Complex urban systems and urban structure plans: how can they work together?

Lessons from the city of Antwerp

Author:	H.W.G. (Gijs) Textor s2250055
Study:	Master thesis infrastructure and environmental planning
Faculty:	Faculty of spatial science
University:	University of Groningen, the Netherlands
Supervisor:	Dr. W. S. (Ward) Rauws
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Preface

You are about to read my final thesis of the master program environmental and infrastructure planning at the University of Groningen. This thesis discusses the flexibility and adaptivity of urban structure plans and how these plans can help cities to grow to their maximum potential. My interest in this subject was immediately aroused when I took the course by Dr. De Roo about planning theory. In this course the complex system was introduced and how we as planners should work with this concept. With this concept combined with adaptive thinking in planning, which was introduced by Dr. Rauws in the course EIP Interactive Workshop, my thesis topic became clear immediately. This thesis, which I worked on with great pleasure, could not be written without the help of a couple of people: in this preface I want to thank these people.

First of all, I want to thank my supervisor Dr. Rauws. Thank you for your time and critical reflections on this thesis the past year. Especially the theoretical insights and feedback on the conclusion and discussion enhanced the end result of the thesis to an academically grounded research.

Secondly, I want to thank the interviewees who were willing to spare some time for the interviews and were willing to share their knowledge with me. The empirical case study on the structure plan of Antwerp could not be possible without their generosity. Last but not least, I want to thank my brother and girlfriend for helping me with rewriting the text a couple of times.

Abstract

Cities are planned by urban structure plans. This is done to get the most profit out of the potential space specific qualities that are present in an area. Without these urban structure plans it is hard to profit from these potential qualities because these potentials can be easily overlooked.

A city is a complex urban system and because of this, planning in cities has a lot of uncertainties. For an urban structure plan these uncertainties are difficult because circumstances change over time. To integrate the changing circumstances of our society in urban structure plans, urban structure plans need to become more flexible and adaptive. For example, flexibility gives the design of an urban structure plan the space to put forward or postpone certain decisions or projects, and adaptivity gives the design of an urban structure plan the possibility to be responsive to changes that were not included. In this thesis these aspects are further elaborated on to understand how urban structure plans can support a complex urban system better.

To conduct this research, different questions were created. These questions are answered upon through a literature study, a desk research, and interviews on the case of the structure plan of Antwerp. The research indicates that different tools for public planners come forward in the urban structure plan of Antwerp. These tools are: starting images; the ability to bring forward or postpone; and using fewer rules and more plans of a smaller scale.

To conclude, it seems that a city development plan (urban structure plan) can be better equipped to support the adaptive capacity of a complex urban system in a western European context. Most likely, this can be accomplished by providing room for uncertainty through the implementation of the following tools: starting images; the ability to bring forward or postpone; and using fewer rules and more plans of a smaller scale.

Keywords:

Complex urban systems, Urban structure plans, Flexibility, Adaptivity, Strategic structure plan of Antwerp.

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1. Introduction

1.1 Structure plans and complex urban systems

The project of "De Blauwe Stad" in Groningen, the Netherlands, is a big financial failure. This housing project started in 2004 and should have been an economic boost for the eastern region of Groningen (Rauws et al., 2014). Because of the stagnation of the housing market, which was a result of the financial crisis in 2008, only a few housing plots were sold. The consequence: a loss of 29 million Euros for the Province of Groningen (Gemeente Groningen, 2013).

This example of "De Blauwe Stad" shows that structure plans often are difficult to manage and are vulnerable to change. In this research, that examines structure plans in city regions, the environment is very likely to change because a city region is a complex urban system. The tension between a structure plan and a changing environment is what this research is focused on.

To reduce this tension, new styles of planning are introduced to the planning process with the aim to be more participative. These styles include serious gaming (Poplin, 2012), the actor relational approach (Boelens, 2009; Boelens, 2010), and many more. A number of these new styles refer to a different manner of participation of different actors in the planning process. Serious gaming refers to the process of more public participation through online games in urban planning (Poplin, 2012), and the actor relational approach includes a way of urban planning where a planner needs to work with existing coalitions and networks (Boelens, 2010). All these styles were introduced because actors wanted to have more influence in urban planning.

