

# Limits to Growth

**Urban growth and environmental degradation  
in the Capital area in Iceland**

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## Abstract

This project addresses the problem of increased environmental degradation, whereas humanity is having increasingly more effect on the ecological environment. It considers the urban environment because it is one of the most, if not the most, resource demanding aspect of society. This project discusses how urban growth and urban development in the Capital area has made the region increasingly less sustainable and further brings forward the ideology of degrowth as a way of decreasing environmental degradation caused by the region. In terms of degrowth, the limits to growth for social, economic and environmental aspects are discussed. Further, structural characteristics for decreasing environmental degradation are presented.

This project discusses how the limits to growth can be conceptualized in terms of urban planning and sustainable development. In terms of this, how sustainable development; and economic and urban growth are generally perceived and how they are limiting for one another. It analyses how the building stock and transportation in the Capital area have developed since the mid-20<sup>th</sup> century, and more specifically leading up to the financial crisis, and how this influences sustainability, by looking at indicators for urban development that indicate the level of environmental degradation caused per capita. This project further discusses how degrowth can be implemented in the case of the Capital area in order to move closer to goals of sustainability. In terms of urban development, implementing structures that result in less environmental degradation.

## Preface

This report is produced as a master thesis for the master program Urban planning and Management from the department of Urban, Energy and Environmental planning, at Aalborg University. It was produced in the period of February until May, 2015.

In my studies in Urban planning and Management, I have been interested in the ecological aspect of urban planning and how the human habitat influences nature. In my research, the dynamic between the environmental and economic aspects of urban planning has further been interesting to me. It should be noted that I, the author, can be said to be an advocate for sustainability. Because of this, I decided to write my final thesis on the subject of how urban development can be implemented in order to reduce environmental degradation and move urban development closer to goals of sustainable development, which to me is one of the most important, if not the most important, aspect of urban development and urban planning.

Literature and data in the report is referenced according to the APA referencing style, where a full list of bibliography can be found in the end of the report. The empirical data is mostly from Icelandic sources. Therefore, the names of the reports and data have been translated into English. Further, personal communication that is not available for the reader to look up are referenced only in text, showing the date of communication.

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## List of abbreviations

AMCA	- Association of municipalities in the Capital area – Samtök sveitarfélaga á Höfuðborgarsvæðinu.
CR	- Critical Realism
GDP	- Gross Domestic Product
GNP	- Gross National Product
INPA	- Icelandic National Planning Agency - Skipulagsstofnun
NRCA	- National Road and Costal Administration - Vegagerðin
WCED	- World Commission for Environment and Development



# INTRODUCTION



## 1. Introduction

Structural characteristics of the human habitat have significant influence on the planet, in terms of appearance and ecological strain. Further, our cities are one of the, if not the most, resource demanding phenomena on the planet. Two of the limiting and problematic aspects man faces today are the threats of resource scarcity and climate change. In the last decades, the requirement for sustainable development has become one of the most discussed aspects of our communities. However, the importance of it, and how imminent the threat of resource scarcity and climate change and the need to react, has been debated. Furthermore, the world's economic system is centered on inducing economic growth, generally referred to as GDP, in a market economy of consumption. This has led to increased use of resources for construction and consumption.

These two goals of growth and sustainability have become two of the most important goals for governments, national and local, to fulfill when planning for and developing urban areas. Further, these aspects have been seen as contradictory where economic and urban growth are seen as being strongly linked to increased resource use, while the requirement of sustainable development is concerned with restricting resource use, in order for resource consumption to be within earth's ecological limits.

Urban growth is an aspect of growth ideology and is the constant expansion of the various aspects in urban areas. Urban growth can refer to population growth in cities, which needs to be met with constructing new structures for residential buildings, commercial buildings and further expansion of transportation systems. Moreover, and more importantly for the scope of this project, urban growth refers to the expansion or growth in the various structures and consumption per capita, in an urban region. Urban growth can result in increased emission, oil use and further growing resource consumption. In terms of this, urban growth is linked to increased resource consumption per capita and further increased environmental degradation, caused by resource use and carbon emission.

The limits to growth have been discussed in terms of growth having limits when it comes to social and economic aspects of society, and further for the environment in terms of growth leading to increased resource use and environmental degradation. The limits to growth have been discussed in many forms, whereas degrowth ideology is seen as a way to decrease the environmental degradation caused by human development.

This is interesting because despite the various attempts and strategies developed to make urban areas more sustainable they have not been effective. On the contrary, environmental degradation due to urban and human development has become increasingly more extensive since the report "Our Common Future" was published in 1987 and Local Agenda 21 was established in 1992. Despite, various attempts of urban and national governments to fulfill goals of sustainable development they have not succeeded. This is here seen as due to the governments focusing more on fulfilling economic growth than they focus on environmental sustainability.

This project is seen as relevant for municipal and regional planners in the Capital area; politicians; managers of construction companies; and further for the public. This is because this problem of urban growth causing increasingly more environmental degradation is one that the whole society needs to take part in changing. In terms of this, an understanding of how different structures and actions influence the ecological environment is here noted as one of the most important component for individuals, companies and governments to make the best decisions for urban development. This project is further relevant for

other urban regions who have goals for economic and urban growth; while aspiring to fulfill environmental sustainability.

The Capital area in Iceland has focused on urban and economic growth while becoming increasingly less sustainable in the recent years. Further, plans and strategies developed by the municipal government in the region, state sustainable development as an important goal. The Capital area in Iceland consists of Reykjavík, the capital of Iceland, and six other municipalities in the region. From looking at the Capital area's position today, it can be said that the area has extensive car transportation infrastructure, low density, extensive car traffic and further a lot of detached buildings and large buildings for commercial activity. In terms of this, there is indeed quite an extent of environmental degradation caused by the region and the area cannot be seen as environmentally passive.

The aim of this project is to show how economic growth in the last decades has made the Capital area increasingly less sustainable whereas emphasizing economic and urban growth is seen as the main hindrance for the Capital area to become more sustainable. For this project, it is seen that increased environmental degradation is a problem. Further, it has a normative position, whereas sustainable development is seen as important.

This project discusses urban growth in the case of the Capital area in Iceland for analyzing how urban and economic growth has influenced sustainability in the region. More specifically from the mid-20<sup>th</sup> century and leading up to the financial collapse that hit Iceland in 2008, and further how degrowth ideology can be applied in urban planning in the Capital area to improve the region's level of sustainability. This leads to the problem formulation, which is the following:

*What are the limits to urban growth and how can the ideology of degrowth be implemented in urban planning, in terms of the building stock and transportation, to move closer to goals of environmental sustainability in the case of the Capital area in Iceland?*

In order to answer the problem formulation three research questions have been established. These are:

1. *How can the limits to growth be conceptualized in terms of urban planning and sustainable development?*
2. *How has the building stock and transportation developed in the Capital area since the mid-20<sup>th</sup> century, and more specifically leading up to the financial collapse, and how does this influence sustainability?*
3. *How can the ideology of degrowth be implemented in urban planning for the Capital area in order to move closer to goals of sustainability?*

This project is structured in a way that the second chapter describes the methodology, where theories of science, in terms of Critical Realism are discussed, and the methods, critical literature review, statistical data and others, used for analyzing this project are deliberated on. The third chapter establishes the theoretical framework where the relationship between economic and urban growth; and environmental sustainability are discussed in relation to degrowth ideology, by this answering research question 1.

The fourth chapter provides introductory information for the case; where laws, regulations, and facilitation of automobile use in Iceland; and plans and strategies for the Capital area are discussed. The

fifth chapter then analyzes how urban growth, in terms of the building stock and transportation, has developed in the Capital area since the mid-20<sup>th</sup> century, and more specifically leading up to the financial collapse, and how it has resulted in the Capital area becoming increasingly less sustainable, and thus answers research question 2. The sixth chapter analyzes how the ideology of degrowth can be implemented in urban planning for the Capital area in order to move closer to goals of sustainability, for answering research question 3.

Chapter seven discusses the future of urban development in the Capital area; complications for implementing degrowth ideology in the Capital area; how urban planning is concerned with degrowth ideology; and further deliberates on the relationship between economic growth and environmental sustainability. The thesis concludes in answering the problem formulation and further some reflections on the analysis and the conclusion are made.

# METHODOLOGY

This chapter presents the theories of science and epistemology for this research project. It further presents the methods applied for establishing the theoretical framework, the case data and for analyzing the case. The chapter moreover presents the research design, and how it is intended to answer the problem formulation and the research questions.



## 2. Methodology

### 2.1 Theories of science

One of the challenging aspects of social science is how difficult it is to manage situations as natural scientists often can. When the social world is researched, many factors influence the subject of research at the same time and therefore many variables effect the subject. Such as gender, age and economic and social factors. Therefore, there is a kind of multi-dimensionality to social science, whereas it is not possible to isolate the cases being researched. In terms of this, social science require a certain abstraction in order for the researcher to include specific indicators and to determine their effects. Abstraction refers to the act of selecting and conceptualizing the data used for research, and is discussed further in chapter 2.2.1 (Sayer, 1992). The abstraction process is important for this project because although certain indicators can provide information about causal relationships, it is difficult to determine the phenomenon being research caused by one factor or another. In terms if this, phenomena need to be researched conceptually.

For it to be worth one's while to research the urban environment, one must presume that the urban environment has some effects on people's lives, either positive or negative. Further, it is important for there to be a possibility for us to change the physical environment, for it to be important to develop theory and plan the physical environment. For this, a theoretical framework for urban planning, a framework on how different structures influence different aspects of society and the environment needs to be in place. Urban planning is an interdisciplinary field of research that touches upon matters of economic, social and environmental disciplines, research and there for knowledge from different fields of knowledge needs to be applied to develop theory and plans (Næss, 2015).

#### 2.1.1 Epistemology

Epistemology is how we view knowledge and is therefore influential in terms of how one researches a phenomenon and what methods one uses. It is important for a researcher to realize his or her relationship with the phenomenon he or she is researching. Therefore, it is important for the researcher to understand knowledge in context to the research.

Knowledge is something that is gained from an interaction with the world. This might be a test or an observation. Knowledge cannot be gained independently from the world because knowledge can only be gained my monitoring and observing a phenomenon, in this case urban growth and how it influences sustainability. Further, in order to "know" something a certain kind of inspection or analysis needs to be in place. This is important to verify if the knowledge successfully mirrors the world. In terms of this, objectifying knowledge by conceptualizing it through theory, instead of it passively mirroring the world (Sayer, 1992).

For the purpose of this project, it is important to establish how the researcher looks at knowledge and consequently selects the methods used in order to acquire knowledge. For this project, critical realism is seen as a fitting theory of science for researching and analyzing the case because it combines methodology from both positivistic and social theories. This will further be elaborated on in the following subchapter.

## 2.1.2 Critical realism

Theory of critical realism, from here on noted as CR, is an established theory when it comes to humanities and social science, such as sociology, psychology, political science and related disciplines, but has not been very common in the field of urban planning. However, research along the lines of CR has been applied in the field of planning while it has not been identified as scientific theory of CR (Næss, 2015).

According to CR “[t]he world exists independently of our knowledge of it” and “[o]ur knowledge is both fallible and theory-laden” (Sayer, 1992, p. 5). That is, what we think of the world, or our theories and knowledge of it does not change the way the world is. According to CR, knowledge is socially constructed because it is produced from how we understand the world (Næss, 2015).

CR can be said to be a combination of positivism and social constructivism. That is, between knowledge being seen as quite absolute and knowledge not being absolute, but related to context. In terms of this, CR challenges both concepts of natural and social science. “CR proposes a way of combining a modified naturalism with a recognition of the necessity of interpretive understanding of meaning in social life” (Sayer, 2000, p. 3).

Different research calls for different methods and theories of science. Although, CR is suitable for some research positivist or social constructivist research theories are better suitable for others. CR is suited for this project because it addresses how social structures influence the physical environment. While a form of effects can be measured quantitatively, like waste production, size of the building stock, emission and so forth, there are social mechanisms that cause these physical effects and need to be conceptualized in terms of social science. Therefore, this research project has a natural and a social aspect to it because in the end, how the man influences nature is an aspect of social science.

CR shares some characteristics with positivism and does not seek others. Using statistical data is a characteristic of positivism and is applied for CR. However, positivism seeks to find laws when it is applied and this is not a part of CR methods. In terms of this, CR and positivism are similar but different. Further, CR realism does not seek to find unique cases. It rejects the idea that the absence of certainty results in knowledge being rejected. In terms of this, the world cannot be defined by a single emergence or indication. CR further shares characteristics with social theory where the qualitative nature of society are analyzed in order to determine the mechanisms between them (Sayer, 2000).

For CR, the connection between indicators need to be evacuated in the context of what is being researched. The number of times someone has observed an event has nothing to do with what causes it to happen. Meaning that what can be seen in the world and the relations between these indicators can insinuate a certain phenomenon that can help explain the world (Sayer, 2000). In terms of the case, indicators shown for growth in the Capital area cannot explain why these events happen but can indicate a form of effect that is caused by socially constructed actions. For the indicators to explain a phenomenon, they have to be conceptualized in terms of growth and environmental degradation.

One of the most important components of CR is an explanatory critique. “Critical” in critical realism refers to having a critical reflection and a critique on social structures. It is critical of social structures that are preventing society to reach a prosperous life (Næss, 2015). CR is thus suitable for this research project because urban growth is here seen as one of the aspects preventing society to consume within the planet’s ecological limits and therefore preventing society from developing towards prosperity. Further, urban growth is not as simple as the population increasing the size of their building stock or the quantity of

emission. Moreover, it connects to why and how different factors grow and how different factors affect the environment and cause people to exert themselves in certain ways. Therefore, analyzing causation.

CR considers the environment around us, excluding the natural and ecological environment, socially constructed. This is true for physical structures such as infrastructure, the economic and money system that we use and the culture that surrounds us. Once structures have been implemented, they can be powerful. Although, structures are established they are only present at the end if they are maintained. "Social structures are reproduced, modified and changed by human actions, usually gradually and slowly, but sometimes more dramatically and fast" (Næss, 2015, p. 5). CR considers the relationship between structures, both social and physical; and action; and how they influence each other. According to the notion of CR, it is not possible to separate the two. Action creates the structures and the structures produce actions. Structures are sometimes used long after they have been produced (Næss, 2015).

This is relevant for this research project because in the case of the Capital area, urban structures, both physical and social, influence the population's levels of environmental degradation. Further, these structures have been produced by society. Moreover, social institutions like economic growth were produced many years ago are today being reproduced and maintained because economic growth is still considered a goal to strive for. A change in social structures with an understanding of the physical aspect, in terms of environmental degradation, needs to be established in order to produce structures, both social and physical, that are designed for reducing environmental degradation. In terms of maintaining structures, urban growth can be maintained if society sees this as a norm. A change in social institutions needs to be in place for new strategies in physical urban development, with new emphasis. In terms of this, using urban planning to produce a certain type of action, developing a more sustainable society.

## 2.2 Research methods

CR considers using various research methods in order for the methodology to be successful. Therefore, using both quantitative and qualitative research methods should produce a better result, while keeping in mind if these approaches are useful for the research. For CR, correlating statistical data is not considered enough to produce a conclusion. Findings need to be supported by theoretical reasoning and empirical qualitative data. Therefore, the use of statistical data can be used as a part of empirical data to document relationships and patterns in the empirical case (Næss, 2015). This makes CR a suitable science theory for this project, because different methods are required to analyse this case because using statistical data provides only half the information needed to answer the problem formulation. This is because it is not enough to explain that growth has happened but it is important to explain what growth produces and what produces growth. In terms of this, the statistical data needs to be conceptualized with theory and by using qualitative methods, such as interviews.

What methods one uses is dependant on the object at hand rather than there being an absolute way of researching the object. Therefore, both qualitative and quantitative research methods are applicable when researching in terms of CR. Each method has certain advantages and certain drawbacks and therefore can supplement each other (Sayer, 2000). It is thus important to be aware of the limitations and qualities of different methods.

### 2.2.1 Abstraction

Selection of the data used for researching a case is an important part of the process. When analyzing a case for a specific purpose, abstraction is important in order to include indicators that are useful for the analysis and excluding others. Even if other aspects of the case are interesting, it is important to limit oneself to what is relevant to the case. Although abstraction seems obvious, it can have negative influences on research if it is poorly executed. One shall select and exaggerate in terms of what is significant to the case. For this case and others, it is important to be aware of the limitations and advantages of bringing different aspects of the case forward and drawing attention to the relevant indicators. For abstraction, it is important to understand the relationships between the selected indicators (Sayer, 1992).

In terms of this research project, abstraction is important for selecting which data to use in order to firstly, answer the research questions and problem formulation and secondly, for the conclusion and this project to be of the highest quality possible, within the limitations of availability of data and time. It is further an important method for extracting the relevant data to produce persuasive arguments for the research case.

For the theoretical framework, abstraction is applied by selecting the literature that is most suitable for answering the research questions and is most suitable for conceptualizing and analyzing the empirical data gathered. More than suitability, only reliable literature is selected for the purpose of this. The suitability of literature is then determined through critical literature review, which will be further described in the following subchapter.

For the empirical data, abstraction is applied in order to select the most reliable data from reliable sources. Further, for selecting data that is suitable for indicating what it is presumed to. For instance, when selecting data to indicate consumption, data for waste disposal is used because how much people throw away indicates how much they buy. The empirical documents and indicators are discussed in text and further elaborated on in the appendix. Moreover, abstraction is applied to select the data that is useful for answering the research questions and problem formulation and leave other aspects out that are not necessary. This is done in order for the thesis to be specific and clear on the subject.

Abstraction is therefore an important method of constructing a research project and can determine if a research project is successful in what it aims to produce or not. It should help provide the methodological, theoretical and empirical data suitable for constructing a successful research project.

### 2.2.2 Critical literature review

Critical literature review is a part of the abstraction process and is about reviewing either specific texts or unlimited number of texts. Usually these texts are unlimited. The researcher makes a critical choice of what literature to look for and is best suited for the project at hand. When using this method it is important to be critical of what to review because if the researcher tries to read most or all of the material for the topic of study it is likely too much for the researcher to manage. Therefore, it is important to focus the review in order to extract information from literature that strengthens the researcher's argument (Wallace & Wray, 2011).

A critical literature is defined by Wallace and Wray as:

“a reviewer’s constructively critical account, developing an argument designed to convince a particular audience about what the published – and possibly also unpublished – literature (theory,

research, practice or policy) indicates is and is not known about one or more questions that the reviewer has framed" (Wallace & Wray, 2011, p. 151).

Successful literature review results in developing a strong argument and framework for analyzing a case. This requires, regular adjustment, monitoring and planning. In some cases, the framework needs to be adjusted along the way in order to adjust the focus of the research. Applying a successful and critical literature review requires practice and is a skill that researchers hone, as they become more qualified (Wallace & Wray, 2011).

In terms of this research project, literature review is used for gathering data for methodology, theoretical framework and for the empirical case study. For the methodological and theoretical framework, academic articles and books written by academics are reviewed. Critical literature review is further applied in order to gather empirical information for the case. In terms of empirical data, laws and regulations are used to describe the legal framework. Planning documents have further been reviewed, in order to establish agendas and plans the Association of municipalities in the Capital area have established. Further, documents and plans were used to evaluate the status and development of the urban environment in the Capital area. A list of the document used for empirical case are shown in appendix A. Further, websites were used to gather supplementary information when needed and in two cases, emails were sent to institutions in order to receive information that is not available in documents and on websites.

### 2.2.3 Statistical data

When using statistical data it is important to quantify the data. That is, being confident and explicit about what the data used indicates and how it is interpreted in order to analyze a case (Sayer, 1992). Statistical data is here used in order to show changes between years for different indicators that demonstrate growth in the Capital area. The indicators used are chosen because they represent economic growth, urban growth and environmental degradation. Further, the indicators used are selected because they are the most appropriate data available. Availability for the statistical data has great impact on this research project. The data that is best suited for a research is often not available and because of this, a researcher might have to make do with what data is available.

In terms of the Capital area, data is limited. Often data is available for the whole of Iceland but not available for the Capital area. For this project, statistical data for GDP and carbon emission is important. Unfortunately, quality data for these indicators is only available for the whole of Iceland. Further, data for oil use is only available for the whole country. Although, GDP has been estimated for the Capital area, the data is not as trustworthy as the data from Statistics Iceland is, and further is not available from year to year. Because of this, data for GDP, carbon emission and oil use in Iceland is used as an indicator for GDP, carbon emission and oil use in the Capital area. Justifications for doing this are firstly, the unavailability of data for the Capital area. Secondly, the fact that the Capital area accounts for 65% of the national population and therefore the data applies to a large part of the population. Lastly, because the ratio between the Capital area and the rest of the country in terms of GDP has from 2007 until 2012 been quite stable with about 4% fluctuation (Snævarr & Júlífusdóttir, 2014). Because of this, data for Iceland can be used as indicators for GDP, emission and oil use in the Capital area.

It should be mentioned that there could be a difference in carbon emission and oil use between areas in Iceland. This is because heavy industry, fishery and other sectors are largely outside the Capital area. However, emission and oil use is displayed for the different sectors. It should further be mentioned that

the population in more rural areas might have higher automobile use where public transportation is lacking and distances can be longer. However, the ratio between the Capital area and other areas can be expected to be quite stable and therefore the growth and decline in the curves can be compared.

Parts of the statistical data are available for the Capital area and are thus better equipped to indicate development in the region. Some statistical data is better equipped than other to indicate a certain phenomenon. Further, it is important to be explicit about what each indicator indicates and what conclusions can be drawn from it.

The indicators in this project have been changed and calculated from their original values. In terms of this, dividing them by the number of inhabitants each year and more, which is described in appendixes. All data is referenced to the source whereas all the data is publicly available online, with the exception of the data for residential and commercial building stock, which is displayed in appendix C.

The indicators used for this project are of different nature and have different values. Because of this, they can be quite difficult to compare. Especially, when they are inserted in one figure to show the difference in curves, as in figures 16, 17 and 18. As described in text, they have been changed to fit in the same figure for comparison. There are different ways to do this. Those displayed in chapter 6 are considered by the author to be the clearest ways of displaying the data for comparison. However, the author realizes that there are limitations to each way of displaying the data, when the data is as different as in these cases. In order to provide transparency and clarity, the data is displayed in an alternative way in appendix D.

The statistical data is acquired from different institutions and from consultancy firms. These are shown in table 1. Figures and statistical data will be further deliberation on in chapters 5 and 6 and in appendixes.

*Table 1 shows the statistical data used for the research project and its sources.*

Statistical data	Source
Ratio of inhabitants per municipality	Statistics Iceland
Population development in the Capital area	Statistics Iceland
Economic growth in Iceland – GDP	Statistics Iceland
Contribution of sectors to GDP in Iceland	Statistics Iceland
Carbon emission per capita in Iceland	Statistics Iceland
Consumption of oil per capita in Iceland	National Energy Authority; Statistics Iceland
Waste per capita in the Capital area	Sorpa (Waste management company owned by the municipalities in the Capital area); Statistics Iceland
Values for density in the Capital area	Alta (Consultancy)
Square meters of residential and commercial building stock in the Capital area	Registers Iceland; Statistics Iceland
Automobiles per 1000 capita in the Capital area	Icelandic Transport Authority; Statistics Iceland
Other numerical data written and not in a figures	VSÓ Ráðgjöf; Capacent Gallup, Verkís (Consultancies)
Data for happiness in Iceland	Directorate of Health

## 2.2.4 Interview

In order to acquire more qualitative data an interview was conducted with Hrafnkell Proppé, who is the director of planning in Capital area, at the AMCA. He is an educated urban planner; has experience from working as a consultant; as a public planner; and has further been an external lecturer at Reykjavík University.

In terms of this project, it is seen as a sufficient to conduct one interview. There are two main reasons for this. Firstly, it is unlikely that other interviewees considered could provide more information needed for answering the research questions than Proppé could provide. This is because he has recently worked on various analyses for preparing the new regional plan for the Capital area and is as mentioned the director of planning in the Capital area, and therefore the most qualified person to interview and for acquiring the information needed. Secondly, the most important aspect of this project is to analyze change in the indicators between years to conclude if urban development in the Capital area has made the region less or more sustainable. Indeed, it is always better to conduct more interviews and analyze more data. However, in prioritizing tasks for this project it is seen as better to spend more time on statistical and literary data. In terms of this, conducting one interview was seen as the best utilization of time and therefore data collection was conducted in this way.

For the purpose of this project, it is seen as being important to obtain information from the interviewee to be better able to explain trends and “explore how they are understood by those experiencing or shaping them” (Cochrane, 2014, p. 40). This is relevant for the interview because Proppé is the director of planning in the Capital area, and therefor is an actor in developing the regional plan.

Semi-structured interviews are according to Cochrane (2014) the most common form of interview conducted by human geographers and further for researching the city. This could be because when a researcher conducts a semi-structured interview he or she is able to manage the interview more effectively. According to Cochrane, this method is especially appropriate for interviewing professionals, which is the case for this interviewee (Cochrane, 2014).

The interview with Proppé is conducted in the form of a semi-structured interview. Meaning that the interviewer did not have a questionnaire but a list of guiding questions to lead the interview, shown in appendix E. The questions are not necessarily asked in the same order as on the list, but the interviewer never the less tries to receive adequate answers for each point of discussion. This way of interviewing allows the interviewee to bring forward information that one thinks is important for the interviewer to know and allows the interviewer to react to new information should they become known. It is never the less important that the interviewer remains in control of the interview in order to receive the information he or she needs and for the time not to be spent on discussing matters that are not relevant (Cochrane, 2014).

The interview is conducted in order to receive two forms of information. Firstly, for factual information and clarifications and secondly, to receive reflective comments in terms of the analysis. In order to receive this information the interviewee is asked about determinants of the growth development; about influential law and regulations in terms of urban growth; and about planning in the Capital area in terms of growth and sustainability. Further, the interviewee is asked to comment on the before established case data and the conclusions drawn from the relationship between sustainability and economic growth. The information is then used to supplement statistical and other empirical data and further as a point of discussion.

## 2.3 Research design

After deciding what subject this project should be focused on, the first step of making this research project is reading about the subject at hand, as Ward (2014) suggests. This is important in order to get a wide understanding of the subject before starting the research. Further, it is important to think about the data available for the subject one is interested in researching. This is to make sure the data one intends to use is available, to avoid problems that might occur if one has assumed that data is available, that in the end is not (Ward, 2014). After reading theory for the selected subject and looking at what data is available, the problem formulation and research questions are established, as the research design in figure 2 shows.

After the problem formulation has been established, the next step is to establish the theoretical framework. For this, literature review is applied to academic articles and books written by academics. By this, critically selecting theoretical data while developing an argument in terms of the problem formulation.

### **By this answering research question 1:**

*How can the limits to growth be conceptualized in terms of urban planning and sustainable development?*

After this, data to introduce the case is gathered. This means, basic information about the Capital area, facilitation of automobile use and on laws and regulations in Iceland. Further, the regional plan for the Capital area is reviewed in order to understand the plans and goals governments in the Capital area have.

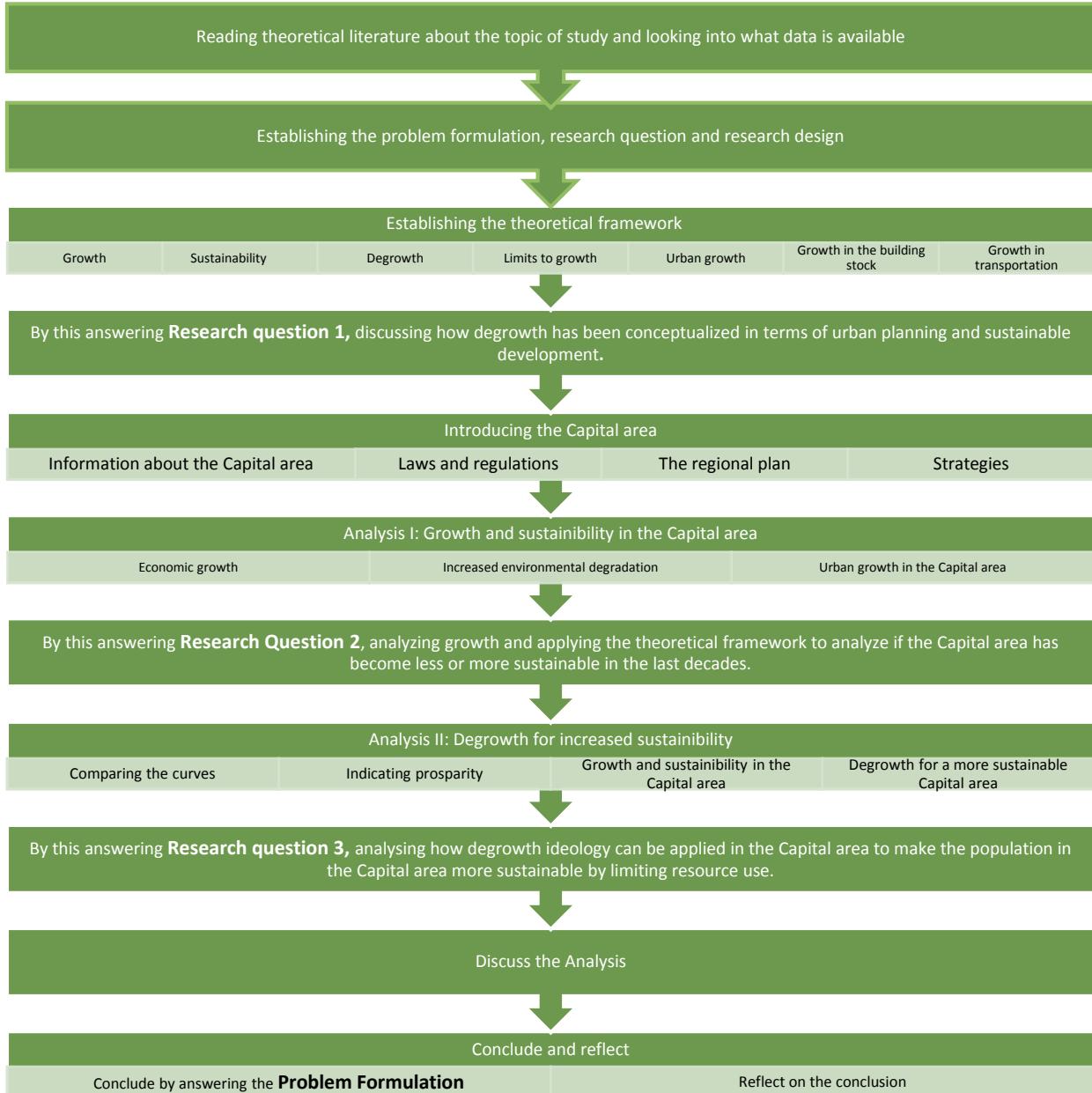
The next stage in the research process is to establish the empirical case data in order to analyze growth in the Capital area. For this, statistical data for indicators is used to show growth in different sectors. For this, statistical data from various sources were used along with planning documents and other literary data. Further, the theoretical framework is used in order to analyze if this development has left the Capital area more or less sustainable.

