore and learn from the problem solving tactics that have been used from other cities in the same cluster. And by thus, allowing improvement in current strategies or implementing strategies that have been considered alien so far, or haven’t been considered at all.

Sustainability and population rates

There are many factors that prove the importance of sustainable cities. We live in society that is getting more and more conscious about the outcomes of human impact on the environment. Therefore, the definition of sustainability used in this paper is mostly focused on the future by controlling the outcomes of the present. Regardless, the past has its influence as well. As it has been pointed out in Chapter 3, there has been a certain loop of repetition going through the ages. The past cannot be changed, but great lessons can be learned from it. One of them is the mastering of utilizing the current resources by future usage forecasting. This is one of the strong stimulations that are encouraging the increasing interest in sustainability, and thus – how can we do it.

Figure 1Population of the planet from 2015 to 2050. Inspired by source: UN, Dept. of Economic and Social Affairs, Population Division (2013).

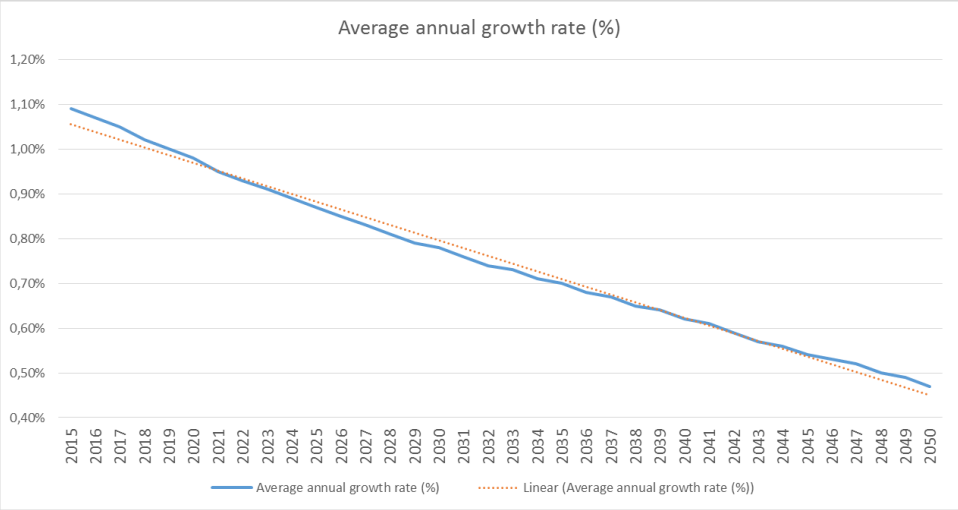


Figure (1) represents the numbers of the current population rates and the expected population rate till year 2050. This specific time frame has been chosen in order to synchronize with the reports of United Nations and other worldwide recognized institution, involved in forecasting the probable world situation by year 2050. This is also an important time frame because the cases of the cities of analysis are also focused on it.

By observing the graph, it becomes clear that the forecast is reflecting only positive progression in the population of the planet, meaning that it will continue increasing. Nonetheless, if we look more carefully, at the data presented in Figure (1), it is noticeable that there is an opposite dependence between the population and the annual growth rate. In order to grasp the importance of that particular state of growth rate, it is time to consider what a population growth means and what factors can influence it in a positive or negative manner.

The perception of population growth acknowledges the importance of the environment and explains how it can modify the population growth. In other words, the quality of environment influences the birth and death rates, which of course are directly connected with the general population growth (Holdren and Ehrlich, 1974)

McGraw-Hill Global Education Holdings, LLC (Ecology Concepts and Applications, Chapter 12, 2016) formulate the most important factors that influence as:

- Food
- Disease
- Predators
- Climate factors such as floods and temperature fluctuations.

Excluding the predators for a moment, there is a great resemblance between the factors which influence the population growth and the problems that sustainability is trying to solve. Keeping this in mind let's get a little deeper in unfolding the meaning and the impact of these factors of the population size; followed by revealing why it is important that the population growth rate from 2015-2050 is slowly decreasing, and its connection with sustainable development.

The population size and the availability of resources are connected, meaning that when resources become limited the population rate starts decreasing. This is due to the influence of the population over the environment in a sense of how much population can a region sustain taking under consideration the resources that are present there. This event is referred to as "carrying capacity" (McGraw-Hill Global Education Holdings, LLC (Ecology Concepts and Applications, Chapter 12, 2016). Putting the focus back on sustainability, it is urgent to acknowledge the dependence between those two factors. The resources of the planet are limited and we have reached a point where it becomes important to implement this understanding in human consciousness and awareness regarding the world around us. The increase of people on this planet means that there are less resources available per capita. Therefore, in order to not put in danger the survivor of the human species, developing sustainability is gaining more popularity. In the definition of sustainability there is a term involved, which I find crucial for proving the importance of sustainable actions – "future generations". From the source of Figure (1), a relative calculation can be made so that the term "future generations" acquires more realistic dimension reflecting the importance of it. The number is approximately 2 145 968 100. That is the number of people which will come to existence in our world in the next 34 years. This number also shows for the well-being of how many lives we are responsible today. More than 2 billion people will also need resources for providing themselves with basic needs that sustain their existence.

United Nations' report on building a desirable and sustainable society, defines human capital as [Human beings and their attributes, including physical and mental health, knowledge, and other capacities that enable people to be productive members of society. This involves balanced use of time to fulfill basic human needs such as satisfying employment, spirituality, understanding, skills development, creativity and freedom]. (United Nations, Rio+20 Conference, 2012, p.11)

Distinguishing the two elements – future generations and human capital, adds more value to the importance of developing sustainable areas, as in this paper the unit of analysis is a sustainable city. These two elements enrich each other by completing their meanings, and by thus increasing the importance of understanding of their presence. Human capital in a way includes the future generations in itself. Therefore, the empirical dimensions of the definition of human capital are expanding. Involving the subject of well-being and improving the quality of existence of human beings, the human

capital also includes the well-being of the additional 2 billion people which are going to be born in time window ending in year 2050. The entanglement of the two elements proves the importance of striving for sustainability of human development, by stressing the significance of improving the well-being of present and future generations.

The importance of developing sustainable cities and communities

Why developing sustainable cities and communities is important?

Sustainability is a hot topic all around the globe, and many nations are making steps in this direction. Nonetheless, despite many efforts, not all communities striving for sustainable development are on the same stage of the "staircase", ending up with building and providing sustainable solution to decrease the negative impact humanity has on the environment. For instance, the residents of many of the cities in Africa have life expectancy of 40 years, which is half the life expectancy in cities which are well governed (Satterthwaite, 2010). To support the statement of differences between locations around the globe, Satterthwaite (2010) explains that the life expectancy today in most cities in Africa is not much different than the life expectancy in Europe 160 years ago, before the governments started shifting focus towards water supplies, health care, quality housing and providing minimum wages for labor.

Big part of the population of nations with low and middle income is concentrated in settlements which are not secured and safe, in the sense of providing the needed factors for supporting and stimulating the well-being of the citizens. These unformal settlements are usually ones that are lacking water, sanitation, health care, law and developed educational system and facilities. There are many differences between these unformal settlements and cities. In the last 60 years the focus of investments and plans for reforming, reshaping and reconstructing the physical environment have been poured in cities. Nonetheless, that doesn't change the fact that the population in many parts of the globe are focused in unformal settlements. The cities, which have had the opportunity to grasp investments and develop projects for leading to sustainability, are sometimes referred to as places with less poverty than the settlements. That would not be completely true because the perception of poverty is mostly connected with financial resources, whereas housing transport, education, etc. have been proven to be crucial in the level of success of peoples' lives in a community. On the other hand, even though cities which are wealthy have the ability to provide safety and higher quality of live, that doesn't necessarily mean that they have a high level of sustainability. That is the case because those rich cities actually have their fair share of green gases – the numbers vary from 5 to 10 times the green gas levels per person. Therefore, it can be concluded that many of those wealthy cities actually have a great negative impact over the climate of the planet, as well as crossing planetary boundaries. This fact

is strengthened by the assumption that without correctly developed strategies and procedures even the wealthiest cities would not be able to manage their resources in a sustainable manner, while the population in them is increasing. (Satterthwaite, 2010)

The wealthy cities have more resources and therefore are supposed to be able to develop and implement strategies which ideally could help achieving higher levels of sustainability. By those means, the cities should be able to provide more healthy and safe environment for their inhabitants. On the other hand, the level of sustainability of cities is not a "pure coin". Even though they indeed manage to provide a better habitat for the community, wealthy cities have a problematic dimension. The levels of environmental impact are still negative and it is expressed mostly in the environmental footprints, a big part of which are the greenhouse gas levels.

"...with the right innovation and incentives in place, cities can allow high living standards to be combined with resource consumption that is much lower than the norm in most cities today."

David Satterthwaite, 2010, p.1

Satterthwaite (2010) summarized that some authors argue that these footprints are coming as the price that needs to be paid, in order to establish a healthy and safe habitat for people. The real question in this case is *whether small ecological footprints and high quality of life can be combined?* Satterthwaite (2010). Even though there is truth in the statement *"price to pay"*, we should also consider that with the amount of investments drawn to areas promoting good quality of life and well-being, there are solutions that can be researched and developed in order to brake the negative correlation between the good conditions of life and the bad environmental footprint. In this line of thoughts, it is also important to mention one of the other factors that have been discussed as prime factors for establishing sustainability - population growth, and its relation with the limited resources of cities.

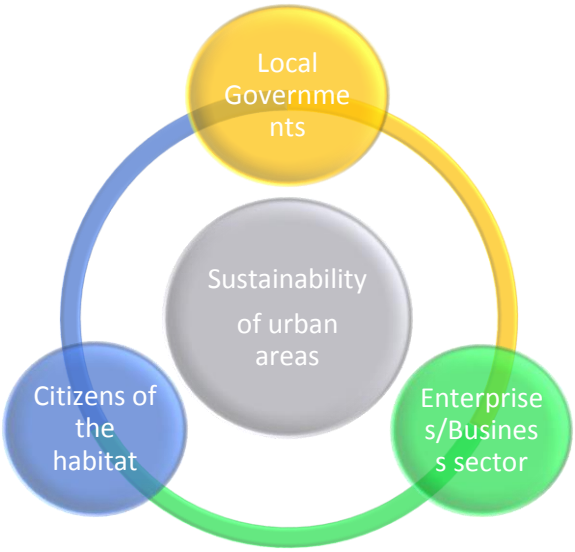
Entanglement between citizens of the habitat, enterprises/business sector and local governments

Urbanization and overpopulation are going hand in hand. According to researches half of the worlds' population already lives in urban areas, and this phenomenon is expected to increase its rate to two-thirds by the year 2050 (National Geographic, article). The increase of population in urban areas has been observed for a time period of few years, as the trend is that the population rate in those areas is going up with a greater fluctuation in the index value than before. A city is a location which has been perceived by people as more promising jobwise and in life prosperity. Therefore, the fluctuation in the rates is justified. This hike puts the cities in a situation of raising the negative possibilities of the habitat's overall performance: phenomenon such as poverty and environmental degradation are more likely to occur.

There are some negative outcomes pointed out by Satterthwaite (2010) that come with overpopulating an urban area, which cannot be ruled out and truly need to be taken seriously:

- Increase of poverty rates, with the inability of local governments to provide services to all citizens.
- Increase of air pollution and lowering the levels of human health.
- Problems with managing large volumes of waste.
- Magnifying the risk of environmental hazards.
- Poisoning of the flora and fauna in the area leading to extinction of species and decease of population throughout the flora and fauna.

Figure 2 The imperative entanglement between citizens of the habitat, enterprises/business sector and local governments. Inspired by Satterthwaite (2010)



The urban areas, such as cities, are some of the few places where the combination of the three parties can be seen. Moreover, it allows observations to be performed in order to establish how they correlate with each other, what influence they have over one another, and the expected outcomes. The cities can be also visualized in one's mind as the playground of the three parties, where the goal is developing sustainability of the urban areas. It is important to acknowledge the entanglement between citizens of the habitat, enterprises/business sector and local governments, and perceive them as equally important for the successful development of an urban area.

Cities concentrate people and organizations which results in the negative influences over the area. Fortunately, the concentration of people and organizations also comes with advantages which can be used to overcome the disadvantages. For example, poverty can the reduced by the advancement of the economic reality and creating more jobs. This solution seems obvious, however, it is not so easy to

manifest. The reason for that is partially because it is entangled with all the rest of possible solutions that can be implemented to overcome the disadvantages of urbanization. In order for a better habitat to be built there is another shift that needs to take place – the local community has to be involved and familiarized with the decisions taken by the local governments for achieving sustainability. According to an article written by David Satterthwaite (2010), who is an editor of the international journal "Environment and Urbanization", disasters are less likely to have a huge negative impact in urban areas that are well governed, rather than areas which are poorly governed and not wealthy. This conclusion supports the importance of involvement of all parties – people, organizations and governments.

Continuing the argument of importance of all actors in a city, so far, the enterprises have been presented as having a positive influence over the poverty rates by providing more job opportunities for the citizens. However, that is not the only important role they have, in the successful and sustainable flourishment of an urban area. Another perspective of the importance of enterprises, is the density of industries in one area. Before further explanation of this statement, let's take a little step back towards the human capital defined as [human beings and their attributes, including physical and mental health, knowledge, and other capacities that enable people to be productive members of society….] (United Nations, Rio+20 Conference, 2012, p.11). In Figure (2) the entanglement of the three elements expresses their strong relation; meaning that they can hardly exist without each other. We should recognize that enterprises are not just constructions defined by law, or are simply consistent from physical facilities. The core of all organizations are the people involved. How successful an organization can be is mostly determined by how productive, loyal and determined are the people working in it. Therefore, enterprises have the power to surpass the environmental footprints of the industries by great compensations. If we take the local governments and the community as the source of decision making, the enterprises as part of the community are taking a big part of the execution of the realization of those strategies. The organizations emphasized by Satterthwaite (2010), as forms of collision of people with a common purpose, can contribute by physically executing waste management and managing public goods and services such as:

- Transport infrastructure
- Water supply for consumption
- Sewers and drains
- Electricity
- Day care facilities
- Education facilities
- Health care and emergency services
- As well as access to system of justice and its required facilities.

All those evidences lead to the acknowledgement that the entanglement is not only real but it is also extremely important. Establishing a good relation and information exchange among the three elements has the power to execute successfully various strategies and procedures, and result in increasing sustainability of urban areas, as in this case cities. The planet is currently in the state of *Anthropocene.* This by itself represent a great shift in the way people look at the world and are forecasting the future possible outcomes of current actions. This shift is fraught with smaller changes of perceptions of the current world. One of them is the recognition of synergy that needs to be achieved using as core units citizens of the habitat, enterprises/business sector and local governments of urban areas.

Importance of local governance

Even though there is a clear dependence among the three elements, a lot of the collaborative actions that have been taken to achieve sustainability in urban areas would not be possible without the adequate presence of local governments. It is important that the community is also involved in the decision making, but by rule the government is the one ruling out or supporting decisions, based on clear judgement and taking under consideration the interests of all the parties. The advantages depend to a big extend on governance structure and its ability to make appropriate choices and later on to execute them, reflecting the local governments and their relations with the community and civil society groups within the boundaries of the urban area. (Satterthwaite, 2010)

Best practices and innovations are coming from many different nations (Lundvall et al., 2002). For instance, a lot of the successful practices emerge from urban areas in countries with low- and middle-income per capita. This is interesting to observe because the factor for their successful solutions on specific topics is focused on changes needed in the nation to increase well-being, and where results are achieved despite the investment restrictions. The lack of sufficient resources is not the biggest obstacle for developing solutions that will help integrating sustainable practices. In a way, the stimulation of improving the well-being of the members of the urban area is much greater starting point than the motivation coming from financial resources. On the other hand, many successful sustainable practices come from countries with are already developed and have focused on decentralization of governments, in the environment of democracy and more available resources. (Satterthwaite, 2010)

To support the idea that well-being is more important than finances, let's examine some sustainable solutions in developing countries. "Netafim" is an Israeli-based company which is responsible for a sustainable solution which is meant to assist smallholder farms in developing countries in their attempts to increase their efficiency in production and lower their costs, and by thus improving the well-being of the whole community in the area. Storm (2014) talks about the low-tech drip technology

as saving water and reducing production costs. The idea behind the technology is that it is dropping a specific amount of drops directly in the root system of the crops by using a tank of water which distributes the water based only on gravity pull. The end result is minimized the investments needed in energy supply and infrastructure. Furthermore, Storm (2014) presents United Nations' observations that the smallholder farmers (which are around 500 million) are providing 80% of the food in the developing world. This technology represents solution for urgent problems such as drought, soil erosion and irrigation systems. As revealed by Storm (2014), "Netafim" product has a payback time of the investment of around a year which makes is a great fit for projects in the rank of microfinances. Today, the drip technology is implemented in 11 countries around the world, among which are Kenya and Mexico.

As following from the example, the sustainable solutions are not originating only from the government, even though every program that has to be implemented in an urban area needs the assistance of the local government in providing "catalysts" for smooth integration, such as policies, laws, norms and public awareness. As another source of sustainable ideas and their implementation, the civil-society groups fall in the spot light. By definition *civil society* is the [aggregate of non-governmental organizations and institutions that manifest interests and will of citizens." Civil society includes the family and the private sphere, referred to as the "third sector" of society, distinct from government and business] (Dictionary, Archive 2009]. Having this in mind, civil-society groups are usually local NGOs and grassroots organizations.

These organizations are particularly important, as stressed by Satterthwaite (2010) because they represent the bridge between the government and the people living in the urban area. They are involved in collaboration with local governments for the cause of achieving better outcomes in the action of improving the environment of the habitat and making it sustainable. This kind of collaboration has higher chances of succeeding if the practiced form of government is democratic; however, these partnerships also result in increasing the democratic levels of local governments. These organizations are usually involved in various programs for increasing the well-being of the community. They are particularly recognized by their participation in urban areas which have high poverty rates and have regions with bad service providing where the focus of attention is helping low-income groups. An example that can be highlighted here is programs which are connected with the housing situations in those problematic areas. These actions are often recognized as "community development", and they include improvement in the following factors (Satterthwaite, 2010):

- Water
- Sanitation

- Drainage
- Waste

Satterthwaite (2010) explains that along with those factors in the spot light, these programs also work on stimulating and improvement of schools' conditions and health care facilities. There is an interesting phenomenon taking place in those programs' implementation. The projects often start as proposing solutions on a micro level, to a specific area or facility. Since positive results are usually produced by the execution of those projects, the local governments recognize the crucial effect they have on the community, as noticing the progress of the community well-being in the neighborhood. The result is recognition of expanding those projects and helping them being distributed all around the urban areas, leading to improving the well-being of the whole community in the area, by providing better environmental conditions. By thus, stimulating not only the sustainable development of the physical aspect of an urban area, but also providing the needed grounds for developing and stimulating the capacities of the human capital of the sustained city. These programs are usually the playground of federations like Slum Shack Dwellers International (SDI). SDI are organizations focused on severe improvement of the situation in countries with significant urban poverty (Slum Shack Dwellers International official web page, April 2016). What makes those federations significantly successful in their approach to local governments is that instead of forming strikes and producing negative publicity regarding what attempts have not been taken or considered, they are focused on collaboration and building partnerships with the local governments; and have learned to take actions by themselves. This strategy is successful because it gives the opportunity for reinforcement of resources and intellectual capacity between the governments and the organizations, while time involving the enterprises and the community itself.

This is a reminder that all actions, for improvement and empowering the sustainable potential of a specific urban area, have to emerge locally. Meaning that it is time to recognize that the source of the power of change the current conditions of existing of human species is in the hands of local governments, NGOs, enterprises and the very members of the habitat, which united are developing global environmental improvement through sustainable development.

Sought sustainability and desirable cities

It has been proven by psychologists that the understanding of well-being of people and what it represents are now shifting from material consumption satisfaction towards spiritual growth and mind satisfaction. In other words, the material culture that has been flourishing in the last decades is recognized as not enough for providing fulfillment. Therefore, the importance of theatres, museums, festivals, libraries, art exhibitions, and other social events are nowadays more desirable than ever (Satterthwaite, 2010). All these represent low-cost consumption while at the same time provide higher standards of living in cities and settlements. This paradigm shift reflects on the change of needs of the population leading to decreasing the consumption levels of physical attributes. This contributes to lower greenhouse gas emissions, and by thus contributing to the healing of the climate of the planet. This indeed has been taken under consideration in cities from the aspects of the *triple bottom line* (Elkington, 1994), which examined cities' performance in economic, planetary and social aspects.