Within these new styles and a more participative approach the developers of structure plans struggle with finding the right balance between flexibility and robustness in a structure plan. Nowadays, flexibility is more important than ever, as our society becomes more and more complex (Albrechts, 2010; Albrechts & Balducci, 2013). The increase in complexity is a result of the rapidly increasing changes in, among others, technologies, production processes, and cultures. Because of this increase in complexity, changes are more difficult to predict and uncertainties are becoming bigger. In this context, a structure plan needs to be altered to a plan that is flexible (can change over time) because otherwise it is likely that the structure plan will interfere with the fast changing dynamics that are present in an area.

The structure plan of Amsterdam offers another example of this struggle between flexibility and robustness. In the structure plan of Amsterdam the robust side of the structure plan is well elaborated. A good vision of quality of life, infrastructure, accessibility and economy is drawn (B&W van Amsterdam, 2003). However, on the other hand, the flexibility aspect of the structure plan of Amsterdam is not well developed and due to this not well prepared for change (Stuurgroep Ruimtelijke Investeringen, Verkeer & Vervoer, 2003). In Amsterdam several housing projects were more expensive than expected. Because of this, money that was reserved for projects in the future was used earlier (Stuurgroep Ruimtelijke Investeringen, Verkeer & Vervoer, 2003) and due to the fact there was not much room for change in the structure plan of Amsterdam, this led to a big hole in the budget. This end result was problematic for the city of Amsterdam and could have been prevented if the structure plan of Amsterdam was more flexible and thus could have adapted to the contextual changes.

Out of our complex society the concept of uncertainty follows. In the last century uncertainty has become an accepted concept in the planning discipline (De Roo, 2010). Uncertainty shows us that relations or circumstances in our world are not always linear, and therefore are difficult to predict. Often relations or circumstances change and this so called nonlinearity brings us back to the

importance of flexibility. Including flexibility in structure plans is a way for planners to make a structure plan more supportive for its dynamic environment considering it can give room to unforeseen changes. An example of a flexible plan that has worked so far is the "Open Lab Ebbinge" in Groningen in the Netherlands (Bergevoet & Tuijl, 2013). The goal of the project is to upgrade an undeveloped area through flexible local initiatives that can be replaced over time with permanent construction of housing (Open Lab Ebbinge, 2016). This plan shows that through a more flexible approach the tension between structure plans and its dynamic environment can be reduced.

So, flexibility is important to cope with uncertainties, but flexibility alone isn't enough. Robustness is also very important in a structure plan because it includes visions that give certainty to the area that needs to be developed. A vision can be very effective to inspire, trigger and motivate stakeholders and other people that are involved in the process (Rauws & Dijk, 2013). Without a clear vision or ambition, it is hard to see the potential of an area. With a strong vision, different parties can be persuaded to think in a collective direction or to develop their own ideas of an area. An example of a strong vision is the structure vision of Amsterdam 2040. This vision emphasizes being economically strong and sustainable. The municipality wants to inspire, trigger and motivate stakeholders and other people that are involved with the four movements: making the centre bigger; green in the city growing in importance; "het IJ" (the river area) becoming more important and the south part of Amsterdam becoming more international (Van Poelgeest, 2011). Certainty in a structure plan is important because it can lead to stimulation of investment (Rauws et al., 2014), creating public support, and creating political support. Without these three crucial elements it is difficult to get a urban structure plan accepted and implemented.

Out of this struggle between flexibility and robustness new views on structure plans are constructed. Several authors agree that for structure plans to succeed in a complex world the traditional structure plans need to become more flexible (Alfasi & Portugali, 2007; Albrechts, 2012; Holcombe, 2012; Rauws et al., 2014; Moroni, 2014). In this thesis all these different ways of thinking are combined to get a broad view on the knowledge of the new way of thinking about city development plans (urban structure plans), and how these plans can be adjusted in such a way that they are able to support the development of complex urban systems better. Important for this research are the urban codes that are used by Moroni (2010), they give a new view on how city development plans can be made applicable for a more and more complex society.

This research aims to contribute to the discussion on how city development plans (structure plans) can be more supportive of the complex reality of our world. This is especially interesting because city regions become more and more important due to the increase in urban areas (Florida, 2010) and the economic value that these areas generate. Out of the new views on structure plans that are mentioned in the previous section, a theoretical framework has been created that can help with viewing city development plans (structure plans) in a more flexible and adaptive way. In this research the theoretical framework is tested with help of the structure plan of Antwerp of 2006 and its revisions. As a result of this 'testing', new opportunities to approach a complex urban system in the plan of Antwerp are addressed and discussed. This research hopefully shows different opportunities for planners to improve city development plans in the future.