### **By this answering research question 2:**

*How has the building stock and transportation developed in the Capital area since the mid-20<sup>th</sup> century, and more specifically leading up to the financial collapse, and how does this influence sustainability?*

The theoretical framework and the empirical case data were worked on simultaneously in order for them to be compatible and align, in order to produce a more focused research project.

After the theoretical framework had been established and the empirical case data gathered and analyzed, it is possible to further analyze the case in terms of the theoretical framework. By this, applying the theoretical framework to the case data in order to analyze how degrowth ideology can be applied for urban planning in the Capital area to move the region closer to goals of sustainable development and decreased environmental degradation.



*Figure 2 shows this project's research design (Own figure).*

### By this answering research question 3:

*How can the ideology of degrowth be implemented in urban planning for the Capital area in order to move urban development closer to goals sustainability?*

After the theoretical framework and the empirical case data had been established and the case analyzed, and by that, the three research questions answered, it is possible to discuss the result of the analysis. Thereafter, the research is concluded.

### **By this answering the problem formulation:**

*What are the limits to urban growth and how can the ideology of degrowth be implemented in urban planning, in terms of the building stock and transportation, to move closer to goals of environmental sustainability in the case of the Capital area in Iceland?*

Consequently, reflections can be made for the conclusion and the answer to the problem formulation.

### **2.4 Reflection on the methodological approach**

For developing a good research project, it is important that the theoretical, philosophical and methodological approaches are applied in the appropriate way and the link between them is understood by the researcher. It is furthermore, important for the researched to understand the limits of data and further the limits of the project's analysis.

Accessibility of data is noted as the main limitation for the research project. That is, it is quite limited what data and indicators have been registered and are available to the researcher. In terms of this, the research could have been more accurate if data specifically for the Capital area were available and further if more data was available. It would for instance have been useful to have longer time lines for most of the data. In addition, having more accurate information for population density in the Capital area for each year would have been useful. Further, information for building stock per unit of land would have been appropriate data for this project. More specific data for GDP would further have been useful.

Although more data and information would have made this project stronger, the data available is suitable for indicating what it is here described as an indicator for, and the data further shows strong correlation between indicators. In terms of this, lack in data available is not seen as having a significant impact on this project. This is because the aim of this project is to display urban growth in a broad term where the specific numbers are not the most important aspect, but the curves and changes in the extent of the indicators from year to year.

As mentioned, social science is context dependent. That is also true in terms of time. The research applies to the time the research and analysis is conducted. What happens after is not the subject of research in this particular research (Sayer, 2000). Therefore, it should be considered that the research project is valid until the time it is produced. What the development is after the period might be different. In terms of this, a new regional plan is to be approved in 2015 that has strategies that are closer to degrowth ideology than the development that has been implemented and planned in the last decades and therefore development might be different in the next decades. However, if development will continue as it has since the mid-20<sup>th</sup> century, urban growth will continue.

There can be limitations to the quality of data used for a research project. In terms of this, the researcher has to do what is possible to ensure that data used is of high quality, for this using official statistical information, high quality academic literature and so forth. Further, the researcher has tried to use as little data that is acquired from a second party in order for there to limit the chance of data being lost in translation. In some cases, this is not possible because information is in reports and cannot be acquired otherwise. In those cases, the researcher uses data from organizations that should be trustworthy. It should be kept in mind that some knowledge is more trustworthy than other knowledge and some knowledge is more empirically and theoretically appropriate than other is. Further, it should be possible to distinguish between those that are more or less well founded (Næss, 2015) and the researcher has tried

to do this. However, one must assume that some knowledge used in this project is more well-founded than other is, but the researcher has aimed in ensuring the use of quality data.

In a project such as this, time is always a limiting factor. Approximately four months' time is allocated for this thesis and what is produced needs to be within this timeframe. The literature read, data acquired and information gathered can never be maximized but further needs to be satisfied, in terms of producing a successful project. That is what is intended to do in the following chapters.

# THEORETICAL FRAMEWORK

The following chapter establishes the theoretical framework needed to answer the problem formulation. It discusses the dynamic between sustainable development; and urban and economic growth and how or if they are compatible. It further discusses the limits to growth, in terms of economic and social aspects; and more important for the scope of this project, discusses the limits growth has in terms of the environment and environmental degradation. The chapter discusses urban growth in terms of structural characteristics. By this describing environmental degradation caused by urban development with structural characteristics of growth and of degrowth. In terms of this, discussing degrowth ideology as a way of reducing environmental degradation caused by urban development. The chapter discusses how the limits to growth have been conceptualized in terms of urban planning and sustainable development and by this answers research question 1.



### 3. Theoretical framework

#### 3.1 Sustainable urban development and growth

##### 3.1.1 Sustainable development

The debate of growth and its limits is not a new one. Modern growth debate emerged in the sixties at a time when people were becoming more aware of the negative influence human developments were having and could have on ecological systems (Xue, 2012b). One of the major contributions to this debate is the report *The Limits to Growth* (Meadows, Meadows, Randers & Behrens, 1972). The report debates that negative ecological and environmental effects were due to economic growth. The report suggested concepts of development such as zero-growth and degrowth.

Gradually, this debate of limits to growth developed into the concept of *Sustainable Development*. The concept was the subject of the Brundtland Report, report of Our Common Future, written in 1987 by the World Commission for Environment and Development (the Brundtland Commission).

In the report, Sustainable Development was defined by the WCED:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs" (WCED, 1987, p. 41).

This means fulfilling our basic needs without compromising the environment. Sustainable development is often separated into three pillars. These are environmental, social and economic sustainability. For sustainable development to be reached each pillar cannot have negative effects on another one and they need to be balanced. This balance is required to produce a continuous cycle of our habitat and community.

According to the report of the WCED "[t]he medium-term prospects for industrial countries are for growth of 3-4 percent, the minimum that international financial institutions consider necessary if these countries are going to play a part in expanding the world economy" (WCED, 1987, p. 46). According to the WCED this growth rate could be environmentally sustainable if the growth is produced by less resource demanding activities with more resource efficiency (WCED, 1987). Hereby, economic growth is deemed as an objective but it should be managed in a different manner. This recommendation of economic growth has been questioned by a number of economists (Høyer & Næss, 2001).

##### Action for sustainable urban development

In 1992, at the Rio de Janeiro conference, the fundamental aspects of the Brundtland Report were the subject of discussion. This conference lead to the establishment of an action plan for sustainable development called Agenda 21 (Næss, 2001).

Agenda 21 is an action plan that is to be implemented on a local level. It is a political commitment of governments to work towards dealing with global environmental problems as well as dealing with social problems, such as poverty. It is a global partnership of governments, which aims to implement sustainable development. It is a strategy for decreasing environmental degradation within the current growth structure. For example, two objectives stated in the document for Agenda 21 are "[t]o make international

trade and environment policies mutually supportive in favor of sustainable development" and "[t]o encourage international productivity and competitiveness and encourage a constructive role on the part of industry in dealing with environment and development issues" (United Nations, 1992, p.8). It suggests more effective resource use, which should generate economic growth and increase production while resulting in less environmental impact. A balanced environment is seen as being important to provide the resources needed for economic growth. These and other notions of Agenda 21 suggest that decoupling between economic growth and environmental degradation is possible and thus consider these aspects compatible (United Nations, 1992). Although the action plan has been in operation for more than 20 years, it is difficult to suggest that it has been effective. Despite actions, global emission has increased 40% since 1990. This is also despite the technological advancements that have taken place in the last decades (Jackson, 2009). Therefore, the effectiveness of these actions can be questioned.

### Sustainability

The notion and ideology of sustainable development has become well established and used in various situations and documents. It is debated both academically and in practical cases. The notion of sustainability can be said to be the ability to sustain. To sustain is defined by the Oxford dictionary as to "[c]ause or continue for an extended period without interruption" (Oxford Dictionary, 2015). Therefore, sustainable economy or environmental sustainability is the goal of endless circulation in systems that do not fail but are sustained because of our actions and because the system is managed responsibly.

Different people put different value into the notion of sustainable development. The phrase is often used irresponsibly and in some cases for notions that are not in fact sustainable and are likely to result in more resource use. They might reduce resource use in terms of one resource type but increase in terms of another, and in the end could be less sustainable. This is true for both governments and individuals. Some people see sustainable development as development that allows people to live within ecological capacity. Earth's ecological capacity is how much resources are available for use without resource use going beyond what earth can provide, which would in the end lead to resource scarcity and us running out of resources. In terms of this, not using more resources than the planet can produce. This is not easily defined or measured because it is difficult to know how much we can use each year without using more resources than earth produces. However, most would agree that earth's inhabitants are now consuming more each year than the planet can produce (Pacione, 2009). For this thesis, sustainable development is seen as development that allows us to sustain the planet by limiting our resource for it to be within earth's ecological capacity.

### 3.1.2 Growth and prosperity

According to the Oxford dictionary Growth is "[t]he process of increasing in size" (Oxford Dictionaries, 2015). The growth concept of can be used for various aspects of society, for population, the building stock, the economy and so forth. Prosperity is not as explicitly described by the dictionary, but is for instance explained to mean "generally successful; successful in terms of material or financial aspects; or flourishing physically or being healthy" (Oxford Dictionaries, 2015). As the complexity of the dictionary definition might suggest, prosperity is not an easy word to define and can in fact mean a different thing to different people, but is always something to aim for.

### Economic growth

"Historically, economic growth has clearly been linked to increased consumption" (Høyer & Næss, 2001, p. 178). That is, more economic growth there is the more is consumed. This is not surprising because "[e]conomic growth is usually defined as an increase in the goods and services produced by an economy in a given time, typically a year" (Victor, 2015, p. 109). It is widely accepted to be the change in Gross Domestic Production or GDP in a country, which is used as an indicator for economic activity. "The GDP counts the economic value of goods and services exchanged on the market" (Jackson, 2009, p. 4). That is, gross domestic production per capita increases from one year to another results in economic growth of this percentage and if gross production per capita decreases this results in declining rate of GDP. This measurement is used because people buy goods and services because they value them and are able to buy them, and because of this GDP is considered a good measurement of our prosperity (Jackson, 2009).

GDP originates from the 1930's in the United States when the government needed an indicator to measure if policy implemented in the Great Depression improved society. Originally, Gross National Product or GNP was used. In 1946, the US determined GNP as the official economic policy for the country. Other indicators were used around the world at the time. Further, in 1953 the United Nations issued GNP as a universal indicator for measuring economic development. Finally, in 1991, shortly after the fall of the Soviet Union, the GDP indicator was established as the indicator for measuring economic development (Victor, 2015).

Economic growth is one of the top priorities of nations, governments and companies. Economic growth measures certain aspects of society and leaves others out. It makes no judgement of the nature of development or if it has positive or negative effects on society. For instance if they have negative effects on health or the environment. Further, what it will mean for society in the future. An oil spill will for instance has positive influence on GDP. This is because cleaning up the oil has positive economic influences where money is exchanged. The negative side effect that is the environmental effects are not a problem in this equation. Further, GDP does not measure quality of life or well-being, such as level of education and health or the quality of resources used. It does not measure how equally the growth is distributed between people or how equal society is. Despite this economic growth has become a measurement of how successful a society is. In many cases, politicians point out economic growth as a proof of their success during an election term in hopes of being reelected (Jackson, 2009).

When it comes to economic growth, it is usually discussed in a positive manner. How to induce economic growth, who has economic growth and so forth. It is not frequently debated why we want economic growth or if it is really something to strive for (Jackson, 2009).

### Prosperity

Prosperity has been quite rationally related to happiness, wellbeing or life-satisfaction. In terms of happiness, it has been shown that non-monetary factors such as temperament, marital status, health, social capital and relational goods give more happiness than material goods and monetary factors. Further, one is likely to feel a more permanent loss in happiness when losing non-monetary factors than monetary factors. Income growth has not been associated with well-being. For instance, experience has shown that people who win the lottery are not happier than other people are over time. People tend to become accustomed to their way of life and in terms of this, happiness is relative to consumption and monetary factors. Happiness is more connected to social comparison. That is how people compare themselves to other people or groups. Because of this, happiness is not likely to decrease if the standard of consumption would decrease for everyone. Further, the gap between people's income status and status of consumption

is what makes people unhappy. Therefore, equality is one of the most important components of well-being and a prosperous society (Sekulova, 2015).

Environmental sustainability is important in terms of prosperity because in order for there to be prosperity there needs to be some form of continuity. That is, we have to have a future. For us to have a future, we need to sustain the planet and for this it is important to decrease environmental degradation and live within the earth's ecological limits. Therefore, sustainability and prosperity have an unbreakable link because it is safe to say that without sustainability there is no prosperity (Jackson, 2009).

More than continuity, prosperity has been said to mean various things. The most common measurement of prosperity has been economic growth. That is, an increase in GDP per capita. Accordingly, higher income will mean more prosperity (Jackson, 2009).

As mentioned, this sounds conflicting due to the fact that for economic growth one needs resources to make goods and services but to have continuity, sustainable development is crucial. It is easy to see that this is conflicting and this will be further discussed in the following subchapters.

### 3.1.3 Growth and sustainability

As mentioned, sustainable development has become one of the most talked about aspects for developing the human habitat today and it has been considered important for urban areas to emphasize sustainability when developed. Further, economic growth is a widely accepted goal and policy of contemporary governments. This notion suggests that it is possible to have environmental sustainability and economic growth and therefore negative environmental impact and economic growth can be decoupled (Xue, 2012b). Sustainable development has even become so well established that not being a supporter for it is nearly politically impossible (Næss, 2001).

#### Ecological modernization

The notion of ecological modernization emerged in the eighties as a way to incorporate matters of environmental and economic nature. That is, reacting to the growing demand of reducing negative environmental impact while maintaining market orientated economics. Therefore, deeming economic growth and environmental sustainability to be compatible and therefore it should be possible to have both (Jänicke, 2008).

"This policy discourse of ecological modernization recognizes the ecological crisis as evidence of a fundamental omission in the workings of the institutions of modern society. Yet, unlike the radical environmental movements of the 1970s, it suggests that environmental problems can be solved in accordance with the workings of the main institutional arrangements of society" (Hajer, 2005, p.7).

In terms of economic development, modernization refers to capitalist market oriented process of developing a more effective production process. Modernization is a reaction to the market economy where technological advancements, innovation and competition are virtues.

"According to the theory of ecological modernization, environmental problems can be solved within the context of existing political and economic institutions by decoupling economic growth from environmental degradation" (Næss, 2011, p. 13). For this eco-efficiency is an important part where environmentally friendly technology plays a part in increasing productivity of resources in order to decrease negative

environmental effects (Jänicke, 2008). This emphasis on technological solutions for developing towards sustainability is controversial because “[i]t’s now widely accepted that technological efficiency is both an outcome from and a fundamental driver of economic growth” (Jackson, 2009, p. 121).

In terms of urban development, ecological modernization is about accommodating economic growth as well as growth in the building stock while reducing environmental degradation. For this eco-efficiency is an important part of where the main strategy is to apply efficient use of land, energy and materials; and developing efficient transportation options (Jackson, 2009).

Ecological modernization is strongly linked to the sustainable development portrayed the Brundtland Report, in terms of sustainability and economic growth being compatible. Moreover, these ideas are today quite dominant in the discourse of sustainability. This ideology is well established in modern politics where strategies and plans are developed from this idea. This is a problem because of the various limits of planning and implementing for both growth and sustainability. Further because of the various limits to growth; social, economic and environmental.

#### Limits to growth

Although the demand for both sustainable development and economic growth are well-established goals of governments today there has, as mentioned, for a long time been a subject of debate. The notion of modern degrowth was put forward by André Gorz in 1972. This idea was followed up in the report “Limits to Growth”. This phrase has been used by many academics to describe concerns of there being limits to growth in terms of economic, social and environmental matters. Recently Tim Jackson used the phrase frequently in his book “Prosperity without Growth” (D’Alisa, Demaria & Kallis, 2015; Jackson, 2009).

In the last decade, this debate of questioning the possibility of maintaining economic growth while decreasing environmental degradation has continued. The notion that economic growth and environmental degradation cannot be decoupled has been the subject of two international conferences, in 2008 and 2010, and the subject of various books and articles (Jackson, 2009; Xue, 2012b).

Without looking at growth in a scientific manner, it should be apparent that nothing on earth is able to grow forever. The economy cannot grow indefinitely and a regression, for some reason or another, is inevitable. An example of a limitation is the fact that our planet is finite and we are running out of it. Therefore, there is a limit to growth. Moreover, economists have not been able to answer the question of how an economy that grows continually is to function within a finite system of ecology. Further, the fact that a growing economy is needed for economic stability seems contradictory. That is, it is difficult to imagine that continuing growth of something can be stable nor sustainable (Jackson, 2009)

When it comes to economic processes it is evident that it is not possible to produce something out of nothing, nor is it possible to make nothing out of something. This is because to make something one needs at least the material or resources to make it, and might need energy or man power to do it. Therefore, all we produce, build and develop needs resources to be implemented (Farley, 2015). Because our resources are finite, a goal or a plan for the future cannot involve a plan for endless growth (D’Alisa, Demaria & Kallis, 2015).

Because ecological modernization is well established and a mainstream ideology there is reason to believe, that the measures that are taken today are not adequate for sustaining the planet. That is, urban development today is not adequate for us to be able to sustain it. Urban development plays one of the largest parts, if not the largest, in determining how much we deteriorate the environment. Although, some

environmental solutions can be helpful for developing more sustainably and causing less environmental deterioration, it is in many cases limited and in the end does not help sustain earth. The decisions we make in terms of urban development have great impact today and for the future. Therefore, it is important that the plans for urban development support goals for sustainable development.

## 3.2 Urban structures and growth

### 3.2.1 Urban growth

Today, more than half of our planet's population lives in cities and the ratio is growing. In the last century, urban growth has been a strong tendency. The population in cities is now growing approximately 3,5% each year. This growth is partly due to natural increase in populations in cities but also due to immigration to cities. The natural growth is then increased because of immigration (Pacione, 2009). Population growth in European countries has been moderate in the last decades. Further, the population growth in European cities is in most cases higher than in rural areas (Næss, 2001).

To accommodate these new inhabitants in the cities the building stock needs to be expanded for providing residential buildings. More than increasing the building stock in ration to the population growth, volume of the building stock has increased. Density has further decreased in many cities and transportation systems have grown in order to accommodate these new inhabitants and the new dwellings. These growth factors cause resource consumption to increase (Høyer & Næss, 2001).

Urban growth in terms of physical structures is thus quite extensive where cities are continuously being developed. Because of the vast size of urban structures, the growth of the building stock causes significant resource use and therefore environmental degradation. The way urban structures are planned can have great influence on the environmental impact caused by constructions, where some structures cause more environmental degradation than others do. Environmental impact can thus be reduced to some extent by applying urban planning and design for solutions that use fewer resources (Næss, 2011). The following subchapter will discuss how different urban structure influence resource use and environmental degradation.

### 3.2.2 Growth in urban building stock

The building stock can be said to be the most resource demanding part of our urban environments. The building stock is the houses we live in, our work places, where we shop and the buildings that house most of the things we do. Each person uses various building locations, some private and others public. Because more square meters of building stock are allocated to each person, more land is in many cases allocated to each person. The building stock is important when it comes to limiting the negative environmental impacts because "the housing sector is the biggest consumer in terms of energy, material and land use" (Xue, 2012b, p. 19). The building industry is resource demanding in terms of energy, materials and manpower, and therefore the building sector plays a big part in producing economic growth (Xue, 2012b). When it comes to the construction of buildings environmental protection cannot be said to be the number one priority. It is more important to accommodate growth and construct building stock that is in demand (Næss, 2011).

The population in Europe in the latter half of the 20<sup>th</sup> century grew by 33%. At the same time, the urban building stock has grown by 78%. Further, land use per capita has on average increased 34%. This means

that the land allocated per capita has not increased nearly as much as square meters of building stock per capita. This is a common trend in European cities. This is because in some cities, buildings have become higher and vacant plots within the urban limits have been utilized. Although, cities have in many cases been densified and more square meters of building stock built per unit of land, floor space allocated per capita has increased and therefore environmental degradation has increased (Næss, 2011).

#### Growth in floor space per capita

Floor space allocated per capita is among the highest in Northern Europe. Floor area per capita in Northern Europe has been growing since the Second World War, both in terms of residential buildings and other types of buildings. Further, the number of inhabitants per apartment unit has decreased (Næss, 2001).

The fact that square meters of residential building stock per capita is increasing has partly to do with change in family composition. Today, there are fewer residents per household than before. This calls for increased physical structures since every household needs basic structures, such as a bathroom, a kitchen and maybe a living area. Therefore, a household for a single resident calls for more square meters per person than a household for two people does and so forth. Contrary to a decrease in the number of residents per household, the size of an average household has increased. With this, the consumption of building stock per capita has increased. Growth in the building stock is not limited to residential buildings. Size of retail buildings, office buildings, buildings for public administration and warehousing has further been increasing (Næss, 2011).

#### Increased resource use

A building has different environmental impacts through its lifespan; of production, operation and demolition. The production of a building requires various resources, such as stone, wood, metals, water and so forth. Not only is the building material itself resource demanding, but transporting the building material to the location of construction can indeed be resource demanding. These three stages of a building's lifespan have different extent of energy demand (Xue, 2012a).

The energy in building materials consumed in the construction stage accounts for approximately 10-15% of the energy consumed in the building's lifespan. The type and size of the building determines the extent of resource use when constructing. Attached buildings require fewer resources than detached buildings, because building material for walls and material for systems such as piping and electricity can be jointly used. When buildings are densely built access roads, sewage and cables can be shared and this can reduce resource use (Xue, 2012a).

The largest part of energy consumed in a building's lifespan is consumed at the stage of operation (Xue, 2012a). Research has shown that multifamily and attached buildings require fewer resources than detached and single-family buildings in the operational stage. This is because less energy is needed for heating and cooling because less heat seeps through the wall in attached buildings. Consumption is much linked to the size of buildings, because larger units need more energy for lighting; heating or cooling; and home appliances than smaller units do. The demolition stage, energy is consumed for tearing down the building and removing the building waste. Therefore, the amount of waste produced in developing buildings is linked to how much resources were used for construction. Therefore, smaller and attached buildings would result in less waste than larger and detached building (Xue, 2012a; Næss, 2011).

### Further increase in consumption

As mentioned larger dwellings call for more energy consumption and material use for construction. Moreover, larger dwellings also call for increased material consumption, in terms of what people put into their residences. With larger dwellings comes higher consumption. Not only because more material and resources are needed to build the dwelling but because in larger dwelling there is usually more furniture, household appliances and so forth, resulting in more consumption and resource use (Næss, 2011; Xue, 2012a).

More than consumption of what people have in their residential buildings; the commercial building stock is part of our consumption in terms of urban structures. That is, the construction of music houses, stadiums, malls and department stores is connected to our consumption. Therefore, consumption brings demand for buildings that can be said to make our urban areas less sustainable. Not only because the resources that are used to build these consumption structures and the land that is allocated to them, but what we buy from the establishments (Høyer & Næss, 2001). The size of building stock is thus linked to consumption and resource use and many aspects of the building stock need to be considered in order to develop the building stock towards being more sustainable.

### 3.2.3 Decreased density and transportation

Since the Second World War, urban density in Europe, as in North America and Australia, has decreased. This has been referred to as urban sprawl. The development of single-family buildings and urban development where large areas of space have been allocated between houses and emphasizing parking facilities and automobile transportation infrastructure has contributed to urban sprawl where increasingly more land is allocated to urban development. Lower density, or urban sprawl, results in increased distances between facilities. A compact city thus results in shorter distances between facilities than in urban development with lower density (Næss, 2011).

The combination of decreased urban density and an increased demand in terms of accessibility has resulted in people having to travel longer distances for their journeys. These factors and the individualization of transportation have led to there being a demand of accommodating increased automobile traffic. To accommodate this development, large transportation structures, with wide roads and increased parking facilities have been constructed. This has contributed greatly to urban sprawl and the expansion of cities resulting in even longer distances. Although road construction may increase road capacity in the short run it induces traffic in the end. Road construction will thus call for more road construction in order to accommodate traffic. Research has shown that low-density urban structures cause an increase in motorized transportation modes. Further, low-density urban structures make it more difficult to provide quality public transportation systems and services (Næss, 2011).

Planning and developing a city in terms of urban density is a work of balance. Urban structures that are too highly densified can have negative side effects. It can have negative influence on ecosystems and vegetation within the city. It can also reduce access to green and open areas. Too much densification can cause urban heat island effects. Higher density can increase the amount of noise and air pollution in inner city areas and cause health problems (Næss, 2011). Because these and other factors the density needs to be balanced in order to develop a city with minimum environmental degradation and health threats.

Construction of shopping malls usually requires extensive transportation infrastructure. That is, the parking spaces for the shopping mall and the road system to enable consumers to drive to the mall. The

consumerism is thus manifested in development of the mall buildings, parking areas and the transport infrastructure around it (Høyer & Næss, 2001).

Today, there is more selection of facilities, such as shops, leisure facilities, workplaces and destinations than ever before. This wide range of selection can be said to be in favor of and contribute to economic growth. Further, it is widely recognized that urban sprawl favors economic growth. This is because with urban sprawl more people are likely to use the private automobile as a mode of transportation and live in single-family buildings. These factors produce more economic growth than if more people would live in multi-family buildings and use public transportation. This is because more resources and construction is involved when developing urban structures with automobile orientated transportation infrastructure, more single-family buildings where more automobiles are bought, more fuel is used for transportation and most likely more heating and consumption with larger single-family buildings (Næss, 2011).

### 3.2.4 Structural effects on sustainability

This subchapter has shown that low-density structures cause more environmental degradation than high-density structures; that detached buildings cause more environmental degradation than attached buildings; that larger dwellings cause more environmental degradation than smaller dwellings; and that individualized automobile transportation structures cause more environmental degradation than structures for public transportation, bicycling and walking. Further, it shows that increased consumption causes increased environmental degradation.

These aspects are all manifestations of growth. Growth in distances between facilities; in the building stock; automobile ownership and transportation structure; growth in consumption; and last but not least resource use. This growth and increased resource use per capita is unsustainable and goes against what can be considered sustainable development. A comparison of growth and degrowth is shown in table 2. This point will be further discussed in the following subchapter.

## 3.3 Environmental degradation and urban development

### 3.3.1 Growth as a limiting factor

As mentioned, there are various limits to growth. These are the negative effects of growth in terms of the economy, the building stock, transportation sectors and so forth can have on other aspects of society. Growth has a negative side effects on many aspects of community. This is especially true for environmental sustainability. Further, growth can have negative effects on social and economic sustainability. These limits will hereafter be discussed.

#### Social and economic limits to growth

In today's economy, it is important to have economic growth merely in order to keep the economy stable. Therefore, growth in today's economy is frequently referred to as economic sustainability. If one tries to imagine how the economy will grow in line with today's growth economy, where population growth is also a factor and the population is estimated to be 9 billion in 2050, that economy would be 15 times the size of today's economy and 75 times the size of the economy in 1950. Further, for the growth economy to develop until the end of the 21<sup>st</sup> century it would become 40 times today's economy and 200 times bigger

that the size of the economy in 1950. It is difficult to imagine what kind of a world this would be (Jackson, 2009).

Most people want economic growth in order to gain access to positional goods and enhance their situation in community. However, if everyone's economic position were to grow at the same time, one person's growth will not differ. This is because economic situation is relative. It is a matter of social comparison and is therefore a zero-sum game (D'Alisa, Demaria & Kallis, 2015). Because of this, economic growth will not enhance ones position if others have the same economic growth. It might enhance one government's or person's position in comparison to another, if the other person or government has less economic growth. However, if everyone has economic growth it is unlikely to make a difference.