To summarize, in his article, Satterthwaite (2010) acknowledges that the time has come to understand that the cities are not the problem. The disadvantages has been produced by institutions, enterprises and the community members. The way a city is built, planned and managed has a huge impact on the performance of the city as a whole, and what coping mechanism can actually be implemented successfully to reduce the climate impact. With the greenhouse gas emissions on focus, there are other problems which are being overlooked. Even if procedures have been put in motion for decreasing the emissions of an urban area that by itself does not make an area sustainable, even though it contributes to it. Factors like infrastructure, providing services and safety of the environment are also extremely important. There are different risks depending on the location of an urban area that demand different approaches. Therefore, there is not an ultimate strategy or solution that can be implemented everywhere, at this time of being. Nonetheless, the government institution responsible for a specific urban area need to make a risk assessment in order to prioritize the sectors which need attention. This of course depends on the capacity, willingness and knowledge with which a government operates on, as mentioned before. The perception that can contribute to more realistic awareness of the institutions regarding the reality is that: It's not cities fault that they affect in a negative way the environment. It is the governments' responsibility to acknowledge their own failures, and it is time for embracing the very significant role that enterprises and community members have in the successful sustainable development of the urban area they are located in.

The concept of "well-being"

Mentality change: What is the new meaning of "well-being"?

The concept of "well-being", as presented by Centers for Disease Control and Prevention, is a state that has many sides. The general perception of well-being is a positive outcome for people, and society as a whole. There are various indicators that measure well-being. However, most of them are not able of measuring how people perceive the world around them and their lives, and how they feel about them. It's important to be mentioned that well-being is dependent of the global judgements of life satisfaction. (National Center for Chronic Disease Prevention and Health Promotion, April 2016)

Recent studies demonstrate that the conventional economic perception and consumption has its limits of contribution towards well-being. Constanza (2007) reflects upon Tim Kasser's book "The high price of materialism", through which an idea is developed that people who seek their happiness in material consumption have lower levels of satisfaction of their lives, in comparison with people who are not as concentrated on consumption as a way of existence. With the increasing power of phycology in human behavior as a unit of society and economy, researchers have concluded that well-being is associated not only with materialism, but also with family, inter-human relations, health and education, as well as status in society. Of the supporters of the idea that human well-being goes beyond materialism is the economist Richard Easterlin (2003), who concludes that [people make decisions assuming that more income, comfort and positional goods will make them happier, failing to recognize that hedonic adaptation and social comparison will come into play, raise their aspirations to about the same extent as their actual gains, and leave them feeling no happier than before. As a result, most individuals spend a disproportionate amount of their lives working to make money, and sacrifice family life and health, domains in which aspirations remain fairly constant as actual circumstances change, and where the attainment of one's goals has a more lasting impact of happiness. Hence, a reallocation of time in favor of family life and health would, on average, increase individual happiness].

These evidences allow the conclusion that human life is connected with the surrounding natural environment. And growing evidences suggest that the connection between good qualities of human life is much more dependent on the ecological-life system, rather than economic growth, driven by increasing of consumption. Thereby, including factors that go beyond material consumptions, such as social relationships, health and knowledge, is crucial and lays the fundamentals for establishing a sustainable economy which will satisfy and secure the expanded global perception of human well-being.

Climate change

Importance and significance of climate change

In order to build a better reflection of the importance of climate change, one must first answer the question **"What is Climate Change?"**. For the purposes of the investigation of this paper, the definition of the World Meteorological Organization (WRO) will be used. According to WRO (Commission for Climatology, retrieved: 2016), Climate Change is [a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external factors such as persistent changes to the atmosphere or changes in land use].

However, to enrich this definition and reveal its connection to sustainable development, another perspective must be taken under consideration. According to United Nations Framework Convention on Climate Change (UNFCCC), human influence over the state of Earth's climate is a main factor in the climate change that our planet is experiencing. Thus, UNFCCC (Commission for Climatology, quote retrieved: 2016) defines climate change as [a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods].

From those two definitions it becomes clear that climate change is influenced by two main directives - the natural order of progress of our planet, and the influence of human development over time.

Furthermore, it has to be acknowledged that there is a difference between "climate change" and "weather". This difference is well represented by Mike Hulme in his book "Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity". There he represents one of his ideas that "climate is what you expect, weather is what you get" (Hulme, 2009, p.4-9). For a long time, climate change was considered as a given state of nature. It was not so long ago when researchers in science and economy started to discover that a big part of the climate change is influenced by the development progress of our society. At the beginning of 21st century, climate change became a key narrative, reflecting in social, political and economic perspectives. In this regard, an important understanding is that the modern perception of climate change, as well as the relativity between climate change and sustainable development, is a collision between different scientific philosophies and the level of global awareness. There is no doubt that the public awareness for climate change is increasing, especially in the last years. This is a step further towards creating a global network of awareness and unity of nations. It could lead to drastic progress in innovation, utilization of resources,

networking, and mutual help, in order to overcome threats that we, as a species and society, foresee in future.

On the other side, there is another frame that is crucial for understanding and overcoming the threats of climate change; and this is how society frames climate change. The "framing effect" is an idea emerged in psychology, and described by Plous (1993), as how people have different reactions towards a particular situation, depending on the perception of the situation. This is an important definition for the true understanding of how society values climate change. The main factor that influences humans' perceptions nowadays is the media. It is more than well known that through the past years managing climate change has been represented mainly as a responsibility of corporations and large businesses (McWilliams and Siegel, 2001). However, it is becoming clearer that climate change is also dependent of the moral realization, of its importance and possible outcomes, of individuals, small businesses, as well as governments. All this leads to the beginning of understanding why governmental and business strategies were wrong. This has set the start for mobilizing activities to improve/change these strategies.

Furthermore, an interesting idea has been presented by the Project for Public Spaces (PPS) which concerns environmentalism. According to Ethan Kent (2015), who is the Vise President of the organization, there is a new term which has to be brought to light concerning the environmental preservation – *Placemaking*. This is an important perspective for this thesis, because of its relevance to the connection between society and the surrounding environment. The conclusions of PPS (2015) are particularly intriguing because they embrace the actions for solving issues such as overconsumption, climate change and ecological footprints. In its core *placemaking* is a practice which is meant to encourage and empower people to take action and give their contribution to the world outside of their homes and beyond their ownership by working together in unity (Kent, 2015). Going beyond the materialistic consumption, one of the most powerful tools for making an urban area sustainable is the actions that people take to improve the environment and unlocking their desires in manifesting contributions to their community. The state of sustainability of cities affects the community, but the actions of the community not only affect the level of sustainability. They are also one of the most powerful inspirations for achieving sustainability.

Nonetheless, even though "What is climate change?" is the core question that needed an answer, it is far from being the only important one. As the link between climate change and human influence has been already recognized, more questions have emerged. One of them is **"How do people affect climate?"**. This is a complicated question to answer since climate is changing over time, and requires observation of rather long periods of time. Regardless, scientists have already pointed the attention in

the direction of emissions of greenhouse gases. Researches have proven that greenhouse gases cause increasing of the temperature all around the globe. The problems arising from the caused global warming are related to food security, water resources, along with health threats and the biodiversity of the planet. Another negative influence of human development is emissions of air pollution and land use. There are challenges in front of understanding how the climate changes because it doesn't change with the same trends all around the globe. There are different levels of pollution in the variety of geographic locations (Natural Environment Research Council, retrieved: 2016). Therefore, it is not enough to observe only the climate change of the planet, but also it is important to analyze local and regional changes. This allows governments, businesses and society to adapt successfully to the occurring changes and to build strategies for solving potential negative outcomes in future.

To get a full grasp of the significance of climate change, the other side of the previously presented question has to be reflected too – **"How do changes in climate can affect our lives?".** This is a question that related to the topic of possible disasters, as well as disasters that we have already witnessed through the years. The pollution produced by developed industries has a huge impact. Damaged water supplies, extinction of various species, lack of ability to produce and sustain needed food supplies, are just a small part of the damage. The negative influence of human development is going to turn against humanity if precautions are not taken. Extreme weather conditions such as stronger and more dangerous storms, natural disasters threatening the life and well-being of people, damaging the current infrastructure of transportation and built human habitats, are just one of many. (Natural Environment Research Council, retrieved: 2016)

Thus far, it can be seen that there is a definite connection between the state of nature and human development. Our development as civilization has always been influencing the state of our planet. However, in the last decade, it has become clear that our industrial progress and way of existence is influencing on a much higher degree the environmental balance. A domino effect is present. At this point of increased awareness around the globe, it is becoming only logical that the solution for preventing the increase of probable negative outcomes is sustainable development and climate adaptation.

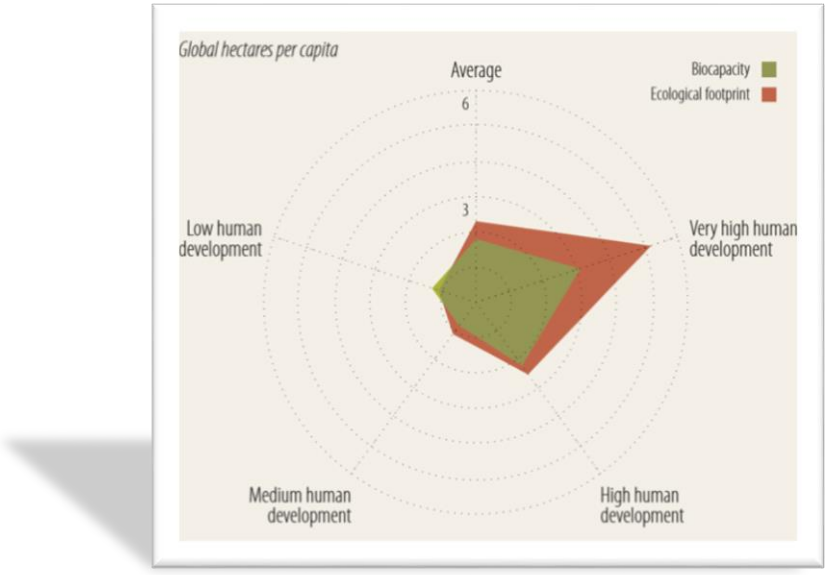
Planetary boundaries: Society of consumption is unsustainable.

History of human development shows that we never fully grasped the impact we have on our planet. By thus, preventing ourselves from controlling the damage we have caused. Even today, there are still representatives of science, technology and other sides of human knowledge of progress, that choose to close their eyes to the evidences of global environmental regression. Some of the factors, recognized as a confirmation of the rightfulness of the desires of economic growth, according to United Nations (Rio+20 Conference, 2012) are:

- GDP are still rising throughout the world;
- Among most of the nations, life expectancy is increasing;
- Evidences of human-caused climate disruption are still not absolute defined;
- Some of the previous predictions about environmental catastrophe have not come true.

There is no doubt in the truthfulness of these statements. However, there is much more to the picture. The advances made in environmental sciences have allowed a more informed and realistic assessment of the environment, exploring both local and global events. Evidence is pointing to the loss of forests, extinguishing of numerous species, decrease in the levels of clean fresh water, increase of the levels of atmospheric and ocean pollution, etc.

Figure 3 Ecological footprint of consumption. Source: Blog: Desdemona Despair, 2015.



Statistical data shows the negative relation between economic growth and environmental impact. Environmental degradation and climate change have come to the point of creating a real threat for human kind's survival. Therefore, it has become necessary to execute strategies for managing the

negative impacts of economic growth in order to react adequately to the climate threats being present, and expected in future. The reports released by United Nations Human Development, in 2011 and 2013, are arguing that environmental disasters are not only going to slow down human development but also are able to reverse it (Blog: Desdemona Despair, 2015). Furthermore, they recognize the importance of climate change, as one of the biggest threats humanity is facing today. In order to spread awareness and inspire change, United Nations is focusing mostly on climate change and proposals for sustainable goals in the development agendas set for 2015 and times ahead. Moreover, another consideration is coming into focus – preservation of the rights of future generations to have a secure amount of resources and capabilities for their survival not to be put in danger by present actions of human kind.

Theoretically, our planet has the capacity to maintain the existence of human kind. However, in the last 12 000 years that is not particularly the case. With the development of villages, agriculture, later on the industrial revolution, and the rapid economic and consumption growth, mankind is using more and more resources, which of course are limited. Fortunately, the progress in environmental sciences allow for a more realistic perspective to emerge – the perspective of planetary boundaries.

In 2009 a team of 28 scientists from different nationalities have determined 9 planetary boundaries, in which humanity can continue its development. The planetary boundaries can be viewed as a framework which sets the limits of abuse of the planet. The boundaries draw the lines in which human kind can thrive without jeopardizing the survival of future generations. Stockholm Resilience Centre (2015) recognized the following boundaries:

1. Climate change

2. Change in biosphere integrity (biodiversity loss and species extinction)

3. Stratospheric ozone depletion

4. Ocean acidification

5. Biogeochemical flows (phosphorus and nitrogen cycles)

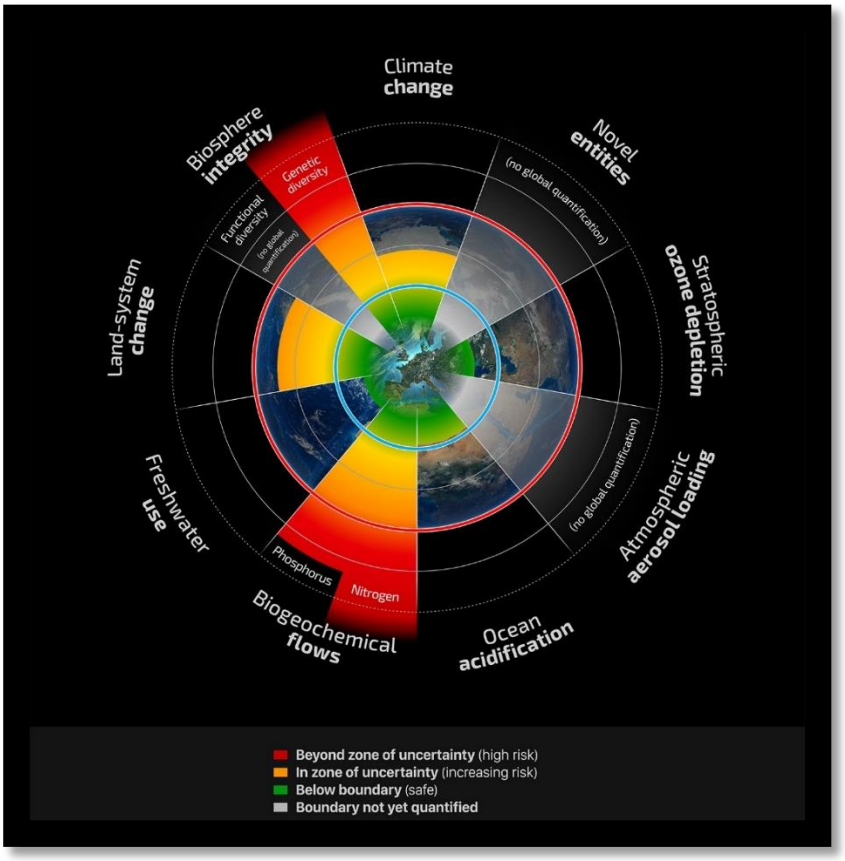
6. Land-system change (for example deforestation)

7. Freshwater use

8. Atmospheric aerosol loading (microscopic particles in the atmosphere that affect climate and living organisms)

9. Introduction of novel entities (e.g. organic pollutants, radioactive materials, nanomaterials, and micro-plastics).

Figure 4 Planetary Boundaries: A safe operating space for humanity. Source: Stockholm Resilience Centre official web-page. Information retrieved April 2016.



The formulation of the idea of planetary boundaries proved to be very important for the development of future strategies and the determinations of levels of sustainability. It also allows the establishing of "safe boundaries" which can guide economic growth and development. In January 2015, 18 researchers discovered that four out of nine planetary boundaries have already been crossed in result of human activity (Stockholm Resilience Centre, 2015). There four are:

1. Climate change;
2. Biosphere integrity;
3. Land-system change;
4. Biochemical cycles.

Climate change and Biosphere integrity have been identified as "core boundaries" since the negative affect of mankind on them can cause swift in the state of Earth, and therefore those two boundaries have a huge influence over the rest of the defines planetary boundaries. According to Professor Will Steffen, a lead researcher at the Australian National University, going beyond a boundary can turn the

Earth into less hospitable place, and thus increasing the state of human well-being all around the globe. (Stockholm Resilience Centre, 2015)

Figure (4) illustrates the levels of fulfillment of the planetary boundaries based on the current strategies for growth and development of human society. Biosphere integrity is “off the charts”. As it is marked with red it shows that the decrease of biosphere integrity is in the zone of high risk. The results reveal that right now Homo sapiens is at a turning point. The activities conducted by our species are starting to affect the balance state of the ecological life-support system. This is one of the main indicators proving the need for changing the current economic model, with one that is oriented towards preservation and recovery of the life-support system of the planet. This includes not only a turn back from society of consumption, but a social change, as well as recognition of the importance of environmental preservation. There is an interdependence and interrelatedness between all life forms on Earth, which has to be brought to global realization.

Cities involvement in global warming

The model of establishing what is the contribution of cities is based on their greenhouse gas levels. For example, areas which produce energy mostly based on fuel fossils will have a higher rate of greenhouse gases. However, that is not the only factor regarding their contribution to global warming, because often the energy produces in a certain area is being exported and used by powering the activities performed in another location. That is why the greenhouse gas levels are being found as assigning the emissions of energy that has been providing the electricity used in the boundaries of the cities. That explains why some cities have lower environmental footprint from energy usages, especially when they are provided with electricity coming from renewable energy resources, such as wind power or hydropower. (Satterthwaite, 2010)

Based on this allocation of energy production and consumption a paradox is occurring. The wealthy urban areas which have the resources to afford using more energy have bigger contribution than the areas which are poor and have serious problems with energy supply. This is particularly interesting because it focuses the attention to the fact that even though wealthier cities have access to more resources and developing innovations (Lundvall et al. 2011), their ability to afford higher levels of electricity consumption leads to greater environmental footprint. Which brings us back to the question of whether cities can provide high levels of safety and well-being to the community while at the same time lowering the environmental impact.