1.2 Objective

The goal of this research is to understand how urban structure plans can support complex urban systems, in order to develop a more flexible and adaptive structure plan that retains its robustness. This is a difficult task because, traditionally, structure plans have a strong emphasis on robustness (Albrechts & Balducci, 2013), and with robustness alone it is difficult to incorporate the unpredictable changes that often occur in a complex world. Increasing the level of flexibility and adaptivity can be a way to make room in a plan for these changes. With a structure plan that has both robustness and flexibility, the space specific advantages can be retained and changes over time can be included.

1.3 Research questions

Out of the objective the following main question is formulated:

How can the adaptive capacity of city development plans be increased to more fully support a complex urban system in a Western European context?

To answer the main question the following sub-questions are formulated:
- What are the strengths and weaknesses of traditional urban structure plans in dealing with uncertainties?
- How can a complexity perspective inform a city development plan to increase its adaptive capacity and in this way be more capable of supporting a complex urban system?
- Which elements that support the adaptive capacity of a city development plan can be identified in the structure plan of Antwerp of 2006, and how do these elements work?
- Which lessons can be identified on how public planners can strengthen flexibility and adaptivity in urban structure plans?

1.4 Case: Structure plan of Antwerp

In this study, theories about structure plans and complex urban systems are applied to the case of the structure plan of Antwerp. The structure plan of Antwerp is interesting for this research because the plan experiments with the new views on structure plans and is seen as a first step in a new chapter of more flexible and adaptive structure plans.

In the plan of Antwerp there are three main aspects that make the plan interesting for this research. Firstly, the structure plan of Antwerp is flexible in a way that it includes urban development strategies without end images. The different sections of the plan have a dimension of vagueness. This means that some elements are left open so that other actors can fill in these spots later on, while staying within the framework that is given by the strategies (Fini & Pezzoni, 2011). Secondly, the structure plan of Antwerp involves the citizens in the planning process and acknowledges that citizens possess a great deal of knowledge (Fini & Pezzoni, 2011). Finally, the structure plan of Antwerp has been evaluated extensively. With the start of the plan in 2006 (Lorquet, 2012), four different design bureaus including BUUR (2014) have helped to make the plan suited to the problems that this region will be facing in the years to come. These evaluations can give more insights in the structure plan and on how it includes flexible and adaptive processes.

Initially the structure plan of Antwerp was made to cope with the complex urban issues of Antwerp and to give the city a new image (Fini & Pezzoni, 2011). This was necessary because a large part of the population had abandoned the city in the last few years and there were no strategies to prevent the view of a closed city in decline (Fini & Pezzoni, 2011). Out of the structure plan of Antwerp five fields of improvement came forward. These improvements are: "De Schelde" as a core structure; water as the binding element of nature areas; a green webbing; the liveability of the surroundings of the "Albertkanaal"; and transport within the whole city (Lorquet, 2012). "De

Schelde" has a strong strategic aspect in the plan because it includes different programs of international level, but also quality of life. This area lies next to the former port areas in the north and the south of the city and encloses the city centre and the main station (Lorquet, 2012). In the "soft core" the watercourses and the channels must be the binding element between the five park structures. This park structure binds "De Schelde" with its hinterland and is called "De Groene Singel". "De Groene Singel" brings the big parks closer to the city centre and is accessible for cyclists and pedestrians (Lorquet, 2012). The last area of improvement is the "Albertkanaal". In this region both banks of the channel will be upgraded in terms of living, working, and recreational space (Lorquet, 2012). The infrastructure of the city will be improved with higher and bigger bridges across the channel and with many road improvements and expansions (Lorquet, 2012). Thus, the structure plan of Antwerp has been made to improve the spatial quality of Antwerp in a way that makes people want to live in the city again, while also attracting companies to the city.

For this research, studying the structure plan of Antwerp provides insights into the ways that ideas about urban structure plans and complex urban systems should or should not be implemented. The goal of the case study is to test if these ideas are present in practice and what their impact is in reality.

1.5 Thesis structure

The thesis is structured in the following order: the theoretical background of the concepts of urban structure plans and complex urban systems are addressed in chapter two. With this, sub-questions one and two are answered and a conceptual model is build that shows how urban structure plans can be more supportive of complex urban systems. In chapter three the methods that are used in this research are explained and discussed. Thereafter, the case study of the structure plan of Antwerp is situated, examined and discussed in chapter four. This is done by conducting interviews with professionals, civil servants and consultancy offices. With this information, sub-question three is answered. In chapter five the results of the different sub-questions are discussed and interpreted. An important aspect of this chapter is that the empirical findings of sub-question three are complemented by the literature study of the first two sub-questions. With these complements of empirical findings and theory, sub-question four is answered. At the end of the conclusion the main question is discussed and answered with the knowledge of the four sub-questions.