Economic growth has social limits in terms of equality between social groups and nations. Economic growth is often discussed as being a tool for equality. That is, to produce economic growth in developing countries to save them from poverty and poor conditions. For this, the UN suggest 3% economic growth. Further, according to the UN it is also acceptable for the western countries to have the same economic growth. Growth in these terms leads to more inequality. This is because if economic growth in the United States and Ethiopia would be 3%, the gap between the nations would widen because yearly increase in salary in the US is 633 dollars and 3,6 dollars in Ethiopia. Increase in 10 years would mean 7257 dollars for the United States and only 41 dollars for Ethiopia. Thus making the economy less sustainable by increasing the gap between poor and rich. This can be transferred to a national level where growth in these terms would increase inequality within a country. With growth, the gap between groups increases as the time passes (Høyer & Næss, 2001). One of the social limits of growth is that it will never provide enough for everyone but lead to inequality (D'Alisa, Demaria & Kallis, 2015).

Another limit to growth is that it is often used as a measurement of prosperity. In terms of GDP, prosperity is seen as satisfaction with material consumption. That is to say, the more material assets you have, the happier you are. Needless to say, this is not that simple. Prosperity is more linked to having the possibility to flourish. Being able to work, receive and use one's education, being healthy and taking part in society. It is not only about how many commodities or how much square meters of building stock one has. By having the basic material things, such as food and shelter brings relatively much happiness. Receiving basic qualities of life in terms of physical and materialistic things can significantly increase quality of life. However, when a person has more than needed happiness does not grow in relation to how much one has. Food can be seen as an example of this. If one is very hungry or starving, a small amount of food can increase happiness extensively. If one wants a specific kind of food for one's pleasure that food might bring some happiness. Further, if one has too much food or eats too much it might not increase happiness or even become a burden. The same can be said for buildings and the material things that are in a home. Basic residential buildings will increase happiness in terms of having a roof over one's head. A spacious house might increase happiness in terms of giving more options. However, owning a large house does not increase happiness at a rate of having a house instead of no house and not to the extent of having a spacious house. Further, the size of the house and all the material things in it might even become a burden. Therefore, there is not a linear relationship between economic benefits and happiness (Jackson, 2009). In terms of this "[p]eople with higher intrinsic values are both happier and have higher levels of environmental responsibility than those with materialistic values" (Jackson, 2009, p. 149). Meaning, that people that put great value in material belongings are less likely to be happy than those who are more responsible in terms of the environment and value material things less (Jackson 2009).

### Ecological limits to growth

As touched upon, growth in general and economic growth has great limits in terms of environmental sustainability. Urban development today, has extensive influence on the environment in terms of environmental degradation. “It’s now widely acknowledged that an estimated 60% of the world’s ecosystem services have been degraded or over-used since the mid-20<sup>th</sup> century” (Jackson, 2009, p. 13). At the same time, the world’s economic system has become five times as big as it was in the 1950’s. Further, if it will keep growing at the same rate it has it could become more than 75 times larger in 2100 than it was in 1950 (Jackson, 2009).

Our economic system is today generally seen as a closed system. Meaning, it is not influenced by factors outside the man-made environment and vice versa. As mentioned, this is not the case since it is not possible to make something out of nothing. Therefore, this kind of economic process is not connected to its ecological roots and most aspects of the process do not consider the actual resource extraction of the production process and its environmental impacts (Bonaiuti, 2015). GDP as mentioned measures the flow of goods and assets. However, does not consider where the materials that are needed to produce these goods and assets come from and thus ignores this aspect of the process. This limits today’s economic rules to consider the environmental effects of economic development. It encourages all kinds of development and economic activity whether it causes extensive environmental degradation or none at all (Jackson, 2009). Because of this, this system has incentives for development that is polluting and causes environmental effects as much as for other development, and therefore is damaging for society.

The two main problems and limiting factors that humanity is faced with are resource scarcity and climate change. That is, the over use of resources will lead to us exhausting them and the burning of fossil fuel is leading to carbon emission and accumulation of greenhouse gasses in the atmosphere which is leading to climate change (Jackson, 2009). Resource efficiency has been noted to be one of the ways to make cities and urban areas more sustainable. However, there are various limits to implementing resource efficient solutions. It is limited how much reduction in carbon emission can be achieved by shifting to new energy sources, than fossil fuel, and therefore the goals governments set in terms of this can be quite unrealistic. Although, transportation emits little or no fossil fuel there are still various problems and environmental impacts that are unsolved (Næss, 2001).

As mentioned, urban development has largely been characterized by urban sprawl with low density where transportation by automobile is emphasized. Because of this, larger areas than can be considered necessary have been allocated to urban structures and this has further caused environmental degradation. Even if automobiles would emit little or no carbon, large areas of land would still be allocated to urban structures and therefore they would still have negative effects for biodiversity, cause loss of habitats and decrease food security. It has been estimated the most common cause of extinction is loss of habitat. This is commonly a cause of human action and furthermore a cause of urban development (Næss, 2011). Further, this would not decrease distances in urban structures, which would remain automobile orientated, and inadequate for public transportation, walking and bicycling (Næss, 2001).

Moreover, low-density structure calls for more resources in many ways. Constructing and maintaining the transportation structures would still be resource demanding. Even though automobiles do not emit carbon, the lifecycle of an automobile is resource demanding. Resources are needed for production of the automobile, then it needs to be transported to where it is used, then parts are needed during the operation stage and further demolition demands resources and further produces waste (Næss, 2011)

Although, fuel efficiency has increased it has been a problem for cities to reduce energy consumptions to targets of greenhouse gas emission (Næss, 2011). This is because even though automobiles, building stock, and other aspects of the urban environment have become more energy efficient people are not using less energy as solutions for eco-efficiency have been expected to enable them to. As an example, in Norway energy consumption from 1960 until 1996 almost doubled despite the fact that buildings had become more energy efficient. The technology for more efficient energy use allowed people to buy less energy, thus paying less for energy. Instead of using less energy, and saving money and energy, the residents increased their consumption (Høyer & Næss, 2001). This is a kind of rebound effect. This means that when a solution to a problem is applied, its positive effects are canceled out by subsequent growth processes or rebound effects. Various examples show the same results. That even though eco-efficiency is developed through technical advancements the benefit of this is erased by resource use through growth in consumption or industrial growth (Jänicke, 2008).

Another side to this is that even though people would use less energy because of eco-efficiency there would still be the problem of money saved by this. The money saved would most likely be spent on other services and goods that would cause environmental degradation. In some cases, it might even cause more extensive environmental degradation than the energy efficiency saved in the first place. This shows that there are other aspects need to be considered in order to develop a community that can sustain the planet and causes less environmental degradation (Jackson, 2009).

#### Decoupling economic good and environmental bad

Decoupling is the act of disassociating environmental bad and economic good (Jackson, 2009). Environmental bad, refers to aspects that have negative effect on the environment and result in environmental degradation. Further economic good, is what can be considered a positive development in economic terms. That is, in today's economic system, profit and GDP (Jackson, 2009).

A common strategy in today's economy is facilitating economic growth while aiming for environmental sustainability. For a growth economy to be possible, environmental bad need to be decoupled from economic good. That is, economic growth cannot be linked to environmental degradation. According to Jackson (2009) absolute decoupling has not been possible as what this chapter might suggest. Further, some relative coupling has been implemented when it comes to resource- or eco-efficiency, where less is needed to produce more. There has been a partial decoupling between GDP and carbon emission in the world. That is, in the last 18 years GDP in the world has risen faster than carbon emission. However, environmental bad and economic good have not been successfully decoupled (Jackson, 2009). Further, "[i]f economic growth without negative environmental consequences were to be possible anywhere, this would most likely be in societies with a high level of prosperity, a high degree of economic freedom of action, as well as a high level of knowledge among the citizens" (Næss, 2011, p.13).

#### 3.3.2 Sustainable urban development

Urban development and land use today has great environmental impact. The extent of environmental impact can be said to be in conflict with contemporary requirements of sustainability.

"In order for the development of land use, patterns of built-up land and infrastructure in an area to be characterized as sustainable, it must secure that the inhabitants of the area can have their

vital needs met in a way that can be sustained in the future, and is not in conflict with sustainable development at a global level" (Næss, 2001, p. 505).

Different structures and buildings have different impacts on the environment. It is possible to plan, to some extent, for the influence urban structures have on the environment. The main emphasis for this is to plan for and implement urban structures that use as little resources and energy as possible and further induce the least resource and energy use while fulfilling social needs and prosperity.

In order to advance sustainable urban development there are various steps that need to be put in to strategies and implemented. It is important to stop urban sprawl and limit the land that is being allocated to each person. Further, it is important to avoid building outside of current urban limits and focus on densification and building in brown fields. The densification and construction of services should be targeted at areas close to urban centers and in proximity to strong public transportation routes. It is further important to utilize infrastructure that has already been implemented to limit the use of resources. Expansion of the road system and parking facilities needs to be avoided. More emphasis should be put on public transportation and transport option that produce no emission and needs fewer resources for infrastructure and for the lifecycle of the transportation method, such as walking and bicycling (Næss, 2001).

Square meters per capita also needs to be decreased, both for residential and commercial buildings. This is especially true for Nordic countries where the number of square meters of building stock allocated per capita, is among the highest in the world. It is further important to consider the type of buildings implemented. That is, planning for and construct buildings that cause the least environmental impact in their life cycle. That is, limit the volume of material used for construction, for this co-using walls and infrastructure is important; energy efficiency and quality materials to decrease maintenance for the operational stage; and limiting the environmental effects for the demolition stage. For this, constructing attached buildings with smaller units who have less environmental impact than detached and large units (Næss, 2001). Essentially, plan our urban structures for reduced resource consumption (Høyer & Næss, 2001)

In a case where sustainable urban development is implemented "[i]nnovation will still be vital, but it will need to be targeted more carefully towards sustainability goals. Specifically, investments will need to focus on resource productivity, renewable energy, clean technology, green business, climate adaptation and ecosystem enhancement" (Jackson, 2009, p. 138). Further, it is not enough to only rely on innovation and technology since its benefits are likely to be limited if growth in building area per capita, land allocated per capita and emission per capita is maintained. In terms of technology, it should be mentioned that technological systems require energy and the material needed to construct them, which are in many cases be rare materials. It should therefore be considered that technology can also cause extensive environmental degradation (D'Alisa, Demaria & Kallis, 2015).

For sustainable urban development, investments need to be made in order to reduce the environmental impact of urban development instead of investments towards producing economic growth. It is important to decide if novelty, consumption and the size of the building stock to the extent it is today is actually more important than sustainability. That is, if we actually need all the things we consume in order to have prosperity and well-being (Jackson, 2009).

More than planning and making strategies for urban structures that cause decreased environmental degradation, tax can be imposed in order to reduce environmental impact. For instance by having high tax on private automobiles. The money obtained through tax can then for instance be used to strengthen

public transportation and by this environmental impact will most likely be reduced. By this, private automobiles, who have negative environmental effects, are made less accessible and public transportation more accessible. Taxation can also be important to make sure that those who pollute pay the cost of it. Both to be able to counter the effects of certain contaminating development that have negative environmental impacts and to discourage people, companies and governments from polluting. Further, subsidies can be used to reward positive behavior in terms of environmental concern (Latouche, 2009).

### 3.3.3 Degrowth and urban planning

#### Degrowth

Degrowth is essentially a critique of growth. It is critical of economic growth and growth in general as a social objective and a part of social structure. It is about equitable downscaling of consumption and production in order to live within our planets ecological limits. It is not about doing less of the same, as ecological modernization would suggest, but doing something different. Degrowth holds ideas of various aspects of society from pollution, to equality, to feminist ideology. Further, it has ideology that is relevant to urban planning where growth is manifested in urban structures and the consumption within them, which lead to extensive environmental impacts. It challenges the idea that growth is connected to well-being or prosperity and that goals for economic growth are not compatible with goals of environmental sustainability. It does not suggest negative growth but a different kind of objectives and plans. Although it suggests some aspects of community should be decreased, there are some factors of society that should flourish; such as renewable energy, education and healthcare. As a result, the size of the economy and environmental impact should be decreased. According to notions of degrowth reducing environmental impact while producing economic growth is not possible (D'Alisa, Demaria & Kallis, 2015).

#### Degrowth in urban planning

"From a sustainability point of view, the most problematic traits of development in the cities of the industrialized countries are closely linked to economic growth and the strategies of businesses and authorities to stimulate this growth" (Høyer & Næss, 2001, p. 181). Urban planning has traditionally been a tool to accommodate growth by planning for new buildings and infrastructure but has not really attempted to control growth. Planners are often technical professionals that are closely connected to growth rationalities, where they produce physical solutions for constructing buildings and infrastructure (Høyer & Næss, 2001) for cities with continuously growing populations that have increasingly more environmental impact (Næss, 2001). Today, planners are faced with the fact that cities and human habitats have outgrown the ecological limits and this needs to be addressed.

"We can't change ecological limits. We can't alter human nature. But we can and do create and recreate the social world. Its norms are our norms. Its visions are our visions. Its structures and institutions shape and are shaped by those norms and visions. This is where transformation is needed" (Jackson, 2009, p. 188).

By this, we need to change the way we think about and implement urban development, construction and consumption. We need to restrict what has negative environmental effect and avoid doing things that have negative influence on the environment. The way we consume is up to social structure. Consumption has become a social status and therefore the home, the automobile and the things we have are now in many cases a part how we look to other people. For this, we need to dematerialize our lives in order for

us to stay within ecological boundaries. Consumption and economic activity, making sure peoples material needs are met, has been seen as a way to ensure well-being. However, this is not a way to ensure peoples well-being into the future where this is likely to lead to us running out of resources (Jackson, 2009). Jackson has pointed out three main factors that need to be improved for our society to be more sustainable. "In the first place, we have to establish ecological bounds on human activity. Secondly, there is an urgent need to fix the illiterate economics of relentless growth. Finally, we must transform the damaging social logic of consumerism" (Jackson, 2009, p. 204). For this, the building stock, transportation and our daily lives need to be dematerialized. Meaning, they cannot be centered on consumption but need to be planned for us to keep within ecological limits.

Urban planning is influential when it comes to determining the extent of resource use. If urban planning is proceeded with growth as an objective and implementation, the environmental impacts are likely to be extensive. If degrowth is emphasized, the environmental degradation is likely to be decreased. Table 2 compares the environmental degradation likely to be caused by urban development if growth on one hand or degrowth on the other hand is emphasized. This is shown in terms of structural characteristics that are floor space per capita; type of buildings; density; and the transportation mode emphasized in urban planning. By implementing these structural characteristics, urban planning can be used to produce a certain kind of action, where implementing urban structures to accommodate public transportation, bicycling and walking can induce people to use these transport modes.

The figure shows, as this chapter might suggest, that environmental degradation will increase with growth in floor space per capita; with detached buildings that causes increased resource use; decreased density; and if automobile as a transportation mode is emphasized, which both result in growing distances and growth transportation infrastructure. On the other hand, environmental degradation should decrease if urban planning is applied in terms of degrowth. That is, reducing floor space per capita; implementing attached buildings that uses fewer resources; increasing density and emphasizing public transportation bicycling and walking, which both reduces distances and resources consumption.

Table 2 shows development in one way or the other. A third way is not shown because that would mean no development, which hardly seems likely. Further, if there is no further development degrowth ideology probably is not useful nor is other urban planning knowledge. The two ways displayed, growth or degrowth, are shown here as two emphasis in urban planning. How extreme or moderate the application of these solutions is would then determine the extent of the development and structural changes. It shows what should happen if development is in the direction of either emphasis. For example, if size of the building stock per capita would grow moderately it would have moderately more environmental degradation and if the size of the building stock per capita would for instance double, the environmental degradation caused by the building stock might double. The same is true for implementing structural characteristics of degrowth. Degrowth is likely to result in lower resource use which is more likely to allow us to sustain the planet and implement and reach goals of sustainable urban development.

Table 2 shows the different structural characteristics in applying growth or degrowth ideology, and how this influences environmental degradation (Own table made from theoretical framework).

Structural characteristics	Growth	Degrowth
<b>Floor space per capita</b>	<b>Increased floor space per capita.</b> <ul style="list-style-type: none"> <li>More resources required for a building's lifecycle.</li> <li>More land allocated to urban development.</li> <li>More resources used for furniture and appliances.</li> </ul>	<b>Decreased floor space per capita</b> <ul style="list-style-type: none"> <li>Fewer resources required for a building's lifecycle.</li> <li>Less land allocated to urban development.</li> <li>Fewer resources used for furniture and appliances.</li> </ul>
<b>Type of building</b>	<b>Detached buildings</b> <ul style="list-style-type: none"> <li>More resources needed for a building's lifecycle.</li> <li>Requires more land.</li> </ul>	<b>Attached buildings</b> <ul style="list-style-type: none"> <li>Fewer resources needed for a building's lifecycle.</li> <li>Requires less land.</li> </ul>
<b>Density</b>	<b>Low-density urban structure</b> <ul style="list-style-type: none"> <li>More land allocated to urban development, per capita.</li> <li>Requires more resources for construction, maintenance and demolition.</li> <li>Increases distances and reduces opportunities for walking, bicycling and public transportation.</li> </ul>	<b>High-density urban structure</b> <ul style="list-style-type: none"> <li>Less land allocated to urban development, per capita.</li> <li>Requires fewer resources for construction, maintenance and demolition.</li> <li>Decreases distances and increases possibilities for low emission transportation.</li> </ul>
<b>Transportation mode emphasized</b>	<b>Emphasizing automobile use</b> <ul style="list-style-type: none"> <li>More land allocated to urban development.</li> <li>More resources needed for construction.</li> <li>More resources needed for operation.</li> <li>More carbon emission.</li> </ul>	<b>Emphasizing public transportation, bicycling and walking</b> <ul style="list-style-type: none"> <li>Less land allocated to urban development.</li> <li>Fewer resources needed for construction.</li> <li>Fewer resources needed for operation.</li> <li>Less carbon emission.</li> </ul>
<b>Impact</b>	<b>MORE ENVIRONMENTAL DEGRADATION</b>	<b>LESS ENVIRONMENTAL DEGRADATION</b>

### 3.4 Summary

This chapter has described the relationship between sustainability; and urban and economic growth. It discusses how sustainable development and economic growth are perceived today. Sustainable development and economic growth are both considered important goals that governments aspire to fulfill. Therefore, economic growth and sustainability are seen as being compatible. Further, economic growth is used as a measurement of how successful governments or people are although material assets do not determine happiness or well-being. This is perceived despite there being strong indications and research showing that economic growth is clearly related to environmental degradation and therefore incompatible with economic and urban growth.

Urban development is one of, if not the most, resource demanding aspect of our society. This is because a vast amount of resources used to construct and maintain our cities in terms of the building stock, infrastructure and transportation structures. Different structural characteristics have different environmental impact and therefore it is important to consider these effects when planning urban areas,

if the goal is truly to ensure sustainability, and by sustainability maintain our resource use within earth's ecological limits.

This chapter has further demonstrated the limits to growth, in terms of social, economic and ecological limits. It has described what kind of spatial structures should be implemented to allow a more responsible use of resources for developing within earth's ecological limits. It further shows how the ideology of degrowth can be useful in order to implement sustainable urban development by showing the difference in environmental degradation from maintaining today's growth rationality or developing and planning in terms of degrowth ideology. The result of this comparison shows the importance of ending this goal of growth and economic growth if we want to sustain our planet. This chapter has conceptualized growth in terms of urban planning and sustainability, and by this answered research question 1.

As mentioned, ideology of ecological modernization is common and urban growth has in many cases made cities less sustainable, causing them to cause increased environmental degradation. The Capital area in Iceland is one of these examples where floor space per capita has increased, density has decreased and automobile transportation has been emphasized. The case of the Capital area will be presented in the next chapter. Further, chapter 5 will describe urban growth in the Capital area and by using the theoretical framework, determine if this development has rendered the Capital area more or less sustainable. After this, the theoretical framework will be further applied, in chapter 6, to the case data for the Capital area to analyze and discuss how degrowth ideology can be applied to move the Capital area closer to goals of sustainability.

# INTRODUCTION TO THE CASE: THE CAPITAL AREA

The following chapter introduces the case of the Capital area. It further discusses laws and regulations; and facilitation of automobile use in Iceland. Moreover, it provides basic information for the Capital area whereas the municipal structure and population numbers are presented. Further, the currently valid regional plan is presented along with goals and aspirations municipalities in the Capital area have.



## 4. Introduction to the case: The Capital area

### 4.1 Icelandic law and framework.

#### 4.1.1 Laws and regulations

The planning power in Iceland is in the hands of the municipalities. This was established in to laws in 1998 when the planning act became effective. The planning act determined that the whole country would be subject to planning and moved the planning power from the national authorities to the municipal governments. Before this, the national planning authorities generally managed municipal planning, often in cooperation with the municipalities, with the exception of Reykjavik, which had for a long time managed their planning matters. The planning and building act of 1998 established planning stages to be applied for planning in Iceland (Theodórsdóttir, 2000).

Planning in Iceland lies in four hierarchical stages. The highest one is the national plan that is for the whole country. After comes the regional plan that considers two or more municipalities. Next is the municipal plan that describes what is prohibited and allowed in a municipality. The lowest stage is the local plan that considers what will be implemented in a relatively small area, such as a plot for a building or a neighborhood. As mentioned, the planning power is in the hands of the municipality and therefore the municipal plan is the only law-binding plan. The national and regional plans are more of a strategic nature than law binding. Never the less, plans should be in accordance to the planning stage above (Planning regulation 90/2013).

The planning and building act further, made environmental impact assessments a compulsory part of land-use planning (Theodórsdóttir, 2000). The first point in the first chapter of the planning and building law states that planning should enfold rational and efficient use of land and resources. Moreover, it should prevent overuse of resources and environmental degradation and enable sustainable development (Planning and building act 73/1997). The updated laws and regulations from there on confirmed these criterions.

Some changes have occurred in the years from when the planning act and the building act were initially established until the more recently approved building and planning acts. One of these is the number of parking spaces suggested for buildings. Although, regulation for number of parking spaces for a residential or a commercial building is to be determined by the municipal government, there was in the first building act a list of criteria that should be applied if the municipal plan did not regulate parking spaces. That is, if number of parking spaces was not specified by the municipality, it should be two parking spaces per apartment unit larger than 80 square meters and one parking space for apartment units smaller than 80 square meters. In terms of commercial buildings such as offices and stores, the building regulation suggested that for every 35 square meters of commercial building stock, there should be one parking space. For other kinds of commercial buildings, here should be one parking space for every 50 square meters. For schools intended for people in the age between 16-20 years, the regulation suggests five automobile parks per classroom and additional parking for staff members. The regulation further, suggests that if a building plot does not provide room for a parking space the space can be set on another plot. In the currently valid building regulation, the number of parking spaces are not specified (Building regulation 441/1998; Building regulation 112/2012). Although these numbers are not law binding and the decision of how many parking spaces are to be implemented is determined by the municipal government, it can be said that these guidelines are influential for municipalities and developers in terms of planning. According

to Proppé (Personal Communication, 24.04.2015) this suggestion has become quite dominant and is until today still maintained, even though this suggestion has been removed from planning law. According to Proppé, one of the reasons for this is that if a planner wants to suggest a plan different from the suggestion it can be quite complicated and the planner needs to provide reasoning and rationalities for having more or less parking spaces. It is in many cases more problematic in execution and therefore this suggestion is in many cases implemented (Proppé, Personal Communication, 24.04.2015).

Road law can be said to influence urban development in the Capital area. The National Road and Coastal Administration considers road construction for connecting two or more towns. The main road system in the Capital area is thus managed by the NRCA. In terms of this, the law does not differentiate between urban and rural main roads and therefore, the same laws apply. Road laws state that no building structures can be located in less than 30 meters from the middle of a main road (Road act 80/2007). One of the requirements of main roads is the limitation of road intersections. This calls for construction of parallel roads that collect traffic that lead to intersection. Because of these regulations, the road system is longer and more land demanding than it needs and should be (Proppé, Personal Communication, 24.04.2015).

#### 4.1.2 Facilitation of automobile use

Mentality in Iceland is quite automobile orientated. An example that shows this, is that the regional plan for the Capital area for 2001-2024 states that “owning an automobile is a part of Icelandic culture [það er hluti af menningu íslendinga að eiga bíl]” (nes Planners, 2002, p. 27). It further states that owning an automobile is important (nes Planners, 2002). As mentioned, fees and taxes can influence what transportation methods people use and how they consume. Fees and regulations can determine how expensive or inexpensive and easy or difficult it is to have and use a private automobile.

Parking is generally free in the Capital area. There are few areas where people are charged for parking. The majority of them is in the central of Reykjavík, in the old part or the first section in figure 12. Further, people have to pay for specific parking spaces at two universities, two locations of the national hospital and at the domestic airport. All these locations are quite central although not in the very center. Further, these areas also offer free parking. Parking in the Capital area is therefore mostly free of charge. Shopping malls for instance do not charge for parking (Bílastæðasjóður, 2015). This makes it easier and less expensive to have an automobile and can be said to contribute to facilitating automobile use in the Capital area.

Another incentive for automobile ownership is that in terms of insurance one is likely to pay less per automobile for insurance, if one has two automobiles. Three large insurance companies were asked for this information. All agreed that one is likely to pay less for each automobile if one has more than one. One company gives 10% discount of both insurances if one is to insure two automobiles, relative to one automobile. Another said that a customer is likely to receive approximately 5% discount were he or she to add a second automobile. All three stated that the more a customer insures the more discount he or she gets. However, the price of insurance varies in relation to age, likelihood of damage, history, how much this individual insures at this company and other factors. Never the less, there is an incentive for having more than one automobile with the insurance companies where people pay relatively less for insurance of two or more automobiles than for one automobile (Vörður, Sjóvá & TM; Personal communication with service representatives; April 13, 2015). This is here not considered as a major influence but is one of the factors that facilitates automobile use.

There have been some positive changes in automobile taxation in terms of environmental impact. In 2011, fees for automobile ownership were changed so that they are related to how much carbon the vehicle emits per kilometer and one pays more if the vehicle emits more. Before, the fee was determined by the weight of the vehicle. In terms of this, a vehicle that exhausts more pays higher taxes (Director of Internal Revenue, 2015). However, the incentives for automobile ownership in Iceland are many.

## 4.2 About the Capital area

The Capital area is located in the southwestern part of Iceland, as shown in figure 3. The Capital area consists of Reykjavík, which is the capital of Iceland, and six other municipalities that are conjoint and in some cases the municipal land of one municipality is not conjoint and therefore it is necessary to go through other municipalities to get to different parts of a municipality. This is true for Reykjavík and

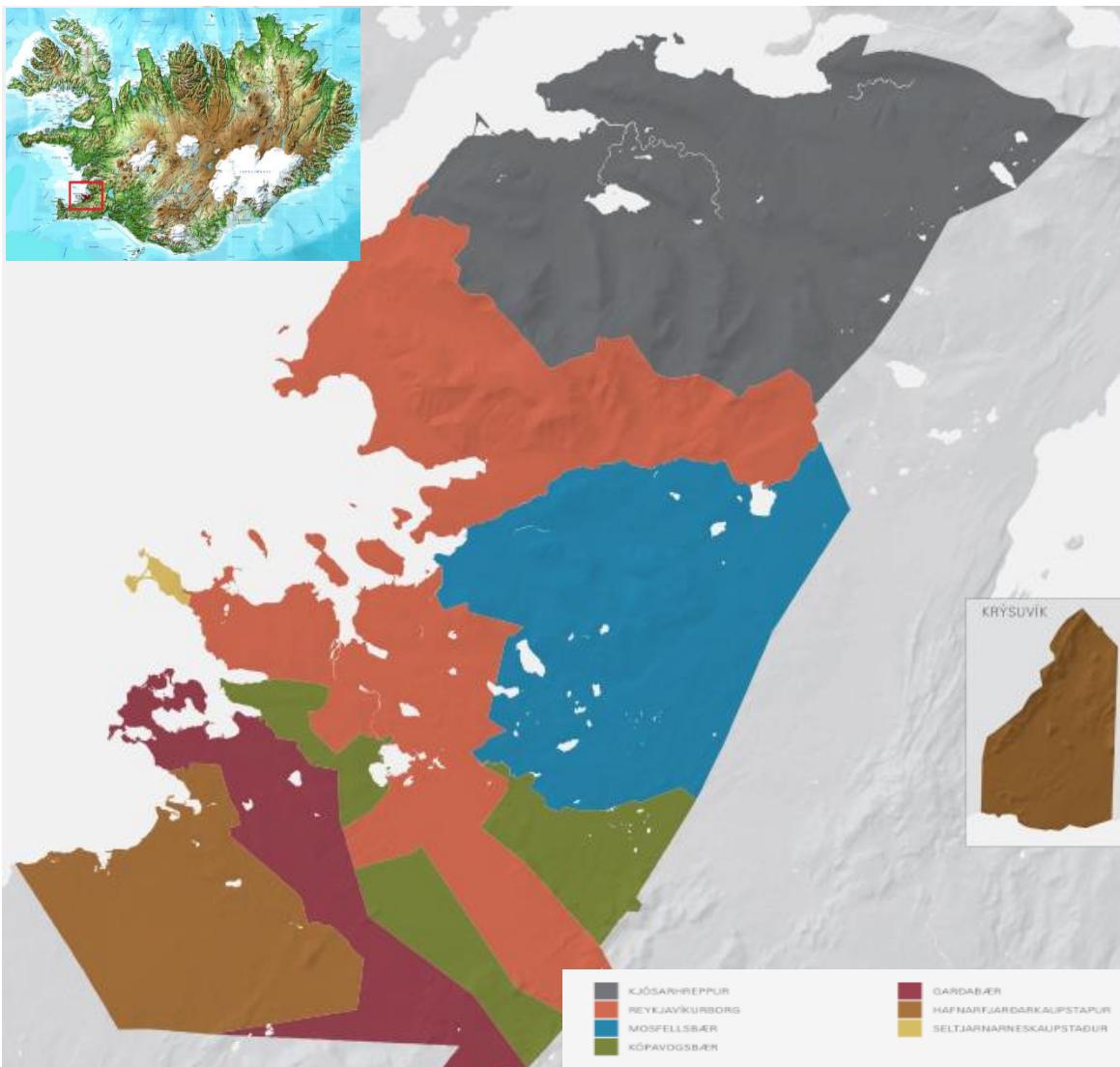


Figure 3 shows location of the Capital area in Iceland and the seven municipalities (Extreme Iceland, 2015; AMCA, 2014).