Entanglement between sustainable development and climate change

Multiple stress

Current literature examining sustainability and sustainable development have reached a point where it recognizes the presence of multiple stress, influencing sustainability. The stress arrives from ecological and socio-economic systems and the problems they are facing. From the contribution of meteorological institutes and various collaborations with other organizations, it is now possible to predict to the extent to which stress factors are likely to change. Therefore we are able to consider their influence in forecasting the future impact on the planet and our civilization, regarding climate change. The Millennium Ecosystem Assessment (MA, 2005) by World Resource Institute (WRI, 2000) has collected and reviewed many literature sources with the purpose to establish the conditions and trends of ecosystems, services related with them and the socio-economic context in which they occur (MA, 2005). With a broad source of information and relevant assessment of the information, the MA identified two main categories as drivers of change. The direct drivers are a group of drivers which affects the ecosystem in a very specific and quantitative measurable way. The indirect drivers affect the ecosystems usually by influencing few direct drivers, appropriate example here would be demographic changes and change in political situations. With the development of society both type of drivers have changed rapidly. From the direct drivers, food production has increased with around 150%, water use and installed hydropower capacity has doubled, wood harvests have tripled. On the other hand, indirect factor such as population has doubled since the 60s of the last century, while the global economy is six times more developed in comparison with few decades ago. (Yohe et al. 2007)

From the perspective of the original definition of direct factors, climate change is not theoretically a major stress source. However, it is the only direct factor which significance represents an importance to regions, ecosystems and resource management all around the globe. With the made forecasts of social-economic impact over the environment scholars have emphasized that the magnitude of climate change will keep growing. (Yohe et al. 2007)

Support of sustainable development

This section will bring up the question of relation between economic development and adaptation ability. The literature in regards of economic development suggests that fundamentally the factors which determine a country's ability to develop sustainability are connected with the factors which

influence the adaptation capacity relating to climate change (Yohe et al. 2007). In order to explain further the relation between those factors, a step should be taken further in examining the "5 capital" model developed by Porritt (2005) which consists from the following types of capital: manufactured, financial, human, social and naturel. Those 5 dimensions of capital correspond with the terms of access to resources, entitlements, institutions and governance, human resources and technology, expressing the entanglement of economic development and adaptive capacity. Many others also researched the different expressions of capital. Lucas (1988) concluded that the differences in human capital are so large that they can explain the poverty presence and its lack in different countries. On the other hand, according to Moretti (2004), businesses which hire more educated workers are growing faster and have higher rates of productivity. In addition to these findings, there is a study examining the role of social capital and the ability to exploiting financial structures, by Guiso et al. (2004). They have concluded that social capital matters most where both levels of education and law enforcement are weak. A wide range of literature has been reviewed by Winters (2004), where the findings revealed a relationship between trade liberalization and poverty reduction. Further investigation of this interdependence led to the conclusion that the positive form of existence of the relationship depends on the stability of markets, the ability of handling economic risk occurring from changes of the markets, access to technology, resources, honest and capable government, and policies for conflict resolutions and accumulation of human capital. In the end of the supporting arguments of entanglement between the levels of economic development of a countries, levels of adaptiveness to climate change, variability and extremes, an explanation from Sala-i-Martin et al. (2004) have to be included. They have explained economic growth by expressing its variations in human capital, health measures and access to resources, through investigating economic growth's involvement in primary school education, factors influencing human health levels on a national level, access to affordable goods and income per capita. (Yohe et al. 2007)

The relation between sustainable development and adaptive capacity

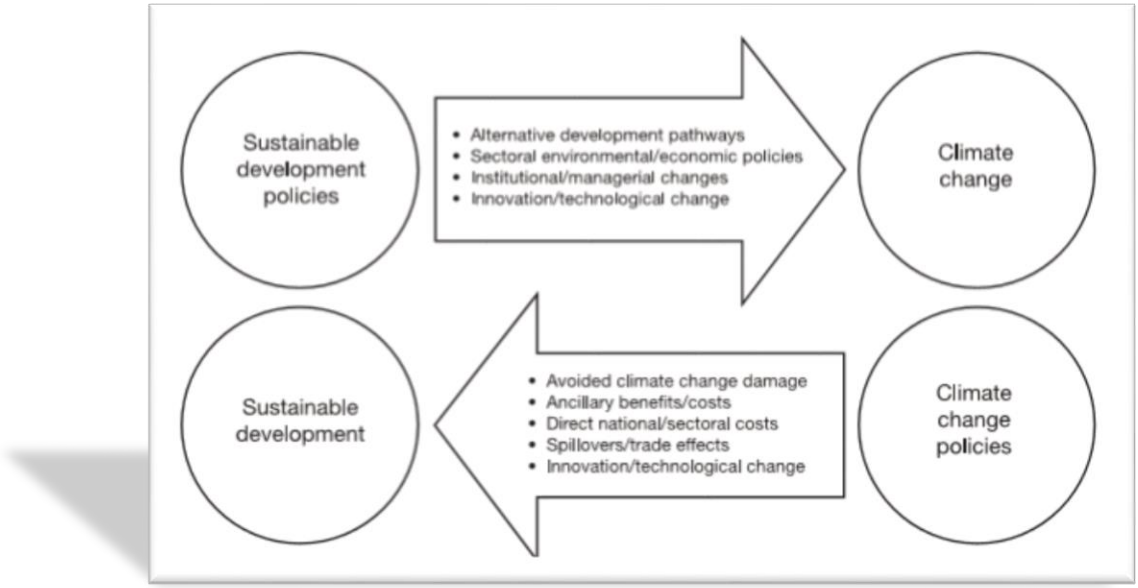
Climate change has always been changing through the ages. However, in the last decades with the development of economy, the extrinsic impact over the environment has been caused by the rapid growth of human industries and civilization. Different regions have been affected by the climate change, therefore scholars and governments have acknowledged this and have been focusing on taking measures in order to protect the urban areas and their inhabitants from potential bad impacts, emerging from the climate change. Many organizations are working on problems related to climate change which result in differences in assumptions and forecasting restrictions used as frameworks or guiding lines, which a successful strategy of adaptation could be based on.

The United Nation's International Panel of Climate Change (IPCC) has developed a set of scenarios in order to enable the forecasting of future climate impacts. The scenarios are meant to forecast by year 2100 to make easier to imagine the future now. There are four main storylines which formulate four main scenarios: A1, A2, B1 and B2. The separation of storylines is due to the different future they represent. Their purpose as a whole is to represent the various uncertainties in front of humanity and the future of the planet. Also, they cover a wide range of key factors such as demographic and technological change, and economic development. However, since they are meant to forecast a potential future, their feasibility or potential of occurring should not be based only the current economic, social and technological situation. (IPCC, 2000, p.5)

Based on the propositions of IPCC, it is evident that there is indeed a connection between development and climate adaptive capabilities. Therefore, it follows that the choices made for reaching a certain type of development and the reasons that define them are affecting the levels of climate impact over areas. It also changes the capacity of the system to manage the occurred climate changes. This statement has been supported by Shaw (2006), Jung (2005), Haddad (2005) and Tompkins and Adger (2005). Their work has been summarized in Perspectives on climate change and sustainability (Yohe et al. 2007, page 817), by presenting the importance of the factors as follows: local-scale disaster risk reduction and resource management, broader social dimensions (including government), societal engagement and rights, and levels of education. In addition to the acknowledgement of those factors from scholars, there has been another connected, expressed and investigated by Munasinghe and Swart (2005). As it is shown in Figure (5) bellow, climate change adaptation and sustainable development are not only connected but can reinforce each other.

In the stage of development that humanity is at, a lot of innovations are taking place. There are a lot of technologies which can be used as support to reducing the climate impact, and at the same time act as protections from the negative influence of climate change. These technologies and knowledge in the area can be used for decreasing energy consumptions, gas emissions, pollution from industries, etc. It is also important to recognize that technology, even though able to have a positive impact, is not the ultimate solution to resolving all problems. Or in that matter, completely "curing" our planet from climate changes. In Perspectives on climate change and sustainability (Yohe et al. 2007, page 817), an important side of the discussion has been focused on the actual influence of climate policies, and one of the biggest dilemmas with them. This is being argued by Gupta and Tol (2003) that climate-policies impact on the interaction between human and property rights.

Figure 5 Two-way linkages between climate and sustainable development. Source: Swart et al. (2003)



The measures which are meant to contribute to sustainable development or climate change adaptation should not be taken through isolation processes. The sustainable development of a region as well as its capability to adapt to the occurring climate changes are two sides of the same coin. They are influencing each other to such extent that excluding one from the other and taking solely decisions for solving current or future issues for only one of the two dimensions is not logical. Nor it will result in a positive impact for the two dimensions of change. Therefore, the consideration of confined measures would appear as irrational. In support of these allegations, Brooks et al. (2005) concluded that there is a significant importance for the adaptive capacity to include the aspects of health, governments and education. This realization is an interesting addition to the theory of direct and indirect drivers because it implies the importance of expanding the horizon beyond just categorizing influencing drivers. It also extends the prism of understanding of those factors by stressing that there are factors which are so critical in global context that they cannot be surpassed, delayed or ignored.

However, since the influence of such a direct factor as climate change is global, it is still hard for society to handle it on a global level. The theory rarely focuses on global sustainable solutions, and rather investigates and observes the different units of the global community. There are organizations as United Nations and other global institutions which are increasing the global awareness. Nonetheless, as far as they can go, at this point of social development and awareness, is proposing establishing of policies and global standards, in order to guide the developed and developing countries in their journey to sustainable existence. The distortion in the process of applying the principles of sustainable development has been reflected in the literature. Haddad (2005) emphasized the differences between the overall performance of economic development and the level of economic development in different

regions, influenced by the ways different people take different decisions, even if they are facing similar problems with same set of given information. Therefore, communities and their economic development differ globally.

The importance of differences and decisions made for adaptation and development have been noticed in the past. Based on information from different historic adaptation, Kates (2000) have exposed that there is indeed a difference between the successful implementation of climate adaptation measurements among societies with different access to resources. In relation to the notion of importance of utilization of technology, and the awareness of the limitations of the used technology, Ford et al. (2006) showed that technological development can alter the adaptive capacity of a community and the generations to come. The present understandings of climate change, adaptation and sustainable development will have influence over the perceptions on these matters in future. Therefore, the policies which are being adopted today have to be very carefully considered from all three angles before being implemented and finalized. We have reached a point where the entanglement between our actions and climate change of our planet is very strong. It is unthinkable to try to implement and accept decisions which are reflecting, or are in favor of only one of those aspects.

Globalization deepens the problem of establishing rational decisions based on both sustainable development and climate change. On one hand, climate change is a global event and it affects every region on a global scale. On the other hand, the resources on every region, as well as planetary, are limited. The conflict is causing disturbance in the contribution that each country could have to the global climate adaptation. It changes the results of adaptation capacity that a country has for facing its own obstacles caused by climate change. Thus, the outcome is uneven positive contribution to climate change globally, as well as added pressure to the decision making of separate communities.

Implications for environmental quality

Even though the entanglement between economic development and environmental security is gaining more popularity, it is still challenging for countries or regions to balance the effects of implemented policies regarding both sides of consideration. One of the biggest question marks today is connected with the usage of resources. This by itself represents a difficulty for creating balanced economic development and decreasing the environmental impact of human species over the planet. However, the acknowledgement of the environmental harm is a big step forward in comparison with what history shows us as known approaches for progress. Now, drivers and technologies can be considered, created and implemented in economic development with the means of making it sustainable.

However, the limitation of resources represents a true challenge for the knowledge that humans had so far, the way the world has been seen, and alters the direction of development by stimulating exploration of resources that are not limited. This shift in perspectives is a preposition for unbalanced, and not fully understood solutions for countries around the world.

In order to manage this problem in particular, monitoring over individual development of urban areas have gained popularity. Depending on the results of the observation processes, reports have been presented to the public which create an evaluation, allow for the observant to see the bigger picture and to draw upon the noted differences. In that relation Kates et al. (2005) have showed that the reflections have been made mainly from two perspectives: health of environmental resources and quality of environmental services. Since this includes both resources and their proper utilization, it is true for both developed and developing countries. As explained above, climate change is such a strong driver that from this perspective there is no difference between developed and developing countries, in a sense that they are all facing the climate change. The differences come from how the reaction to the driver diverse between the urban areas. Accordingly, developed countries do have an advantage – more financial resources, less poverty, more educated human capital, etc.; all that leads to the understanding that the factors encouraging sustainable development are more strongly expressed in the developed world.

In order to fully grasp the importance of environmental quality, a definition should be introduced. Winter-Nelson (1997) define environmental quality as a set of properties of the environment, by concerning both global and local characteristics, and evaluates their influence over human beings and other living organisms. This evaluation is performed by reflecting the needs and means of existence of various species, and their purpose. The definition has been specified further by the European Environment Agency (Environmental Terminology and Discovery Service, retrieved 2016) through emphasizing the relativeness, to the matter, of characteristics related with natural and built environment, and their consequence to physical and mental health. With the understanding of what environmental quality is, the importance of maintaining seems rather obvious.

Nevertheless, what appeared for a long time to be less distinct was that environmental quality goes beyond servicing as inspiration for sustainable development and climate adaptation. Even though, creating new approaches for developing sustainability and decreasing the negative impacts of climate change, it is also very valuable to use what is already present. In other words, the systems and approaches used up to this moment should not be blindly overruled, or claimed as inefficient and useless to the new set up goal for humanity. Rather, there is a need of transforming and including them into sustainable management practices. This can be achieved by recognizing various stimuli. According

to Bansal (2005) and Clark (2002) there are drivers which can stimulate sustainability. They have acknowledged that altering legal requirements may have possible positive effect on triggering increase in motivation for sustainable development. An example of their statement would be the various legislations which are being adopted by governments with the intention to stimulate sustainable development of an urban area, in terms of environmental preservation. As it will be presented later on in the process of building the argument of the thesis, countries as Denmark and Holland have developed adaptation strategies for sustainable development and climate adaptation. However, it is hard to forecast the long term impact of climate change with great accuracy, as it is hard to predict the direction of interest of the parties involved in sustainable development. Therefore, at this point of developed practices and gained knowledge about sustainable development and environmental impact, the action that have been taken, and will be taken in future, are not the ultimate ones. Rather, they are work under constant progress, and at this time of being they cannot be defined any differently, because of the increased tension between environmental protection and economic development which are now observed and discussed from various ecological and social perspectives, as explained by Kates et al. (2005).

Chapter 4: Framework for sustainable cities – Triple Bottom Line

Theoretical foundation: the "Triple bottom line"

For a long time sustainable cities have been seen as green or eco cities. Which have shaped the perception that decreasing the negative impact of urban areas is the most important function or purpose of a sustainable city. Even though, that is a crucial part of the perception of sustainability of an urban area, it is not the only goal that sustainability represents. Cities are locations with a great mixture of population and activities, which extends the definition of a sustainable city by integrating social, economic and environmental development.

The framework which will guide the investigation of the cities chosen for the purposes of this paper is the *Triple Bottom line*. This phrase has been introduced to the world in 1994 by John Elkington, who is the founder of the British consultancy organization called "SustainAbility". Initially the triple principle was developed in order to be implemented in the corporate world and to improve the performance of corporations, by providing a better measurement approach of profits, return of investments and shareholder value (Elkington, 1994). According to Elkington, this was possible by adding two factors with significant importance – society and environment. The result of his idea was three-dimensional perspective over performance – people, planet, profit (3P).

Environmentalists and scholars who have examined sustainability had seen the expansion of Elkington's concept beyond the corporate world. The Triple Bottom Line (TBL) concept has been used from people in and out the academic world for measuring sustainability. According to Andews Savitz's (2006) the TBL as a way of measuring sustainability levels in areas with different size, […captures the

essence of sustainability by measuring the impact of an organization's activities on the world ... including both its profitability and shareholder values and its social, human and environmental capital]. (Slaper, 2011, p.1)

There is no universal method for calculating the TBL. That also applies for the ways of measuring the three components. Even though, this sounds unedifying, it is actually a strength, since it allows for the observer to adapt the TBL regarding the needs of the entity that has being measured. Slaper (2011) summarizes that the 3P can be used for measuring various entities among which:

- Business entities
- Projects
- Policies
- Geographic entities defined by boundaries.

On theory there are measures which are particular for each element of the TBL.

Table 2 Measures for sustainability grouped for each element of TBL. Inspired by Slaper (2011)

Economic Measures	Environmental Measures	Social Measures
• **Income** • **Employment growth** • **Enterprises sizes** • **Employment rates by industry** • **Enterprises percentage by industry** • **Revenues by industry**	• Emissions types and levels • Prioritizing of pollution causes • Excessive nutrients • Consumption levels of electricity • Consumption levels of fossil fuels • Waste management – solid and hazard • Changes in landscape	• Unemployment rates • Share of female labor force • Household incomes • Urban poverty • Share of educated population with a post-secondary degree or certificate • Crime rates – violence • Life expectancies

The economic measurements are the ones that focus on measuring financial states or, in other words, the flow of money in the area that has been chosen for investigation. It typically looks at incomes and costs, taxes and factors which are related to business climate in the area. The results of this dimension are enrichened by the environmental measures which reflect on the national resources and they usage and importance. This dimension often includes the results of observations concerned with pollution of

the environment and waste management. Ideally, the results from the environmental dimension should help the investigators to identify the environmental impact of activities and policies. The circle is completed by measurements of education, well-being and social capital represented in the section of social measures (Slaper, 2011).

Practical research: People, Planet, Profit

The theoretical formulation of the TBL is recognized by many people – both in the academic and business world. The beauty of the model is that it can be implemented in various situations and used to investigate the performance of multiple entities – firms of any size, countries, areas, cities. Therefore, there are cases where it is chosen to be used from companies to investigate the sustainability levels of cities, as places of centralized urbanization. The practical perspective of the framework of sustainable cities in this paper is the report of Arcadis (2015), Design and Consultancy for natural and built assets. In their report they have presented a framework based on the 3P model with the outcome of balancing the three dimensions – social, economic and environmental.

Every city is unique and has its own problems to overcome and factors that has to be prioritized in order to find the right solutions. Cities are much more than a physical location. They are places of unity of different sides of human life and therefore they provide physical environment for developing an emotional attachment. In that way, they too become objects of emotional attachments. In this spirit, in the report of ARCADIS (2015), 50 cities have been included in the observation. Each one of them is standing by itself in its own uniqueness and success. The agency is comparing the 50 cities by distributing various factors among the three dimensions of the Triple Bottom Line. The results are very interesting because they show that the indexes for Planet, People and Profit have different value expressions. That would mean that the strengths and weaknesses regarding sustainability of the cities are distributed in different areas. Furthermore, these results allow for the researchers to draw conclusions of what are the problems that cities are facing. Therefore, forming of groups among the cities based on common obstacles to overcome is possible. The triple index report has implementations beyond scientific observations. It can be useful for organizations and governments in urban areas by providing them with information, which can assist or inspire them to take actions. Hence, allowing them to form strategies and policies for improving the sustainability levels of the particular urban area they belong to.

The limitations of the report include the number of cities. Another important specification would be that those cities are located in 31 countries. To that expands the validity of the research by confirming

its international relevance. In ARCADIS' report (Arcadis, 2015, p.11) the cities which have been selected have provided data regarding:

- Wide-raging geographical coverage
- Levels of economic development
- Forecasts for future growth levels
- Perceptions of future potential sustainability challenges.

The provided data has resulted in quantification of cities' performances. After that the results has been divided among the three dimensions of the TBL, followed by raking of the cities. The overall result is which cities are performing well in developing their sustainability and which cities are more troubled. The positive side for the cities which have not scored high in the ranking matrix is that since the results are distributed among the three indexes – people, planet and profit, it can be seen were the performance is especially weak and by thus providing a suggestion direction of taking actions in the more troubled areas. The key factors for each dimension have been showed in the Table (3) below.

Table 3 Key factors used for calculating the people, planet and profit index. Source: Arcadis, 2015, p.17-23.

People	Planet	Profit
• **Transport Infrastructure** • **Dependency Ratio** • **Inequality** • **Literacy** • **Education** • **Work-life balance** • **Health** • **Green spaces** • **Property prices**	• Energy use and renewable mix • Natural catastrophe exposure • Air pollution • Greenhouse gas emissions • Solid waste management • Drinking and sanitation	• Transport infrastructure • Energy efficiency • Economic development • Ease of doing business • Importance to global networks.

One of the most puzzling questions is "How do we create sustainable cities?". There are many organizations which are trying to give an answer to this question, or at least set the direction of thinking which will lead to the ultimate answer. Among these organizations is ARCADIS, contributing to finding ways of providing closure on this topic, and therefore assisting other organizations by providing such analytic information for sustainable performance of cities.

The leading organization in the global scene of involvement in sustainability programs is United Nations. One of the prime events regarding sustainable development will be hosted in Ecuador starting on 17th of October 2016 – Habitat III. Habitat is a program which relates to Housing and Sustainable Urban Development (Arcadis, 2015). Habitat III is the third conference with the agenda to establish secured political commitment for sustainable urban development, address poverty and future challenges in front of urbanization, and in particular – the "New Urban Agenda". (Habitat, 2014). That is why results from Habitat were taken under consideration in Arcadis' report.

It can be seen from Figure (8) in Chapter 5 that there is no city which has achieved a perfect performance in all criteria. This is true because of the uniqueness of the situation and environment figuring in each urban area. However, this framework can still be used as a starting point for establishing which cities are more successful in developing sustainability than others. That is possible through the unfolding of a clearer vision of what are the present problems; and enabling the emergence of more narrow questions – regarding specific problematic areas. In terms of contribution, this analytical data will help cities in their planning and development of strategies for overcoming the obstacles for achieving high(er) sustainability levels.

Chapter 5: Analysis

Why should sustainable cities be developed?