2. The urban structure plan and complexity

In chapter two the link between structure plans and complexity is made. A new framework for urban structure plans is presented and at the end a conceptual model provides a clear image of all the main aspects of the chapter.

2.1 The urban structure plan

The origin and development of the urban structure plan over the years, and the advantages and disadvantages of urban structure plans are described in this section. In the following chapters this background information, as well as the introduced definitions, are used to explore how the original urban structure plan can be adjusted to a structure plan that is able to more fully support a complex urban system. In this research a traditional urban structure plan is seen as: 'a time-bound spatial vision on a specific area' (Rutgeers 2005, p. 34). This definition can be divided into three parts: time-bound; spatial vision; and a specific area. Time-bound means that a structure plan cannot change extensively over time. It is this aspect of the definition that this research examines. The second part, spatial vision, includes the common goal, ambition, and ideals of the plan maker or makers. This second part is crucial in a structure plan because it is hard to reach certain expectations without them. Setting expectations can be done by multiple actors that are involved in the area and is also called the robust side of an urban structure plan. The third part, a specific area, means that an urban structure plan is always spatially oriented. It always focuses on a specific area because it uses the place-specific advantages of an area.

2.1.1 The Origin of urban structure plans

Formulating urban structure plans is a core aspect of the planning discipline (De Roo, 2010a) that began somewhere in the 18th and 19th century. In this time, urban structure plans were the core of city planning. This can be seen in the structure plans of Lisbon in 1755, Edinburgh's New Town in 1766 and Boston in 1820 (Platt, 2014). However, in the middle of the 20th century the structure plan began to lose its popularity (Neuman, 1998). Scholars and practitioners began to critique this kind of planning because the idea was born that the planning process was more important than the plan itself (Davidoff & Reimer, 1962). Over the years more and more authors began to focus on the process side of planning (Healey, 2003 ;Innes, 1996). The structure plan was no longer as important as it was in the 18th and 19th century. The most likely cause of this shift was that our world was becoming more complex (Albrechts, 2010) and the structure plan could not cope with this change in complexity.

The traditional urban structure plan was made from a top-down perspective and had three main values that should be protected. These values were and still are: social values, market values and ecological values (Kaiser et al., 1995). Social values consider connections between the physical environment and the quality of life. So, this involves how people appreciate their environment and because each person is different and appreciates different elements in their environment social values are different. Market values means that the land should be put to its optimal use. This is important for a good and strong market. However, it does not fulfil all the needs of the different actors of an area. Because of this, the government should keep an eye on the different processes that are taking place, to correct the market failures. Ecological values are about the role of the natural environment in human lives. Ecological values are important for the health of the people themselves; for the existence of the human race and for the existence of the earth. It is of utmost importance that these values keep existing.

The teleocratic approach (Moroni, 2010), includes the idea of traditional urban structure plans and sees planning as the fundamental and unavoidable central means for (public) land-use

regulation. This means that planning is a top-down process where no bottom-up initiatives, such as tacit (local) knowledge, are included. From the teleocratic point of view, a structure plan is a plan with a directional set of rules, with the goal of establishing a desired overall end state. These directional rules give coordination to the contents of the (private) independent urban activities that shape the area. According to this view, planning controls the whole process from a fixed point in time. An example is the structure plan of Haarlem. This plan, issued in 2005, gives a vision until 2020 (Stork, 2005). The problem is, however, that it has no real space for flexibility and adaptivity over this period of 15 years. The teleocratic way of thinking is still commonly present nowadays (Moroni, 2010), even in plans that need a much more flexible approach as a result of the urban environment becoming much more complex. It is because of this, that urban structure plans get the critique that they cannot support an urban environment that includes high degrees of uncertainty (Larsson, 2006).

2.1.2 The development of urban structure plans over the years

Since the traditional view described as the teleocratic approach of Moroni (2010), urban structure plans have mainly changed in three ways: structure plans became more bottom-up; more flexible; and more adaptive. In essence, this has changed the emphasis on the structure plan from a general and subsidy based plan, to a plan that wants to exploit local opportunities (Hartman et al., 2011). These changes can also be seen as a shift from equity to diversity. This all has happened to make the structure plan more supportive of the specific environment that the structure plan is designed for.