Kópavogur. These six municipalities are Kjósahreppur, Mosfellsbær, Kópavogsþær, Garðabær, Hafnafjörður og Seltjarnarnes. Figure 3 shows the municipal land owned by the municipalities where a large part of the area is rural. Kjósahreppur, shown in gray, has only 220 inhabitants and is has a low density. The municipality is to a large extent a recreational area and has holiday homes. The part of Reykjavík, shown in orange, that is in the top part of the figure is mostly rural. The extent of built structures will be discussed in subchapter 5.3.

#### 4.2.1 Population

The Capital area has approximately 211.000 inhabitants. Therefore, approximately 65% of the Icelandic population, of 325.000 inhabitants, lives in the Capital area. As mentioned, Reykjavík is by far the largest municipality at the Capital area, as shown in figure 4.

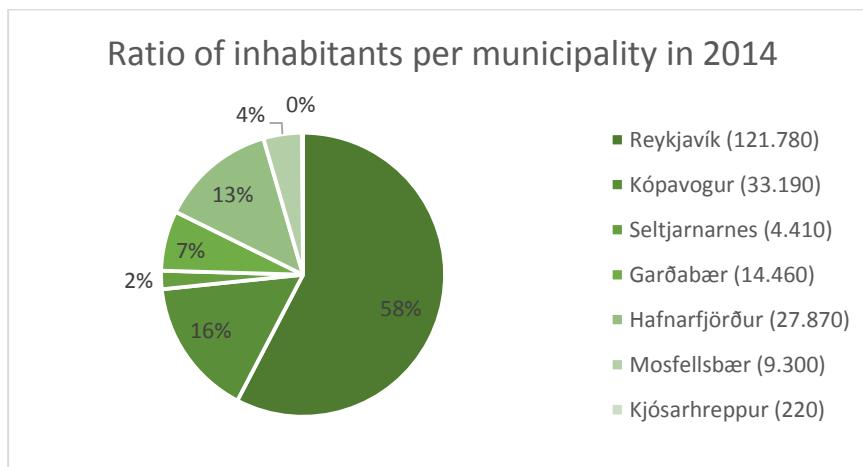


Figure 4 shows ratio of inhabitants in each municipality. Number of inhabitants is shown in brackets behind each municipalities name (Statistics Iceland, 2015).

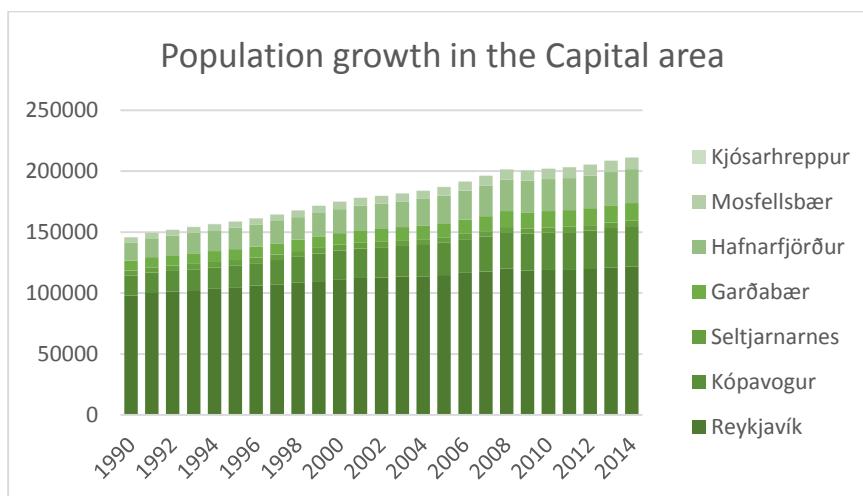


Figure 5 shows population growth in the Capital area, divided between municipalities (Statistics Iceland, 2015).

Population in the Capital area has been growing since the 1990, as shown in figure 5. Population growth in Iceland has been the highest in the Capital area, which is a general trend for capital regions. This is both due to people moving from other areas of the country to the city and due to immigration from other countries. Immigration was quite frequent in the years 2005-2008. In 2008, there was a decline in population growth. This can be connected to the financial collapse that hit Iceland in 2008. This led to people, mostly immigrants, emigrating from Iceland (Þorsteinsdóttir & Snævarr, 2014).

#### 4.2.2 Regional plan and strategies for the Capital area

As mentioned, a regional plan is a plan made by two or more municipalities to display their mutual goals and strategies. The current regional plan for the Capital area is for the era 2001-2024. Further, a new regional plan is currently in the making and is expected to be approved in 2015.

The currently effective regional plan, predicts that the population in the Capital will grow from 168.000 in 1998 up to 228.000 in 2024. By this, growth of approximately 2.300 inhabitants each year. The plan states that inhabitant per apartment unit will in 2040 have decreased from 2,67 in 1998 to 2,4 inhabitant per apartment unit. Further, it is planned that apartment units in the Capital area will grow from being 62.900 in 1998 to 94.950 in 2040. The plan suggests the same economic growth rate as the years before, thus aims in further economic growth (nes Planners, 2002).

In terms of commercial buildings, it is estimated that most of the new commercial buildings shall be in new neighborhoods and by this not close to the city center. Further, it is estimated that in the future there will be a need to have more square meters per staff member in commercial buildings in all sectors, in terms of this aiming at growth in square meters of commercial building stock. This is stated without it being rationalized why this is important. The plan further states the private automobile use as being a part of Icelandic culture and necessity because of weather conditions in Iceland. It further suggests a 50% growth in automobile traffic, from 1998 until 2024, due to population growth and growth in industries. It plans for longer distances driven and therefore suggests extensive construction of automobile transportation infrastructure. It plans for building large transport tunnels, road flyovers and bridges. This is to facilitate increased traffic and road demand (nes Planners, 2002). This is interesting because the plan states just under 36% in population growth while suggesting 50% increase in automobile traffic.

Growth and development in the public transportation sector is said to be needed. However, this service seems to be more related to accommodating individuals that cannot manage to have an automobile but not as an effective strategy for urban and transportation planning. That is, with population growth, it is expected that the group that uses public transportation will grow but they do not plan for a changed ratio between people using public transportation and automobile as a mode of transportation, which at the time was 96% (nes Planners, 2002).

Although the plan emphasizes automobile as a transportation method and extensive transportation infrastructure, sustainable development is stated as one of the most important aspects of the regional plan. In terms of this, densification with mixed land use for commercial and residential buildings is suggested. It suggests that land should be used and managed responsible and encourages construction within established urban areas where public transportation is emphasized and reduced resource use and environmental conservation is suggested (nes Planners, 2002).

Development of economic activity in the Capital area is emphasized in the regional plan. The region should develop commercial and business industries and be competitive while being sustainable. It should develop

towards being a competitive city in an international scale, be competitive in terms of business, finance and people. The Capital area should further be prepared to react to growth in population, growing economy and social changes (nes Planners, 2002).

Municipalities in the Capital area aspire to fulfill sustainable development and economic growth. The currently valid regional plan for the Capital area, for the period of 2001-2024, plans for continuing the economic growth rate that was before the approval of the plan. Further, it plans for progress and growth in industries in order to provide a better future and prosperity for inhabitants. Moreover, the plan aspires to fulfill sustainable development for a better life and a prosperous future (nes Planners, 2002).

The municipalities in the Capital area have all taken part in the Local Agenda 21 action plan. Agenda 21 in Iceland lasted from 1998 to 2009 (Gíslason, 2010). This before mentioned agenda was thus a strategy for these municipalities to fulfill sustainable development within the economic growth driven society. Although it is difficult to find statements in agendas and planning documents that declare economic growth as a clear goal for the Capital area, the municipal and regional plans generally plan for reacting to population growth with growth in residential buildings, in industries and in economic systems and further continuing the GDP rate it had until then, which was growing. In terms of this, municipalities in the Capital area can be said to aim towards economic growth.

### 4.3 Summary

This chapter has been an introduction to the case and presented basic information about the Capital area and further presented plans and aspirations the municipalities in the Capital area have. The chapter presents basic information for the Icelandic planning system. It further discusses how low density structure and facilitation of automobile use is embedded in Icelandic law and regulations and further in structure.

The chapter presents the municipalities in the Capital area and numbers for population growth. It further discusses that the currently valid regional plan is very automobile orientated on terms of mentality and emphasis on construction of transportation infrastructure and flyovers. The plan further establishes that the municipalities in the Capital area aspire to fulfill urban and economic growth; and sustainable development. The goals of sustainable development are stated in the regional plan and the municipalities take part in Local Agenda 21 action plan for sustainable development.

The information from this chapter will be used to analyze how degrowth ideology can be applied to urban planning in the Capital area to move the region closer to goals of sustainable development and will further be applied to the discussion chapter.

Now that methodology has been discussed, the theoretical framework established and the case of the Capital area presented, the next chapter will analyze growth in the Capital area and how it has effected sustainable development.



# ANALYSIS I: GROWTH AND SUSTAINABILITY IN THE CAPITAL AREA

This chapter demonstrates growth in the Capital area. In terms of this, population growth; economic growth, otherwise known as GDP; growth in carbon emission; oil use; waste production; growth in the building stock for both residential buildings and commercial buildings; growth in the area allocated to the building stock and infrastructure; and growth in the use of the private automobile.

The chapter further analyses the effects urban growth in the Capital area, on how the regions level of sustainability has developed. By this answering research question 2 on how the building stock and transportation has developed in the Capital area since the mid-20<sup>th</sup> century, and more specifically leading up to the financial collapse, and how this has influenced sustainability.



## 5. Analysis I: Growth and sustainability in the Capital area

### 5.1 Economic growth

Figure 6 shows economic growth or GDP in Iceland in the years from 1980 to 2014. No official numbers are published for GDP in the Capital area and because of this, it is necessary to use GDP in Iceland as an indicator for GDP in the Capital area. As mentioned, the population in the Capital area counts for 65% of the national population. Further, a report published by the AMCA shows that the ratio of GDP in the Capital area to other parts of the country is generally similar. Therefore, GDP for Iceland can be said to indicate growth and decline in GDP in the Capital area (Snævarr & Júlíusdóttir, 2014).



Figure 6 shows the GDP index for economic growth in Iceland from 1980 - 2014 (Statistics Iceland, 2015).

GDP in Iceland has been mostly rising since the 1980, as shown in figure 6. Around 2008 GDP took a steep dive when the financial collapse hit in Iceland. After the decline, the GDP index quickly rose again, and has today almost reached the same GDP index level it was just before the financial collapse.

Data for the years 1997-2014 shows how much each sector contributes to GDP. The most interesting numbers are shown in figure 7 and discussed here. A figure for all sectors can be seen in appendix B.

According to the data, the top distributor to economic growth is public administration, education, health care and social services, and contributes between 17-21%. The second largest contributor is production, which contributes from 10-17% (Statistics Iceland, 2015).

Production has played a large part in generating economic growth although its part decreased towards 2008 and its part increased after the financial crisis. What is interesting is that the sectors that increased the most towards 2008 and declined after the crises were the building- and construction industry and the finance and insurance industry. Ratio of other sectors did not change dramatically. However, sector for sale, repair and maintenance of motorized vehicles and trailers; did take a dive around 2008 (Statistics Iceland, 2015).

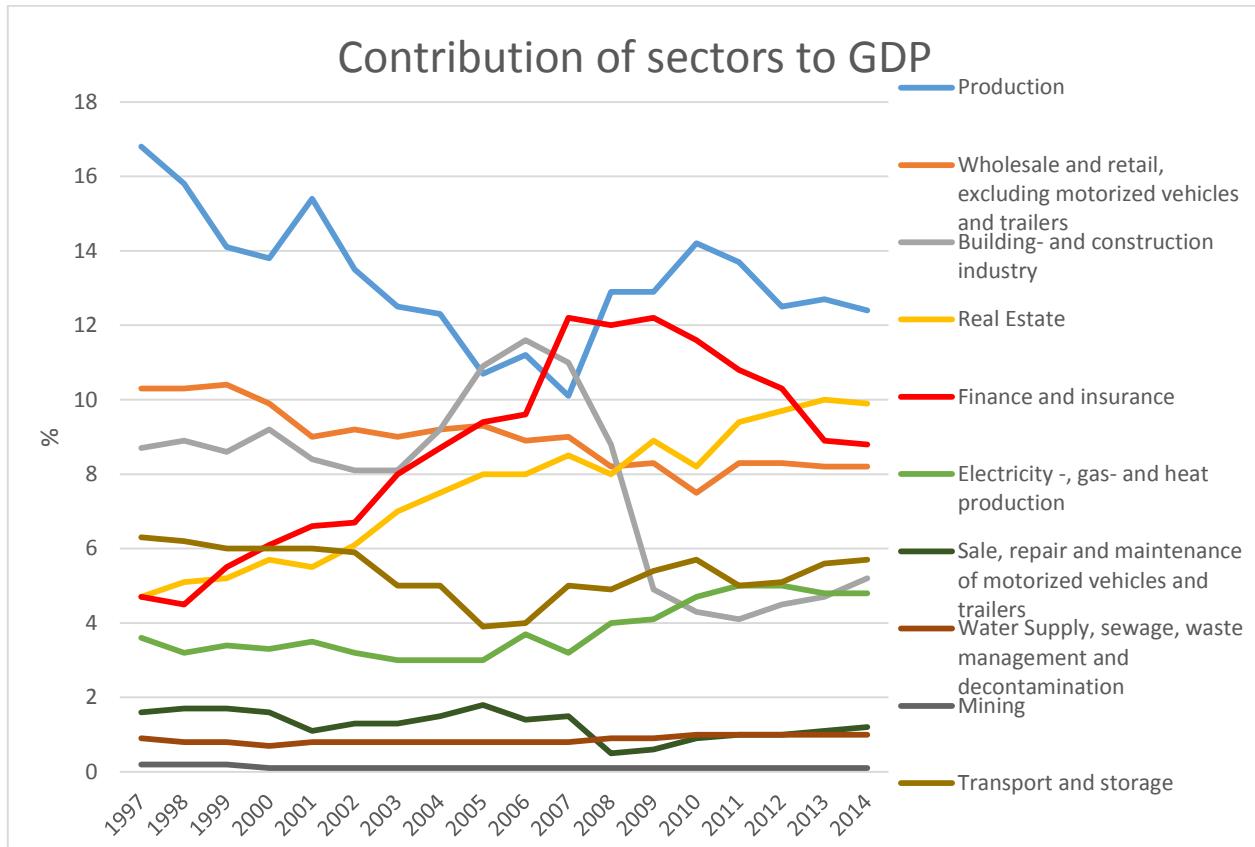


Figure 7 shows the contribution of different sectors towards GDP in Iceland (Statistics Iceland, 2015).

According to a report published by the AMCA, economic growth in Iceland in the years 2000 and 2005, was estimated to be 27%, where 24% of this growth was due to construction such as buildings, infrastructure and construction in the energy sector (Snævarr & Júlíusdóttir, 2014).

From the data, it can be concluded that the building and finance industries, along with production, played the largest parts in the production of economic growth in the years leading up to the financial crisis. From this, it can be determined that construction, transportation and energy use are major contributor towards GDP in Iceland.

## 5.2 Emission and resource use

### 5.2.1 Carbon emission

As for GDP, it is necessary to use data for the whole of Iceland when indicating carbon emission because this data is not available specifically for the Capital area. As for GDP, it is seen as giving an indication of carbon emission per capita in the Capital area because the population accounts for 65% of the national population. Carbon emission is an indicator for exhaust and thus negative environmental impact inflicted by the population on the environment. It is here used to show the growing environmental degradation caused by the Icelandic population. Not just in terms of content but also in terms of how much each individual emits. Total emission can further be seen in appendix B.

Emission per capita in Iceland has generally increased since 1990, as shown in figure 8. It has increased both in terms of quantity of emission but also for emission per capita. The three biggest categories of emitters are industrial processes, road transportation and fisheries. Carbon emission was more or less growing from 1990 until 2008 when it declined.

From 2004, there was quite a steep growth in carbon emission until 2008. At the same time, growth in industrial processes was quite steep. This might be partly due to the hydraulic power plant and aluminum plant were established at this time. The figure shows that exhaust due to road transportation increased towards 2008 and decreased after. In the years from 1990 until 2008, carbon emission from road transportation per capita in Iceland increased 31%. Further, in the years 1990 until 2007 total carbon emission from road transportation increased 74%. In terms of this, growth in emission due to road transportation was steep. Further, total carbon emission between 1990 and 2008 increased 34% per capita and 67% for total quantity emitted.

Even though Icelandic municipalities approved the Agenda 21 action plan in 1998 it did not reduce carbon emission in Iceland. On the contrary, carbon emission increased in the following years.

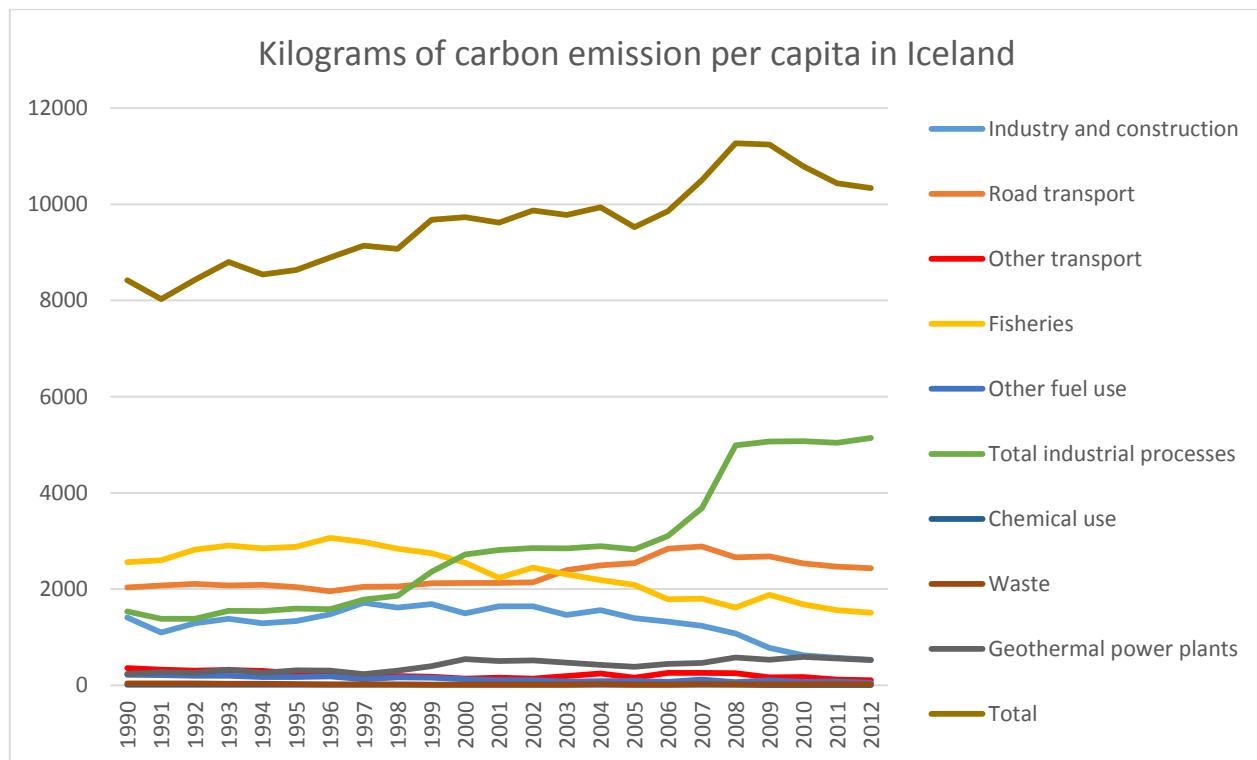


Figure 8 shows kilograms of carbon emitted per capita in Iceland for the years 1990-2012 (Statistics Iceland, 2015).

## 5.2.2 Fossil fuel

Figure 9 shows consumption of oil per capita in the years between 1990 until 2012. Consumption of oil is shown as an indicator of environmental degradation and impact. The figure shows that the three biggest categories of users are automobiles, domestic fishing ships and foreign air travel. The total consumption of fossil fuel can be seen in appendix B.

From the data, it can be seen that the proportional rise, quantity per capita is quite high for automobiles. Although the growth in oil use for automobiles, per capita, increased significantly from 2000 until around the financial fall, it increased even more in total quantity. Further, the total quantity of oil used in Iceland by automobiles went from 190 tons in 2000 up to being 286 in 2007. This means a 50% increase in just 7 years. Further, oil consumption per capita for automobiles in Iceland increased 42% in the years 1990-2007, and increased 75% for total consumption of oil for automobiles in Iceland (National Energy Authority, 2015; Statistics Iceland, 2015).

Oil used in the construction industry grew slightly in the beginning of the 21<sup>st</sup> century although it was quite steady in the era. It is further noticeable that the oil use per capita in the construction industry decreased after the financial crises and reached the lowest point, for the era between 1990 until 2012, in 2011.

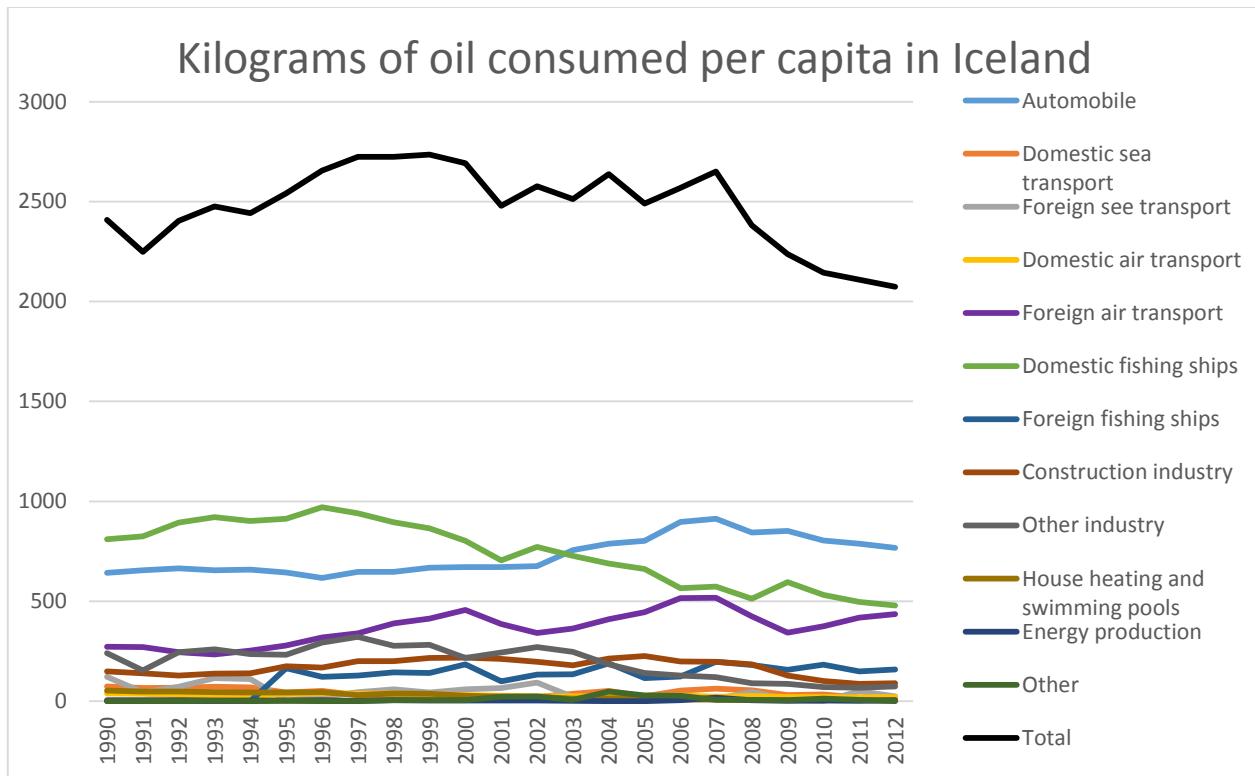


Figure 9 shows kilograms used of oil per capita in Iceland in different categories (National Energy Authority, 2015; Statistics Iceland, 2015).

### 5.2.3 Waste disposal

Figure 10 shows waste disposal in the Capital area from 2001 until 2013. The figure shows two values, waste disposal in recycling stations and waste collection. Recycling stations are stations that are based in each neighborhood of the city where people are to dispose of products that are to be recycled, such as clothing, furniture, home appliances, recyclable containers and so forth. Further, it is for disposing of waste that is too large or cannot be thrown in the home waste bins, such as unusable furniture, construction waste, batteries and so forth. Disposal is in some cases free of charge for individuals. However, they have to pay for disposing construction waste and some other materials. Further, companies and developers

have to pay for disposing of all waste and material. Waste collection is what is retrieved from waste bins in people's homes and from businesses in the Capital area (Sorpa, 2015).

Waste disposal is here used as an indicator for material used and disposed of, and by this for consumption per capita. More waste per capita means more resource use and consumption. Therefore, waste disposal indicates environmental degradation caused by individual and companies in the Capital area.

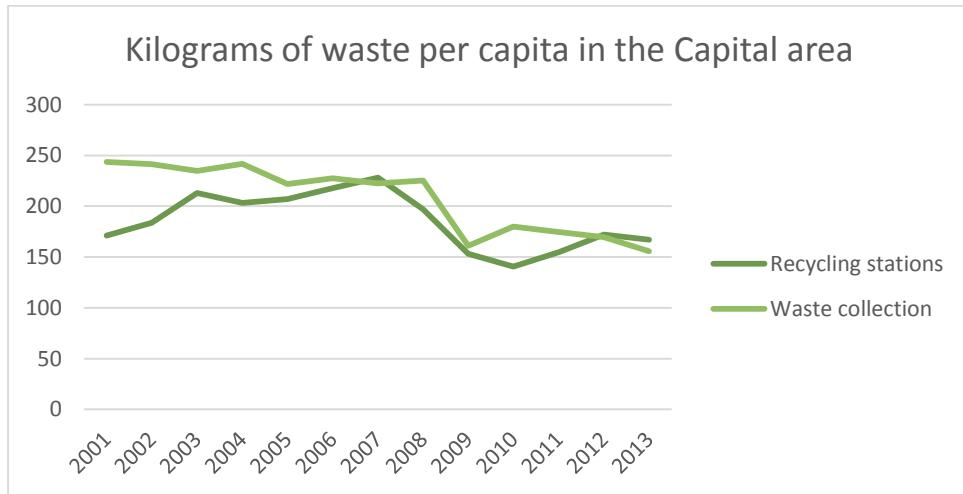


Figure 10 shows waste disposal per capita in the Capital area, for collected waste and Recycling stations (Sorpa, 2015; Statistics Iceland, 2015).

From figure 10, it can be seen that waste from recycling stations increased from 2000 until 2007 when it declined quite dramatically. Waste collected was quite high in the beginning of the era and had little fluctuations but decreased significantly in 2008 when economic growth declined and the financial crisis hit. In terms of this, consumption increased and decreased similarly as GDP did leading up to and shortly after the financial crisis.

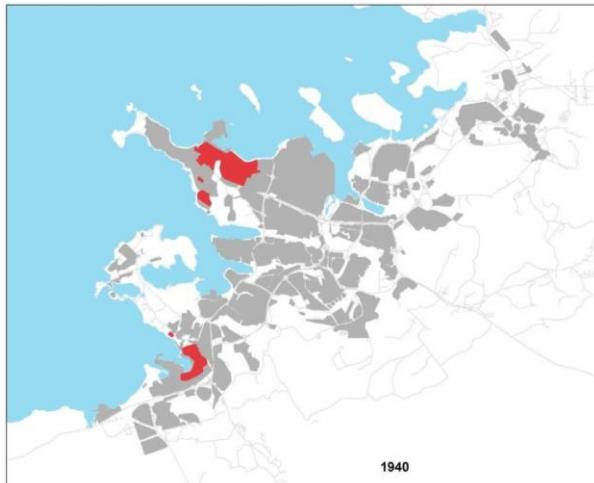
According to Proppé (Personal Communication, 24.04.2015) plans for new location for dispatching waste needed to be reevaluated after the financial crises. Plans had been made in accordance to previous development and growth in waste disposal, that a new location for disposing waste was to be opened. Because consumption and waste disposal decreased significantly after 2008, it was possible to use current dumpster locations longer and delay the use of a new location for a garbage heap. In terms of this, decreasing both the input and the output side of consumption where fewer resources are needed for consumption and less environmental degradation for disposing of waste.