Cities are the most successful playground of economic and social life for the past years. Their popularity will only continue to grow through the following years. Researchers forecast that by 2050 two-thirds of the population and the economic growth will be placed in cities (United Nations, 2014). That makes them a very important unit of our civilization, as being the center of innovation, wealth and human unity. Nonetheless, the constant immigration in those urban areas is resulting in disadvantages of urbanizations – lack of green spaces, pollution, bad service rates, etc. As much as urbanization is important to the progress of humanity, it is also important to make it environmental friendly. This results not only in positive re-enforcement of the environment, but also will reflect in a positive manner over human population. Therefore, there is a desperate need of strategies that will contribute to greening the environment and stimulate equality in society. The importance of connection between the society, the governments and the industries in the area is undeniable. Thus statement is supported by Molly Elgin-Cossart who recognized that [an important objective of infrastructure is connectivity – to better connect individuals, especially those from traditionally marginalized groups, to the services they need to thrive…] (Center of International Cooperation, article, 2015).

Why Copenhagen and Rotterdam got chosen?

In the process of research, the reason for choosing Copenhagen and Rotterdam as subjects of investigation for the thesis was the results of the research made by Arcadis, as an effective framework for this thesis. The result could be improvement of strategies by mutual cooperation and learning from each other. This is an approach that can bring a lot of positivism towards the facing issues in urban areas in the same cluster, but it must not be forgotten that each city has its uniqueness; and no foreign mastery of an obstacle should be taken as a "pure coin".

The performance of each city has been observed in all dimension. Figure (8), from Chapter 5, shows that based on the results of the 3P index calculations, when the individual results of Copenhagen and Rotterdam in each dimension have been overlapped , those two cities are in top 5, from 50 cities in 31 countries, of sustainable performance. These results definitely put Copenhagen and Rotterdam in the spotlight of sustainability, defining them as leaders in sustainable development of urban areas with a unit of analysis – cities.

Figure 7 Measurement aspect of the performance of Rotterdam. Inspiration Source: Arcadis, 2015

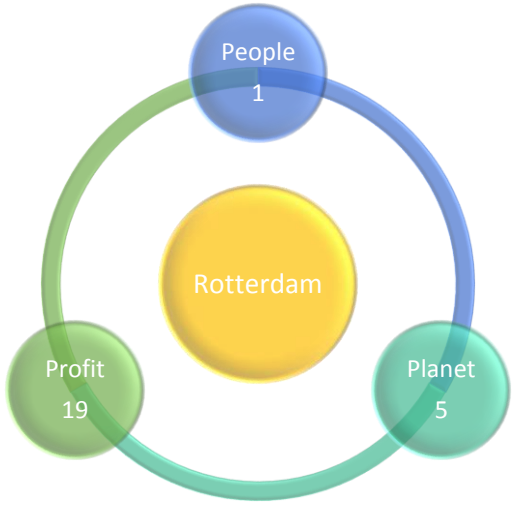


Figure 6 Measurement aspect of the performance of Copenhagen. Inspiration Source: Arcadis, 2015

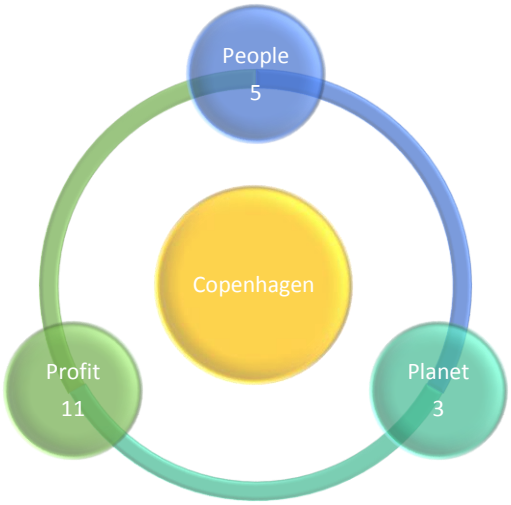


Figure 8 Scoreboard positioning of Copenhagen and Rotterdam. Source: Arcadis, 2015, p. 12

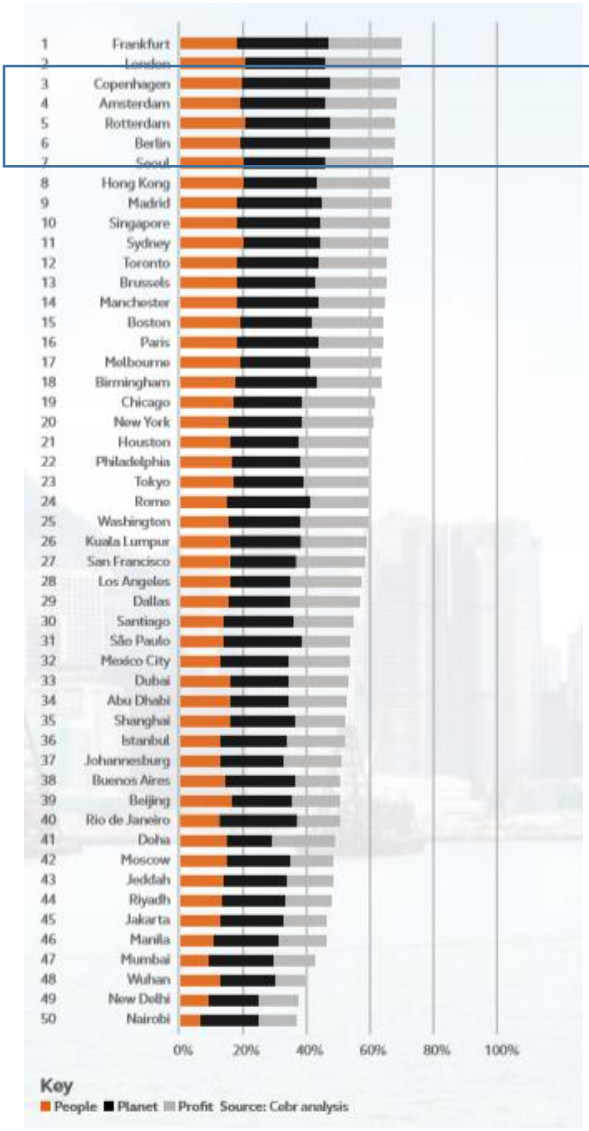


Figure (6) and Figure (7) are expressing the measurement aspect of the performance of Copenhagen and Rotterdam. As Copenhagen taking 3rd place and Rotterdam on the 5th place supports the assumption that those cities truly are leaders in sustainable development of urban areas.

On the other hand, on Figure (8), their individual achievements in the results can be seen. The overall suggestion of the interpretation of the results is that if there is a comparison to be made among the Planet, People and Profit index results, the Profit index is the strongest one from all three. Nonetheless, another interesting observation is the contradiction in the results in People and Planet index. They are not as synchronized as the results on the Profit index. In fact, the differences point out that for Copenhagen the weakest point is the Planet. On the other hand, Rotterdam seems not to perform so well in People index. These results cause for an intriguing conclusion from first sight. Even though, both cities are Delta cities, and therefore – facing similar issues and problematic aspects of urbanization, they do not perform equally well in the three dimensions.

Furthermore, it becomes clear that Copenhagen and Rotterdam have managed to establish different success levels in the different dimensions. This means that despite their common problems, they have different approaches of overcoming obstacles and adapting to climate change. This could be due to different strategies for developing sustainability, different factors which are present in environment – social, natural surroundings and political. The results of the 3P index measurements, except for being very positive, also rises a lot of questions with many probable answers. This is the third reason that makes Copenhagen and Rotterdam particularly interesting as subjects of examination for this thesis.

Copenhagen

Copenhagen is the capital of one of the most successful Scandinavian countries – Denmark. The area of the city is placed on more than 74km^2, and has an overall population of more than 2 million people (Statistics Denmark, January 2016):

- Municipal population – 591 481 people;
- Urban population – 1 280 371.

Copenhagen is the proud owner of the title "European Green Capital" for 2014. Based on all the sustainable programs and activities that have been performed in the city through the years and to this day, this is a well-deserved price. Probably the most famous sustainable implementation in the urban area of the Danish capital is the bicycle-friendly environment. This has become a reality owing to the well-developed transport infrastructure spreading all around the city. The success with the infrastructure doesn't only affect cyclists, but also has a positive impact on the usage of public transportation. Through the implementation of solutions for rising the efficiency of transportation in the area, Copenhagen aims to reach 75% of the population to be using bicycles, public transport or walking as means of transportation, by 2025. Some might say that this is a bold goal. However, they might be wrong, since by 2015 50% of the journeys were already made through those three transportation solutions (European Commission, 2014).

On the side of high transportation efficiency, the city has also been focusing on various approaches towards decreasing the environmental impact of the private and business activities; among which are public-private partnerships (Andonova, 2010) working on projects related to eco-innovations and sustainable employment. One of those projects is the development of the North Harbor (European Commission, 2014). Green projects like this have the potential to be exported and implemented in areas outside of Copenhagen. This increases the value of the North Harbor project.

The innovation in the name of sustainability doesn't stop here. Copenhagen has turned itself into a place of great change and transformation, and is working on the development of a brighter future. Forecasts reveal that by 2025 the amount of expected investments for reducing emissions will be from direct investments - $472 million, and $4.78 billion of the investments will be coming from the private sector (Blue and Green Tomorrow, Article, 2014). The changes taking place for reaching carbon neutrality in the next 10 years are focused on improving the energy efficiency of buildings; reducing the levels of energy usage in general; refocusing the energy production towards renewable resources. Except changing the buildings and the infrastructure of the city, Copenhagen is also making steps for managing bigger issues – such as facing the dangers of floods by literally reshaping the streets.

Another perspective that needs to be acknowledged as a positive strategy towards increasing the levels of sustainable performance is the recognition of importance of the citizens. More specifically, the local government has been collaborating with organizations and universities in the spirit of lowering the unemployment rates while at the same time building a greener future for the whole community. In addition, there are various initiatives gaining popularity, such as KARMA (European Commission, 2014). KARMA is an initiative which targets promoting cycling as main means of transportation; and has been accomplishing very successful communication with citizens; and reaching positive results in engaging the members of the community in more environmentally friendly and responsible lifestyles.

There is much more to be said about Copenhagen's solutions for developing sustainability which will be discussed further and in more detail in the next sections of the thesis. By then, the following quotation is a good ending of the introduction of Copenhagen's significance in sustainable development:

"But in Denmark, sustainable city planning is not a niche; it's just what we do."

Brain Vad Mathiesen, (The Guardian, Article, Braw E., 2013)

Rotterdam

Found in year 1270, Rotterdam is a city with a lot of history and accordingly have went through a lot of changes during the years. It is located in South Holland with a population of 630 383 people (by collected data in 2014)(CBS StatLine, 2015). In comparison with Copenhagen it seems as it is a lot smaller, however for the demographic disposition of Holland it is one of the biggest cities. The reason to specify the importance of demographic population distribution across the Holland is because this country is particularly interesting with its even population configuration among its urban areas, which creates stable levels of population distribution in the country. Putting the size of the city on a side, population-wise, it has established itself as the biggest cargo port in Europe, and classifies on 10th place in the world. Rotterdam's delta disposition has given its contribution to the success of the urban center. In combination with well-developed strategies for managing the particular obstacles of the urban area, it is now recognized as the "Gateway to Europe"; or according to Europe as an originating point – "The Gateway to the World" (Rotterdam Climate Initiative, 2011).

On the notion of sustainability, Rotterdam has a goal to be the most sustainable port city in the world. The actions that are planned to be performed to achieve this state of development are a combination

of collaboration between different parties for developing green, safe and healthy environment, and therefore establish a better future for the community. However, the ambitions of the city doesn't stop here. A part of the development strategy is to eventually share the knowledge, and successful practices with other urban areas in the Holland, and expand to an international exchange or ideas.

Another factor that makes Rotterdam interesting, as a subject of examination for the thesis, is the twist between the past and the future. In the past, the city has being developing industries which were based mostly on fossil fuels. This became unsupportable with the emergence of climate change impacts. Therefore, Rotterdam came with a solution which does not remove the old industries. Instead, the city created environment which allowed for those industries to become the foundation of the greener future. To clarify this statement, a good example would be the presence of already developed power plants, agricultural and food industry, which providing the foundations needed for a bio-based economy (Rotterdam Climate Initiative, 2011). Nonetheless, there are still industries which have not made the full transition, meaning that they still have relatively high emission rate. Therefore, the process "Carbon Capture and Storage" has been implemented in the area; which idea is to capture the emissions, released from the operating of the companies, and not allowing them to go to the atmosphere and increase the levels of pollution.

Rotterdam, as an urban area, doesn't only acknowledge the importance of the participation of the enterprises. As a city that recognizes the importance of sustainable functioning, there is also collaboration and informative initiatives around the area meant to increase the awareness of the citizens of this habitat. In fact, one of the strongest motivational factors behind sustainable development in Rotterdam is the creation of a better living environment for its people. This is just one of the keys in the Rotterdam mentality presented by the mayor of the city (Sustainable cities, Local stories, article quote):

"Reducing CO2 emissions by 50% in 2025, making sure that we are prepared for climate change, and boosting economic growth - together we can achieve these goals if we, as market parties, citizens and government authorities, pool resources and join forces. Our willingness and ability to put our backs into this is what makes this innovative collaboration an example in point of the Rotterdam mentality."

Ahmed Aboutaleb

Sustainable solutions of Copenhagen

In the past a main conception was that environmental preservation entangled with business development would intervene with the economic growth (UNDP, 2012). Fortunately, that is not the case anymore, and positive outcomes of environmental friendly solutions have been seen. The city of Copenhagen has chosen the path of sustainability because of other factors, as well. Limited resources foresee the need for strategies and decisions which would lead to more efficient usage of those resources. Considering that half of the population of the world is living in cities, Copenhagen community finds it only logical then that cities should be the first units of urban development that are engaging in developing sustainability. (Copenhagen Carbon Neutral by 2025, 2012, p.4-5)

The harbor

It was presented that one of the main problems the city of Copenhagen is facing today is the old sewage system. This holds a negative impact against the city not only because of its incapacity to manage the expected uprising waters and increasing of the volume of rain events. Another issue, which brought attention to the sewage system was the pollution it distributes to water pools with which it is connected. The highlight focus for investments, solutions and proposed strategies landed on the condition of the harbor. Since the water was polluted from the old sewage systems and the local industries the zone of the harbor became unpleasant to the citizens. Because there was a high rate of neglecting the area, swimming was impossible in this conditions. The chances of this area turning into an unmaintained region were too high. As explained in “Copenhagen: Solutions for sustainable cities” (ARUP, 2012), the inadequate capacity of the sewage system of handling the current needs and issues that the city is facing were resulting into flooding the harbor with wastewater. Further issue was becoming the relocation of the industrial zones, which led to unused space and lowering down the progress of the harbor area. With this collection of problems and potential future threats it became clear that the Copenhagen harbor needed to be taken care of as a place of good image and physical occupations. In relation with the Climate Adaptation Plan and the resources at use the following solutions have been implemented through time in order to turn the harbor blue again:

Modernizing the sewage system and Divert local rainwater

Using new technological approaches has enabled the improvement of sewage system functioning. Rainwater reservoirs and conduits were constructed, which allows for the ability to separate wastewater from the rest of the water flow in the sewages by storing it until there is enough space again in the sewage to handle it. In addition, actions for cleaning up the sewages were taken. In order for heavy metal compounds to be removed different cleaning steps have taken place, including

physical, biological and chemical. Furthermore, heavy metals have been discharged by gasification and incineration processes to remove nutrition salts. Another technique used by the city is closing many of the channels connecting the sewage systems and the harbor. By lowering the number of affective exits to the harbor and using a strict policy of only discharging wastewater in the harbor during heavy rains, the negative impact of high wastewater volume going out to the harbor have been decreased sufficiently. Another important implementation is the new way of distributing the water. Since there are expected heavier rains in future, which means higher water volumes, the innovation in the approach is diverting. A local channel system has been put to use with the idea of creating local rainwater pro-active systems. This allows for the rain water and the wastewater to be stored and managed on a local level. The pro-active system allows, depending on the reached water levels, different paces of releasing the water in the harbor with the result of decrease changes of floods, and abuse of the harbor capacity. (ARUP, 2012)

Blue recreation space and Innovative automatic warning system

With the withdrawn attention of industrial world from the Harbor, there was a lot of space which was not utilized in any way. Through the solution for the Harbor's integration into the city, and including it again as a landscape in the city an innovative idea has emerged. By building a Harbor Bath it became possible for changing the image of the Harbor to a cultural center and a place of entertainment, by at the same time creating a safe, desirable and flexible environment to satisfy many of the needs of the citizens. What makes this idea innovative is that typically pools and bath spaces are built on land by adding water. The challenge that architectures and the organizations involved in the Harbor Bath project were facing were connected with solving question related to how a construction as big as this can be built in the water, and at the same time to create pleasant conditions for the users. (Archdaily, 2009)

Figure 9 Illustration1: The Harbor Bath principle of construction. Source: Archdaily, 2009

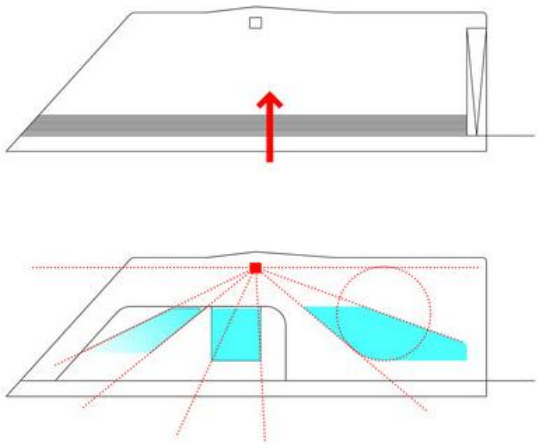
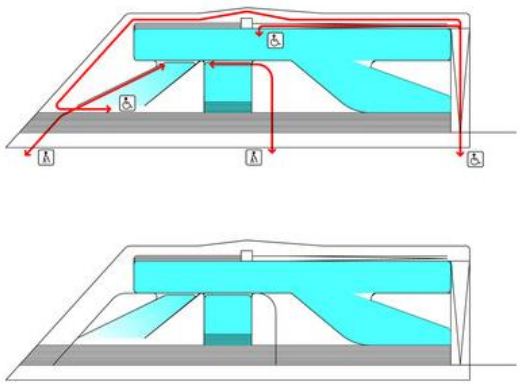


Figure 10 Illustration2: The Harbor Bath principle of construction. Source: Archdaily, 2009



The illustration from Figure (9) and Figure (10) represents the physical expression of the Harbor Bath idea. The Harbor Bath is a bended plate that connects the pier with the new promenade and the water. The pools locations are based on calculations from radial lines originating from the lifeguard post in order to increase safety by completely avoiding blind spots of the pool area. Since there is a jumping area, the depth of the diving pool has been entangled with the geometry of 12 meter at the 5 meters of jump height. In order for the area to be welcoming and convenient for all citizens a large single ramp has been constructed for allowing access to all areas, considering the needs of people with disabilities. These are all aspects of the idea of the Harbor Bath. The further implementation of the Harbor Bath into people's lives is that it is free of charge and can accommodate up to 600 people. The Harbor bath idea is innovative not only because of its reversed principle construction for the area of Copenhagen, but also because it uses the strategy of improving the life style of Copenhageners by providing them with a place where they can have a swim in the middle of the city, a place where resting and aquatic activities are available, and a place of decreased stress levels from the hurry city life. By using the positive outcome from the contribution of the construction to bring the image and usage of the Harbor to another level. (Archdaily, 2009)

In addition to the newly well-developed entertainment zone on the Harbor the city has successfully integrated in society a new automatic innovative warning system which is accessible for free on the site of the city, and is also available for mobile devices with differently originating software. The goal of the warning system is to measure the bacterial levels of the water in the Harbor and forecasts where and when it is safe to swim. This is a "nice touch" for the city hence the higher water pollution levels before applying the current innovations which enhanced the efficiency of the sewage system. (Copenhagen Carbon Neutral by 2025, 2012)

Planning regulations and urban design

In terms of adaptation and implementation of the strategies needed for overcoming climate change negative impacts and increasing the quality of life in the city in general, planning regulations are needed. The new additions to the planning regulations of the city are mostly connected with the distribution of rain and wastewater and the utilization of the sewages. For the new developments of the city is it obligatory to use separate systems for handling wastewater and water from storm surges (Copenhagen Carbon Neutral by 2025, 2011). There is a difference of the rules applied for utility providers and landowners. According to the new regulations the utility providers operate a reimbursement scheme. At the same time, a landowner who is connecting to the sewer system is repaid the connection charge amount if the rainwater is distributed locally. Shifting the focus to whole areas instead of individual properties, new sewage system has been established, which is referred to as a "three-tiered", and its main purpose is to protect the new area from flooding, by adaptively reacting to the changing conditions of the environment. The concept of the system is that there are three different elements of it which are meant to operate with different types of water – roof, road and black waste water. The "three-tiered" system is also related with the urban design of the city of Copenhagen. Since Copenhagen is a Delta city and most of the problems of the urban area are interconnected with the sea levels and rain events, it is indeed important for the city to implement solutions in the urban design. Therefore, now the urban design is completely integrated into the wastewater management system in several aspects, overlapping urban design decisions from development of green roofs to storage capacity of the area. (Copenhagen Carbon Neutral by 2025, 2012)

Robust and integrated management system and Long term thinking

The main problem with the harbor was connected with the not good condition of the sewage system. It is interesting to observe how from recognizing one main problem, and finding several solutions to it might lead to a whole different aspect of looking at the problem. In the case of Copenhagen's Harbor there was a transition from the physical extend of the problem, to adding non-materialistic approach and focusing on integration of a part of the urban area into to community. This transition of approaches, their entanglement and successful implementation emerges from collaborations between different private and public organizations, as well as the more individualistic involvement of the citizens of Copenhagen.