The concept of bottom-up influence came, among others, out of the idea of co-production by Albrechts (2012). Co-production should create a supportive community to increase the active role of citizens in the planning process. As Ostrom (1996, p. 1073) wrote: 'co-production implies that citizens can play an active role in producing public goods and services of consequence to them'. Because of the bottom-up influence, the government structure changed from a central government structure to a multi-layered government structure (Hartman et al., 2011). This change can also be described as a shift from government to governance. The layered structure means that different actors, such as market parties, civilians, and pressure groups also have a bigger role in how choices are made in a complex urban system. In this governmental structure, different municipalities are responsible for their own governmental level (Hartman et al., 2011). An example is the Netherlands. More and more municipalities are responsible for their own territory on different levels, which is not possible for a municipality on its own and therefore needs help. So, in this example, co-production is used more and more often. Amongst others, the concept of co-production changed the way of thinking in planning to a process that has many more bottom-up initiatives.

Other examples of concepts that made planning processes much more bottom-up, are collaborative planning of Healey (2003) and consensus building of Innes (1996). These new concepts came to be as a result of the problem that planning does not have enough communication between different levels in society. Through this, an increase in thinking about ways as to how different levels in society can, and are, willing to communicate and work together, came to be, and a more bottom-up approach to planning has started. Nowadays this way of thinking can be identified through the way urban structure plans are designed. They are not a product of just top-down planning anymore, but instead became a mix of the top-down approach and the bottom-up approach. An example of a structure plan that is much more bottom-up oriented than the structure plan of Amsterdam is the structure plan of Almere. In the structure plan of Almere, the citizens create ideas and make decisions for the development of their city within the framework that is created (De Meulemeester, W. & Feddes, F., 2009).

The growing flexibility of structure plans came out of the loss of the idea of malleability in the planning discipline (Hartman et al., 2011). Out of this trend a more open planning process came about where more flexibility was incorporated in urban structure plans. More flexible plans have the

capacity to adapt because they have more room for change within the plan (Rauws et al., 2014). An example of a flexible plan, is the plan for a flexible neighbourhood from STIPO (2013). The STIPO plan includes the possibility to change buildings and the neighbourhood as a whole. To accomplish this, a network of commitment and financial involvement is needed to make it work. A flexible plan like STIPO needs a lot more of financial support in the beginning phase than traditional plans because more flexible structures need to be included (STIPO, 2013). Another example of a flexible approach to planning is that of Moroni (2010). Moroni (2010) used urban codes that fit in the idea of flexibility in the planning discipline. These urban codes give room to the people who live in a certain area to make their own choices within the framework that is created.

With the inclusion of flexibility the concept of adaptivity was, and still is, needed as well. Adaptivity means that a structure plan should contain the possibility to give feedback between interventions and that it has the option to be responsive if this is needed (Rauws et al., 2014; Folke et al., 2005). Hartman et al. (2011) also add to the concept that the adaptive capacity of a plan depends on the possibilities to seize opportunities that come from autonomous processes. An example of this is the change that arises when the Olympic games are organised in your city, and for the Olympic games a lot of extra money is available for road infrastructure. These autonomous processes are time-bound, which is why a plan needs to be adaptive, so as to grasp the changing opportunities to increase the spatial qualities.

An example of an adaptive structure plan is the structure plan of Antwerp, which also is analysed in this research. The structure plan of Antwerp includes different development frameworks where different local actors can make the plan space specific. Because the plan is not fixed from the beginning, processes over time can be used, which results in a plan that can support its environment in the best way possible.

So, the development of urban structure plans becoming more supportive of complex urban systems has started, but needs to be developed more. With structure plans being more supportive of complex urban systems, complex urban systems can be supported more in their development.

2.1.3 Advantages and disadvantages of structure plans in guiding a complex urban system

After addressing the changes of structure plans over the years, nowadays two core advantages and disadvantages are present. In the search for an urban structure plan that can better support a complex urban system, these advantages need to be preserved whereas the disadvantages need to be improved.

The two core advantages of most of today's urban structure plans are: it gives certainty (robustness) (Rauws et al., 2014), and it has a steering capacity, a vision (Neuman, 1998; Rutgeers, 2005). The robustness of a structure plan gives the opportunity for actors to know if a structure plan is going to affect any of their interests or not and for how long. In this way, they can correspondingly react to it, with as result that the urban structure plan can increase the possibility to provide the following: political support; public support; and investments.