### 5.3 Density and spatial structure

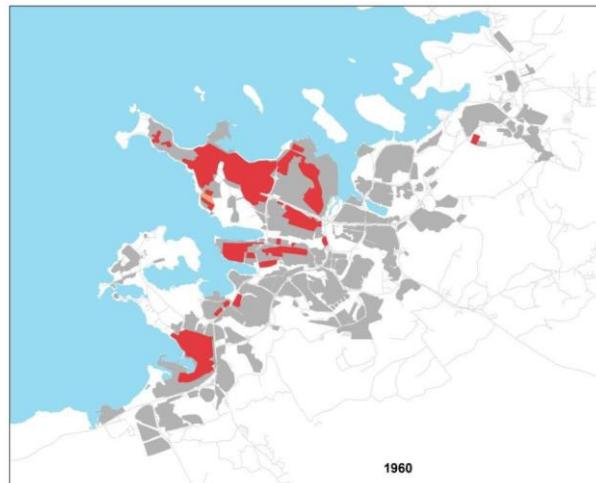
Reykjavík and the Capital area urbanized relatively late in comparison with other European cities. Reykjavík did not become a town until the late 18<sup>th</sup> century and grew slowly until the middle era of the 19<sup>th</sup> century. Urban planning did not emerge until the beginning of the 20<sup>th</sup> century and in that century the vast majority of the Capital area was built (Reynirsson, 2014).

Figure 11 shows how density and area allocated to urban structures has changed since 1940. The grey area on the figures shows the area currently allocated to urban structures and the area colored in red shows the area allocated to urban structures for the year the figure represents. As shown in figure 11, density of

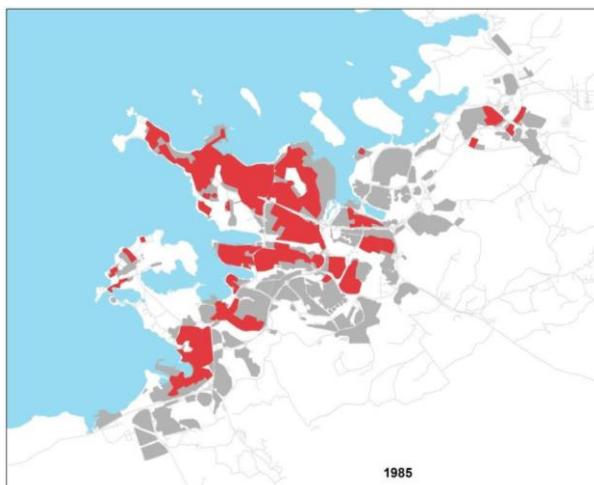
the Capital area in 1940 was quite high, with approximately 120 inhabitants living per hectare. The urban structure that had been built until 1940 was quite dense, with a grid like street structure and suitable for walking between destinations. The structure of this area can be seen in the first section in figure 12.



120 inhabitants per hectare in 1940.



70 inhabitants per hectare in 1960.



54 inhabitants per hectare in 1985.



35,5 inhabitants per hectare in 2013.

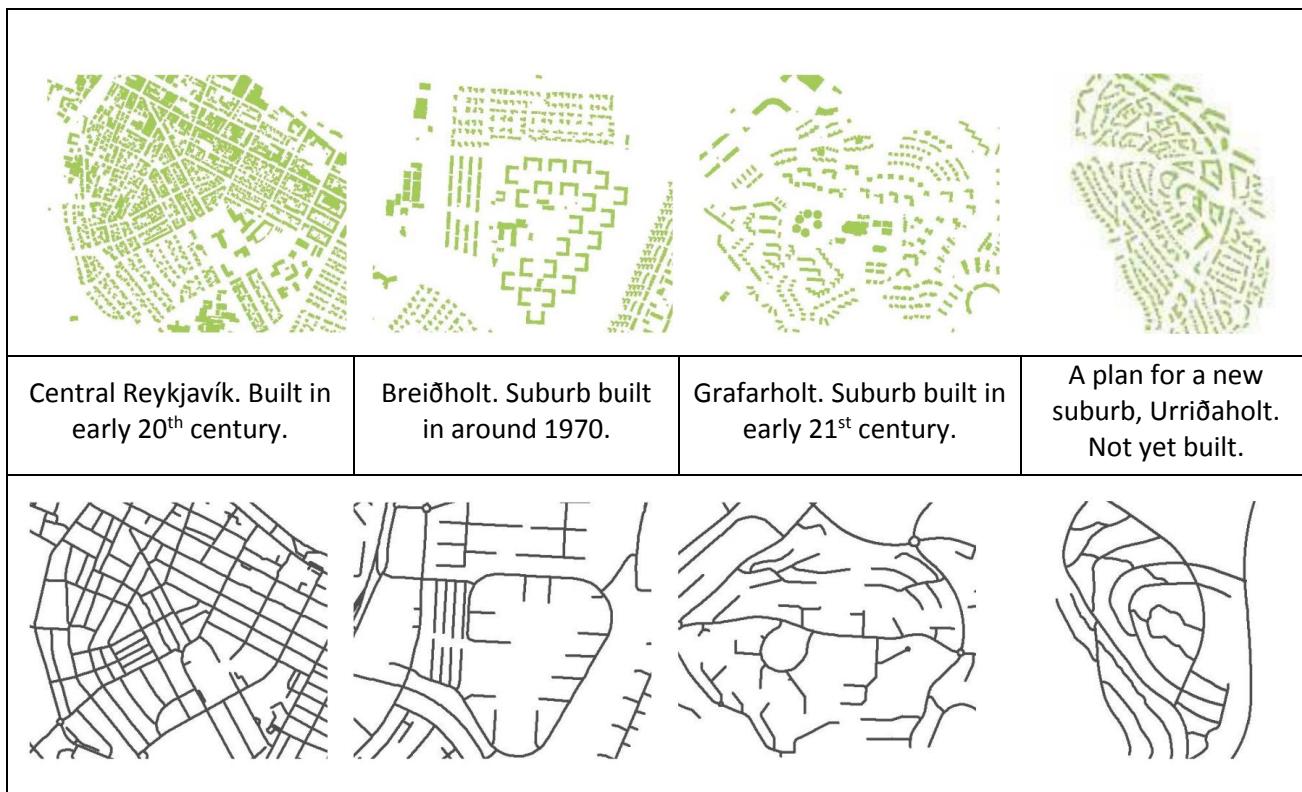
*Figure 11 shows development of density in the Capital area between 1940 – 2013 (Alta, 2014b).*

In 1960, the density had decreased. In the time from 1940, areas with more detached buildings were constructed, although a large part of buildings constructed were multi-family buildings. Some parts constructed in this era have grid structured street systems but some have structures that have are more similar to what can be seen in suburban areas. However, urban density in this era remained quite high.

In the sixties, plans of building suburban areas, from American inspirations, emerged. In the seventies, eighties and nineties of the 20<sup>th</sup> century and in the first decade of the 21<sup>st</sup> century suburban and low-density construction was the trend. In this era, suburbs developed increasingly towards a low-density structure (Reynirsson, 2014). This resulted in the fact that by 1985, density in the Capital area had reduced to 57 inhabitants per hectare, as shown in figure 11. In the years between 1960 and 1985, suburban

neighborhoods were built. These are neighborhoods with a large ratio of detached houses and single-family houses. They are characterized by large parking areas and large distances between buildings. In order to accommodate the traffic, highways lead traffic from the city center towards the neighborhoods where streets lead traffic in and around the neighborhoods where dead end streets lead to the apartment units. An example of this structure can be seen in the second part of figure 12, which shows the structure of a part of a suburb which consists of detached single-family buildings, single-family row buildings and multi-family buildings.

As mentioned, the suburbanization continued into the 21<sup>st</sup> century. Figure 11 shows that in 2013, density had decreased to only 35,5 inhabitants per hectare. This means that in 1940 density was more than three times higher than in 2013, and more than three times more land is allocated to each person in 2013 than in 1940. The areas constructed between 1985 until 2013 are built even further away from urban centers than the neighborhoods before and with larger distances between structures. Moreover, highways were widened, and large traffic constructions and flyover road junctions built. Grafarholt is an example of a suburb built in the beginning of the 21<sup>st</sup> century and its structure can be seen in the third part of figure 12.



*Figure 12 shows the structure of four areas in the Capital area, built in different eras (INPA, 2014).*

Figures 11 and 12 explicitly show that from the early 20<sup>th</sup> century until early 21<sup>st</sup> century, urban density has greatly decreased and urban structure has become increasingly characterized by dead end street structures; detached buildings; large distances and increased land between building structures; and extensive transportation structures for automobile use. This is another way automobile use is facilitated, in the case of the Capital area, with urban structures that is very suitable for using an automobile, but unsuitable for walking, bicycle and implementing quality public transportation systems.

Fourth part of figure 12 shows the structure for a new suburb that is planned to be constructed in the coming years. This structure is denser and less land demanding than the structures implemented from the 1970's until the 2010's. Never the less, this area is located in quite a distance from urban centers and is in a sense quite automobile orientated, although it is planned to be a sustainable neighborhood in many ways. However, this will not be discussed further in this thesis.

## 5.4 The building stock

As shown in figures 13 and 14, the amount of square meters allocated to each person, both in residential and commercial building stock, in the Capital area increased from 2000 until around 2008. This trend is in line with economic growth, resource use and carbon emission where it declined around 2008.

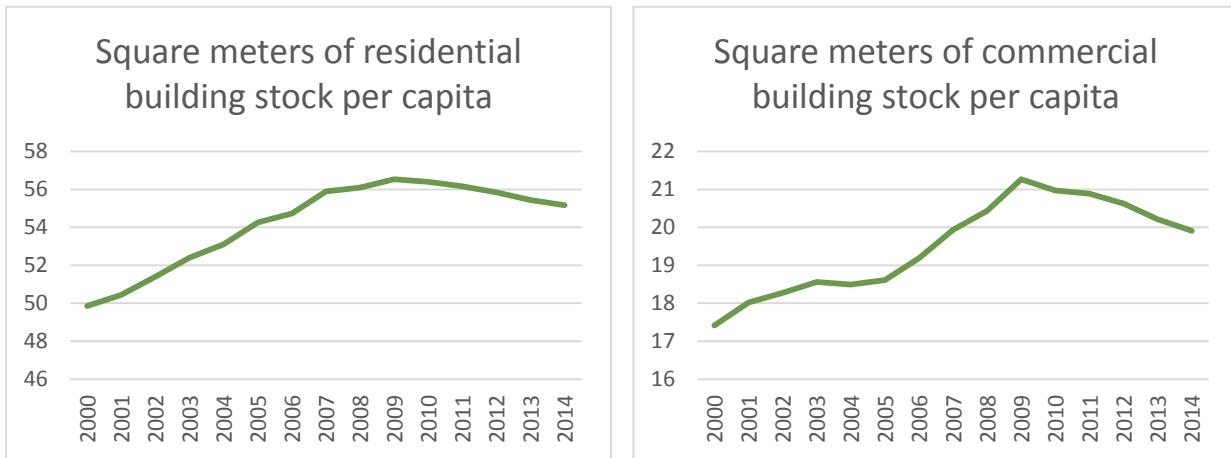


Figure 13 shows square meters of residential building stock per capita in the Capital area, from 2000-2014 (Registers Iceland, 2015a; Statistics Iceland, 2015).

Figure 14 shows square meters of commercial building stock per capita in the Capital area, from 2000-2014 (Registers Iceland, 2015a; Statistics Iceland, 2015).

Between the years 2000-2008, suburban areas were built where construction of detached buildings, as mentioned, was quite common. As can be seen in figure 13, the average square meters per person in residential buildings increased significantly from 2000 when the average person had just under 50 square meters until 2008 when square meters per each person had increased to over 56 square meters. However, the growth and decline in the residential building stock per capita was not as steep as in the commercial building stock and kept growing after 2009 but decreased in ratio to population growth (Registers Iceland, 2015a; Statistics Iceland, 2015).

What has contributed to this development is the fact that fewer people live in each apartment unit today than before. In 2007 2,53 people lived per apartment unit compared to 2,68 in 1997 (Verkís, 2009; Statistics Iceland, 2015). There are different components that cause this. The size of families and the population's age composition has like in other countries changed in the last years where the average age is increasing and the size of families decreasing. The average woman has fewer children today than before and people have children later in their lifetime. Parallel, the population is aging with more people in the higher age groups and fewer in the younger age groups. Because if these factors fewer people are likely to live per residential unit (Alta, 2014a). Further, families today do not only consist of mom, dad and the kids but now more people live alone and in many cases people have separated and live separately with

the children spending every other week with each parent. These new demands for residential building stock can thus cause more square meters of building stock being allocated to each individual.

In a report by The Icelandic Planning Agency, it is estimated that in 2012 approximately 75% of the commercial building stock in Iceland was in the Capital area. Further, it has been estimated that the commercial building stock in Iceland went from being 640 thousand square meters in 1996 to being 900 thousand square meters in 2006 and up to approximately 1.200 thousand square meters in 2012. This means an increase of 40% in only a decade and almost 88% increase in total square meters of commercial building stock in Iceland in 16 years. Further, growth in commercial building stock per capita in Iceland went from 2,4 square meters in 1996, to 3,0 square meters per capita in 2006 and up to 3,8 square meters per person in 2012. Therefore, more than 50% in 16 years. The report further states that in 2012, the Capital area had over 4 square meters of commercial building stock per capita while other areas of the country had just under 3 square meters per capita. This difference can be expected because a part of the services provided in the Capital area service the whole country. Further, square meters per capita is quite high when compared to other nations. For example, compared to Denmark which has under 2 square meters per capita and Norway, which has almost 2,5 square meters per capita (INPA, 2014). In terms of this, growth in the commercial building stock has been quite extensive in Iceland and more so in the Capital area and is further quite high in comparison to neighboring countries.

The commercial building stock in the Capital area grew significantly between 2000 and 2008, as shown in figure 14. It should be mentioned that the numbers here are different from the data from the report by INPA, because the following data contains the complete building stock where common areas and other square meters are counted. As can be seen in figure 14, square meters of commercial building stock per capita grew more slowly in the beginning of the era but grew steeply after 2005. This growth can be related to construction of large units of commercial buildings. Before 2000 quite a lot of commercial buildings had already been built, for instance Kringlan, a 41.000 m<sup>2</sup> shopping center. In 2001 another large shopping center, 62.000 m<sup>2</sup>, Smáralind, was built. As mentioned after 2005 this development of growth in square meters of commercial building stock per capita was even steeper, even though population growth was quite positive in the era. Contributing to this were for instance Korputorg, a 45.550 m<sup>2</sup> shopping center built in 2008. Bauhaus, a 22.000 m<sup>2</sup> department store built in 2008. Turninn, a 22.000 m<sup>2</sup> commercial buildings with offices and other facilities. Further, few sport and recreation facilities were built in the era. These are for instance, Egilshöll, a 30.500 m<sup>2</sup> sport and recreational hall built in 2003, and Kórinn, a 14.500 sports hall built in 2007 and was later enlarged. More than these, various large department stores, supermarkets and other commercial buildings and facilities were built in this era. What most of these constructions have in common is that they are large, with large parking facilities and built in areas with low urban density and even in areas where few buildings were before (Registers Iceland, 2015a; 2015b; Statistics Iceland, 2015).

What is interesting about this era is that approved municipal plans had established growth plans for both residential and commercial construction for the era. Further, both residential and commercial building development exceeded what had been planned. That is, more was built than had previously been planned and most likely, more than can be considered to be needed (Verkís, 2009).

This increase in square meters per capita, both in terms of the residential and commercial building stock, indicates an increased resource use per capita. With this, each individual is causing more environmental degradation than before. Building stock per capita further decreased after the financial crisis. With the decline, each resident's resource use and part in environmental degradation decreased.

## 5.5 Transportation

As the urban structure suggests, the private automobile is the most common form of transportation in the Capital area. In 2014, it was estimated that 77% of people in the Capital area use private automobiles as a mode of transportation. Further, 19% walk or ride a bicycle and only 4% use public transportation (VSÓ Ráðgjöf, 2014).

As figure 15 shows, automobile ownership increased from 1994 until the financial collapse when it decreased suddenly. The growth in ownership was further steep in the five years leading to the collapse. With lower density, larger buildings and increased distances, as well as better economic circumstances, automobile ownership has grown through the years. Registered automobiles per 1000 capita grew from 437 automobiles per 1000 capita in 1994 to being 763 automobiles per 1000 capita in 2007. After this, as is true for indicators previously mentioned, there was a decline in automobile ownership when the financial crisis hit.

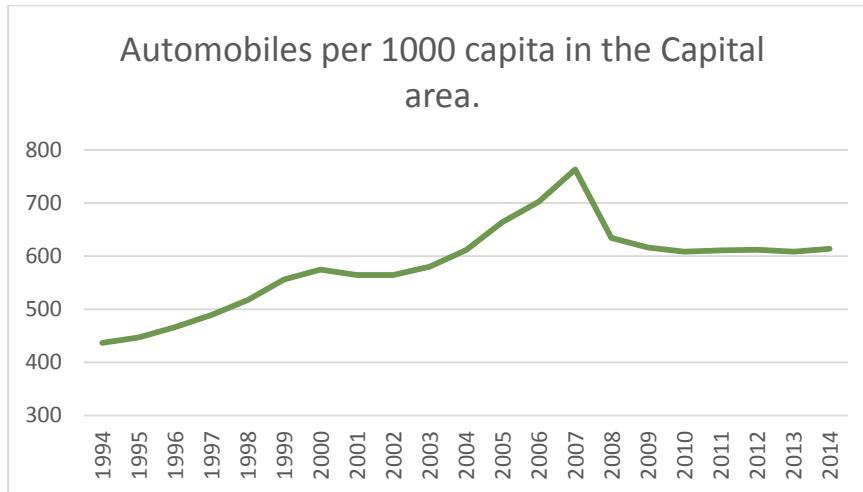


Figure 15 shows development in automobile ownership per 1000 inhabitants in the Capital areaa (Statistics Iceland, 2015; Icelandic Transport Authority, 2015).

Not only is the private automobile the most common mode of transportation in the Capital area, but it is quite common for households to have two or more automobiles. A survey by Capacent Gallup showed that most of the people that answered, 4821 people, had at least one automobile in their household. Only 4,3% answered that no one in their household had an automobile. 43,1% answered that there was one automobile in their household. 40% had two automobiles in their household. 9,9% had three automobiles in their household and 2,7% had four automobiles or more in their household. Further, when the numbers are divided between people that live in a single-family or a multi-family unit it shows that 75% of people living in single-family units had two or more automobiles in their household but for people living in multi-family buildings this ratio was 40% (Capacent Gallup, 2011). It should be kept in mind it is likely that more people live per unit in a single-family unit since they tend to be larger units. Never the less, this shows a link between people living in single-family units and higher automobile ownership.

Increased automobile use indicates increased resource use and environmental degradation in terms of construction of road infrastructure, oil use, maintenance and for disposing of the automobiles. Automobile ownership decreased after the financial crisis. When automobile ownership decreased, environmental degradation can to be said to have decreased. Although, the automobiles that were present at the time

Table 3 shows table 2 in the context to the Capital area in order to demonstrate urban growth and increased environmental degradation in the Capital area (Table made from theoretical and empirical data).

Structural characteristics	Growth	Growth period in the Capital area
<b>Floor space per capita</b>	<b>Increased floor space per capita.</b> <ul style="list-style-type: none"> <li>More resources required for a building's lifecycle.</li> <li>More land allocated to urban development.</li> <li>More resources used for furniture and appliances.</li> </ul>	<ul style="list-style-type: none"> <li>Residential building stock, 13% increase in square meters per capita in the years 2000-2009.</li> <li>Residential building stock, 30% increase in total square meters in the years 2000-2009.</li> <li>Commercial building stock, 22% increase per capita in the years 2000-2009.</li> <li>Commercial building stock, 40% increase in total square meters in the years 2000-2009</li> <li>Waste in recycling stations, 15% increase per capita, in the years 2001-2008.</li> <li>Waste in recycling stations, 30% increase in content in the years 2001-2008.</li> </ul>
<b>Type of buildings</b>	<b>Detached buildings</b> <ul style="list-style-type: none"> <li>More resources needed for a building's lifecycle.</li> <li>Requires more land.</li> </ul>	<ul style="list-style-type: none"> <li>Suburbanization in the Capital area from the middle of the 20<sup>th</sup> century until the beginning of the 21<sup>st</sup> century.</li> </ul>
<b>Density</b>	<b>Low-density urban structure</b> <ul style="list-style-type: none"> <li>More land allocated to urban development, per capita.</li> <li>Requires more resources for construction, maintenance and demolition.</li> <li>Increases distances and reduces opportunities for walking, bicycling and public transportation.</li> </ul>	<ul style="list-style-type: none"> <li>Urban density decreased from 120 inhabitants per hectare, in 1940 down to 35.5 inhabitants per hectare in 2013.</li> <li>Land allocated to urban development is now 16 times larger but the population only 4,8 times larger.</li> <li>In 2013, 280 square meters of land were allocated per capita, while 83 square meters of land were allocated per capita in 1940.</li> </ul>
<b>Transportation mode emphasized</b>	<b>Emphasizing automobile use</b> <ul style="list-style-type: none"> <li>More land allocated to urban development.</li> <li>More resources needed for construction.</li> <li>More resources needed for operation.</li> <li>More carbon emission.</li> </ul>	<ul style="list-style-type: none"> <li>Automobiles per 1000 capita increased 75% in the years 1994-2007.</li> <li>Total number of automobiles increased 119% in the years 1994-2007.</li> <li>Increased construction of transportation infrastructures in the growth period.</li> <li>Consumption of oil for automobiles in Iceland, per capita increased 42% in the years 1990-2007.</li> <li>Total consumption of oil for automobiles in Iceland increased 75% in the years 1990-2007.</li> <li>Total carbon emission in Iceland from road transportation increased 74% in the years 1990-2007.</li> <li>Carbon emission from road transportation per capita in Iceland has increased 31% in the years 1990-2008.</li> <li>Total carbon emission in Iceland has increased 67% and per capita 34%, in the years 1990-2008.</li> </ul>
<b>Impact</b>	<b>MORE ENVIRONMENTAL DEGRADATION</b>	<b>Urban growth has resulted in more environmental degradation caused by the population and by each individual.</b>

when the crisis hit had already caused environmental degradation, this resulted in decreased emission; less need for transportation construction; and less need for automobile renewal.

## 5.6 Growth impact on sustainability

The data concludes that growth from the mid-20<sup>th</sup> century until the financial crises in 2008 has made the Capital area less sustainable. That is growth in carbon emission, oil use, waste production, building stock, automobile ownership and growth in distances with lower density, has resulted in increased resource use per capita with increased environmental degradation.

As the chapter has demonstrated, the Capital area has been going through an era with quite extensive growth in many forms. Table 3 shows how growth in the Capital area has been conceptualized with table 2 from the theoretical framework on urban growth. It shows how the Capital area has caused increasingly more environmental degradation and has become less sustainable until the end of the growth period, around the financial collapse.

### Floor space per capita

As shown in table 3, size of residential buildings per capita has increased. This leads the area becoming less sustainable because the increased size of residences calls for more building materials and more land for construction. Further, larger dwellings call for more resources for heating and maintenance. Increased consumption has further been connected with increased size of dwellings (Xue, 2012a) and this is compatible with the statistical data where waste disposal in recycling stations increased towards 2008. Waste disposal in recycling stations can be said to be a good indicator for consumption connected to buildings because these numbers represent the disposal of waste related to building construction; and other larger building fixtures and furniture. In terms of this, resource use per capita in the Capital area has increased; for resources used for construction, heating, maintenance, consumption and more land is being allocated to residential buildings.

Increased size of commercial building stock has also had negative influence on how sustainable the Capital area has become. Larger units call for more building material, heating, energy and maintenance. What also has negative effects is the fact large commercial buildings were built in the outskirts of urban areas, alongside highways, where it is difficult to reach by public transportation. More than the buildings being large most of them have large parking spaces, which further contributes to unsustainable land use. Not only does construction of this kind of commercial buildings make the city less sustainable, but also the consumption that is linked to compartments store. That is, more consumption results in increased resource use and therefore a less sustainable community.

### Type of building

As mentioned, detached buildings became increasingly more common from the mid-20<sup>th</sup> century towards the beginning of the 21<sup>st</sup> century, with the emphasis on suburban structures. Single-family buildings became especially common in the beginning of the 21<sup>st</sup> century. This has resulted in the Capital area becoming less sustainable, as table 3 shows, with more resources being used for constructing, heating and maintaining buildings. Further, more land is allocated to the detached and single-family buildings than attached and multi-family buildings.

### Density

As table 3 shows, density has decreased extensively from 1940. When numbers for density are analyzed in the context to population numbers, the Capital area today covers 16 times more land while the population is only 4.8 times larger. Today, only 35,5 people live per hectare, compared to 120 in 1940. This means that just over 83 square meters of land were allocated to each person in 1940 while today; each person has just over 280. This development and urban growth has resulted in the Capital area becoming less sustainable.

The urban structure and the building stock have developed towards the area becoming less sustainable. This is because the urban structure that has been implemented in the recent decades has increasingly more environmental impact, due to its low density and automobile orientated transportation system. This kind of urban structure consumes large areas of land and therefore can result in construction in natural areas and possible loss of animal habitats. Further, because this kind of urban structure covers large areas of land it makes distances longer than they have to be. As result of this automobile ownership has increased, which results in more use of fossil fuel and increases emission. Further, more construction material is needed to make the traffic infrastructure than if density was higher.

### Transportation mode

As shown in table 3, automobile ownership has grown extensively in the years from 1994 until 2007. Automobile ownership per capita has increased 75% and further number of automobiles registered has increased 119% in the period. Oil use per capita has increased 42% from 1990 until 2007, and total oil use for automobiles in Iceland has increased 75%. Carbon emission has further increased 31% per capita in Iceland between 1990 until 2008. Moreover, total carbon emission for automobiles in Iceland has increased 75% from 1990 until 2008.

It is safe to say that the Capital area has in the last decades become increasingly less sustainable and caused increasingly more environmental degradation, with carbon emission per capita in Iceland increasing 34% from 1990 until 2008 and total emission increasing 67%. In terms of this, the buildings stock and transportation developed in the Capital area has had negative influence on sustainability and made the region less sustainable.

## 5.7 Summary

This chapter has described how economic and urban growth has developed in the Capital area since the mid-20<sup>th</sup> century, using different indicators for economic development and environmental degradation. It shows how growth in carbon emission; oil use; waste disposal; amount of land allocated to urban development; size of the building stock in terms of residential and commercial buildings; and automobile ownership has made the Capital area less sustainable.

The chapter determines that growth in the building stock has led to more resource use for buildings' lifecycles and by this for heating and consumption of fixtures and furniture. Further, the increased size of the building stock leads to more land being allocated to urban development. Increasing number of detached buildings has further lead to increased resource use for buildings' lifecycles and for more land to be allocated to urban development. Automobile use has been emphasized as a mode of transportation, which results in increased automobile use and resources for the automobiles' lifecycles and for

infrastructure construction. These factors all contribute to lower density, whereas density has decreased extensively.

The chapter determines that urban growth in the Capital area in the decades, and especially in the years, leading up to the financial collapse has made the region increasingly less sustainable. By this research question 2 of how the building stock and transportation has developed in the Capital area since the mid-20<sup>th</sup> century, and more specifically leading up to the financial collapse, and how this has influenced sustainability, is answered.

Now that the theoretical framework and the case information have been established; and urban growth in the Capital area analyzed and the fact that urban growth in the Capital area has rendered the region less sustainable has been determined. It is possible to analyze how degrowth ideology can be implemented in planning in the Capital area in order to move the region closer to its goals of sustainability. For this, applying the theoretical framework to the case data.



# ANALYSIS II: DEGROWTH FOR INCREASED SUSTAINABILITY

This chapter discusses how ideology of degrowth can be applied to urban planning in the Capital area to move the region closer to goals of sustainability. The chapter shows that there is indeed a link between environmental degradation and economic growth and further that GDP is a poor indicator for prosperity in Iceland. This chapter will moreover deliberate on the Capital area becoming less sustainable with economic growth; and how growth goals have been fulfilled while goals of sustainable development have taken the back seat. Further, structural principles that can be applied in urban planning to develop the Capital area towards becoming a more sustainable urban region shall be discussed. By this the chapter answers research question 3 of how degrowth ideology can be applied in the region to move the Capital area closer to goals of sustainable development.



## 6. Analysis II: Degrowth for increased sustainability

### 6.1 Comparing the curves

Figure 16 shows how the indicators discussed in chapter 5 are put together in one graph. In order for them to fit in the same range and to be compared, some units were divided by 10 or 100. The units should therefore not be analyzed but similarities in the curve in terms of growth and decline. Here as in chapter 5, the length of the time periods indicators are available for varies. Further, all indicators can be compared in the years 2001-2012. Appendix D shows how the indicators are compared by their percentage of the highest value. The alternative way is shown for clarification because of the difficulty in comparing the indicators.