Through the history of Copenhagen it is visible that the taken approaches for improvement of the city have been orientated in long term development and interconnection of projects. A proof for that is the formulated in 1976 the Wastewater Management Plan, which in long term has allowed observation

and presented unnoticed opportunities, in previous times, such as building a Harbor Bath in year 2001. (Copenhagen Carbon Neutral by 2025, 2012)

Water efficiency

The change of the levels of groundwater has been forecasted as a crucial problem. Even though, it has been determined as a problem of the future that doesn't exclude the reality that levels of groundwater are also a problem in present days. As a growing city and an urban center of development, Copenhagen's overall need of water is increasing which leads to depletion of the groundwater, as a resource, and creates deficiency in water supply around the city.

The main challenge for the city is how to maintain the quality of drinking water in future, as using groundwater as a source. Added to the factor of limited groundwater source, pesticide spills around the city are not contributing positively to the drinking water situation because of the contamination they are creating in the water sources. This line of events leads to the inconvenience of the need for the water to be piped from long distances around the city in order to satisfy the rising water demand of the community of the urban area. On the other hand, in "Copenhagen Carbon Neutral by 2025 (2012), the expected rising levels of groundwater are deepening this problem since they cause spills from the ground wells and this causes distribution of a treated water.

Created an evidence base and SMART system management

In order for an effective solution to be presented, first the evidences should be clear. In this regard, the city of Copenhagen started executing initiatives for creating an evidence base. Because of the changing conditions of the climate and therefore the environments, there are also changes in the groundwater conditions. Copenhagen is located in an area with relatively high concentration of underground waters, spread through the territory of the city. Groundwater affects the conditions on the surfaces. By changing the purity levels of groundwater a change of the chemical conditions of the soil are inevitable. From another perspective, the misplacement of groundwater also affects the stability of the surface by changing the pressure points in the ground. These factors have an impact on the urban design on the area. Therefore, as a solution actions of mapping the sediments bellow the city have been taken. The accuracy of the results from the mapping analysis has been improved by new SMART system management which regulates the water pressure. Other innovative measures have been brought to light which include creating a detailed groundwater model in combination with 3D mapping reaching 300 meters of depth under the city. Last but not least, the city has implemented a construction models of a hydrological cycle around the city for increasing the efficiency of distribution of water supplies. (Copenhagen Carbon Neutral by 2025, 2012)

Water efficiency

In most cities the water losses goes up to 40-50%. The main reasons for these high percentages are leakages of pipelines and inefficient regulation of the water infrastructure in a city. The city of Copenhagen has realized those shortcomings in the regulations and have placed a lot of investments in this area. The minimization of water loss in the city's water infrastructure has been achieved through a lead detection technology combined with the SMART system management. These measures have proven to be highly effective in saving the water supply of the urban area, and decreasing the waste of water down to only 6%-7%. (Copenhagen Carbon Neutral by 2025, 2012)

Apart from the losses presented by the previous not very successful utilization of the sewage system around the city, another crucial moment in water management proves to be the management of rain water. One of the hardest parts of managing rainwater is the factor that it is running water with changing location. In the past there wasn't really an efficient way to handle a run-off water. However, the current principle has been applied in Copenhagen is the local storage and contain of rain water which makes its guidance through the city (above and underground) easier by slowing it down, and by thus creating time and opportunity for the sewer system to take it. There is also a need acknowledged, that there should be a separation between the rainwater and storm water management. Nevertheless, they have to be integrated in all new developments around the city, and face the same principles of management but divided into two different main systems. (Copenhagen Carbon Neutral by 2025, 2012)

Table 4 Five main types of systems employed for efficient waste water management. Inspired by Copenhagen Carbon Neutral by 2025 (2012)

Evaporation	**Green roofs**
Recycling	Local reuse of water storages for gardening, washing clothes, flushing, etc.
Percolation	Permeable paving
Delay	Paved areas which store water and move it around before the time has come for it to be discharged in the sewage system; also called "Balancing ponds"
Purification	A variety of methods for filtration and separation (for example – oil separators, filters, etc.)

Financial incentives and Awareness Campaigns

Copenhagen Carbon Neutral by 2025 (2012) emphasizes that few tactics have been developed for stimulating the involvement of businesses and individuals in the Waste Water Management. The

tactics are mainly divided on two approaches – material stimuli and information distributions. First, incentives have been developed for reducing the rainwater spills into the city and into the sewer system. Approximately 3000 Euros have been available to companies and citizens for encouraging them to reuse collected rainwater, with 5 Euros per cubic meter for reducing the wastage of drinking. On the other side, the information exchange has been managed through various presentations with the aim of reducing the consumption of water per person. The optimal target of increasing the awareness of citizens is cutting down the consumption from 110 liters per day to 100 liters per day.

Cycling

The main problem that this solution is fighting is gas emissions and pollution of the air. Therefore, the battle as described from the city is between two and four wheels. The tendency leans towards the law that if people can afford a car they would prefer having a car. A lot of resources have been put into promoting cycling in the area. The city is located in an area which is flat and easy to be travelled with a bike. However, the obstacle is that the climate is not particularly convenient for cycling all the time. The forecasts point that in the winter the temperatures in the area drop to -15^{o} , and the usual annual rainfall density is around 600mm. Focusing a lot of efforts on promoting cycling has a positive impact on the environment, considering the population rate in Copenhagen. For building the presentation of sustainable solutions, Copenhagen Carbon Neutral by 2025 (2012), stresses that around 50% of the population is using bicycles as main means of transportation. It also has to be considered that the first bike lane was built in 1896, and the first cycling lane plan was written in early 1980s. Since then the infrastructure is just continuing to improve and develop. The first major step that the city has done in favor of cycling is building an infrastructure. The cycling infrastructure consists from bike lanes which are separated from the other roads and provides safe travels for the cyclists. With the development of the infrastructure of the city many roads were transformed because of building more direct lines which are connecting key locations all around the city.

An addition to the infrastructure is the so called “green waves”. The green waves are a smooth line of green light across the city. The idea is to make the cycling trips easier and faster in rush hours. The principal is built on an average speed of cyclists around the city, which is 16 km/h. However, the speed on which the traffic light switch is based on is 20 km/h, because it is considered that it stimulates the faster cyclists to slow down without creating extra tension in the trips. The green waves are enabled in the morning and afternoon rush hours. The green waves are not only based on speed but also on quantity of cyclists passing an intersection. In other words, if there are five or more cyclists heading for an intersection at the same time, the light will stay green until they all pass the intersection. Nonetheless, at this point of urban development the green waves are not present everywhere around

the city. They are concentrated in the main streets of the city where the traffic is more intense. According to researches, around 80 000 people will ride the green waves per day, which represents approximately 26% of the cyclists entering the city center per day. (Online source: The Blog, 2014)

Furthermore, there are many initiatives that are active across the country. One of which is the Cycling Embassy. Even though, this is not an organization which is highly focused on improving the cycling perception of Copenhageners, it is still important to acknowledge its contribution. It should not be forgotten that the development of Copenhagen does not only depend on local society understandings and development initiatives. The influence of the Danish culture should be recognized as important. Danes are a cycling oriented nation and that does contribute to the successful integration of better cycling environment around the city of Copenhagen. However, Copenhagen is still the most sustainably developed city in the country. The Cycling Embassy is an organization with extremely positive impact which works towards increasing the preferences of using a bike, and strives to lower the need of using four wheels. One of the newest and most successful programs implemented from the Cycling Embassy is oriented towards children's education of the benefits and importance of using a bike. The campaign is covering the number of 50 000 children (Dalhof, 2015). In 2015 the focus of the event was to educate kids how important are lights in traffic. This is an initiative which enables the knowledge transfer from school to the city streets, and has proven to be very important since Danes start riding bicycles from a young age.

From a national perspective, another innovative idea has established itself as extremely successful and has positive influence over the everyday life of Danes. This is the family bicycle. An interesting concept which is not present in many other countries. It gives the convenience of parents to transport in a more efficient and easier was their children around the urban areas. The successful utilization of the innovative idea has been encouraged even further by it being free of charge for locals and tourists in Copenhagen in particular. (Copenhagen Carbon Neutral by 2025, 2012)

Integrated public transport

The concept of public transportation has rising importance in big areas. The main purpose of this kind of transport is to serve as means of transportation of the general public. It is extremely popular and necessary in urban areas. There is a specific way of managing the public transportation in an area. It connects with the infrastructure built for it, as well as synchronization of the traffic forecasts and time estimations, which are meant to result in more accurate and efficient transitions through the city veins.

Public transportation has an impact not only on citizens' everyday lives, but also influences the natural environment in an area. It is still one of the main ways to fight air pollution, because of the increased

usage of cars and other individual means of transportation operating on fossil fuels. According to a report of sustainable solutions implemented in Copenhagen, there has been a severe increase of car usage. For a time period of 40 years the number of cars has gone up with around 1.5 million automobiles, in Denmark. Accordingly, that led to increase in the CO_2 emissions. (Ministry of transport, Denmark, 2011)

Most of the solutions that have been used to give public transportation a green light are in the frame of services, and improving the citizens' experience while using public transportation. A big part of the solutions are connected with the ticketing principles. Copenhagen has a high population rate, which means that the amount of people which are targeted for using public transportation is high. Therefore, one part of the solution is creating an integrated ticket, which can be used through three of the main types of transportation – buses, trains and metro. Another idea which has made the user experience very friendly is the SMS ticketing. This concept is taking advantage of the higher use of electronic mobile devises. By using the service of SMS ticket the passengers are enabled to receive an electronic version of a ticket based on their starting location and ending destination. By using the SMS ticket service the experience of the trip is not only more efficient but in general gives the possibility for lowering ticket price, since the operational costs are minimized. This concept has become possible through a collaboration between two main parties: the company responsible for the three main ways of public transportation – bus, train, metro; and the mobile operators in the area. This is a crucial collaboration which enables the payment easiness of the SMS ticket by including the financial value of the ticket into the phone bill, received monthly by users. The results from this implemented idea are showing that around 60% of the tickets for public transportation in Copenhagen are now purchased on that principle; with the forecast of complete extinguishing of the usage of paper tickets in near future. (Copenhagen Carbon Neutral by 2025, 2012)

The physical actions towards popularizing public transportation as main means of transit through the city are focused on improvements which are directly focused on the material assets of public transportation, as well as implementation of software. Of course, these still contribute to the better travel experience of the citizens. Since one of the main obstacles recognized from the city of Copenhagen is not good enough placement of stops around the city, an important decision which have had a positive impact on the community is the integration of more bus stops in closer proximity with the metro stations and other public transportation facilities. This will create easiness in transfer between transportation means and provide better transition experience, in addition to the user friendly services. Another feature, which principle has already been introduced in the previous solution "Cycling", is also applied for the buses. A software connecting current locations and speed of buses allows for traffic lights to be kept green in a trace, with the purpose of reducing the time spend of a

trip by using the so called “bus priority signaling systems”. The technology applied for tracking the buses from the traffic control operators is also being used to contribute to the accuracy of information by enabling for the data to be reviewed online from mobile devices. Among the last solutions that have been introduced to the public is the establishment of parking areas for bicycles around the metro and train stations, where citizens can leave there bikes enjoying safety and easiness in transition between different types of transportation. Of course, the possibility of citizens not desiring to leave their bikes before continuing their travels has been taken under consideration. It has resulted in adding special compartments in trains so that bikes can also be carried in a convenient way where long trips are taking place. (Copenhagen Carbon Neutral by 2025, 2012)

At this point of development the city of Copenhagen has been very successful in sustainable implementations for improving the well-being of citizens by promoting preservation of the environment. Through collaborations and user oriented strategies Copenhageners are now enjoying an efficient, highly integrated and reliable public transportation system.

Waste management

A fundamental philosophy of managing waste successfully in the city of Copenhagen, is treating the waste as a resource. In Copenhagen Carbon Neutral by 2025 (2012) is emphasized the city has truly transformed the understanding of waste by techniques like setting a fixed price for collecting recyclables, charges for residual waste based on volume of the waste, and others. Furthermore, Copenhagen Carbon Neutral by 2025 (2012) discloses various programs which have been implemented for years Copenhagen’s significant progress have been made in managing waste in comparison with other cities. The current results are less than 2% of waste sent to landfill. Waste has been recognized as a mean to help develop sustainable solutions across the urban area. Around 60% of the waste has been recycled, and the waste which is residual has been used to produce heat, which is added to the heating distribution system of the city. The transformation activities around the efficient utilization of waste have been supported and stimulated by regional legislations through integrated strategies and policies. At this point of development, Waste Management is playing an important role in establishing sustainability. Using waste as a renewable energy source allows closing a cycle of pollution caused by over-waste amounts over the city. According to an article (State of Green, Article: Making the most of waste), many doors are opening and allowing for it to be successfully included in long term strategies and means for achieving a sustainable and green urban area with well-developed economy.

According to Copenhagen’s sustainable solutions (2012), very positive impact has been made with the creation of a pilot plant, in 2009, for treating 800kg/hour of gathered household waste, as a part of

REnescience project. The project exists as a cooperation between Dong Energy and Amagerforbrænding. The treatment of waste in the farm consists of separating the organic from inorganic waste and converting those in biogas or bioethanol. These have many implementations through the city. Moreover, produced quantities of them are enough to meet the demand of heat and energy in the area.

Public support for wind power

With the peak of renewable energy resources, Denmark is one of the countries that produces its power mostly by using renewables. The most popular green resource in the country is wind, which can be explained by the climate characteristics of the country. Nonetheless, there are obstacles which prevent the full utilization of wind and the required equipment. In the area of Copenhagen these challenges are mainly three (Copenhagen Carbon Neutral by 2025, 2012), which determine the course of the solutions for using green energy.

1. Limited space for implementation in a large scale of urban development.
2. Expensive equipment.
3. Public resistance of the impact of the turbines.

The main ways in which the city of Copenhagen have chosen to face those obstacles is through [encourage popular support for wind power by creating a community owned facility and using local skills] (Copenhagen Carbon Neutral by 2025, 2012, p. 25). Considering the high prices of the needed equipment for building wind mills a solution was required. In that way the development of renewable energy source can continue affecting positively the community and increase the environmental impact.

As a solution, the first wind farm with shared ownership was built in Middelgrunden. The wind farm is owned by utility company and the community, where half the ownership belongs to the utility company, and the other half is shared among 8 650 locals. From efficiency point of view, each share ideally produces 1000 kWh/year, and had been sold for DKK 4 250. Even though, that was a huge step in introducing the wind mill principle to the community, there was still skepticism regarding the noise produced by the wind turbines and the way installations would affect the urban landscape. Therefore, the strategy that was chosen was to directly introduce members of the community to the equipment. A Public Awareness Campaign has been held which expressed itself in organizing demonstration tours of on-shore wind turbines in order to help convince the public that the expected noise negative impact is not present. (Copenhagen Carbon Neutral by 2025, 2012)

From the perspective of equipment, measures have been taken to lower the costs and increase the efficiency of construction. Another problematic factor for establishing successfully the wind mill equipment is the severe winter conditions. For that reason, specially designed foundations have been developed. However, many other factors also played an important role in the successful execution of this strategy. Optimization was needed and it was also focused on tidal movements, ice loads, the importance of robust submarine cables, fatigue strength, etc. In time, a high efficiency for construction of wind turbines was developed, lowering the time of construction down to 18 hours for constructing two turbines. The production and installation of wind mills therefore lead to producing energy, which rose the need of establishing a grid reinforcement. This is truly an important completion of the solution because of the increased energy levels intermitted from the turbines, and avoiding the risks of power shortages, and unbalanced energy grid. (Copenhagen Carbon Neutral by 2025, 2012)

The future intentions of the city are entangled in the national development plans. The Danish government has set an aim of 50% of the electricity in the country to be produces by wind power by 2030. Since this is rather soon, this kind of ambitions and deadlines are drives for innovation in the renewable sector. Therefore, in combination with the forecasts and recommendations of the Copenhagen Climate Adaptation Plan, the city has set a goal for 100 new wind turbines to be build till 2025 (Copenhagen Carbon Neutral by 2025, 2012). This strategical goal is combines with the urban design of the area and leads to plans of locating new plantations with wind turbines outside of the city – considering both land and sea as a building base. All these goal are planning to be achieved in the cooperation of organizations and the support of the community.

Keeping the city warm

Society's activities are mostly based on fossil fuels, which are not only harmful for the environment and the climate of the planet, but also are limited. In the last years, we have faces nothing but rising fuel prices. This has been turning into a big problem since big part of all equipment being used depends on fossil fuels. Acknowledging that, Copenhagen once again came up with a solution for lowering down the negative and stressful impact of the transition from fossil fuels to renewable energy sources.

This solution has been present since the 1920s. However, the purpose for its creation was to soften the impact of the sudden rise of fossil fuel prices in the 1970s. In that time the city faced a crises driven by dependency of fossil fuels, higher levels of air pollution and low energy efficiency. Nonetheless, today this system has been developed further and is the biggest district heating system in the world, as well as most prosperous. Since the city already has developed a good waste management, the entanglement of the waste into energy was a good strategy. However, with the principle of working of

the district heating which combines Combined Head and Power (CPH) to capture and re-use energy heat. The efficiency of the district heating comes from its ability to capture the energy that would otherwise be lost in the electricity generation process, and then distributes it around the city. The results have been tremendous – 98% of the city has been supplied with the energy from the district heating system. (Copenhagen Carbon Neutral by 2025, 2012)

Along with the CPH the innovativeness of the district heating in Copenhagen is using waste as an energy source, instead of using the initial fossil fuels used for the functioning of the district heating. Even though the district heating system needed to be adjusted because of the change of energy source, this does not require an overall reconstruction of the system and its equipment. The system has installed steam network from the very beginning which was used mostly to supply hospitals and industry. The original construction of the system allows for changes and adaptation of the physical core of it through a longer period of time. However, there are frequent rehabilitation checks which have been going through time in order to maintain the efficient work of the system and keep providing the good results of its implementation in the community. For the adaptation of the system to use renewable sources, a waste-to-energy plant which has been converted into biomass is planned be used as a substitute of the coal fuels in the district heating, and achieve 100% renewable energy from the CPH. Another step in the utilization of the district heating would be using geothermal energy in the network, which is one of the long term strategies of the city of Copenhagen. Another positive side of the system's impact of the community and sustainable development of the urban area, is the optimization of the operational efficiencies of the system. These include seasonal reductions to the temperatures of the heat supply for reaching optimal temperatures and increasing the flexibility of the district heating network. (Copenhagen Carbon Neutral by 2025, 2012)

In order for all these optimizations to be present, and for the system to be adapted to the current environmental needs, a connection has been established between the existing and new buildings, so that the coverage of the city is complete. In an article from State of Green (District heating in the Copenhagen region, retrieved 2016), a collaboration between three heat market organizations has been formed – CTR, VEKS and HOFOR, which optimized the heat production from:

- 2 large CHP plants: Amagerværket and Avedøreværket
- 1 biomass fuelled industrial CHP plant in Køge
- 3 waste-to-energy CHP plants: ARC, Vestforbrænding and KARA/NOVEREN
- geothermal heat and surplus heat
- 50 peak load boilers

With the further implementation of district heating the market interest in district cooling is increasing in different areas. It's becoming clear that the benefits of collaborating with district heating bring symbiosis and has a good economic impact.