The steering capacity (vision) of a structure plan can pursue actors to choose a certain path, to inspire, to trigger and to motivate (Kotter, 2008). To bridge certain problems, the steering capacity can be used through revealing shared values and showing innovative ideas that match with the plan (Rauws & Van Dijk, 2013). Visioning can even gap problems that at first hand seemed totally opposing from each other and is done by redefining problems, strengthen the link between process and content and make integral and appealing vision products (Neuman, 1998; Rauws & Van Dijk, 2013). Appealing visions can include many different products, such as: books, internet pages, movies, and images.

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The two core disadvantages of most of urban structure plans nowadays are: the great top-down view in urban structure plans and the little use of local knowledge. In urban structure planning many changes have been made from a top-down to a more bottom-up approach, but this still is not enough to cope with the uncertainties that are present in our society (Moroni, 2010). Most urban structure plans that are made currently are still too teleocratic (Moroni, 2010). This means that many urban structure plans are, in their core, too much led by a central organ or organisation. In urban structure planning this organ or organisation can be the government or an advisory agency that does not know enough of the area. Concluding, it is not necessarily bad to have a top-down view on an area, but there also needs to be sufficient room for change (Moroni, 2010).

The second core disadvantage comes out of the complexity of a structure plan. The problem is that local knowledge of an area is often not used enough (Portugali, 2006). The reason for this is that in a complex urban system, knowledge is situated and tacit (Moroni, 2010). It is situated in the sense that it is specific in space and time, and it is tacit in the sense that it is knowledge that is acquired by a process of doing. Therefore, it is internalized in the minds of the individuals that live in that specific area and cannot easily be learned by specialists or other people outside of that area. Because of this, it is hard for planners to make an integrated plan on its own (Moroni, 2010). To learn more about local knowledge, it is important to involve the locals and to make use of their skills (Albrechts, 2012).

To conclude, the structure plan has undergone a lot of changes but this is not enough to support complex urban systems in a satisfying way. In the next chapter complexity theory is addressed in a way that urban structure plans can hopefully make the last steps to dismantle the core disadvantages, and in this way make it possible for an urban structure plan to have a better supportive capacity for a complex urban system.

2.2 Complexity and Planning

Nowadays complexity and planning are often mentioned in one sentence, but this was not always the case. At the very start planners were thinking with the idea of closed systems (De Roo, 2010b). This technical view on planning has a significant connection with the teleocratic planning of Moroni (2010) and was a way of thinking that was centred around reaching the end through direct causal relations. The first time that complex self-organising systems were introduced was in the 18th century, by the social philosophers and economists of the Scottish enlightenment (Smith, 2008). After this, many other authors began to think about complexity and planning, however it was first Allen, among others physicists, who coupled complexity to social and urban dynamics (Portugali, 2006). Out of the studies of all these authors the idea came about that planning can understand and work with complexity.

Paragraph two and three will both give an answer to the second sub question of this research: How can a complexity perspective inform a city development plan in order to support a complex urban system? This is accomplished through first addressing the concept of a complex system where the acceptance of uncertainty and the different sorts of uncertainty are explained. In the end, the concepts of self-organisation and coevolution are addressed to work with the uncertainty in a complex urban system.

2.2.1 A complex systems perspective

With the complexity theory, the concept of complex systems came into the planning discipline. This concept gives an abstract representation of the complex society which we live in. As Batty (2005)

mentioned, a city is a complex system. A complex system is open and complex in the sense that it can exchange matters with its environment (Portugali, 2006). In a city, this process can be seen as connections of traffic, knowledge, money, etc. The word complex in 'a complex system' has a twofold explanation. Firstly, parts of the system are so numerous that it is hard to find any causal relations. The relations that exist in such a system are nonlinear of nature. In a city, these actors can be seen as government structures, companies and citizens. Between these actors numerous relations are present which makes it very difficult to predict any causal relation. Secondly, because of these nonlinear relations it is hard, or even impossible, to know which relations will give rise to emergent events (Portugali, 2006). Certain events such as bike or car trajectories, or popularity of specific stores, are special behaviour of citizens that often cannot be foreseen by planners.

Complex systems also have the skill to self-organise and coevolve (Rauws et al., 2014). Self-organisation means that a system can organise developments out of its relations without external coordination. In a city this is done by, for example, the citizens or companies that organise activities which the whole city can profit from. Coevolution means that actors change in a two way process, the relations influence each other at the same time. In a city this can be observed in the relations between companies, or between companies and citizens, for example. All these aspects make a complex system very uncertain because nobody knows exactly in which direction it will evolve and it is, therefore, by definition uncertain (Portugali, 2008).