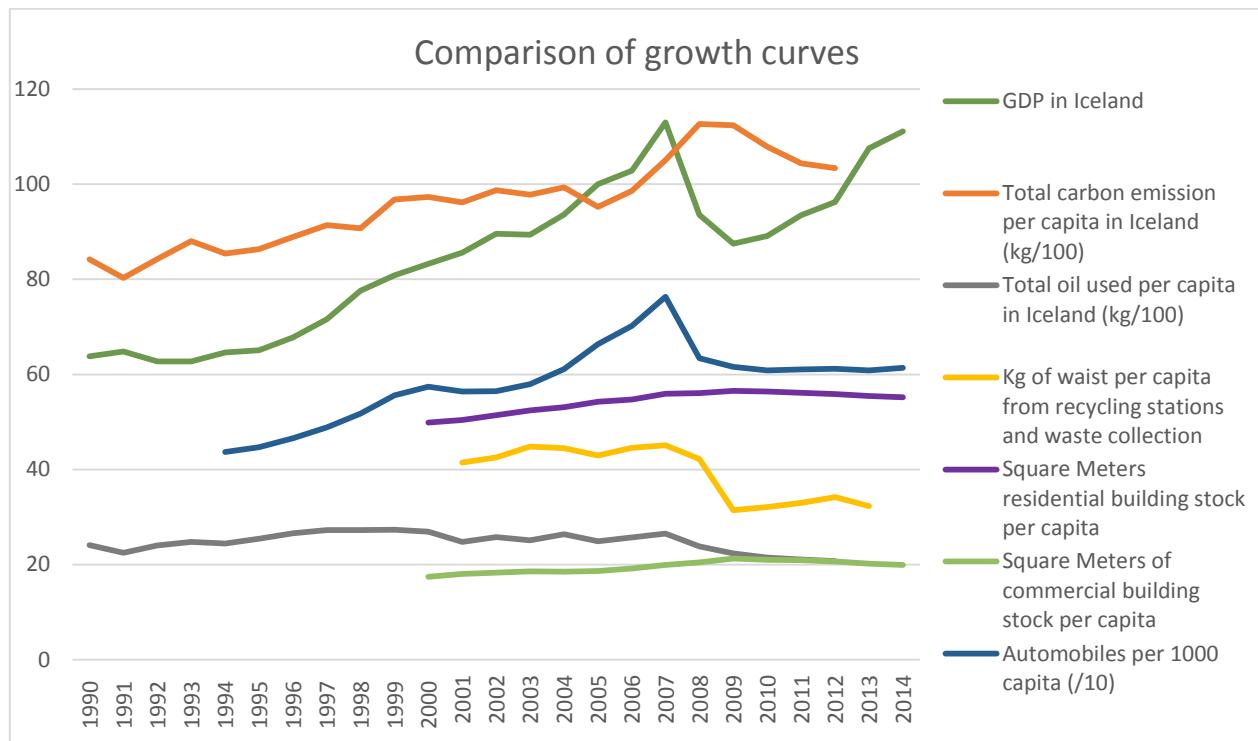


Figure 16 shows a comparison of the growth curves. Some units have been divided by 10 or 100 in order for all units to fit into the same range. In terms of this, it is meant for comparing growth and decline, but not units (Statistics Iceland, 2015; National Energy Authority, 2015; Sorpa, 2015; Registers Iceland, 2015a; Icelandic Transport Authority, 2015).

As figure 16 shows, all indicators grew in the two decades before the financial collapse and declined after. That is, economic growth; carbon emission; oil use; waste production; square meters per capita for both residential and commercial buildings; and automobile use per capita. Although, the rate of decline varies, all indicators declined following the financial collapse. The extent and time of decline varies as can be expected, because the different indicators have different flexibilities, in terms of it being easier to reduce automobile use than it is to reduce the amount of square meters per capita since the buildings have already been built, but people might decide not to renew their automobile or stop using it. Further, the decline does not show up on the same year due to different dates of measurements and emergence of the effects. More than the indicators shown in figure 16, other factors of urban development followed this growth trend towards the financial collapse. That is, land allocated per capita grew with decreased urban density and extensive growth in transportation infrastructure.

The development indicates that there is indeed a link between, resource use and environmental degradation in the Capital area, on one hand, and economic growth, on the other. The case of the Capital area shows this explicitly because of the financial collapse, where there was a steep decline in the GDP indicator, where other indicators followed the decline, resulting in less environmental degradation per capita. In terms of this, the Capital area became increasingly less sustainable towards the end of the 20<sup>th</sup> century and in the beginning of the 21<sup>st</sup> century, until approximately 2008 when the Capital area's rate of sustainability increased. As a result, it can be said that the financial collapse has made the Capital area more sustainable.

Although the curves are very compatible in terms of growth before the financial crisis and decline when the crisis hit, it is interesting to see that GDP has grown more in the last five years than the other indicators. This suggests a partial decoupling between environmental degradation and economic growth. Further, growth in carbon emission and GDP in Iceland can be said to follow the same trends as has been general in the world in the last decades, where GDP has grown more than carbon emission. For the Capital area, this is true for development both before and after the financial collapse. However, the most noticeable level of decoupling can be seen after the financial collapse. The relationship between GDP and carbon emission will be further discussed in subchapter 6.3.2.

Population in the Capital area can be considered a population with high level of prosperity, high level of economic freedom and high knowledge among the citizens. However, the Capital area has not been able to accommodate growth without negative environmental consequences. This corresponds with Jackson's (2009) writings and further enforces the theory that it is not possible to accommodate economic growth without negative environmental consequences. Therefore, reaching sustainability in a society where economic growth is a goal seems beyond the bounds of possibility.

## 6.2 Indicating prosperity

As discussed, GDP is an unobtainable goal if the main goal is to reach sustainable development. As mentioned, GDP is a poor indicator to measure prosperity and well-being. Further, it is a poor indicator for prosperity and happiness in the Capital area.

### 6.2.1 Happiness and economic growth

Prosperity has, as mentioned, been associated with both GDP and happiness. Figure 17 shows the data for happiness of the Icelandic population. This data from the Directorate of Health shows how people that were asked, rated their level of happiness on the scale from 0-10 (Guðmundsdóttir, 2015). This information is then compared to GDP by calculating what percentage each value is of the highest rate of happiness and the highest rate of GDP in the period. By this, it is possible to compare these different indicators to determine if there is a link between growth and decline in happiness and GDP in Iceland. Appendix D shows an alternative comparison of happiness and economic growth in Iceland, for clarification, because the values are different and difficult to compare.

As figure 17 shows, curves in GDP and happiness in Iceland do not correlate. Happiness on the contrary was lower in 2007, when GDP along with other indicators had the maximum rate, than in 2003. Further, GDP was high in 2007 and 2014 when happiness was lower than it was in 2003 (Guðmundsdóttir, 2015). Figure 17 therefore shows that there is not a correlation between growth and decline in happiness and GDP in Iceland.

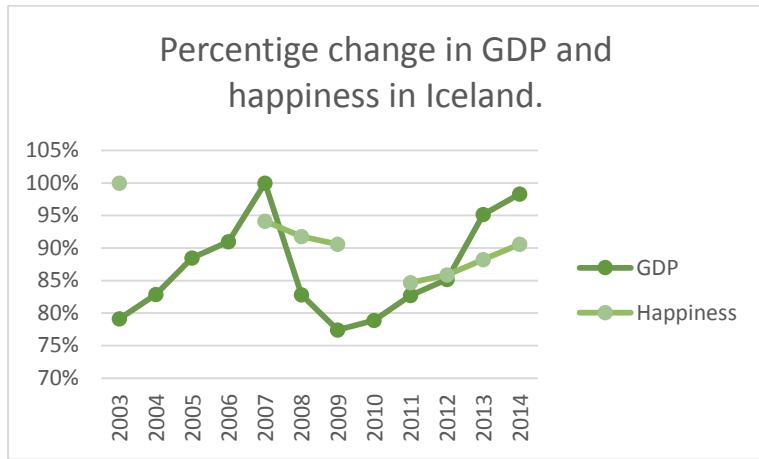


Figure 17 shows a comparison of growth and decline in happiness and GDP in Iceland, where each unit is a percentage of the maximum value in the period from 2003-2014 (Statistics Iceland, 2015; Guðmundsdóttir, 2015).

According to Guðmundsdóttir (2015) at the Directorate of Health, only 1% of happiness can be explained by income. Further, financial troubles according to the research, explains 3% of happiness. More influential are marital status, 8%; health, 6%; and social connections, 11% (Guðmundsdóttir, 2015).

This is consistent with the theoretical framework on connections between GDP and happiness, which states that happiness is determined by non-monetary factors and not by monetary factors. Theory further agrees that if one has financial troubles one is likely to be unhappy whereas living with sufficient means is likely to make one happy. Further, more wealth than what is required for living comfortably will not provide growth in happiness. In terms of this happiness in Iceland, and according to theory, is determined by non-monetary factors rather than monetary factors such as GDP. From this, it can be concluded that GDP is a poor indicator for happiness and therefore for prosperity in Iceland.

## 6.2.2 Economic growth as an indicator for prosperity

When looking at the goal of economic growth in perspective, one might ask why it has been established as goal to pursue. One might wonder what the actual benefits of reaching this goal of infinite growth are for the economy and further, for the urban environment. As mentioned, economists have not yet explained how infinite growth is to be possible. Further, it seems problematic to pursue a goal that by definition cannot be reached. Infinite growth is not possible because it is not possible to produce an infinite number of goods and provide infinite number of services.

As discussed, economic growth has historically and theoretically been linked to carbon emission. That is, the economic good, that is economic growth, and the environmental bad, that is carbon emission. As figure 18 shows, this can be argued to be the case in Iceland. The figure shows that GDP and carbon emission in Iceland have a very similar growth curve upwards until around 2007 when they both decline. This suggests that there is indeed a link between GDP and carbon emission, and thus environmental degradation.

Despite the correlation, GDP declines a bit earlier than carbon emission. Further, GDP takes a deeper dive than carbon emission and starts to rise in 2009 while carbon emission does not. The comparison shows that there is quite a strong coupling between 1990 and 2007. However, after 2008 a partial decoupling can be seen. It is difficult to determine why this is. When comparing GDP and carbon emission per capita,

this correlation is not as strong as when GDP is compared to total carbon emission in Iceland, as can be seen in appendix D, although it correlates strongly with a partial decoupling after 2007.

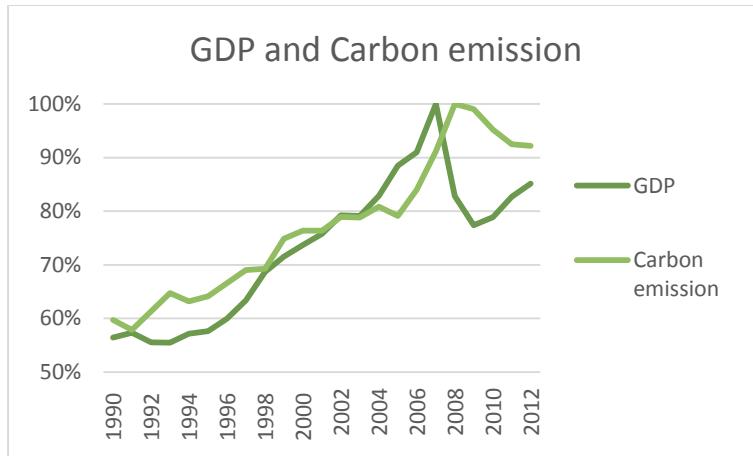


Figure 18 shows a comparison of GDP and carbon emission as a percentage of the highest value in the era 1990-2012 (Statistics Iceland, 2015).

Figure 18 shows a strong correlation between GDP and carbon emission. In terms of this, it can be seen as contradictory to aim in decoupling these indicators completely in order to reach sustainable development and produce economic growth each year. It seems difficult or even impossible for governments to have goals and plan for growth in GDP, in its current form, and for it not to be linked to environmental degradation. This is not surprising because, as mentioned, total decoupling of GDP and environmental degradation has not been possible in any society.

As noted, the GDP indicator was originally developed in the 1930's, then as GND, and has not changed much since then. However, many aspects of society have changed both since GND was established and further since GDP was established in 1991. The social aspect of society has changed greatly; and the economy and the financial systems today are very different from what they were. Finally, yet importantly substantially more is known about the environment and how humans have influenced and degraded it. In terms of this, it seems important that the way success and prosperity of a society are measured should also develop to be well suited to society's aspirations and further, society's needs.

As the theoretical framework discusses, more than it being outdated and the fact that it induces environmental degradation, there are many other reasons why GDP should not be considered an economic good in general and further for the Capital area. One of these reasons is that the goal of economic growth is a zero-sum game, because even though there is economic growth in Iceland it does not necessarily change how much each individual can consume in terms of his or her wages. This is because everyone's economic situation increases and each individual has the same ratio as before, one person's comparison to the next person would not change. Therefore, this would not change people's status because the way people feel about their status and what they want is a question of social comparison, which is socially constructed. As an example, if all municipalities in Iceland have economic growth, the ratio between them would not change. Because of this, it seems economic growth should be the lesser important goal between economic growth and sustainable development.

As mentioned, GDP is a poor indicator for successful development because it does not differentiate between positive and negative development. It does not measure a building's quality or if it serves the

purpose it is planned to serve. It only shows that something has been constructed. It further does not measure quality. Therefore, it does not show what the benefits of these developments are. In terms of this, a community can have terrible life quality for 90% of inhabitants if the other 10% have significant consumption and fulfill growth in GDP. If society is successful in terms of equality, it does not contribute to GDP. Therefore, GDP is not a good indicator of prosperity and well-being in Iceland, nor the Capital area.

### 6.2.3 New indicator for prosperity

It has until now been established that reaching sustainability and producing continuous economic growth is not possible. When evaluating the importance of these goals, growth and sustainability, it can be said to be more important to fulfill the goal of sustainability because the main idea of sustainability is to live and develop earth in a way that allows it to be sustained and by this ensuring continuity. Because there cannot be development without continuity, sustainable development is here seen as the most important aspect of urban development.

Economic goals need to be compatible with other goals society has. The economic system is manmade and socially constructed, and the goals and requirements with it. On the other hand, resources are something man cannot control and thus man has to use them as nature provides them. In terms of this, it is important that measurements of prosperity are compatible with society's goals and induce, rather than go against, what society needs in terms of the future, which is real prosperity and wellbeing. Economic growth is short sighted. It is about producing more each year than the year before. Sustainability is about making sure that we can keep living on this planet indefinitely. In terms of this, it might be said that economic growth, as it is today, is the limit to sustainability.

If the goal is sustainability, economic growth in current form cannot be fulfilled. Because of this, GDP cannot be used as an indicator for prosperity. If an indicator is something that is needed to measure if society is becoming more or less successful or has more or less prosperity, it cannot measure something that produces environmental bad as economic good. The extraction of resources and thus the environment needs to be part of the economic system and considered in context to economic development. The indicator needs to consider society and the economy as an open system where the planet is part of the equation. Evaluating nature needs to be part of the supply system in order to prevent over use of resources resulting in resource scarcity. A new indicator for prosperity thus needs to consider the environmental degradation caused by aiming at a certain prosperity goal. In terms of this, no growth does not mean decline in economic growth but it means doing something different. For this, degrowth ideology can be applied as an alternative to the growth rationality.

## 6.3 Sustainability and growth in the Capital area

As discussed, the municipal governments in the Capital area emphasize growth and sustainable development within current systems and structures. In terms of this, the development in the Capital area is in line with ideology of ecological modernization. That is, by making slight changes that are meant to enable the region to reach ambitious goals of sustainability as Agenda 21 and other strategies for sustainable development have suggested. The region has aspired to produce urban and economic growth; and sustainable development. However, development in the region has only managed to produce the growth aspect of their plans. This subchapter will deliberate more on the fact that the Capital area became less sustainable leading up to the financial collapse.

### 6.3.1 Urban growth and sustainability in the Capital area

As discussed urban growth in the Capital area towards the financial crisis, rendered the region less sustainable as years went by. Construction of buildings has played a large role in providing economic growth in the Capital area where the building and construction industry provided between 8-12% towards GDP in Iceland from 1997 until the financial collapse, in 2008. In terms of this, the larger the building is and the more resources used for construction the more GDP the developments will provide.

The way prosperity is measured in GDP is an obstruction for developing towards sustainability because embedded in the goal of GDP is to build larger and detached buildings; and more infrastructure, and by this using more resources. GDP thus has an incentive for people, companies and governments to use more resources towards their buildings and infrastructure. In terms of this going against one goal to fulfill another one.

Transportation in Iceland has further had high contributions towards GDP in Iceland in various ways. Partly through the building- and construction sector. However, it is not possible to distinguish between construction in one sector or another. When looking at the extensive transportation infrastructure established in the years and decades before the financial collapse it is clear that this has contributed towards GDP. As figure 7 shows, sale repair and maintenance of motorized vehicles and trades has contributed from 0,5% up to 1,8% of GDP. This ratio rose in the years towards the financial collapse and declined after the collapse. However, this rate has today started to increase.

Figure 7 further shows that transport and storage have contributed generously to GDP, or approximately 5-6%. It is not possible to distinguish how much each transportation sector in Iceland and the storage sector has contributed. However, this indicates how these sectors that can be resource demanding contribute to GDP.

The subject of alternative energy sources for automobiles has been widely discussed in Iceland in the last years. In terms of this automobiles that use electricity and methane as an energy source have been quite noticeable in the discussion. It is now possible to access electricity in few parking spaces in the Capital area and in some cases, it is possible to park free if one has an automobile that uses alternative energy sources. Automobiles that use alternative fuel sources have become increasingly more common. Today, approximately 2% automobiles run strictly on electricity, under 1% are methane and fossil fuel hybrid and 2% are electricity and fossil fuel hybrid (Icelandic Transport Authority, 2015). This development, although more sustainable than only using fossil fuel, is a characteristic of ecological modernization. That is, an attempt to fulfill sustainability within current structures by making small adjustments. In terms of this, only the fuel part of automobile use is being decreased while the construction, transportation, maintenance and disposal of it are resource demanding, and further the construction of transportation infrastructures for private automobile use is extremely land and resource demanding. Moreover, developing these new technologies and solutions for alternative energy use can be resource demanding. These small solutions are thus not considered adequate strategies for developing more sustainable urban regions in the case of the Capital, nor in general.

### 6.3.2 Economic growth or sustainability in the Capital area

When looking at figure 16, and from what has until now been discussed, it can be concluded that the Capital area has only been able to achieve its goals of economic and urban growth. Not only has it failed to achieve the goals for sustainable development, stated in the regional plan for 2001-2024 and noted in

strategy for Agenda 21, but on the contrary moved further from it. Growth in the Capital area has, as discussed, been fulfilled in various ways. Such as through the building stock, construction and consumption. This development is not surprising because generally governments emphasize economic growth and general growth more than sustainable development. Further, as Næss (2011) suggests environmental protection is not the number one priority when it comes to developing the urban environment and accommodating growth. This is the case for the Capital area, where environmental sustainability has not been emphasized. The data shows no sign of reduced environmental degradation caused by steps taken and plans made for sustainable development. The only factor that has influenced sustainability in the Capital area in a positive way is the financial collapse in 2008, which rendered the Capital area more sustainable with less environmental degradation caused per capita. However, it is difficult to say if this development will go on or if growth rate will develop towards being the same as before.

Development since the financial collapse, as mentioned, shows sign of decline in environmental degradation. Today, indicators shown in figure 16, other than GDP, seem to be ceasing decline and becoming more balanced and in some cases growing. Further, GDP has grown extensively since the financial collapse and automobile ownership seems to be growing. It should be noted that this is a relatively short period and therefore it is difficult to predict future development. Especially because of the swift changes in the last years. However, observing this fast growth in GDP and looking at the development until now and in correlation to theoretical data, suggests that indicators will in the near future start to increase again. Although, there might be a partial decoupling to this development, in terms of environmental bad and economic good, other indicators and thus environmental degradation can be expected to rise with GDP. We cannot know if the indicators will follow the growth trend of GDP. However, we do know that if indicators mentioned develop upwards, it will leave the Capital area less sustainable and keep the governments in the Capital area from reaching their goals of sustainable development.

Governments in the Capital area want to fulfill growth and provide its citizens with more material goods and monetary elements. They have succeeded in fulfilling this goal by allowing implementation of urban structures in the Capital area that use increasingly more resources for construction and maintenance; increasingly more services for construction work; and further increasingly more home appliances and products are consumed with increasing size of the building stock. Moreover, consumption related to automobile use increased towards the financial collapse. This development is implemented at the expense of environmental sustainability. In terms of this, increased resource use for urban development in the Capital area is indeed linked to economic growth. Providing monetary goals has left the Capital area less sustainable. As the theoretical framework has established it is not possible to have both economic growth and sustainability because growth is linked to consumption and is dependent on more and more goods being produced and services provided each year so that GDP is higher each year than it was the year before.

Further if the Capital has the goal of infinite economic growth, which by definition is what the goal of economic growth is, it cannot be sustainable. Therefore, if the goal is as stated in the regional plan from 2001 to have the same growth rate their goals of sustainability cannot be reached. Because, continuing urban growth at the rate it has developed in the Capital area will not provide the result of a sustainable region. If the goal is in the end that economy will multiply itself, reaching this goal could not enable the population in the Capital area to keep within earth's ecological limits.

If indicators return to their former state of growth, the Capital area becomes less sustainable and inhabitants cause increased environmental degradation, it can be said that the population in the Capital area will not be living within earth's ecological limits. It is difficult to determine how many resources each person can use in terms of being sustainable and where this ecological limit actually lies. However, if one considers what earth's population is using in terms of resources and the fact that Nordic countries are one of the biggest consumers in the world. It seems unlikely that it would be possible to sustain the planet if each individual on earth would consume to the extent that the average person in the Capital area does.

### 6.3.3 Action plan for sustainability

As mentioned, Agenda 21 was established in Iceland in 1998 and was implemented by municipalities in the following years. What is interesting is that this action plan has not shown result in terms of decreasing carbon emission, neither in terms of total emission nor emission per capita. In terms of this, emission has increased since it was established, resulting in less sustainability in the Capital area.

This can be said to be quite interesting because environmental awareness, tools for decreasing environmental degradation, and steps taken for sustainable development have never been more dominant than today. However, environmental degradation has never been more severe.

Although, Agenda 21 has not provided the expected or planned results, it has had some impacts on environmental matters in the Capital area and in Iceland. When it was established, it required municipal governments and officials to consider the ideology of sustainability. It brought the subject to the surface and increasingly more people became aware of the concepts of sustainability and sustainable development, and the importance of it. Before it was established, the factor of sustainability was not very visible in municipal planning and strategies. Further, municipalities today in some cases have department allocated to environmental matters and the requirement of considering environmental matters and degradation is a legal obligation in Iceland (Building regulation 112/2012). However, it is difficult to say if this had been the development without the establishment of Agenda 21 or possibly a different action plan would have been more effective. Needless to say, it has not been effective but has possibly been favorable in terms of communicating environmental matters to governments, companies and individuals but it is difficult to determine if this development has moved us further from or closer towards goals of sustainability (Proppé, Personal Communication, 24.04.2015).

## 6.4 Degrowth for more sustainability in the Capital area

Degrowth is an ideology and principles that in theory can be applied to move urban areas closer to goals of sustainability, in the broadest term, for environmental, social and economic aspects. Further, principles of degrowth can be helpful to reduce environmental degradation caused by urban development and urban areas and move society closer to goals of environmentally sustainable development.

As Jackson (2009) describes, there are three main aspects of degrowth ideology that need to be fulfilled in order for urban areas to become more sustainable. These are, to limit the resource use each individual needs for his or her lifespan to be within earth's ecological limits; change this broken system of aiming for relentless growth; and further, to suspend consumerism.

As mentioned urban development is one of the most resource demanding aspects that earth's population causes. In terms of this there are various principles of degrowth ideology that can be applied to make

urban areas more sustainable. Structural effects of urban development within degrowth ideology can be seen in table 4.

As table 4 shows, it is possible to reduce environmental degradation caused by the Capital area by decreasing floor space per capita in terms of residential and commercial building stock. By this, fewer resources are needed for the building's lifespan. Reducing floor space per capita should further decrease consumption of furniture and appliances. Constructing attached and multi-family buildings would reduce the resources needed for construction and maintenance and further reduce the energy required for heating. Moreover, it is important to densify urban development so that less land is allocated per capita and less energy is needed for transportation. In terms of this, building in brown fields and constructing within the urban areas current urban limits. Density should further be increased in order to better utilize infrastructure that has already been implemented. Moreover, construction of services should be targeted at areas that are close to urban centers, in proximity to public transportation. Further, emphasizing public transportation, bicycling and walking is important.

*Table 4 shows structural characteristics of degrowth. The table is the second half of table 2 in chapter 3.3.3.*

Structural characteristics	Degrowth
<b>Floor space per capita</b>	<b>Decreased floor space per capita</b> <ul style="list-style-type: none"> <li>• Fewer resources required for a building's lifecycle.</li> <li>• Less land allocated to urban development.</li> <li>• Fewer resources used for furniture and appliances.</li> </ul>
<b>Type of buildings</b>	<b>Attached buildings</b> <ul style="list-style-type: none"> <li>• Fewer resources needed for a building's lifecycle.</li> <li>• Requires less land.</li> </ul>
<b>Density</b>	<b>High-density urban structure</b> <ul style="list-style-type: none"> <li>• Less land allocated to urban development, per capita.</li> <li>• Requires fewer resources for construction, maintenance and demolition.</li> <li>• Decreases distances and increases possibilities for low emission transportation.</li> </ul>
<b>Transportation mode emphasized</b>	<b>Emphasizing public transportation, bicycling and walking</b> <ul style="list-style-type: none"> <li>• Less land allocated to urban development.</li> <li>• Fewer resources needed for construction.</li> <li>• Fewer resources needed for operation.</li> <li>• Less carbon emission.</li> </ul>
<b>Impact</b>	<b>LESS ENVIRONMENTAL DEGRADATION</b>

In terms of implementing these structural characteristics, many steps can be taken. Because of the low density in the Capital area, many areas within the current urban limits that are suitable for developing buildings on. Some areas are close to main transportation infrastructure and some are centrally located, such as Elliðaárvogur, which is planned to be constructed before the year 2030 (Reykjavík, 2013) and a former parking lot by Lækjartorg, where constructions have now began. A lot can be improved when it comes to the public transportation system whereas a tram or a bus rapid transit system can be suggested as a solution. Further, owning an automobile would either have to be made more expensive or it made more beneficial to use public transportation, bicycling or walking. This can for instance be implemented

by decreasing parking facilities in central area or making them more expensive. It can be implemented by adding bus lanes or changing existing lanes to bus lanes, in order for it to be as quick or even quicker to travel to the center by public transportation as by a private automobile in the Capital area.

In terms of decreasing the size of the buildings, it could be possible to give tax incentives for those who build by specific requirement. Further, it should be cost efficient for the developers to build attached and smaller units, since that would require less material and provide more efficient use of land, in order for more to be built per constructing plot. It is moreover possible to limit energy use by making energy more expensive through taxation. This can be done by having what is estimated to be the basic or the acceptable energy use inexpensive and make energy more expensive as the consumption increases. Allowing those who save energy to pay little for energy but those who consume more than is estimated to lead to a successful development, pay more.

These steps result in less land being allocated to urban development; fewer resources required for construction and maintenance; and less emission because of shorter distances; and less resource use. Fulfilling these principles in the Capital area would result in less environmental degradation caused by each person in the region, and by this reducing the amount of resources each individual needs in his or her lifespan. Urban development that follows these principles could result in constructing urban areas that demand minimum resource use.

Sharing facilities is a large part of degrowth ideology and for reducing environmental degradation caused by urban development and urban areas. Planning for more shared facilities could greatly decrease environmental degradation caused by the population in the Capital area. It should not be important for people to own all of their facilities and appliances privately. One way of sharing facilities is using public transportation instead of individualized transportation methods such as private automobiles. Shared automobiles can be available for lease for the situations when people need automobiles. Multi-family buildings are moreover a form of sharing. Other examples of facilities and services that can easily be shared are holiday homes, laundry facilities and shared spaces in multi-family buildings that can be used for gatherings and events, instead of everyone having facilities every day that they require sporadically. This could reduce resource use in terms of building stock, construction and appliances greatly.

Luxury consumption and novelty are aspects of society that should be easily cut down on. Much of the things we do and consume are not important for acquiring prosperity or enhancing our quality of life. Examples of this is buying new furniture; new fixtures; a larger apartment unit; or other material objects, not because we need them, but because we want them; or because we think we want them. We might even have the same kind of object we crave but feel like having a new one. In terms of this, it is important for society to decide if luxury consumption and novelty is more important than actual prosperity and sustainability. This need of having new things is socially constructed. It is not a real need and this aspect of environmental degradation should be easily discontinued without it having a long-term negative effect on people's happiness. This is because, as mentioned, happiness is more a question of social comparison than what people actually have and consume.

Changing what people want and what they aspire to is difficult. Therefore, managing people to use fewer resources and consume less in terms of novelty and basic necessities is difficult. The best way to decrease resource consumption is if the population wants to decrease consumption. For this, the population needs to be aware of the effects their consumption has in order for them to react and make informed decisions concerning their consumption. This is where research and education plays a large role. For this, it is important that urban planners and academics; research and mediate information for urban development

and the effects different structures have to the many sectors of society. This means, mediating to politicians and to the population. Politicians need to have the knowledge to implement the solutions and the population has to be educated to both select the officials that implement structures for sustainable development and further make the right choices in their consumption.