Keeping cool and CO_2

There is an increased demand of air conditioning and cooling caused from the development of the area. This is a problem that Copenhagen is facing. According to the Climate Adaptation Plan and the Danish Meteorological Institute researches the temperatures will rise with 2-3% by 2050. Therefore, the demand for air conditioning is increasing and will continue increasing. Eventually, leading to the point where the supply cannot meet the demand. The solution presented by the city of Copenhagen is the building of two district cooling systems which will take the pressure of the demand for traditional air conditioning and will decrease problems connected with contamination of the environment because of increased fossil fuel demand of the system.

District cooling operates on the same principle of district heating. Put in a nutshell the cooled water is produced centrally and then distributed to the users using system of pipes. There are two main options for placing the equipment assets of the construction of the district cooling. The pipes can either be located in places where there were no pipework at all, or they can also be implemented in the areas where the pipework of the district heating is located (Copenhagen Carbon Neutral by 2025, 2012). This makes the district cooling system of the most flexible solutions for developing sustainability in Copenhagen.

The cooling stations operate on a new type of principle for the city and are connected with the district heating network. The capacity of a cooling station is 15 MW and uses a combination of resources. It entangles the seawater from the area in the periods when it has sufficiently low temperature levels, using it as a natural cooler. When the demand for heat increases, it uses the extra heat produced from the district heating system to create balance between the demands of the community. There are different methods used for establishing proper functioning of the cooling system. These three methods are meant to deal with different scenarios from both perspectives of demands and climate conditions. First, there is a "free cooling" which takes place when the seawater temperature is below 5.5 degrees Celsius and the cooling demand is lower than 2400 kW. In that scenario all demands are covered by free heat cooling heat exchangers. The second method comes into action in condition of seawater temperatures between 5.5^{o}C and 11.5^{o}C. Since the water temperature in this case is not low enough to be completely sufficient by itself, there is a need of combined mechanisms, which also sets the name of the method – "Combined operation". Heat exchangers are pre-cooling the water before the so

called “chillers” are being used for cooling it down till the proper temperatures. The third method is referred to as “Chiller cooling”. When the seawater temperatures reach levels higher than 11.5^{o}C, the water is too warm to be used for any of the above methods, because they are not efficient enough to handle these high temperatures and convert them. Therefore, absorption and compression chillers are used to provide all the cooling. (Copenhagen Carbon Neutral by 2025, 2012)

Sustainable solutions of Rotterdam

Reducing CO_2 emissions

One of the most important tasks included in sustainable development is the measures taken for reducing CO_2 emissions. As any other area aiming as achieving lower carbon emissions, Rotterdam will benefit from this and will gain a competitive advantage in areas that go beyond less polluted air. Paying attention to the carbon emissions is important since according to research of the Regional Carbon Initiative (RCI), the expected emissions if no measures are taken would double till 2025, in comparison with the carbon levels in the atmosphere in 1990, regarding Rotterdam’s area.

Since 88% of the emission in the Rotterdam area are produced by industry and energy generating systems, a cluster has been formed. This strategic solution has proven to be crucial for the decrease of environmental impact not only in Rotterdam, but on national level. The contribution of the cluster is expressed in the way the parties in it complete each other. The collaboration of the parties allows for increase in production efficiency, savings of energy and building infrastructure to support all the processes. In this wat the cluster is giving its contribution to lowering the impact. The infrastructure allows an exchange between residual heat and the produced CO_2, leading to working responsibly. Furthermore, the cluster is also helping to rise the levels of attractiveness of Rotterdam for developing local businesses. (Gemeente Rotterdam, 2011) This is expected to add value to the economic development of the city, and by thus allowing for more resources to be implemented in projects connected with the sustainable development of the urban area.

All this puts emphasis on the importance of reducing the industry negative influence over the natural environment. Therefore, Rotterdam has embraces several other concrete measures for reducing the levels of CO_2These measures focus on lowering the energy consumption, involving biomass in energy production, techniques and policies for capturing and storing of the generated CO_2. In order for those measures to be successfully implemented, the city of Rotterdam recognizes the tight connection among its strategies and external factors. Among those are the national climate agreements, financial

support from the state and the European Union (EU), and official EU positions on certain measures against the high levels of CO_2 emissions. (Gemeente Rotterdam, 2011) The perspective Rotterdam has taken for managing sustainable development is interesting because of the implemented relation between intrinsic and extrinsic factors of influence.

Figure 11 Effect of measures RCI 2015. Source: Rotterdam Progtamme on Sustainability and Climate Change, Gemeente Rotterdam, 2011

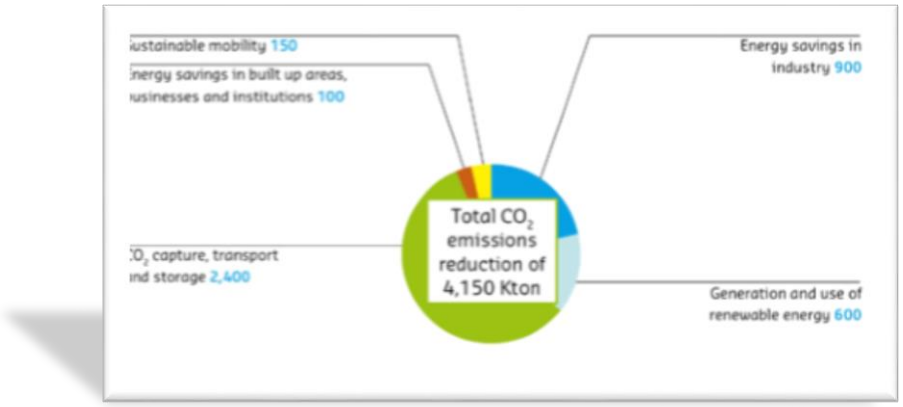
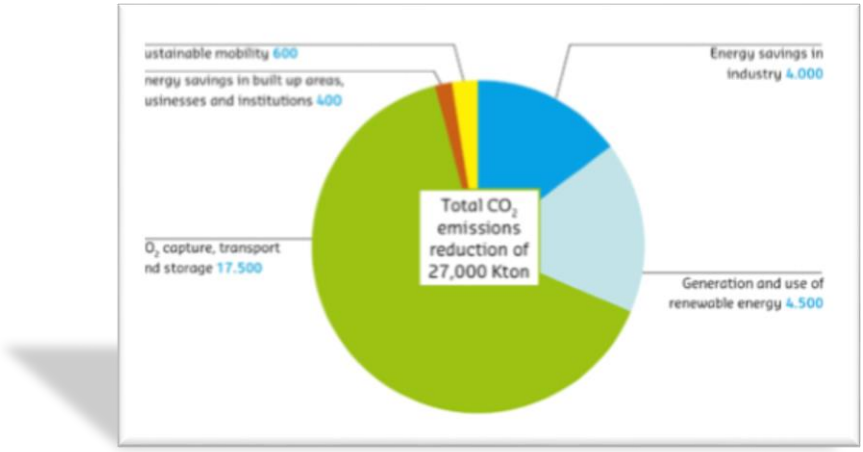


Figure 12 Effect of measures RCI 2025. Source: Rotterdam Progtamme on Sustainability and Climate Change, Gemeente Rotterdam, 2011



The two figures above show the share of contribution to the emissions in the area divided through sectors of influence. It is visible that big part of the emissions have been produced by transportation activities. The forecast of increased involvement of traffic to the high CO_2 levels has been a signal to Rotterdam to take measures for lowering the percentage share of traffic.

For the changes in transportation to have relevant impact on the goal for lowering emissions, a lot of initiatives have to be performed. Unfortunately, the numbers point to the fact that even if bio-fuels,

electric transport, or innovation in technological aspect of the machinery of transportation vehicles, are going to be used as substitutes of the fossil fuel based transportation means, that will not have a great influence over the forecast made by the RCI. However, Rotterdam has chosen not to lose hope in this venture. Instead, to increase the involvement of the community and the government body of the urban area, as well as creating better environment for local businesses to give their share of contribution. This is still an ongoing process, which is meant to increase the positive impact of all the alterations made in the sphere of transportation. (Gemeente Rotterdam, 2011)

Energy savings

Another change that needs to take place is to reduce energy usage by the year 2020. This goal has been set by the European climate target stating that […reducing greenhouse gas emissions by at least 20% compared to 1990 levels, increasing the share of renewable energy in final energy consumption to 20%, and moving towards a 20% increase in energy efficiency] (European Commission, Brussels, 2014, p.12). There are several ways for achieving this target and reducing the environmental impact of climate change. Rotterdam also acknowledges that there are other positive sides to decreasing energy consumption. It has been noted that lowering the energy consumption will also lead to increased competition. From this point of view of the problem, local businesses and the rate of employment will rise (Gemeente Rotterdam, 2011).

Being a delta city presents a lot of opportunities to this urban area, which allows for expansion of the horizon of opportunities and solutions. It is true that Rotterdam has a strong industrial development, however there is a way for it to be utilized in a positive way. As one of the main moral strategies of the city is to promote collaboration, the solution found for energy savings is related to the concentration of local and international small and big companies on Rotterdam's port. The path that Rotterdam has chosen, as presented by Gemeente Rotterdam (2011, p.28), in order to contribute to the goal set in 2020 scenario, includes three approaches:

- Increased investments in replacing equipment and innovation in the business environment.
- Developing and improving heating systems and steam networks.
- Stimulating process innovation in the business environment.

The energy saving solution of Rotterdam is highly related to the business environment, awareness of the community and government involvement. The involvement of the business environment is particularly strong on this problem. There are a lot of local businesses which are able to take the initiative to contribute to energy savings more than it is required by law. On the other hand, bigger owners, such as housing corporations have the ability to make their contribution through improving

the physical dimensions of their properties by turning them into more “green building”. Another possibility for them would be making contracts with the residents which inform for their duties to maintain the new upgrades of the facility, as well as being encouraged to give their personal contribution to a better green future of the area. The participation of the governmental body in the solutions of energy savings goes beyond the manifestations of policies and regulations, guiding the process of higher energy efficiency. From the perspective of government facilities also being participants in energy consumption, they have the opportunity to benefit energy efficiency through making their own facilities more environmental friendly, as well as promoting and helping projects related to public spaces. A good example would be the management of street lighting. (Gemeente Rotterdam, 2011)

Another solution that the city of Rotterdam sees as a good attempt to achieve 2020 scenario is the particular focus on buildings and how can they be used as a source of improvement. The approach taken by the city was to release an initiative to connect all new buildings, as well as 4 000 of the existing buildings, to the installed heat networks by 2015. Meanwhile, installing the cooling networks around the urban area. The core idea behind this was keeping the focus on improving the sustainability of the heating network in order to keep the improvement of the energy saving results. The last piece of the picture of the solutions chosen to increase the percentage of energy savings is the focus on reducing electricity. Even though electrical consumption does not have such a direct effect on gas emissions, it does contribute to the climate change and managing energy supply. (Gemeente Rotterdam, 2011)

Biomass

Biomass is considered a renewable source of energy. As well as solar and wind power, the usage of biomass as an energy source gives its contribution to the preservation of environment. The implementation of biomass in energy production does not directly affect the gas emissions in the atmosphere. However, it represents a great opportunity to lower them, since it makes human activities less dependent on fossil fuels. Moreover, what makes biomass a good alternative is the possibilities of its multiple implementations. And its cultivation is sustainable. The concept of applying biomass in energy production is not new to Rotterdam. The city has been using it since the beginning of 20th century. As it has been reflected in the Rotterdam Program of Sustainability and Climate Change (2011), the fact that the city of Rotterdam has already been familiarized with the usage of biomass, and now – with the technological progress which leads to more efficient cultivation, it gives the city a great advantage for popularizing the concept of using biomass in chemical industry, product production and as a substitute of fossil fuels in transportation.

With all the experience of Rotterdam in using biomass it has turned into the “bio port” of Europe. Through all the efforts put in promoting sustainable development, Rotterdam has reached a point of global admiration for its ways of achieving sustainability, but also has become “the Mecca” of bio industry. The great disposition of the harbour and it being a deep sea port and Rotterdam’s interested in bio industry is a great environment for flourishment. The possibilities for […inland shipping, short-sea, rail, pipeline and roads to and from the European hinterland] (Port of Rotterdam, 2-15, p.1) have opened new horizons for the development of the area. The role of Rotterdam as a bio port of Europe is very important since it stimulates and encourages the use of biomass as a main source of energy, provides good natural characteristics of the area for stimulating production, exchange and usage of biomass, as well as other renewable resources. This solution have turned into a very successful initiative as [the world’s largest renewable industrial cluster] (Port of Rotterdam, Bio Industry, retrieved 2016).

The case of the Rotterdam’s port development is a great example for a sustainable-stimulating idea supported by well-developed strategy. The success of the concept of bio port comes also from the values with which it has been related to. The entanglement is examined by Hennissen (2011), who concludes that between values promoting sustainability not only on a local, but also international level, and investments of assets in the development of the port results in creating nautical infrastructure, good hinterland connections and in collaboration between the renewable cluster and the petrochemical cluster in the urban area.

Sustainable mobility and transport

Important perception of development has to be brought up in order to support the choice of this solution. Urban areas are not simply “developed”, they are also keep “developing”. Having this in mind the forecast of climate adaptation is altered, and thereby enriched. The development of urban area is often expressed in industrial development as well as population growth. These facts affect many elements involved in the concept of sustainable development, in both social and environmental perspective.

With the increased development of urban areas the demand for better mobility solutions is increasing. In the case of Rotterdam, this results in the acknowledgement of the insufficiency of the transport infrastructure of the area. The inadequacy is due to the need of adaptation of community needs, as well as infrastructural change towards environmentally friendly urban area. The lack of high efficiency in the previous transport infrastructure of the city has led to desires in the members of the community to live in a healthier environment, which expanded their environmental consciousness; and results in

relocation of households. The Gemeente Rotterdam (2011, p.30) presents the solution that the city of Rotterdam has perceived is the sustainable one involves:

- increased focus on minimizing the motor based vehicles involvement in traffic rush-hours
- stimulating cycling and car sharing, as main means of transportation
- balancing the traffic flow through the city, focusing on the inner city
- increasing the share of electric transport.

To successfully approach this resolution Rotterdam has taken under consideration different perspectives. In 2011 an evaluation of the rate of cycling trips has been made, showing that only 25% of the trips in the city have been made on a bike. This is a relatively low rate when comparing to the cycling popularity in Copenhagen and cities in Holland, such as Groningen – with 60% (Mark W., 2011). Therefore, with the increased importance of sustainable development the city has chosen to improve its results in this manner by creating a biking infrastructure for easing the access with bikes to different parts of the city. Creating an urban environment with "clean" transportation also involves the implementation of efficient traffic management. The applications of such a system go beyond cycling and car transportation. A great benefit from it is a more efficient logistics. Especially for the decreasing of transition time of trucks and heavy vehicles through the city, as they mostly have to take road which are surrounding the city; therefore adding more distance to the traveling experience. (Gemeente Rotterdam, 2011)

Rotterdam also keeps the focus on the impact transportation means have on the members of the community, as well as the environmental impact. A great change has being planned in shifting the perception of a "better" vehicle. The emphasis here is put on promoting and rising the awareness of the positive contributions of electric and hybrid vehicles – reduced noise and cleaner transportation. This part of the solution of sustainable transport is further stimulated by setting up a charging infrastructure for the electric vehicles. Another stimuli are collaborations between the city and market parties working together on projects related to the development of electric transportation, and the implementation of biofuels in transport means. (Gemeente Rotterdam, 2011)

Less noise pollution and higher air quality

The growth of a social environment affects the atmosphere of a city. Thus being said, along with infrastructure, energy consumption, transportation and industrial growth, noise and air pollution are among the problems an urban area is facing. Even more so in Rotterdam with its speed of development and change. Therefore, this has been looked upon as one of the major obstacles the city has been facing in order to achieve sustainability. As it was already mentioned, Rotterdam's citizens have had the urge to relocate in less intense environment.

According to research made in 2007, 108 000 people were bothered by the noise produced by industrial functionalities, ground traffic and aircrafts. From scientific point of view, loud noises, if experienced for a long time, can cause sleeping disorders and increased stress levels (Gemeente Rotterdam, 2011). On the other hand, air pollution also affects health in a negative way. These are all observations which have their share of disturbance in the quality of life of the members of the community.

As Rotterdam has been a city that recognizes the importance of well-being of its community, measures have been taken in order to reduce noise and increase air quality. Regarding air pollution, initiatives have been started regarding outdoor and indoor air quality. Referring to outdoor air quality, the approach is tightly related to the solutions introduced for sustainable transport and decreasing $C0_2$ levels. Thus being said, the focus for presenting the solutions here would be now directed to indoor air purification. The task of reducing noise and air pollution is more directly related to the well-being of the citizens. On the second place, it's also focusing on the overall sustainability of the city. The acknowledgement of the importance of indoor air quality is crucial due to its relation and effect on the performance of the citizens in their jobs, or their studies. By raising the question of health standards and stimulating schools to make adjustments in their systems. Resulting in having a positive effect on the educational system by increasing the performance of the overall performance of the students, and decreasing the rate of teachers' absence due to health issues. While at the same time the importance of collaboration between public and private organizations have not been forgotten for the unification of schools and housing facilities for students. (Gemeente Rotterdam, 2011)

The main approach that Rotterdam has adopted as strategy to sustainable development in this set of issues includes creating a "low emission zone", encouraging the development of sustainable mobility, emphasise on the benefits of quieter automobiles, and the promotion of clean fuels. In relation to transportation, one of the main means for lowering the noise levels in the urban area is the attempt to install "quite asphalt" and isolation of house facades. (Gemeente Rotterdam, 2011)

Green areas and promoting trees

Being green is one of the fundamental values which goes along with sustainable development. As there is a relation among the environmental dimension and social and economic aspect, developing the green landscape in an urban area is related to all other solutions that the city of Rotterdam has chosen to implement in the journey to sustainability. The encouragement of creating and preserving the green landscape has an extreme importance in the overall picture of levels of sustainability in the urban area. It will not just help increasing the impact of the other solutions. It goes beyond by having a positive impact on biodiversity and food production.