2.2.2 The acceptance of uncertainty in the planning discipline

The most important aspect that led to the acceptance of uncertainty in the planning discipline was the inclusion of the concept of time. In the 00s de Roo (2010b) came with a new way of thinking for planners. De Roo (2010b) argues that you cannot see reality as a fixed point in time when you are working with complex systems. So, with the inclusion of time and the acceptance of uncertainty, a shift in thinking about planning from 'being' to 'becoming' has started (De Roo, 2010b).

The shift to an ontology of 'becoming' is defined as a way of thinking that is more emphasized on actions, movement, relationship, processes and emergence, instead of the outcome and final state of being (Albrechts, 2010). The planner needs to see decision-making in spatial issues not only as a final state but also as a part of an ongoing process of change. This means that planners should play an active role in influencing processes by, for example, stimulating coevolution through feedback loops (Rauws et al., 2014). Nowadays, structure plans are more designed following the way of thinking about being than the way of thinking about becoming (Rauws et al., 2014), but after the acceptance of uncertainty better suited plans can be made for complex issues.

As is described in this paragraph, planning has changed over the years from a discipline of fixed time and certainty to a discipline of a changing world, with a lot of aspects in the planning process that are by definition uncertain. The acceptance of uncertainty gives us a new view on planning wherein planners have to create a new set of tools to handle problems that are uncertain by nature.

2.2.3 Different types of uncertainties

With the acceptance of uncertainty planners began to think about how they could handle uncertainty. As Abbott (2007, p. 504) described: "uncertainty is a perceived lack of knowledge, by an individual or group, which is relevant to the purpose or action being undertaken and its outcomes". In this definition of uncertainty, the aspect of knowledge is shown. Knowledge is very diverse and can be seen in different ways. In this research, knowledge is seen as being constructed in a social process (Abbott, 2005). Because social processes are often uncertain, the construction of knowledge links with the sensitivity of an urban structure plan through the connection with an uncertain environment.

To be able to create urban structure plans that develop an area in the best way possible, Abbott (2007) identifies two sources of uncertainty. These are environmental and process uncertainties. Environmental uncertainties arise from the changing social, economic and physical environment and are experienced by everybody in the concerned area. Process uncertainties arise from the planning process and are experienced only by those actors that are actively involved in the process.

Within these two main uncertainties there are five dimensions that affect planning, namely: causal uncertainties, organisational uncertainties, external uncertainties, change and value uncertainties. These different perceptions of uncertainty are shown in **Fout! Verwijzingsbron niet gevonden.**. Causal and organisational uncertainties include both environmental and process characteristics. Causal uncertainties are "related to imperfect knowledge of the urban environment, of cause and effect relationships in the change processes, and of how these different relationships and processes interact to produce outcomes" (Abbott 2007, p. 505). An example of this kind of uncertainty is a change in how citizens think about green space. A shift in this subject can have significant causal effects on, for example, the city council selections. Organisational uncertainties are "uncertainties about the future intentions, policies, plans and actions of organisations in the planning environment" (Abbott 2007, p. 505). An example of these kind of uncertainties is the European parliament because it is a complex multi organisational environment with all the uncertainties that come with it. External uncertainties and change are on the environmental uncertainty side, and value uncertainty is on the process uncertainty side. External uncertainties arise from the external environment and relate to external processes and events that cannot be directly affected by planning activities, but can greatly affect the planning process. An example of these uncertainties is the national economy that can turn in an economic crisis without any influence of planning activities. Change uncertainties are unpredictable events that can occur during the plan preparation and implementation. Examples of these are: natural disasters, unexpected election outcomes, or deaths of key leaders in organisations. Value uncertainty concerns how much people value a certain area. In value uncertainty it is important to address that both political and community values matter. These different aspects of uncertainty are important for a structure plan to shape the future. If Planners know these differences in uncertainty it is most likely that it is easier for them to create an urban structure plan that can more fully support an area to develop (Myers, 2001).
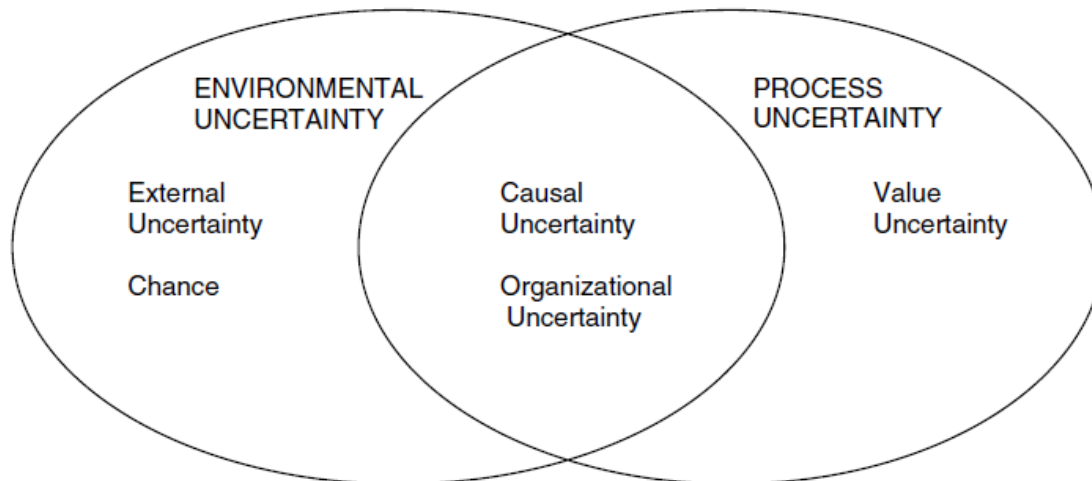
Figure 1. Dimensions of environmental and process uncertainties
Source: Abbott, 2005