Following degrowth ideology does not mean decreasing all aspects of society. On the contrary, some aspects of society are to be increased. These are aspects of community that are indeed likely to help society reach goals of prosperity and sustainability. For the Capital area, this can for instance mean growth in education, healthcare, renewable energy sources or non-monetary factors that should be beneficial to provide prosperity.

When developing a society with reduced environmental degradation it is important to induce and facilitate behavior that is helpful to the goals that community has, and dissuade and discourage behavior that has negative effects on society's potentials to reach its goals. Various tactics can be used to influence resource use and environmental degradation. Taxation is, as mentioned, a way to discourage behavior that has negative environmental effects such as high level of land consumption, high level of emission, high level of energy or resource use and so forth. In terms of this, it can be said to be reasonable that those who pollute and degrade pay the price of it. Not those that produce less or little environmental degradation in their lifespan. Having incentives for positive behavior in terms of societies' goals can further be a useful strategy.

It is important for urban planning in the Capital area and the national government, to provide structures and legislation that enables degrowth ideology. Laws and regulation further plays a large part in inducing more sustainable urban structures and urban planning. An example of this is not having it legally binding to allocate large spaces to highways and road systems within urban areas, and not having laws and regulations that facilitate private automobile use. Laws and regulations can even limit to how much land and resources each person is allowed to use for their private consumption. However, the detail of determining laws and regulations suitable for degrowth ideology are beyond the scope of this project.

## 6.5 Summary

This chapter has discussed how curves in growth and decline of indicators correlate for the Capital area where resource use and environmental degradation has increased parallel to GDP until the financial collapse and how all indicators declined after the financial collapse. By this, the financial collapse made the Capital area more sustainable. It further discusses that there has been a partial decoupling of GDP and environmental degradation. This is most noticeable after the financial collapse where GDP has grown extensively and the indicators for environmental degradation have not followed this trend, although some indicators have started to show signs of growth.

The chapter further discusses that growth in GDP does not correlate with happiness in Iceland, which implies that GDP is poor indicator for prosperity, because happiness was not high at the time when GDP was high. Further, it shows the close correlation between GDP and carbon emission, which suggests that total decoupling of these indicators is not possible and further supports the claim that aiming for economic growth causes increased environmental degradation and therefore a new goal or a new indicator, to measure if societies' prosperity and success is increasing or decreasing is needed.

The chapter further deliberates on how urban and economic growth has influenced sustainability in the Capital area negatively in the years leading up to the financial collapse. It shows how urban development

has contributed to GDP and how governments in the Capital area have fulfilled their goal of economic and urban growth while not fulfilling their goal of sustainable development and on the contrary have moved further away from sustainability with increased resource use per capita.

The chapter concludes in discussing how degrowth ideology can be implemented in urban planning to move closer to goals of sustainable development by suggesting structural characteristic that should be planned for in order for fewer resources to be needed for each person's lifespan while fulfilling goals of prosperity. By this research question 3 of how ideology of degrowth can be implemented in urban planning for the Capital area in order to move urban development closer to goals sustainability, is answered.

Now that the theoretical framework has been established; growth in the Capital area been analyzed to determine the decreased sustainability in the region; and how degrowth ideology can be applied to urban planning in the Capital area to make the region more sustainable analyzed, all three research questions have been answered. Further, the answers will be discussed in the following chapter.



# DISCUSSION

This chapter takes themes from the analysis and brings forward interesting points of discussions. The chapter discusses the future of urban development in the Capital area, in terms of the new regional plan that is to be established in 2015; and what can be expected in terms of growth and urban development. It further discusses some of the complications of implementing degrowth ideology in the Capital area, of social opposition and possible rebound effects. It further elaborates on the role of urban planning in implementing degrowth ideology. The chapter moreover brings further discussion on the relationship between environmental sustainability and economic growth. Where these goals are presented as two opposite choices where only one can be fulfilled.



## 7. Discussion

### 7.1 Future of urban development in the Capital area

Discussing urban development in the past brings one to consider the future of urban development in the Capital area. A new regional plan for the Capital area is now under way and is close to being finished. The goals stated in the new plan are in many ways different from goals and aspiration stated in the currently valid plan. In terms of the structural characteristics that have been discussed in the previous chapters and shown in table 2, the new regional plan has some goals that are likely to increase the level of sustainability in the Capital area, should they be implemented.

The goals stated in the new regional plan are, practical or beneficial growth; effective transportation; and developing forward by being competitive. In terms of this, urban development is to aim in densification while emphasizing transportation modes that decrease resource and energy use, and further transportation modes that do not put more strain on the road systems. By this, facilitating public transportation, bicycling and walking. This is done in order to accommodate new inhabitants in the city, without assigning further strain on the road system. These goals are set to accommodate population growth and further growth in tourism, which has been quite fast in the last five years (Statistics Iceland, 2015). They are further set to decrease environmental degradation and enhancing public health. In terms of economic aspects, the Capital area is to be a competing urban area that should be able to compete for people, finance and investments internationally. Moreover, the plan promotes diverse economic structures and emphasizes innovation, new knowledge and the creation of value. The plan further aims in local production of food in the Capital's neighboring areas (AMCA, 2014).

In terms of environmental degradation caused by strategies in the regional plans, the new plan shows a new direction in transportation planning, which is likely to result in less environmental degradation. Densification further is likely to cause less environmental degradation. The size of the building stock is not discussed in the plan, nor the types of dwellings that should be emphasized. Therefore, the new regional plan is likely to result in less environmental degradation than the plan from 2001 and further, lesser environmental deration caused by capita than today. However, the economic aspect, here discussed as competing for investment, people and companies, which by definition is economic growth, is emphasized (AMCA, 2014).

Although plans have been made for densification, it should be mentioned that in the regional plan for 2001, goals of densification, mixed land use and a responsible use of land were also stated (nes Planners, 2002). However, urban development after the regional plan for 2001-2024 was approved had even lower density than areas that had been developed until then and further increased the amount of land allocated per capita, as discussed chapter 5. Therefore, urban development does not necessarily fulfill the strategies made in the regional plan and future development in the Capital area might even leave the region less sustainable.

It has been predicted that in 2040, the population in the Capital area will be between 267-280 thousand and account for approximately 67% of the Icelandic population (Alta, 2014a) compared to 64% today (Statistics Iceland, 2015). This is estimated to call for accommodating approximately 70 thousand new inhabitants in the next four decades. Further, it has been estimated that on average 2,3 inhabitants will occupy each apartment unit (Alta, 2014a). Because of this, the importance of building smaller apartment units is even more important, than just making them smaller for today's rate of inhabitants per apartment unit.

Because the only structural aspects suggested in the regional plan are densification and sustainable transportation, it seems unlikely that the plan, if implemented, will make the Capital area extensively more sustainable. Further, the fact that market ideology is likely to be emphasized because of the stated goal of competition; it seems likely that the goal of economic growth will be put in front of the goal of sustainable development, where there is a question of which goal to fulfill. Therefore extensive decrease in environmental degradation should not be expected (AMCA, 2014).

The regional plan for 2001-2024, has goals of both urban and economic growth; and sustainable development, where the municipalities in the Capital area managed to fulfill urban and economic growth while emphasis on sustainable development took the back seat. Although the new regional plan has a transportation plan that is likely to cause less environmental degradation per capita than the currently valid one, the plan still has goals for both sustainable development and; urban and economic growth. Therefore, in the case of the Capital area, as history and theory suggests, it is unlikely that goals for decreasing environmental degradation will be fulfilled at the expense of fulfilling economic and urban growth.

Statistics Iceland predicts that population growth in the Capital area might come to a stop in the middle of the 21<sup>st</sup> century, or even decline (Statistics Iceland, 2015). This is interesting, because this would mean that the Capital area has only half a century to accommodate growth for developing the region towards using less energy and resources per capita (Proppé, Personal Communication, 24.04.2015). This is because, structural characteristics of the region will in the end determine the extent of environmental degradation caused by each person. Therefore, the Capital area needs to use this era of development to develop the Capital area towards being more sustainable. Here development is seen as necessary to accommodate growth in population. In terms of this, it is important that the environmental degradation per capita does not increase but decreases.

## 7.2 Complications of implementing degrowth ideology in the Capital area

There are two problematic sides to applying degrowth ideology in the Capital area. Firstly, because it is difficult to change current social structures and secondly, because of the rebound effects the implementation of degrowth ideology can have.

### 7.2.1 Social and urban structures

In the Capital area, there are many strong social tendencies that go against degrowth ideology. The increasing size of the building stock is most likely due to private choice and further a higher standard of living in Iceland. According to Proppé (Personal Communication, 24.04.2015) the increasing size of the building stock and increasing quantity of apartment units is further due to increase in available funding, whereas it was quite easy to get a loan for construction in the growth years before the financial collapse. Proppé, also suggests that one reason for people's aspiration to live in suburban structures, in single-family buildings with courtyards and significant private space around them, to be connected to the fact that a large group of people have moved from more rural areas where single-family buildings with land or a yard around it is quite common. Further, culturally aspirations have developed towards having a single-family building and two automobiles in the driveway. It might thus be considered a cultural characteristic of the population to have enough space around them, although his aspiration and the idea of what the ideal life looks like seems to changing with new generations.

As mentioned using automobiles as a mode of transportation is quite dominant. It can be said that automobile use is quite deeply embedded in the population's norms and aspiration and can be said to be part of what people consider important for the ideal lifestyle. Further, it can be said that public transportation has in the last years, been seen by many as a second-class transportation mode. In terms of this, many would consider public transportation to be a transportation mode for poor people and teenagers. Moreover, this cultural aspect seems to be retreating, although this point of view is still quite common.

In the recent years, bicycling as a mode of transportation has grown and there has been prominent development in bicycling infrastructure in the Capital area. This development of bicycle infrastructure is planned by the municipalities in the Capital area, to continue. This development is prominent in terms of applying degrowth ideology. However, this development has not been without opposition, whereas many projects for improving facilities and infrastructure for bicycles has been meet with negative discourse. Where many see this as weakening the private automobile's position or compromising it. In terms of this, it seems people are afraid of losing their privileges.

Further opposition of implementing structural characteristics of degrowth ideology have been apparent. A recent example of this is that in the last years the municipal government in Reykjavík has approved to close the busiest part of the shopping street in the city center to automobile transportation, during the summer months. Each year when the closing has been approved by the municipal council in Reykjavík it faces opposition by politicians in the municipal council (Reykjavík, 2015) and further by the association of storekeepers in the shopping street (101 Reykjavík, 2015). Although, the legitimization of this association has been questioned and whereas not many shopkeepers are a part of this association. However, the association has been quite loud in its opposition.

In terms of this, implementing structural characteristics in accordance to the ideology of degrowth, can be expected to face considerable opposition in the Capital area. Social structure is here accounted as the major hindrance for the Capital area to implement structural characteristics and develop towards ideology of degrowth. However, mentality might be changing. This could be because the idea of what the ideal life might be changing. Further, the financial collapse might have influenced the population in some way. Perhaps, monetary aspects have become less important after the extensive GDP growth and consumption led to the financial crisis and the economy in Iceland to collapse. This is difficult to determine.

What can be said is that changes are often difficult. Challenging norms and social structures is furthermore difficult. In terms of this, it seems likely that when people are deprived of their benefits, opposition is likely to emerge. Most people want the luxury of having large apartments, an automobile and various commodities. In terms of this, it is important for society to determine what is actually the most important aspect of urban development; consumption or sustainability.

This change is further difficult because the economic system is global whereas, the Capital area and the rest of the country are a part of a system and further, Iceland is part of the global system. If the Capital area would fully cease to take part in this system of economic growth, it might lead to a crisis. Today's social system is internally connected whereas different sectors of society are dependent on growth. Such as the construction marked is built around growth where decreasing construction extensively is likely to result in unemployment that causes the government to have to pay more unemployment benefits that further influences other aspects of society. In terms of the global economy, it could become more difficult for people in Iceland to trade with other countries if they do not take part in the global growth economy. This aspect is beyond the scope of this project. However, it can be said that it is difficult for one region or

one country to cease taking part in the global economy where as these structures that are being reproduced are imbedded in society. A change from the growth economy could, as mentioned happen quickly or gradually. However, a change in social structures and urban development is needed if the goal of environmental sustainability is to be reached.

A global agenda might be important for this. Alternatively, one county might be able to set an example to some extent. However, degrowth does not have to start with a revolution. Degrowth can start with an individual or a society. It is an ideology where different components of it can be applied to society gradually. Degrowth can start small, by people consuming less of what they do not need. By reducing from having two cars in a household down to one, or deciding to live an automobile free lifestyle. Further, governments can set goals for small changes, such as densification and improve public transportation and facilities for bicycling and walking as a first step to degrowth and can then gradually reduce the resources required for urban development in a region.

## 7.2.2 Rebound effects

One of the most challenging aspects of planning for and implementing solutions for sustainable development is to plan and make alteration that actually decreased environmental degradation. This can be difficult because even though a solution decreases one aspect of environmental degradation it might increase another more extensively. Further, long-term effects of development or construction needs to be considered and not short-term gains or solutions.

As discussed in the theoretical framework various rebound affects can occur when energy efficient or other solutions that are to decrease environmental degradation are applied. That is, energy use increases even though buildings become more energy efficient. Rebound effects of eco-efficient solutions can be seen in the Capital area. In terms of Iceland, and the Capital area, where oil use for automobiles has increased despite automobiles becoming increasingly more environmentally efficient. In terms of this, people are likely to use more resources if it costs decreases.

As mentioned, the other major problem that needs to be managed in degrowth ideology is that when people use less energy and consume less they are likely to save up money that is then spent. This money could be spent on something that has even more environmental degradation than the degradation that was decreased by saving the energy or resources in the first place. In terms of the Capital area, if more people use public transportation, bicycle or walk most of their journeys, it is likely that this will make them spend less money for transportation. This money will then be spent on something else, such as traveling abroad or new commodities that might cause more extensive environmental degradation than caused by them using an automobile. For degrowth to be implemented these kinds of problems need to be managed. For this, work sharing has for example been mentioned. Further, it seems the economic system would need to be completely restructured for degrowth ideology to fulfill sustainable development completely. The details of how this should be executed is beyond the scope of this project.

It can be considered if developing new solutions is actually the best way for us to reduce environmental degradation. It is difficult to determine how much resources new solutions and technology will require. Further, if it would be better for sustainability not to develop new solutions for energy passive buildings and environmentally friendly automobiles. Odds are that we should not, because with more solutions and more technology in the last decades, environmental degradation has increased. In terms of this, it seems

plausible that the best way would be to decrease the resources used for urban development by consuming less, in terms of all aspects.

Degrowth ideology is not flawless and there are many aspects of it that need to be considered and orchestrated. The main importance is to reduce the resource use caused by urban development and the human population in order for the planet to be sustained. In terms of this, whether it is called degrowth ideology or something else, urban development and the earth's population in general needs to facilitate this important goal of sustainable development in order for us to sustain this finite planet.

### 7.3 Urban planning for degrowth

When it comes to degrowth, urban planning plays a large role. This is because urban planners can influence the built environment. In terms of this, urban planning and planners can influence the physical structures and determine how much resources are allocated for construction of the built environment; how resource demanding urban structures are during their operational stage; and further how much environmental degradation is caused by their demolition.

This means, planning for structures that induce sustainable mobility and urban development that require limited but adequate resource use. Urban planning needs to induce positive development. In terms of this, make structures that provide the wanted effects. By not planning for less of the same, as ecological modernization suggests with eco-efficiency as the Capital area has until now; but plan for something that is different like degrowth is. Applying degrowth ideology in planning and developing our cities is important if we want our cities to be sustained. This is because we cannot change the ecological limits of earth but we can change how we use earth's resources. For this, we need to have a clear vision of the importance of continuity, make plans that are beneficial for the earth to be sustained, and create a new society with new norms and social structures that allow us to live within the limits earth has. Moreover, we need to cease this goal of economic and urban growth and by this limit growth.

Urban planning can thus influence the built environment. However, if governments are not willing to make decisions on and approve plans for these structural characteristics this is difficult to implement. In the end, it is up to the elected officials what is planned and implemented. Further, if private developers are against implementing these structural characteristics they might be difficult to implement since developers also influence development.

There is a lot urban planning can do to implement degrowth if politicians, construction companies and the people agree with implementing these strategies. A change in social institutions, as mentioned, needs to be in place for new methods and ideology to be implemented in urban development. What planners can do is to make society aware of the consequences of different structural characteristics and try to have them implemented. However, if society is against it and the politicians prefer economic planning to planning for sustainable urban development, developing degrowth ideology into structures can be difficult. The limit for degrowth is thus if people or politicians agree with the importance of environmental sustainability and are willing to do what needs to be done in terms of this. Moreover, if they consider it to be important to make these structural changes to develop towards sustainable urban development.

Consumption of luxury and novelty is difficult for planning to manage. Urban planning can suggest limiting commercial building stock where square meters of building stock are limited to the population number in order for it not to exceed what is seen as appropriate. Lower number of square meters for commercial building stock, should result in less supply of commodity that should result in less consumption. However,

people's consumption is difficult to control. What planners can do is to make people aware of the results of this and the environmental degradation caused by it in order for people to have the information they need to make the best decision for their consumption.

Planning for structural characteristics of degrowth are today being implemented to some extent. Although they might not conceptualize as being implementations of degrowth ideology, densification and improvement in public transportation is today being implemented in many western cities. Every implementation that results in actual decrease in resource use and environmental degradation, not only changing in what way the environment is degraded, can be considered implementations of degrowth ideology. However, the actual implementation under the name of degrowth has not been applied to the author's knowledge. Nonetheless, some characteristics are planned to and have been implemented that should decrease resource use and environmental degradation. How effective the steps the Capital area plans to implement, is yet to be analyzed.

#### 7.4 Environmental sustainability versus economic growth

As this thesis has until now discussed, the relationship between economic growth and environmental sustainability is worrisome. As it is not possible to fulfill both while these two factors remain two of the most important goals stated by governments.

Because governments aspire to fulfill both of these goals, it is difficult to imagine that governments would be willing to compromise economic growth and economic development, in current form, to fulfill goals of environmental sustainability. Effects of economic development can emerge in short time periods and be effective in providing short-term benefits. Further, effects of emphasizing environmental sustainability is something that is less obtainable and the effects and further the importance of it can usually not be seen in the day-to-day routines. In terms of politics, economic growth is something that politicians can produce in the short term they have been elected for while promoting sustainability might not show them as being as successful. In terms of this, it is unfortunate that the goal that can be provided and showed to demonstrate successful development in a term has negative influence on environmental sustainability, and thus sustainable development.

In today's economic system, economic development is in many ways important for society to function. In order for people have food on their tables and a roof over their heads, they need to have income. For them to have income there needs to be something constructed, sold or a service provided. Further, to receive funding for construction projects and other projects in general, there needs to be an economic benefit for the investor. That is, the investor will in most cases require his investment to be beneficial and therefore will have to be paid back more than he or she invested in a project. The tendency is further to maximize the rate of investment. When one of the most dominant goals is to make a profit, it is difficult to develop more sustainable urban projects.

It seems difficult for politicians today to implement strategies for degrowth. If that is to be possible there has to be support from voters on the matter. One might ask if a politician has the chance to be reelected in today' political and economic environment, if he or she does not work towards developing economic growth and growth in the different sectors of society. Some aspects of degrowth ideology and the task of changing the economic system could lead to people losing their freedom to consume to the extent some do today. Extensive resource use has, in the world and in the Capital area, become a way of life. Many

aspects of urban development and transportation modes in the Capital area are a kind of luxury that people are likely to oppose to loosing.

In terms of this, the population would have to become aware of the importance of limiting resource use. People have to consider if they have the right to use up majority of resources in this time and age, not allowing future generations to have the same opportunities as we do today. One might wonder if humanity today can sacrifice their consumption privileges and luxuries for the coming generations. In terms of this, meeting present and future needs.

It is in many cases understandable that economic growth is fulfilled to provide people with jobs and for a region or country to be able to take part in today's economy of selling and buying goods and services. Although the extent of emphasis put on growth can in times be extensive and to the point of being destructive, not only for environmental sustainability, but also for social and economic sustainability. Because of this, economic aspirations need to be modified, and the way the economy works today needs to be modified in order for it to facilitate a healthy economy and environmental sustainability, and further sustainable urban development.

## 7.5 Summary

This chapter has brought forward some interesting aspects of the analysis. It has discussed and concluded in that the new regional plan has plans for some structural characteristics that can be expected to decrease the extent of the environmental degradation caused by the Capital area. However, the new plan aspires to fulfill both economic growth and sustainable development and therefore it can be expected that economic growth will be emphasized and implemented on sustainability's expenses.

The chapter further discusses that there are many complications of implementing degrowth ideology in urban planning in the Capital area, where social structures are encountered as the biggest obstacle of implementing sustainable development. Further, rebound effects are noted difficult hindrance to overcome when developing more sustainable urban area.

The chapter further discusses the role of urban planning in implementing degrowth ideology and determines that providing the information of the different effects structural characteristics have in terms of environmental degradation is one of the ways urban planning can contribute to the implementation of degrowth ideology. Further, if there is a will among people, politicians and companies to genuinely implement structures that lead to less environmental degradation, urban planning can provide knowledge of structural implementations for the urban environment.

The chapter concludes by more generally elaborating on the relationship between economic growth and sustainable development. Where it is discussed how economic growth, as a goal that can be fulfilled quite quickly and even easily, is usually implemented where goals for sustainable development, that is a long term goal that is more difficult for politicians to show that has been fulfilled, takes the back seat.

Now that the theoretical framework has been established, the analysis executed and discussed, it is now possible to answer the problem formulation and conclude with some reflections.

# FINAL INTERPRETATIONS

This final chapter will conclude the project by answering the problem formulation. Further, some reflections will be made on the project and its conclusions.



## 8. Final interpretations

### 8.1 Conclusion

With the growing importance of governments fulfilling economic growth and environmental sustainability, it seems unfavorable that these goals are in contradiction to one another. The Capital area is a good example of an urban region where economic and urban growth has been fulfilled while environmental sustainability is compromised. Urban development has influenced environmental degradation caused by the Capital area in Iceland extensively. This thesis has discussed this dynamic of urban growth and sustainable development with the goal of answering the following problem formulation:

*What are the limits to urban growth and how can the ideology of degrowth be implemented in urban planning, in terms of the building stock and transportation, to move closer to goals of environmental sustainability in the case of the Capital area in Iceland?*

The thesis has discussed the theoretical framework on how growth and sustainable development have been conceptualized in terms of urban planning. It discussed how sustainable development and economic growth are incompatible because resource use is embedded in the production of economic growth. It further, discusses the reason for emphasizing environmental sustainability to allow the earth to be sustained. It deliberates on the limits to economic growth, and growth in general, in terms of social and economic aspects but more importantly in terms of the environmental aspect of sustainability. Moreover, degrowth ideology is presented and discussed in terms of being a possible strategy for developing more sustainable urban areas. By implementing structural characteristics that require fewer resources than urban regions use today, in order to limit the environmental degradation caused by urban development. By this, answering research question 1 of how the limits to growth can be conceptualized in terms of urban planning and sustainable development.

The thesis further describes the different indicators that represent environmental degradation caused by urban development in the Capital area. The indicators show that urban growth in the Capital area since the mid-20<sup>th</sup> century, and especially in the years leading up to the financial collapse, resulted in the Capital area inflicting increasingly more environmental degradation and further, made the region increasingly less sustainable. In terms of this, increasing carbon emission per capita; increasing use of fossil fuel per capita; growth in waste disposal; growth in distances between facilities because of decrease in density; the increasing size of the building stock per capita; increase in detached buildings; with the increasing automobile ownership; and extensive construction in automobile infrastructure. Further, GDP has grown parallel to the indicators for environmental degradation. By this answering research question 2 of how the building stock and transportation has developed in the Capital area since the mid-20<sup>th</sup> century, and more specifically leading up to the financial collapse, and how this influences sustainability.

The comparison of indicators for the Capital area revealed quite interesting results. All indicators, that is indicators for environmental degradation and GDP, increased in the years leading to the financial collapse and further all declined after the financial collapse. Further, collapse in GDP and other indicators resulted in the Capital area causing less environmental degradation than when GDP was high, making the Capital area more environmentally sustainable. This implies that the financial collapse made the Capital area a more sustainable region and has had more positive effects on sustainable development than the strategies

applied to induce sustainable urban development. This leads to the conclusion that there is a defined link between environmental degradation and economic growth.

The data further shows that GDP is a poor indicator for prosperity in the Capital area. This is because it does not correlate with happiness in Iceland but does correlate with increased environmental degradation. In terms of this, a new indicator for prosperity is needed that does not induce environmental degradation but determines real prosperity.

Degrowth is here seen as a suitable ideology for increasing sustainability in the Capital area, by decreasing environmental degradation caused by the region. By this, implementing structural characteristics of degrowth and taking the steps to develop urban structures that require less resource use in their lifecycles. That is, decreasing the floor space per capita, building attached and multi-family buildings; densifying urban buildings and structures; emphasizing public transportation, bicycling and walking; reducing automobile use; and by this decreasing land and resources that are needed for urban development. As discussed an extensive part of the resources we use are allocated to urban development. In terms of this, it is here seen as important to apply urban planning with degrowth ideology in order to develop the Capital area, as other urban areas, towards being more sustainable. By this answering research question 3 of how the ideology of degrowth can be implemented in urban planning for the Capital area in order to move closer to goals of sustainability. By this, all three research questions that together form the problem formulation have been answered and for concluding this project, some reflections will be made in the following subchapter.

## 8.2 Reflection

As mentioned, the Capital area is a typical case that shows the dynamic between environmental and economic goals. This phenomenon of economic benefits being preferred over environmental benefits is a common one where environmental degradation caused by urban and human development in general is having an extensive impact on the planet.

Generally, in urban development, growth is accommodated while environmental considerations take the back seat. This emphasis on urban and economic growth is one of the most influential reasons urban development is causing increasingly more environmental degradation. The need to reduce the resources used for urban development is global. Further, degrowth ideology can be applied globally, both for urban planning and other aspects of society, to make it more sustainable in terms of environmental, social and economic aspects.

### Authors reflection

This project has a normative view (Allmendinger, 2009), in a way that degrowth ideology is seen as a normative approach to planning. In terms of this saying “how the world ought to be and provides ideas about how to achieve this state” (Allmendinger, 2009, p. 10). Accordingly, this project discusses sustainability as a goal to work towards and further suggests structures and solutions that should theoretically develop society towards being more sustainable. This project is written with the provision that the goal to strive for is sustainability. If sustainable development is not seen as an important goal or not a goal at all, this analysis would be irrelevant.

For this project, environmental sustainability is seen as one of the most important aspects of urban development. Because of this, other aspirations that society strives for could be seen as less important

for this project. This might influence the author to neglect other aspects of society. Here continuity is emphasized over short-term solutions. In terms of this, economic growth is seen as less important than sustainable development. Social sustainability is seen as important although it is not emphasized in this project. Economic sustainability is further seen as important whereas, economic growth and economic sustainability are not considered the same aspect.

The author further has a strong focus on degrowth as being a solution for decreasing environmental degradation. This might influence the author in neglecting other possible ways for developing urban regions to be more sustainable. Further, this project does not account for the full extent of the influences and problems that degrowth ideology might inflict. However, the author considers all implementations that decreases resource use and maintains development within earth's ecological limits and towards sustainable development to be positive.

#### Methodological reflection

The use of CR has been suitable for this research project. While the statistical data is used as the foundation of analyzing growth in the Capital area the qualitative data is important for conceptualizing growth to understand to some extent what causes these indicators to grow, and urban growth to occur. Further, the theoretical framework is crucial in conceptualizing the qualitative and quantitative data. CR is useful because it allows a combination of methods for positivism and social constructivism, which is important for this project whereas social structures cause effects that can be quantified. This method is useful because it is difficult to analyze the indicators for urban growth without understanding what causes them and what they mean to social life.

CR has thus been useful for analyzing the indicators, through statistical data analysis, and conceptualizing the data in terms of the social aspect of the urban environment, in terms of what causes the growth, and how growth influences other aspects of society. In terms of this using indicators for making a critical reflection on society and on urban growth.

CR has further been suitable for this research project because it considers the environment, excluding the natural and economic environment, as socially constructed. This is important for this project because it suggests societal changes for making structural change. For it to be possible to suggest these changes, it needs to be possible to make the changes to induce the desired effects. CR considers it possible to change social structures and suggests that we can decide if we reproduce these structures or change them.

#### Further research in terms of environmental degradation

Much research is to be done in order to display the effects of aiming for economic growth, in the current form, and for displaying the increasing environmental degradation caused by the human population. Further, for showing what can be done to decrease environmental degradation and to allow people to have the knowledge needed to make informed decisions in terms of urban development and development in general. Researching the influence consumption has in terms of urban growth in the Capital area has been interesting. However, there are various other aspects of environmental degradation caused by both the population in the Capital area, and in general for the Icelandic population. These are for instance environmental degradation caused by industries in Iceland. Where hydraulic power plants, aluminum plants and other industry that causes extensive environmental degradation have been constructed to accommodate economic growth in Iceland. Where current governmental plans aim in continuing this

development at the same time as being a participant of the Kyoto protocol and has, as other nations, goals of sustainable development.