The effect of planting trees, green facades, building roof gardens, etc. is better image for the city, as well as improving the health rates in the area. As researches show, being in a greener environment results in decreased stress levels and increased concentration. Having more trees and green parks around the city helps reducing the noise produced from industrial activities and traffic, which makes the success of reduced noise tactics greater. On the other hand, shifting from social to environmental perspective, by having green roofs, the buildings around the city will give their contribution to the overall aging of the facility, save energy and can help with water storage. (Gemeente Rotterdam, 2011)

The key to the successful execution of this solution is efficient communication with the community. Here, the emphasis is not on the individual, rather it's important for all the parties of the community to be involved in the initiatives of planting more trees, building more parks and creating green roofs. In comparison with previous years, the citizens. Small business owners, along with the big corporations in the area, have been persuaded in involvement in activities related to the manner, more than ever before. For example, groups of residents and entrepreneurs are collaborating for the execution of farm initiatives. Many companies have been examining production processes and end products with the purpose of monitoring companies and controlling the inner procedures towards sustainability for the environment and the community. Whereas, some private community members have started initiatives in their neighbourhoods by creating their own gardens for the area. (Gemeente Rotterdam, 2011)

Investments in sustainability, sustainable products and services

Rotterdam places a lot of focus on creating a better business environment not only to stimulate business in a purely economic perspective, but more specifically to highlight the importance of business contribution towards the climate change and the environment in the urban area. There are several clusters, already presented in this chapter, which contribute to lowering the environmental impact individually and in collaboration. Furthermore Rotterdam is basing this solution on

collaboration on different institutional levels by uniting the Sustainability and Climate Change Program considerations with the Regional and Urban Economy Program and the Clean Tech Delta. This unification of organizations and their efforts affects both the climate adaptation progress and the sustainable economy of Rotterdam. (Gemeente Rotterdam, 2011)

The concrete measures taken by Rotterdam are summarized by Gemeente Rotterdam (2011, p.38):

- Encouraging leading businesses and organizations to share and exchange information in results of achieving sustainable entrepreneurship in order for inspiring other businesses to follow their example.
- Stimulating the creation of sustainable products and services, as well as encouraging their usage and increasing the demand, which will result in increasing the share of organizations interested in pursuing sustainable entrepreneurship.
- Improving the treatment of very successful businesses which are already operating in a sustainable manner in hopes for them to locate parts of their businesses in Rotterdam.
- Continuing developing the Dutch Water Centre.
- More investments in sustainability through cooperation with different parties from the business circles, such as developers, housing corporations, study programs, lobbying in Hague and Brussels, and encouraging of knowledge transfer.
- Building appropriate pre-conditions for structural approach to innovation and strengthening sectors. This would be possible through the collaboration between different industries in the area – the energy and chemistry clusters, water and delta technologies, construction and sustainable mobility. An expression of this collaboration is the Icos Cleantech Early Stage Fund II.
- Increasing the competitive behaviour by encouraging businesses, universities and colleges to focus on creating innovation and solutions towards sustainability.
- Using the city as an experimental ground for projects.
- Separating re-cycling from refuse, and increasing the use of residual heat.
- Maintaining international image of energetic and innovative world port city

Public support of sustainability

It cannot be said which of the three dimensions of sustainability is more important than the others. Therefore, Rotterdam has always tried to implement the solutions in a way that involves and stimulates all three – people, planet, profit. This particular solution is focused primarily on the social aspect of sustainable development. Every solution that has been initiated by Rotterdam is an important element for the sustainable development of the city. The solutions are effective because they maintain, help and stimulate the achieving of the results of the rest of the solutions.

Thus being said, the social aspect of the implementation of all sustainable solutions is playing a main role in the success realization of every solution. Rotterdam endorses the key influence of society over the adaptation capacity of the urban area, and the investment of assets in sustainable solutions. It is clear that public acceptance would have a tremendous positive effect of the sustainable development of the area. The main tactic that Rotterdam has chosen for manifesting the solution of public support of sustainability is to encourage and implement knowledge exchange for sustainability in the education system, covering all levels of education. By doing so, the urban area is opening another door for increased performance of the sustainable solutions, and creates the possibility for smooth transition between the old paradigm and the new one – sustainability and sustainable development. (Gemeente Rotterdam, 2011)

A program for nature and environment has been introduced to the educational program of primary schools. Meanwhile, students from higher levels of education, such as secondary schools, colleges and universities have been given the opportunity to meet with representatives of the business world of Rotterdam and semi-governmental institutions. The purpose of those meetings is to increase the awareness of the youngsters of what obstacles are faced by Rotterdam for achieving sustainability and sustainable development, from first hand. Collaboration between universities and organizations have been encouraged in order to close the gap between theory and practice. In various universities and colleges, agreements have been made to create more sustainable curricula. Rotterdam, has turned into a place where many universities and colleges have developed programs for sustainability. This also helps sustaining the image of Rotterdam as a center of sustainable knowledge exchange, as well as reflecting its dedication to taking actions towards sustainable development of the urban area. (Gemeente Rotterdam, 2011)

Preparation for climate change

Creating solutions for sustainable development is the prime focus of Rotterdam as a sustainable urban area. However, it is not only important to create solutions for improving well-being in sustainable manner. The influence of the climate change has to be taken under considerations and measures for protection should be considered.

The effects of climate change that are already noticed in Rotterdam are heavier rainfalls which increase the chances of flooding in the area. Being a delta city puts Rotterdam in specific group of problems to manage, such as high sea levels, draught, fluctuations in river levels and heat waves. The formulation of Rotterdam Climate Proof program is therefore an important step in preparation. It has been developed in a way to perceive climate change as a threat, as well as an opportunity. The program is focused on opportunities which will turn Rotterdam into a better environment for living, working, investing resources and personal time in. The initiatives for searching solutions for protecting the city can also be seen from other perspective. The need and encouragement of innovative development can result in stronger economy, turning the parties in different spheres partners and by thus inspiring other delta cities around the world to take the path of sustainable development. Rotterdam has put many efforts in analyzing the climate change and its effects on the social, economic and environmental situation in the city, which has resulted in the creation of a Rotterdam Adaptation Strategy (RAS). The end purpose of RAS is to analyze the collected data of research and help creating a climate proofed urban area. The insides gained through RAS will help the emergence of effective and applicable measures for overcoming the expected threats. Another program has been attached to RAS to give its contribution and help for the improvement of the quality of analysis – Research Program of Knowledge for Climate. (Gemeente Rotterdam, 2011)

Through the development of RAS, practical measures have been taken in order to prepare the city for the expected climate change impacts and, at the same time, to utilize the possibilities for innovation and change that climate change represents. It was planned till 2014 many pilot projects to get started for feasibility of adaptive measures and triggering innovation. A good example for the connection between adaptive measures and innovation are Rotterdam's experiments with floating buildings. (Gemeente Rotterdam, 2011) The first project in the sphere of floating buildings is called "Floating Pavilion" and it is part of the climate-proof experiments taking place around the urban area. This is a great example of how Rotterdam is turning the threats of climate change into opportunities for sustainable development. The Floating Pavilion is the product of collaboration between different organizations from the private sector. The design of the project was commissioned to Deltasync and PublicDomain Architects, whereas the construction have been trusted to Dura Vermeer. Floating

buildings is an experiment which are gaining popularity not only in Rotterdam, but around the world as well. For the successful development and implementation of this solution for managing problems with expected rise of water levels, Rotterdam also investigates which locations are most appropriate for the integration of those innovative homes; the Stadshavens is determined as a good location for realizing this project. All those measures are planned to keep being implemented in a way into the educational system by stimulating the knowledge exchange of water and adaptation, on national and international level. (Gemeente Rotterdam, 2011)

The overall aim of the preparation of climate change is to represent the city as a place of innovation, stimulating business environment, good knowledge exchange grid between educational systems, and building a link between business and education circles.

Encouraging sustainable and urban development

New developments and structural reconstruction of the city has a positive impact of sustainability rates in the area by recognizing various opportunities. Districts in the city have already began to transform. Rotterdam Stadshavens, Heijplaat, the Central District near Central Station and the Heart of South are great examples for this shift. They express the possibility of positive effect on the urban environment in a local and regional scale. For these favorable circumstances to be utilized efficiently, different parties have to be involved in order for all needs of those initiatives to be covered. The needed parties of collaboration include developers, housing corporations, construction companies and investors. The benefits of collaboration among all the parties are broad and is able to result in manifestation what has positive impact on different elements associated with sustainability. Through effective communication and unification of capabilities, the developments may have positive effect on biodiversity, energy savings, implementation of renewable energy sources, mobility, and all together on every other implied solution for sustainable development. Another important party in reaching sustainable and urban development is the local government, and more concretely the local council which takes care of citizens in specific areas and the environment they live in. Therefore, the consideration of individual approaches towards sustainable urbanization is often needed and addressed in areas where there are no new buildings. This puts the attention towards the acceptance of sustainability from the citizens of the urban area. (Gemeente Rotterdam, 2011)

The city is focusing on the improvement of existing building and new buildings (including floating buildings), but is also paying attention to their integration and how they can be better connected among each other. One of the issues which stands out here is the exchange of energy and its distribution around the city. The energy supply of the city in central, which means that the city energy

supply is managed through the installed heating and cooling networks. In association with market parties the agenda of cleaner, healthier and greener city of Rotterdam has become possible; referring to the sustainable conditions of individual buildings and the urban area, as a whole. The main measure for increasing the efficiency of energy distribution, and lowering the waste of energy through that process, is to first – improve the conditions of the heating and cooling networks, and second – the construction of innovative forms of water storage. (Gemeente Rotterdam, 2011)

One of the top priorities for Rotterdam has always been the well-being of the community. The Framework Quality of Living Conditions has become a big part of the sustainable development of areas in Rotterdam. The unified efforts of different organization extends to involvement of the government body, as well. Through this sustainable association of businesses and local councils the goal to present relevant information to the residents, and stimulate their desire of contribution to sustainable development, is easier than before. The distribution of ideas connected with urban environment improvement also results in investments in initiatives like planting trees, developing more green areas and other methods for improving the well-being of the community now, as well as providing better base for a sustainable community in future. (Gemeente Rotterdam, 2011)

Chapter 6: Discussion

Research question:

"What is the role of cities in sustainable development?"

Sub-research question 1:

"What are the cities solutions for sustainable development?"

Chapter 5 presents the officially chosen solutions of Copenhagen and Rotterdam for maintaining the current level of sustainability and their ways of keep increasing the success of sustainable development. It is noticeable that there are many similarities, mainly in their sought goals, but also in the approaches taken towards achieving sustainability.

Through the examination of the chosen subjects of analysis it is possible to group the applied strategies in those urban areas. The grouping will allow for a clearer observation of the sustainable approaches of both cities.

Figure 13 Groups of sustainable solutions in urban areas, based on an analysis of Copenhagen and Rotterdam.

Utilizing the delta disposition of the urban areas

Increasing the efficiency of transportation

Strong recognition of the importance of climate change

Utilizing the delta disposition of the urban areas

Both cities desire the application of solutions which will benefit all sides involved in the development of the urban areas. Since both cities are delta cities they have even more in common. The delta disposition gives the benefit of having a harbor. However, there are different approaches to manage the harbors in Copenhagen and Rotterdam. Copenhagen's economic development have withdrawn the industry away from the harbor. The choice made by the city is to try shifting the image of the harbor to a more culture and socially collective environment. The approaches chosen to achieve this goal through benefiting the community are innovative on their own (Lundvall et al. 2002), for example – building a construction in water. The project have had a tremendous success because it contributes directly to the well-being of the citizens, as well as successfully changing the image of the harbor. The creativity of the solution has another side as well. Through this, one, courageous project, the harbor has been re-introduced to the community, and is now being implemented back to the dynamic urban environment.

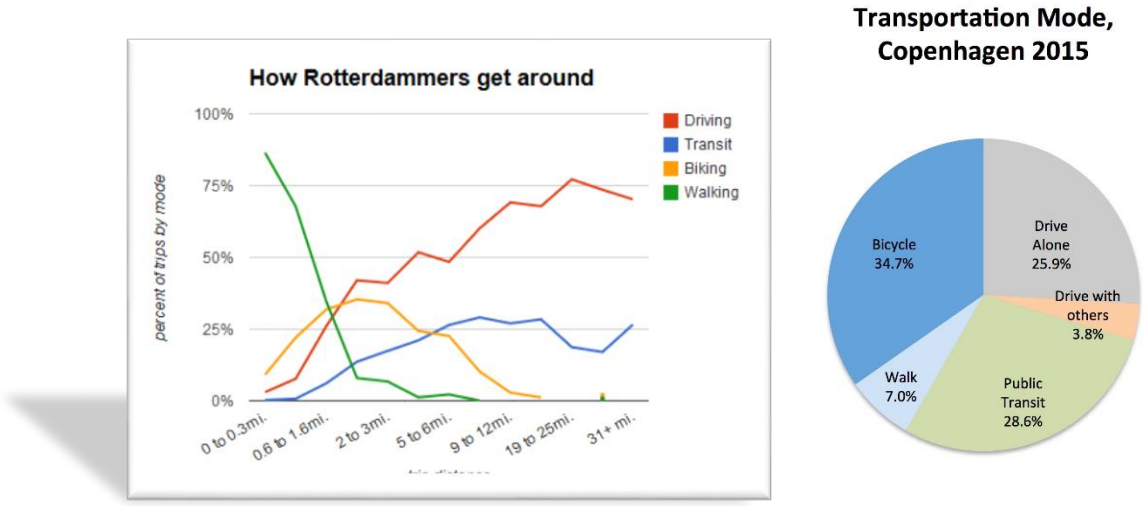
On the other hand, Rotterdam is taking advantage of the harbor in a completely different way. The difference between Copenhagen and Rotterdam regarding managing the harbor is dependent on the industry development. Rotterdam has established itself as one of the most important ports in Europe. Therefore, the power lying in the utilization of the port has a very important role in the development of the urban area as a whole. However, the city is not just maintaining the industry. It managed to transform the port industries into a bio industry. What makes this solution interesting is the emergence of a bio cluster. Through collaboration between businesses with different expertise the cluster stimulates not only the prosperity of the parties involved in it (Kuah, 2002). The bio cluster of Rotterdam has turned into a world famous cluster which contributes to lowering the environmental impact through uniting efforts from different business areas. What is actually observed is encouraging business development in a green way through green practices.

Increasing the efficiency of transportation

Higher economic development of an area turns it into an urban center, which is connected with increased rates of population. Another perspective which has to be thought about is the geographical disposition of the area. As the population grows the populated area is expanding and leads to land growth of the urban area. This being said, transportation is one of the main problems in an urban area. The need of fast access around distant zones in the city is a first priority need for the community. Even though this is a problem, the cities are also recognizing it as an opportunity to develop further sustainability. The cities have different approaches for solving the transportation density, but

ultimately aiming at using the transportation solutions as one of the main initiatives for decreasing CO_2 emissions in the atmosphere; and ways to promote sustainable and healthy way of living among the members of the community.

Figure 14 Rotterdam and Copenhagen transportation trends, accordingly for year 2014 (Rotterdam) and 2015 (Copenhagen)



Most of the solutions of Copenhagen and Rotterdam are focused in few main areas: public transportation improvements, infrastructure, and customers' experience. Figure (14) above expresses the tendencies of used vehicles as main means of transportation in Rotterdam and Copenhagen. Both cities are aiming to maintain sustainable development, and keep stimulating sustainability in urban areas. It can be seen that most of the actions are to overcome the desires of using motor vehicles. There is a main difference between the cities' approaches of handling transportation, and it's connected to the use of bicycles. Even though, cycling is not the most preferred way of transportation in Rotterdam, the city uses a lot of its assets to create compaigns and projects which are proposing other substitutes of motor vehicles. By promoting electic vehicles, Rotterdam is not proposing only a solutions for decreasing CO_2 levels, but also has positive effect over noise pollution; and by thus having a severe positive impact of the well-being of the community.

On the other hand, Copenhagen is among the cities in the world with highest percentage of bicycles used for travels around the urban area. This also depends on the culture which is present in Denmark, since bicycles are preferred way of transportation all around the country. Therefore, the city of Copenhagen is focusing more on how to turn the bicycle into an ultimate way of transportation, by severely improving the infrastructure and software improvement of the working systems. Green waves for public transport and cycling lines are creating a better flow of traffic in the city; and ease the experience of all parties in transportation, simultaneously. Moreover, Copenhagen is taking actions for

expanding the cycling infrastructure and increasing the connectivity among cycling lines all around the city, and by thus allowing more pleasant experience for the bikers. Meanwhile, Rotterdam is also working on improving the transportation infrastructure by implementing solutions like “quiet asphalt”, which aims to have an extremely positive effect on the citizens’ stress levels.

Even though there are a lot of efforts from both cities to implement individual substitutions for motor vehicles, the other big part of the sustainable transportation solution is public transportation. Public transportation can satisfy needs of thousands of people at the same time, which makes it so efficient. Both cities are acknowledging the importance of a better developed public transportation. However, the Danish capital is putting more efforts. Copenhagen is working on increasing the structural disposition of public transport stations around the city, and by that to increase the connectivity between all the different means of public transportation, including bicycles.

Strong recognition of the importance of climate change

Climate change is a crucial part from sustainable urban development, which cannot be skipped with an easy hand. Climate change is one of the main reasons for developing sustainability, and is the prime reason taken under account for the investigation of the thesis. Climate change does affect the global canvas of existence, which puts it in the spot light. It stimulates the focus of agencies all around the world for conducting analyses of climate change. Copenhagen and Rotterdam have both invested a lot of efforts and resources in forecasting the probable outcomes of extreme changes in the climate. Those researches have resulted in the creation of Climate Change Adaptation Plans for both cities. Continuing the discussion of the importance of the climate change, another main idea of the thesis has emerged. The cities have been presented in a positive light, in a sense of their actions for improving the overall state of environment, in all its dimensions. The fact that Copenhagen and Rotterdam have chosen to face the various issues, emerging from climate change, and see them as the opportunities they represent is, an admirable perspective. Moreover, it has turned into a motivation for sustainable development in those two urban areas.

Therefore, it is important to raise the notion that Copenhagen and Rotterdam are delta cities. This has not been investigated in detail in the analysis of the thesis for several reasons. One of them is that focusing strictly on climate change plans would disturb the sharpness of the thesis in answering the research question. Nonetheless, the delta disposition of those urban areas does indeed have an effect of the ways they have chosen to respond to consequences of climate changes. Some of advantages given by the cities are coming from the presence of harbors. As it was already explained, the harbors have a huge role in the overall development of the cities – both in economic and adaptation aspect.

Thus being said, the analysis of the sustainable strategies of both cities shows that their approaches to adapt to climate changes are similar. The focus on CO_2 emissions in the atmosphere has been recognized as a big issue, and has been reacted upon through better management of transportation, and further creation and maintenance of green areas, all around the territory of Copenhagen and Rotterdam. Furthermore, specifically in Rotterdam, the influence of bad air quality and higher levels of noise caused by the high levels of urbanization have become a beacon for acknowledging another side of pollution of the urban area. Through this realization, Rotterdam has put the importance of citizens' involvement in climate adaptation on a higher level than ever before. This approach has switched the perception towards the extent of dependence of well-being on climate change. In other words, the perception for well-being has reached a new philosophical dimension. Now well-being has been looked upon as a result from sustainable solutions, but also as a source of sustainable development. The following segmentation of strategies: focus on renewable resources as a main source of energy and energy and resource efficiency, are supporting further the statement in this group of solutions.

Focus on renewable resources as a main source of energy

Turning our backs to fossil fuels is a decision that is supported by many factors. From which climate change being the most important one, since it affects our society on a global scale. Therefore, it is only reasonable that cities which develop sustainability would be refocusing on renewable energy resources. Copenhagen and Rotterdam are investing a lot of assets in developing implementation of better technology. This thesis have not gone into depth in answering the question "Why those specific renewable resources have been chosen by the cities?" However, an assumption can be made that Copenhagen is having an advantage for utilizing wind as a main renewable resource, because the climate conditions of Denmark predispose for this action. On the other hand, Rotterdam has been implying biomass for many years in energy production, which helps the argument of their further focus on this renewable energy source.

Through the analysis of Copenhagen and Rotterdam it was observed that both cities are focused on improving the implementation of the technologies which are enabling them to produce energy from the two resources. The path they have chosen is aiming at increasing the awareness and knowledge of the citizens regarding the ways of usage of the technology, its positive contributions to the sustainable development of the urban area, and involvement of the public in those processes. The main strategy of both cities is to entangle the usage of renewable resources into people's life in such a way that they become necessity, instead of being one of many options.

The analysis shows that these strategies have really helped enrich people's perception for the importance of renewable resources in general, and those two in particular (depending on the urban area). This proves the significance of the chosen solutions in the main picture of sustainability of Rotterdam and Copenhagen. Moreover, it represents the spark through which further improvements and involvement of the community can be inspired. Thus being said, Copenhagen and Rotterdam has proven one more time how long term thinking can lead to making the right steps towards a sustainable future, even if they seem relatively small steps in the present days.

Energy and resource efficiency

This particular group of solutions is taking a big part of the sustainable development of urban areas. In the subjects of examination, the main solutions for energy efficiency are focused in the areas of water efficiency, heating and cooling systems, waste management, and energy savings. With the increased popularity and necessity of sustainability, the fact that the resources on this planet are limited is being emphasized more than ever before. Therefore, it has become a global initiative to educate people on this matter. This can be seen in many media channels which are reflecting upon the relativity of choosing the right direction to further development of humanity.