Further researching environmental degradation caused by the Icelandic population, or population in the Capital area, that is outsourced to developing countries. This is interesting because a large portion of the environmental degradation caused by Icelanders is not accounted for within indicators registered for Iceland. As an example, natural areas allocated for food production in other countries; resource extraction of various and even rare materials; and emission from producing and transporting goods that are not registered as a part of environmental degradation caused by Icelanders, although the consumers are in the end Icelanders. Researching these aspects is further interesting for other countries, especially western countries where a large part of what they consume is produced in other countries.

Degrowth is an ideology that tackles these research subjects. It discusses how human development can become more sustainable in terms of the environmental aspects and for developing towards a prosperous life.



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## Appendix

### Appendix A: Empirical documents

This appendix shows and describes the empirical documents used in the thesis, in table i. The data is largely presented in chapter 3 and further applied through the thesis.

*Table i shows the empirical documents used for this research project.*

Laws and regulations	About the document
Planning and building act 73/1997	The first planning and building act. Established in 1997 and became effective in January 1998.
Planning regulation 90/2013	A planning regulation that further deliberates on planning laws.
Building regulation 441/1998	Building regulations that followed the planning and building act of 1997.
Building regulation 112/2012	An update to the original building regulation.
Road act 80/2007	Laws on the road infrastructure. Established in 2007.
Planning documents	
Svæðisskipulag höfuðborgarsvæðisins 2001-2024 Eng. The regional plan for the Capital area 2001-2024.	The currently valid regional plan for the Capital area. Approved December 19 <sup>th</sup> 2002.
Svæðisskipulag höfuðborgarsvæðisins 2015-2040. Tillaga til auglýsingar Eng. The regional plan for the Capital area 2015-2040. Proposition for approval.	The regional plan that is currently in development and expected to be approved in 2015.
Aðalskipulag Reykjavíkur 2010-2030 Eng. Reykjavík's municipal plan for 2010-2030.	The municipal plan for Reykjavík, the capital city, approved November 26 <sup>th</sup> 2013.
Reports	
Höfuðborgarsvæðið 2040: Umhverfisskýrsla fyrir tillögu að svæðisskipulagi Höfuðborgarsvæðisins 2015-2040. Eng. The Capital Area 2040: Environmental report for a proposal for the Capital area's regional plan 2015-2040.	Appendix IA, for the new regional plan for the Capital area (2015-2040). The report is an environmental impact assessment for the regional plan.
Umhverfismat tillögu að svæðisskipulagi. Mat a sviðsmyndum um þróun nýrrar byggðar. Eng. Environmental impact assessment of the regional plan. Assessment of different scenarios in developing new urban areas.	Appendix IB, for the new regional plan for the Capital area (2015-2040). The report discusses urban development in the Capital area.

Vaxtasamningur fyrir höfuðborgarsvæðið: Þróun og framrekningur íbúafjölda á höfuðborgarsvæðinu.  Eng. Growth contract for the Capital area: Development and population predictions for the Capital area.	Appendix III, for the new regional plan for the Capital area (2015-2040). The report discusses population development in the Capital area.
Vaxtasamningur fyrir höfuðborgarsvæðið: Höfuðborgarsvæðið og hagkerfið.  Eng. Growth contract for the Capital area: The Capital area and the economy.	Appendix IV, for the new regional plan for the Capital area (2015-2040). The report discusses economic aspects of development in the Capital area.
Skipulagstölur og umferðarspá; Fylgirit IX af forsendum svæðisskipulags höfuðborgarsvæðisins.  Eng. Numerical planning data and traffic estimates. Appendix IX for the regional plan for the Capital area 2015-2040.	Appendix IX, for the new regional plan for the Capital area (2015-2040). It describes traffic productions and transportation matters for the Capital area.
Ferðir íbúa höfuðborgars: Heildarskýsla Október - desember 2011.  Eng. Journeys made by inhabitants in the Capital era: Full report October-December 2011.	A report on journeys made by inhabitants in the Capital area, by a company that provides services in gathering statistics and conducting surveys.
Staðardagskrá 21 á Íslandi: Lokaskýrla um samstarfsverkefni Sambands íslenskra sveitarfélaga og umhverfisráðuneytisins 1998-2009.  Eng. Agenda 21 in Iceland: Final report on collaboration between the AMCA and the Environmental Agency of Iceland 1998-2009.	A report written by the former manager of Agenda 21 in Iceland on the development of this project.
Skipulagsmál á Íslandi 2014: Lykilmælikvarðar og fyrirliggjandi áætlanir.  Eng. Planning in Iceland: Key indicators and established plans.	A report published by the INPA in Iceland, as an appendix for developing the Icelandic national plan that is currently in process of being approved.

## Appendix B: Statistical data for the case information and analysis I

This appendix describes statistical data used in chapters 4 and 5.

### Population in Iceland and the Capital area

For establishing full rows of population growth in the Capital area and in Iceland, it was necessary to use two data collections, which are from the same source. The data that overlapped from the two data rows were not the same and had a deviation between 1 and 63 people. For this data, the average between the two was used in for establishing the data for population development in Iceland and in the Capital area. All population data is for December 1 each year, except the data for 2014 in the Capital area, that had to

be obtained separately and applies for the fourth quarter of the year 2014, meaning December 31, where the population count is rounded to ten. These devotions are small and do not affect the quality of the data in terms of this project.

### Economic growth

Figure 6 shows GDP index or economic growth in Iceland. Excel was used to make a line graph by using data from Statistics Iceland.

Figure 7 shows the contribution of different sectors towards GDP in Iceland. This data is also from Statistics Iceland. The figure shows percentages how much each sector has contributed towards GDP in the years 1997-2014. There were other sectors that contributed and are not shown in this figure, and therefore the added value for each year is not 100%. This is because putting all sectors into the graph would have made the graph less readable and therefore, only the most relevant ones are shown in figure 7. Figure i, below further shows the full extent of sector contributing to GDP in Iceland.

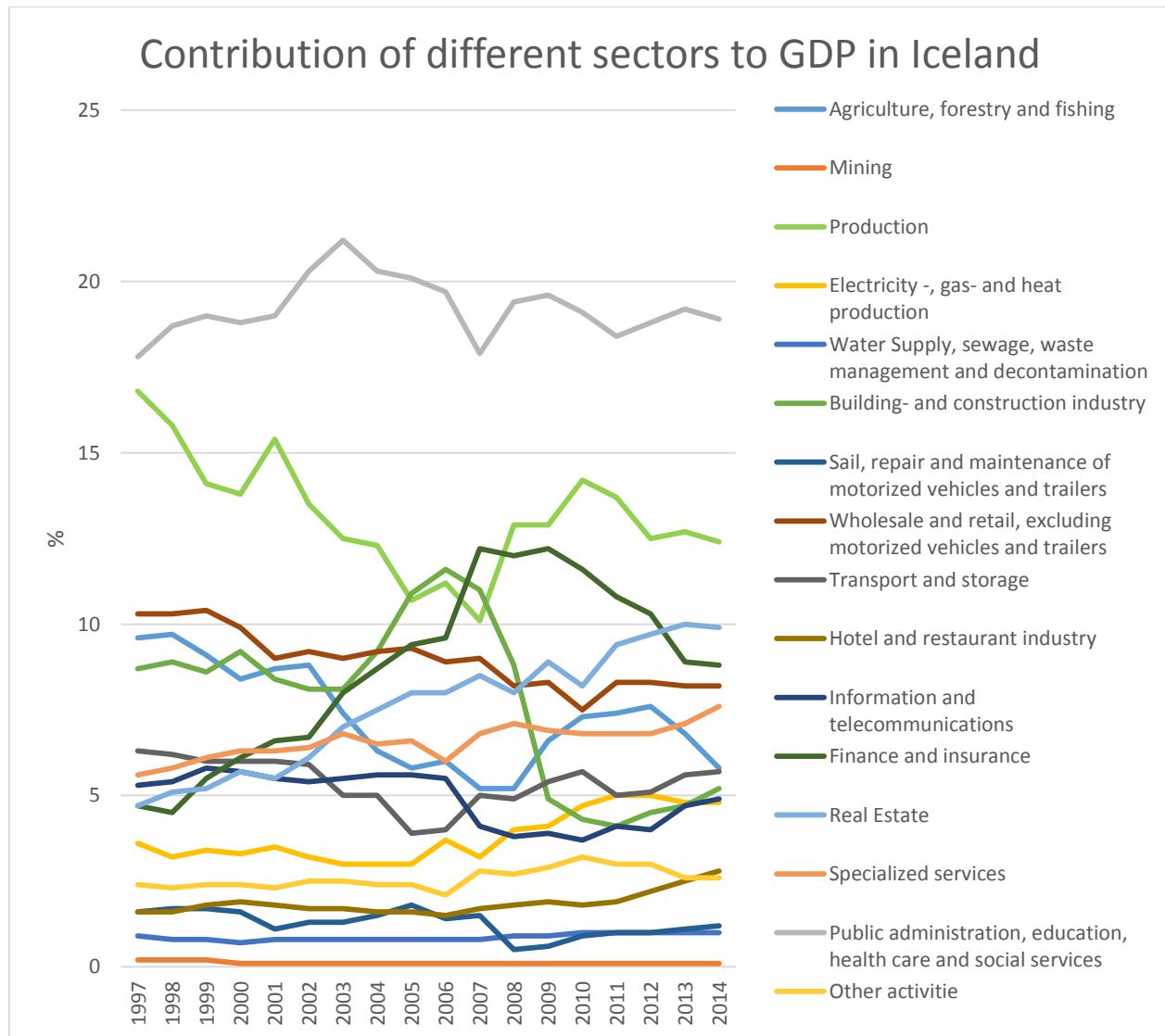


Figure i shows the contribution of different sectors towards GDP in Iceland (Statistics Iceland, 2015).

## Carbon emission

Figure 8 shows carbon emission each year per capita in Iceland. It was made by dividing total emission each year by the number of inhabitants each year, for each of the sectors. This makes it possible to show changes in carbon emission while taking into account changes in population numbers. Figure ii below, further shows total carbon emission without taking into account changes in population numbers. It can be seen that growth in total emission in Iceland has been even steeper than for emission per capita.

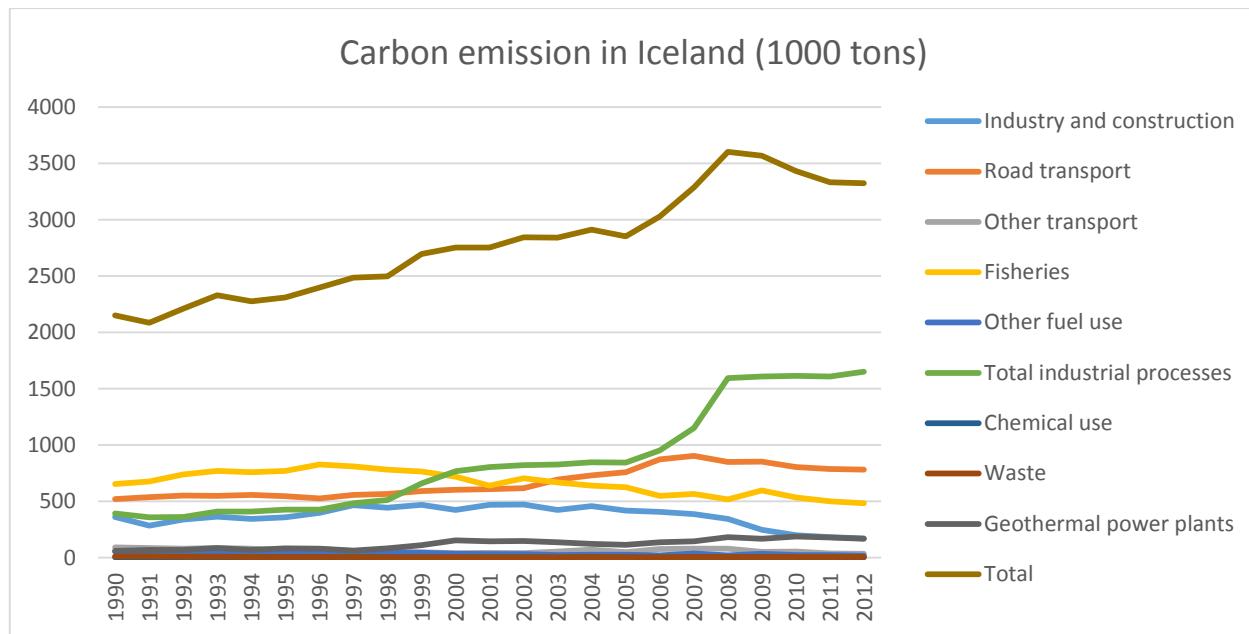


Figure ii shows total carbon emission for Iceland in 1000 tons (Statistics Iceland, 2015).

## Fossil fuel

Figure 9 shows kilograms of oil used per capita in Iceland, in total and for different categories. The graph is made by dividing the liters of oil consumed by the number of inhabitants in Iceland each year. In terms of this, using data from the National Energy Authority and Statistics Iceland.

Figure iii, below, further shows total oil use in Iceland per year. It shows that the quantity of oil used by the Icelandic nation has increased more than consumption per capita.

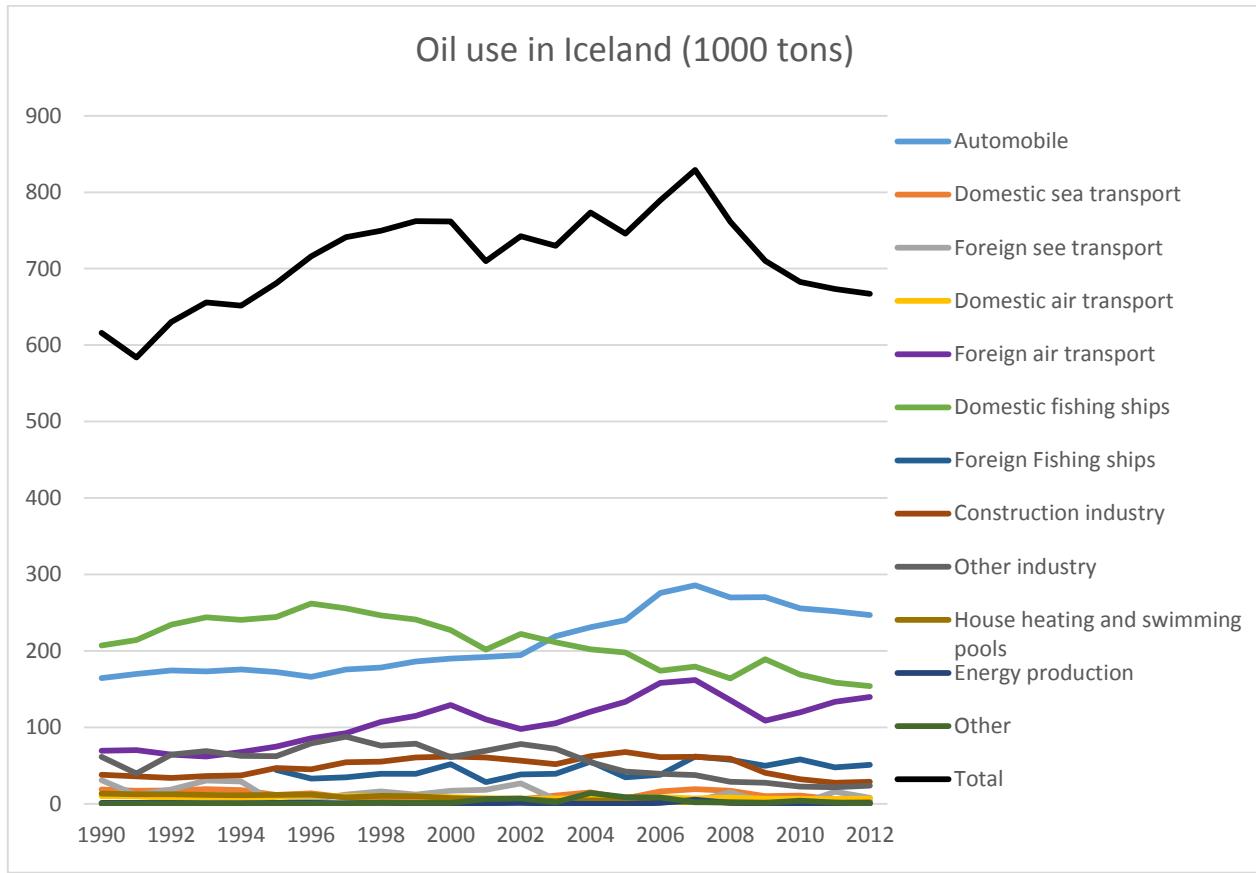


Figure iii shows total oil consumption in Iceland in the unit of 1000 tons (National Energy Authority, 2015).

### Waste disposal

Figure 10 shows waste disposal per capita in the Capital area. The figure was made by using numbers of kilograms of waste from the waste company, Sorpa, and dividing them by the number of inhabitants in the Capital area each year.

Figure iv, below, further shows the total waste produced in the Capital area in the years 2001-2013. It further shows that growth in total waste disposal is even steeper than growth in waste production per capita.

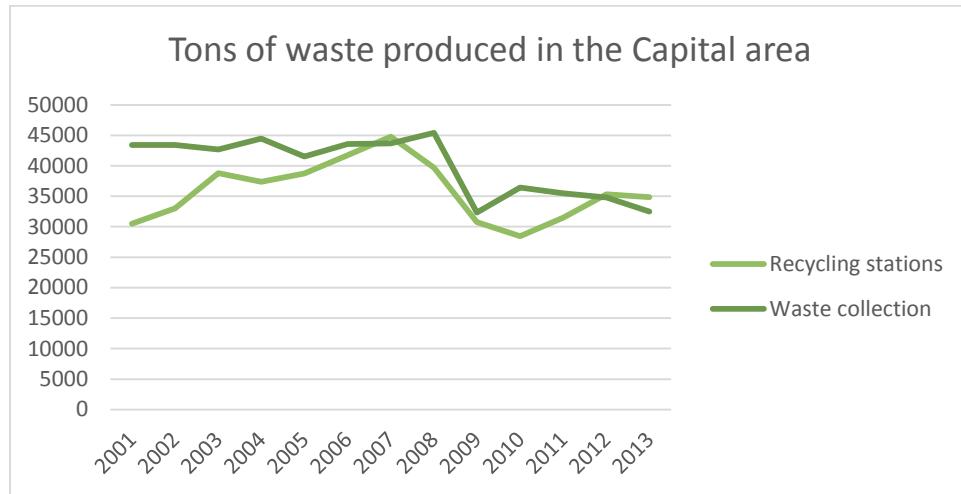


Figure iv shows total waste consumption in the Capital area, in tons (Sorpa, 2015).

### The building stock

Figures 13 and 14 show how the building stock for residential and commercial buildings has developed. They are constructed by dividing the total square meters of each category each year by the number of inhabitants per year.

The limitations of these numbers is that within them are the total square meters of the building stock. This means the shared spaces and everything built. For example, in residential buildings that would mean hallways and shared areas in multifamily buildings. However, these numbers are useful for seeing change between years. Moreover, resources are needed for constructing these shared spaces in buildings and therefore it makes sense to include them.

It can be said that there is a lack of registration in this subject. These numbers were the only numbers suitable indicating the building stock. Therefore, more information of development in the building stock would have been beneficial for this project. However, they are not available.

### Transportation

The data for automobiles in the Capital area is for automobiles with 8 passengers or less. This data, shown in figure 15, is used because most automobiles used for private use are automobiles in this category and therefore a suitable indicator to show automobile ownership in the Capital area. It should be mentioned that total number of automobiles in the Capital area is higher, whereas busses and large transportation automobiles are not included in this data.

## Appendix C: Raw data for the building stock.

All statistical data in this project except data for the building stock is publicly available online. Because the data is not available online, it is displayed in this appendix in table ii. This data has been calculated further in context of population growth for figures 13 and 14 in chapter 5.

*Table ii shows original data for square meters of building stock (Registers Iceland, 2015a).*

Year	Square meters of building stock	
	Residential	Commercial
2000	8.725.797	3.047.529
2001	8.979.959	3.207.509
2002	9.242.492	3.284.711
2003	9.531.119	3.376.213
2004	9.770.171	3.403.096
2005	10.152.687	3.482.596
2006	10.486.275	3.675.917
2007	10.964.509	3.910.914
2008	11.306.941	4.119.318
2009	11.353.028	4.272.102
2010	11.400.953	4.240.334
2011	11.420.763	4.248.791
2012	11.472.144	4.237.551
2013	11.560.776	4.215.480
2014	11.651.941	4.204.627

## Appendix D: Statistical data for analysis II

Appendix C shows statistical data used for analysis II. This chapter shows how the data was used and further an alternative display of the data. The aim of this project is to show a realistic comparison of the indicators. However, it can be difficult to compare the different indicators that have very different units. Because of this, alternative presentations are shown in this appendix, in an attempt to provide the most candid and impartial comparison of the indicators.

### Comparing the curves

As discussed in the text, figure 16 is only for comparing growth and decline in the indicators. Another way this was attempted is to show indicators as a percentage of the highest value for the time period, shown in figure v, below. This is the same as was done for comparing GDP and Happiness and for GDP and carbon emission, in figures 17 and 18. This alternative way of showing the comparison is hereby show, in figure v below. However, it is seen as to crowded for using in the analysis.

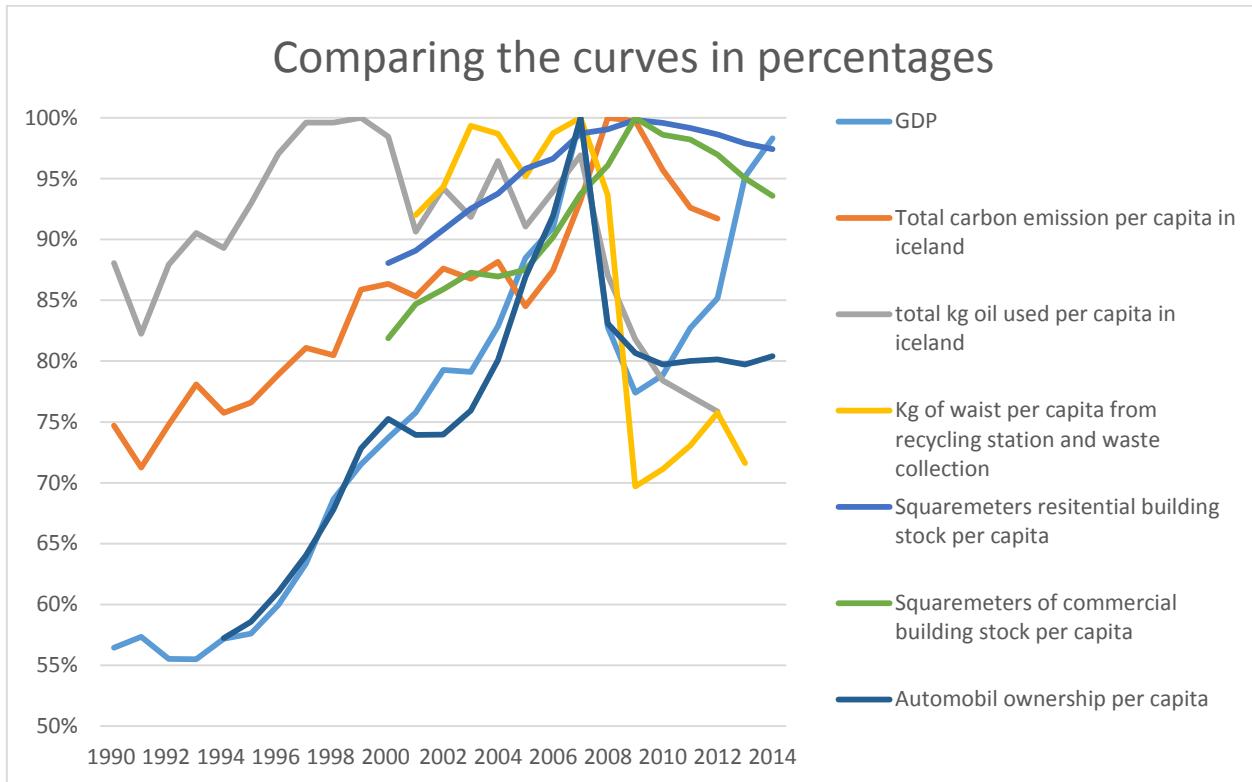


Figure v shows indicators discussed in analysis II in order for the growth curves to be compared. The values are shown as a percentile of the highest value for comparison (Statistics Iceland, 2015; National Energy Authority, 2015; Sorpa, 2015; Registers Iceland, 2015a; Icelandic Transport Authority, 2015).

### GDP and happiness in Iceland

Figure 17 shows a comparison of growth and decline in happiness and GDP in Iceland between 2003 and 2014, as a percentage of the highest value. It should be mentioned, that the values shown are the only ones available. Here it is difficult to compare these different indicators. Another way to compare them is as shown in figure vi, below, where GDP is divided by 10 in order to fit in a similar range as indicator for happiness. The problem with figure vi is that the maximum possible value for happiness is 10. However, the indicator never reached the level 10. Because of this, comparing them as a percentile of the highest value was considered the most appropriate way of displaying the indicators in the analysis.

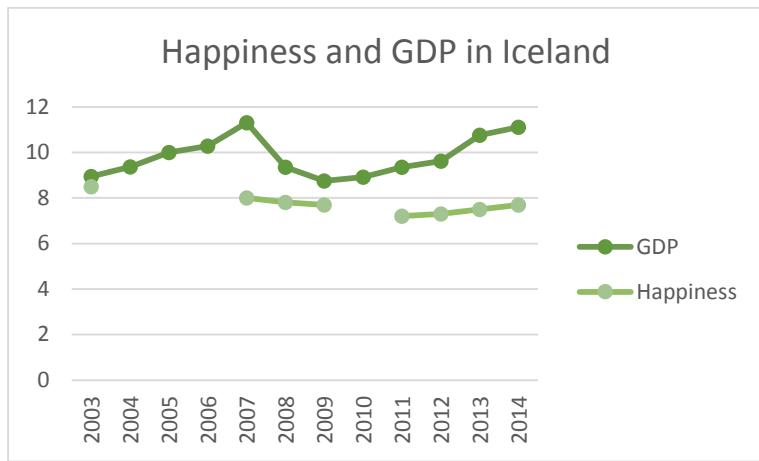


Figure vi shows a comparison of GDP and happiness in Iceland, where GDP has been divided by 10 to suit the range (Statistics Iceland, 2015; Guðmundsdóttir, 2015).

### GDP and carbon emission in Iceland

Figure 18 shows the comparison of GDP and total quantity of carbon emission in Iceland. In figure vii, below, the indicators are shown, as the comparison of happiness and GDP, as a percentage of the maximum value in order to more clearly show correlations in growth and decline. Total quantity of carbon emission was used in the analysis because the correlation was stronger. Total carbon emission was further selected because this is quite a common way to compare the indicators within literature of degrowth. Comparison of GDP and carbon emission per capita is thus shown in figure vii below in order to show the full extent of comparison and for the reader to be able to see these two ways of comparing the indicators.

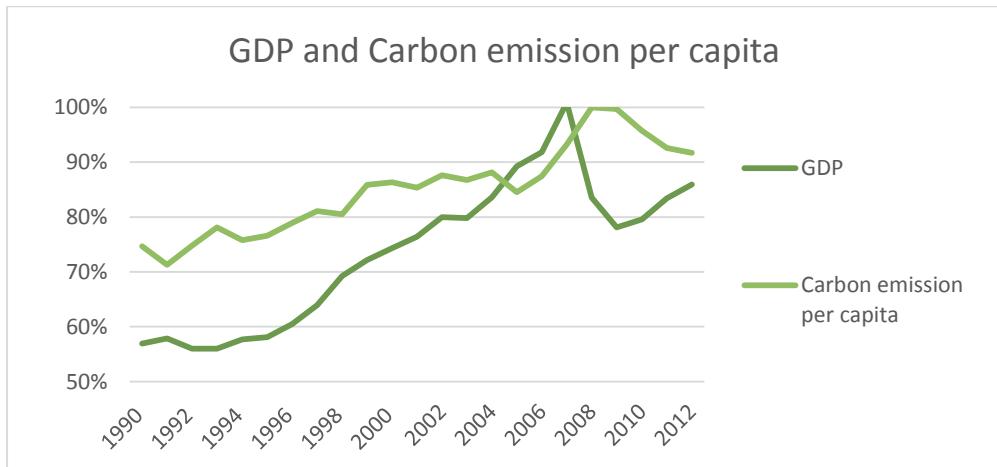


Figure vii shows comparison of GDP and carbon emission per capita in Iceland (Statistics Iceland, 2015).

## Appendix E: Interview questions

This appendix shows the questions Proppé was asked. They were originally in Icelandic and have been translated in order to be displayed in the appendix.

Interviewee is Hrafnkell Proppé, who is the director of planning in Capital area, at the AMCA. The interview was conducted on the 24<sup>th</sup> of April, 2015.

The following questions were asked:

1. What do you consider the main influences for urban growth in the Capital area in the last decades?
2. Do you think that laws and regulations or changes to them have influenced urban planning and urban growth in the Capital area, in the last decades?
3. Do you consider the system as facilitating and inducing automobile use as a mode of transportation?
4. Would you say that economic growth and environmental sustainability are goals for the municipal governments in the Capital area?
5. How has Agenda 21 influenced urban development in the Capital area?
6. Does the AMCA and governments in the Capital area consider economic and urban growth; and environmental sustainability to be compatible?
7. Can you recommend someone that it could be interesting for me to interview on the subject?
8. Can I contact you again if I need further information?