Considering that the two chosen cities are among the leaders in sustainable development in the world, they pay a lot of attention to the limitations of natural resources. A lot of resources – both physical and intellectual – have been put into forming strategies of overcoming resource limitation. The main aspect that both cities have taken is the optimization of the currently existing systems, applied for utilization of the resources at their disposal. Here, a good reminder would be the ways of both cities to manage waste, which displays waste as one of the newest renewable resources on the planet. This approach can serve as an inspiration of many other cities which are trying to develop sustainability. Using efficiently waste as an energy source proves that we shouldn't take for granted what we already have, by being so consumed of the better future that we forget it is our job to manifest it through the present. Even though the analysis in Chapter 5, Copenhagen and Rotterdam are focusing on improving the already existing solutions, which should not put the cities in less favorable position.

In fact, it became distinctly true that the optimizations are innovations of their own. If we take a look at the free cooling, combined operation and chiller cooling implemented in the cooling system of Copenhagen, it shows that the approach taken to improve the cooling, through using the advantage of being a delta city, is a huge breakthrough. Overall, the approach of Copenhagen is involving in its most part the sea disposition of the city, which speaks for innovative thinking, and by thus capturing

new methods of connecting the different natural systems in the area. As for example, now urban design reflects the influence of the ground waters.

On the other hand we have Rotterdam, which once again is focusing on the same problems but in a little different aspect. Since the acknowledgement of the importance of resource efficiency, the city is performing many activities related to spreading the knowledge of our dependence of the surrounding environment, climate change and resource limitations. Rotterdamers are highly involved in the processes of refocusing on better ways of resource management through equipment replacement with more energy efficient technologies; attracted investments in business areas with the ideal of leading to process innovations of the small, medium, big firms; as well as the networks of the existing clusters.

Sub-research question 2:
"What is the impact of the sustainable solutions on the dimensions of People, Planet and Profit?"

It has come to my mind that there are many ways through which we can stimulate sustainability. However, one of the most crucial, if not the most important, decisions we have to make, as human beings, is to accept the connection between us and everything that surrounds us – both natural and artificial. The strong connection among the three dimensions is putting a lot of pressure on our development as a civilization, because of the ripple effect that one decision causes through all the dimensions. There is no doubt that this raises a lot of questions, but it also creates an enormous amount of favorable circumstances, some of which have been utilized by Copenhagen and Rotterdam. From the investigated cases it became clear that the improvement in every dimension has a positive effect on the overall sustainable performance of the two urban areas; with the specification that none of the improvements was actually improving only one dimension. We can improve sustainability through continuing embracing the interdependence among the people, planet and profit aspects of sustainability. While keep manifesting solutions which spread sustainable development in every extent of sustainability. As it was discussed, the people, planet and profit dimension are the general motivation driver. The statement that every strategy, regardless of the group it belongs to, has an effect on all three dimensions, is of high importance.

The unit of analysis in this thesis is a city. The city can be seen as a whole organism, where the solutions, strategies, and the three dimensions are different parties involved in its successful existence as an

organism. The environment in which cities exists is unsustainable in most cases, and still moving down the old paths of development – consumerism believes. This affects both the external and internal environment of the city. Therefore it's in a need of internal change, or in other words – adaptation to the threatening environment.

It is true that the people, planet and profit dimension are representing the goal of sustainability. Therefore, their improvement is a crucial moment in sustainable development. If the performance and conditions in every dimension are improved, this logically is expected to lead to unleashing the true potential of the dimensions. Furthermore, another effect of inner improvement of the dimensions would be their synergy, and so it will result in sustainability. It is intriguing to observe how the cities are using different solutions, and are implementing different strategies for achieving their sought results, but at the same time the outcomes are very similar. Therefore, the further answer would be given by expressing the effects both cities have on the three pillars through their strategies, all together.

Planet

The environmental impact is the trigger for achieving sustainability. That is the case not only because climate change is a direct global driver. Another shade of importance is emerging from the fact that we are not only the victims of climate change, rather we are responsible for the course of events which led us to exist in nature that is very fragile. As being a part of the life-eco-system of this planet, we are directly affected by the environmental quality of it (UNDP, 2012). The actions of both cities regarding the environment are covering different approaches of lowering the negative impact of human existence. A lot of the measures are directly connected with lowering the CO_2 levels in the atmosphere. Other solutions are more focused on inventing efficient ways of producing energy and containing it with lower energy loses. However, the solutions connected with transportation, green areas, using waste as a source of energy instead of just "piling it up" are strongly connected with the higher possibilities for investments, and the well-being of the community.

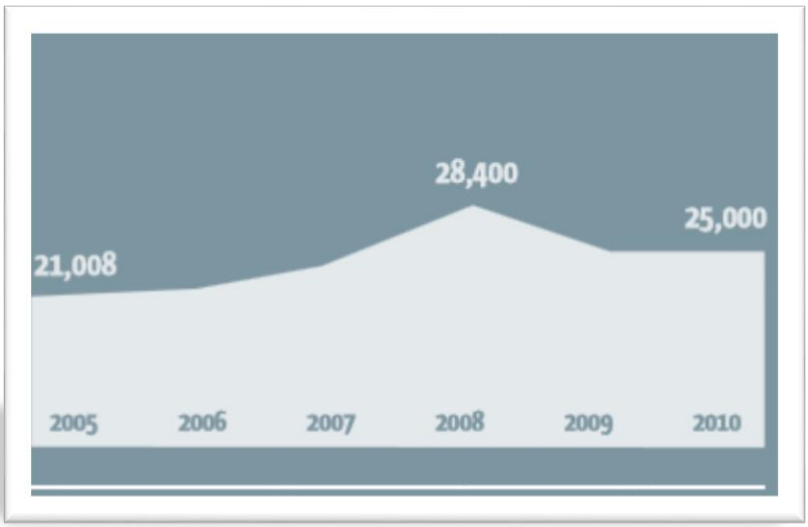
Nonetheless, the results from all chosen activities have a very positive outcome for the environment in the two urban areas. Even more so, the tight entanglement of the planet dimension with the other two, gives opportunities for much higher results than what the success would be if a single dimension was being improved in an isolation. The results are showing less noise pollution, better management of water stocks, preservation of the local flora and fauna, rising levels of air quality in the urban areas, less demand for electricity because of the efficient central heating and cooling systems in both cities. Another perspective in this dimension is the direct dangerous effect of potential climate change. As

delta cities, Copenhagen and Rotterdam's biggest threat is flooding. Nonetheless, through encouragement of developing the harbors the chances of severe damages in case of flooding are decreasing, because they have taken measures for securing the perimeter for preservation of the community (for Copenhagen) and the industry (for Rotterdam)

People

This dimension has a very interesting twist. It has to be acknowledged that Copenhagen and Rotterdam are urban areas which are successfully integrating and expanding sustainable development. This is related with the people's role in the processes of achieving sustainable development. People are the key. Programs, initiatives and organizations such as the Cycling Embassy, classes in school regarding safe cycling, shared ownership in energy plantations, programs in colleges and universities about sustainability, are aiming at educating people about the importance of sustainable development. Through higher levels of awareness of the community, the goal to increase the motivation for public participation and collaboration is more important than simply enjoying the outcomes of implementation of a sustainable solution. A good example is shown in the figure bellow. Figure (15) shows the impact of the integration of windmill industry in the area of Copenhagen. It is clear that through finding a solution for helping the environment, and its realization through the economic development of the urban area, the result is that higher rate of people has been employed, which by itself contributes to the positive perception of sustainability.

Figure 15 Employment in the sector of wind power. Source: Copenhagen sustainable solutions, p. 26



On the other hand, we have witnessed in the analysis, the self-involvement of people in the attempts of Rotterdam to increase the green public and private spaces all around its territory. The fact that

people have organized themselves and have chosen to create and maintain the green appearance of their neighborhood, is a confirmation that the actions towards increased awareness are giving results, and the urban area has turned into a better place to live for people, made by people.

Profit

The chosen subjects of analysis are already urban areas which have reached a certain level of economic development, on a regional, national and global level. This gives them a solid ground upon which to construct strategies for further sustainable development. For instance, the development of the bio port in Rotterdam has turned into a worldwide success. The justification of decisions like this one are highly grounded in the motives of improving the environmental situation in the areas, as well as increasing the quality of life. Even though the level of economic development has been used as a base for reaching sustainability, it has also been "fueled" by the sustainable development solutions in general. In other words, it can be said that in cities like Copenhagen and Rotterdam, the sustainable development has turned into a business of its own.

However, there is something specific about it – the driver is not material possession of assets and liquidity (Parker, 2012). Rather, the exchange currency in this case is the overall existence improvement in the areas. Since all of the chosen solutions in both cities have had an impact not only on the environment, but also on the people, the business environment in the areas has changed. New morals are taking place in developing businesses – new legislations for environmental friendly production processes, and the self-conscious of the people involved in the businesses. I believe that at this point of being, sustainable development in those two urban areas, has manifested itself a new businesses' view of the world, and what contribution of businesses should be to society and development.

We are now in an era of shifting perceptions. The changed focus of firms, to expand their goals horizons beyond simply responding to a demand with the purpose of making profit, results in a new way of making business in Copenhagen and Rotterdam. The most interesting outcome is that this shift haven't had a bad influence over the businesses. Rather, it has stimulated organizational growth in a sustainable way, which by itself increases the whole value of an organization, as a member of the community.

Sub-research question 3:

"How can we improve sustainability through the dimensions of People, Planet and Profit?"

Figure 16 Process hierarchy of sustainability.

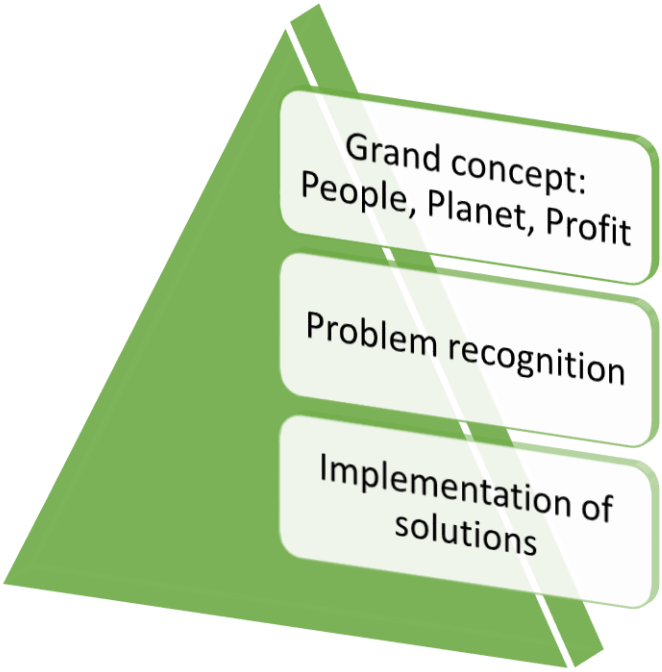


Figure (16) represents a proposal for new way of looking at sustainability, and organizing actions considering sustainable development. This formulation of process hierarchy of sustainability is based on the knowledge gained through analyzing the existing realities of sustainable development in Copenhagen and Rotterdam, and the theory exposed in the thesis. Before continuing further with explanation of this pyramid, some limitations should be exposed. This way of looking at sustainability is a proposal at this stage of investigating the subject of sustainable development. Even though the idea of this concept emerges from analyzing the cases of leading sustainable cities in a global scale, further research has to be conducted for truly justifying this process hierarchy, and its' effect on approaching sustainability.

The "grand concept" is representing mainly the framework in which sustainability has been investigated. However, the three pillars are reflecting the three main angles through which sustainable

solutions can be implemented successfully. Through the examination of Copenhagen and Rotterdam, I have noticed that even though the execution of the solutions goes from bottom to top levels, the decisions for making the solutions, and recognizing them as crucial, are moving from the top to the bottom. That once again proves the endless entanglement and circulation of different elements of sustainability, even if we are examining them from different angles. Therefore, it can be concluded that the Grand concept is not only representing "the bigger picture". It is also turning into a model of reaction and investigation of intrinsic and extrinsic factors.

All the solutions taken by both cities are lying on the bottom level of the process hierarchy – "implementation of sustainable solutions". They are the starting point of manifestation after recognizing the presence of a problem – which is proposed as level two on Figure (16). The role of "problem recognition" in the process hierarchy is very important. With the influence of direct and indirect drivers, we have started realizing that climate change represents a great threat for human existence on this planet. Therefore, this problem recognition is the "wake up call" for manifesting actions towards sustainability. However, even separated, those two levels are aiming to fulfil the Grand concept.

It is truly interesting to observe how the cities are trying to manifest a better future reality through recognizing a present filled with opportunities. Moreover, based on all the results gained from the examination of Copenhagen and Rotterdam, a new perception for the Grand concept has emerged. It can be concluded that there are two ways of perceiving the Grand concept, which are highly related with each other and cannot be examined separately – short and long term thinking.

By presumption, the dimensions in the Grand concept are equally important. However, in the process of investigation of this thesis, the dimension of "People" has turned out to have a key role in the outcomes of the other two dimensions. The new assumption then would be that well-being can be perceived in two ways. According to short term thinking it is a result from developing sustainability. However, according to long term perception, well-being is a way to achieve sustainability. Therefore, a proper conclusion would be that the Grand concept is perceived simultaneously as a linear and as a circular event.

The grand concept as a linear event

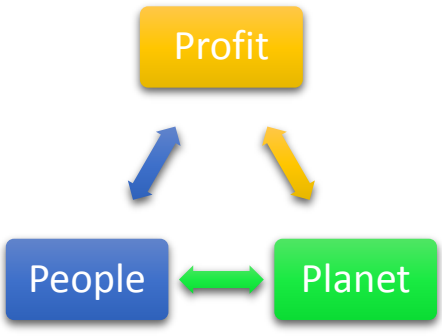
When we are considering short term point of view that means that the focus is on reacting to the current situation (Aaker, 2001), rather than exploring the bigger picture of sustainability. Considering short term thinking the relation then between the three dimensions in the Grand concept goes as follows on Figure (17)

Figure 17 Linear perception of triple bottom line as perspective for process of sustainability

After a certain point of development, when a stable economic state has been reached, enough satisfaction has been gained in order for new focuses and desires to take place. Considering, that climate change is the biggest driver for developing sustainability at the moment, the cities are using solutions which are mainly going through the “Planet” element. The strong dependence of humanity on the environment has to be highlighted in this argument. In other words, the solutions have been focused on improvement of environmental quality (Arrow K., et al, 2012), as an attempt to achieve sustainability. Consequently, the well-being in those cities is turning into a result from sustainable development.

The Grand concept as a circular event

Figure 18 Circular perception of triple bottom line as perspective for process of sustainability



The circular abilities of the three dimensions reveal the possibility for a ripple effect to be created, based on actions aimed even in only one dimension. When the potential of the “People” dimension is fully unlocked, that will cause the opening of the flow of interrelatedness between all dimensions. This

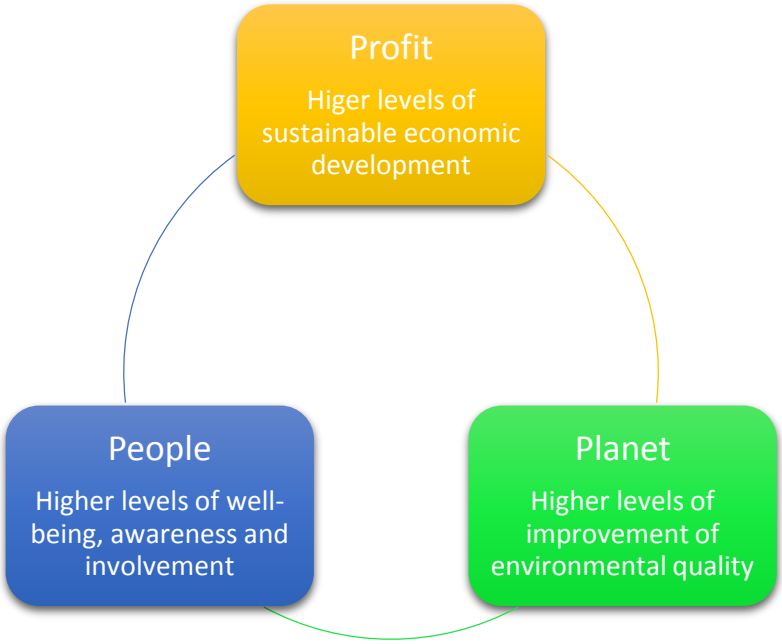
idea was partially explored already by observing that none of the implemented solutions has an observed result in only one dimension. The ideal perception of those elements is that they work in synergy. Even more so, sustainability could not be reached by excluding either of them, according to the applied framework in this thesis.

The linear and the circular perspective of the Grand concept cannot be separated because the outcome of the short term perception is serving as a key for unlocking the circular properties of the three dimensions. Hence, well-being has an extremely crucial role in sustainability of the future, because the motivation for sustainability arrives from the society members. Therefore, when the members of the communities in those cities, as well as on a global level, are aware and have accepted the seriousness of the matter, the synergy will be achieved. And sustainability:

1. Will be taken more seriously by the masses;
2. Will have the full human capital dedication;
3. Will reach new levels of perception.

This all could be expected to result in a closed circle of constant improvement and maintenance of sustainability, as well as having continuous positive effects in either one of the dimensions.

Figure 19 Closed circle of the Grand concept.



Sub-research question 4:
"Can the sustainable solutions be implemented in other urban areas?"

The answer to this question is rather based on assumption and hope for a better future. The distribution of the gained knowledge in cities like Copenhagen and Rotterdam should be expanded to a global scale. We are now staring at the face of global unity, in an aspect broader than global economy. The investigation of the cases of Copenhagen and Rotterdam has not given an information which can guarantee that the same solutions can be successfully implemented in other urban areas. However, the cities already have started expanding their cooperation beyond the urban areas borders. Both cities have begun initiatives which are aiming at bringing foreign expertise, as well as encouraging the exchange of information connected with results from sustainable development.

Enriching the knowledge of other urban areas regarding sustainability and ways of sustainable development is definitely going to contribute to the global sustainable development. Because the goal is not really to take one solution as granted and implement it in a new area. Rather, what seems as a more appropriate approach, the concept of learning economy (Lundvall, 2002) to be applied in the concept of sustainability. Which would result in knowledge exchange among different agents of the three dimensions. And by thus, many alternatives and different ways of implementation of sustainable solutions in new urban areas would be possible.

Chapter 7: Conclusion

Sustainability is a complex topic. It represents the opportunity for humanity to establish better future. However, it is a relatively new concept. This puts restrains on the theoretical background that one can draw from. Therefore, it is important for the theory to be combined with practical solutions. The perspective took in this investigation is that in order for sustainability to occur there are three dimensions which have to be considered: people, planet, profit. They are interrelated. Even more so, there is a circular dependence among those dimensions. One cannot investigate adequately one without the others, and vice versa. When the potential of all of them is fulfilled, then true sustainability can be manifested and maintained through time.

It is true that sustainability can be considered on different levels – global, national, and regional. However, cities are the unit of analysis, because of their importance of human civilization development. They unite different actors, cultures, and conditions. These create a good and flexible environment for changes to be manifested. Therefore, cities are the best places, so far, for sustainable development to occur. Hence, the role of sustainable cities is important because they serve as initiators of the sustainable solutions needed for improvement of every dimension. While at the same time, every solution implemented for improving one of the dimensions, creates a ripple effect in the other two.

The results of this investigation can have a positive effect for both theory and practice. On one hand, the conclusions are expressing the relation between theory and real-world, which could enrich further theoretical examinations of sustainability. On the other hand, the knowledge gained from the cities, can be expanded beyond the borders of the investigated urban areas. It is possible that the exchange of information of successful implementations, can enrich and motivate urban areas around the globe to take steps towards endorsing sustainable development.

Since the conclusions have been based on examining the two cases of Copenhagen and Rotterdam, further examination is needed for forming more precise proposals.

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Dutch Water Center: A center for developing [prediction and protection systems for low-lying coastal areas and river deltas that are especially susceptible to negative impacts from climate change]; improving the flood control in Holland.

Icos Cleantech Early Stage Fund II is a closed private equity fund managed by private equity partner located in Badhoevedorp, Icos Capital.

Deltasync is working with multidisciplinary design, research and consultancy firm, specialized in sustainable flood proof urban development in delta areas. Source:

Dura Vermeer is active in construction, infrastructure, engineering and services, commissioned by third parties, at their own risk.

Public transportation definition: includes buses and other transportation devises, such as light and heavy rail trains, streetcars, etc.

Artificial environment: Meaning used in the thesis – surroundings build by human hand.