Now that the acceptance and the different sorts of uncertainty in the planning process are elaborated on, the next step in this research is to show how to interpret the concept of uncertainty when creating urban structure plans that are better equipped to support complex urban systems. In the next section this question is elaborated on.

2.2.4 Giving room to uncertainty in urban structure plans to better support a complex urban system

Many studies have done research on spatial issues and uncertainty (Allen, 1997; Portugali, 1999; Innes & Booher, 2010; Webster, 2010; Rauws & De Roo, 2011). A central argument in these studies is that discontinuous and unexpected transformations are recognized as a normal part of the development process and that it is not viewed as an exception. This is especially important for a complex urban system, because a complex urban system is uncertain by definition (Portugali, 2008). So, to incorporate uncertainty in an urban structure plan, an urban structure plan needs to be designed in a different way. In this section a suggestion is made that through self-organisation and coevolution more room can be given to uncertainty, and in this way a urban structure plan can support a complex urban system better.

The concepts of self-organisation and coevolution can provide more room to uncertainty in a supportive way to further develop an area. Self-organisation includes the idea that a development emerges without any external coordination (Rauws et al., 2014). An example is an organisation like "Ringland" that is created by the citizens of the city of Antwerp to develop the ring road in Antwerp (Geenen et al., 2015). So, in this area, the concept of self-organisation can flourish without any external coordination. For example, this concept can lead to more local support of the plan and more local initiatives from civilians. Coevolution is a process that drives actors to mutual adjustment (Gerrits, 2008). This is called a process because it never ends. An example of coevolution in an urban context is the use of green space. If the citizens want more green space, the department of planning will adjust itself to that idea, while at the same time the citizens adjust as well. It is of utmost importance that the design of urban structure plans includes space to have concepts like self-organisation and coevolution develop in an area on its own. Thus, allowing space for these concepts where they can work with the uncertainty of a complex urban system.

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So, through the introduction of complexity theory into urban structure plans, a couple of interesting concepts are addressed. The acceptance of uncertainty and with this, the inclusion of time. This gives urban structure plans the possibility to be constructed with the idea of the always changing context. Within this idea, self-organisation and coevolution are mentioned as possibilities to work with uncertainty in a way that a complex urban system can be supported optimally. Namely, it is the case that uncertainty is not always bad. By including the concepts of self-organisation and coevolution in the space that is given for uncertainty, the urban structure plan can become a lot more adaptive. Out of these concepts, different rules and guidelines are developed for an urban structure plan to more fully support a complex urban system to develop. In the next chapter these rules and ways of thinking are explained and discussed.

2.3 A new framework for urban structure plans

In this section a new way of thinking about urban structure planning is addressed and discussed. Urban structure plans need to become more flexible and adaptive in order to better support a complex urban system. In this section the view of nomocracy is added to help urban structure plans take the next step to be more flexible and adaptive. Nomocracy is the opposite of teleocracy and stands for a more flexible way of planning, with the concept of 'becoming' as a core concept. Subsequently, a set of concepts and rules are presented to guide the design of an urban structure plan in a way to make it more able to support a complex urban systems in its development.

2.3.1 Flexibility and adaptivity

Flexibility and adaptivity can help to reform the design of an urban structure plan in such a way that it can support a complex urban systems more fully in its development. Both can help to leave more room for uncertainty in a complex urban system and help plans to become more efficient and successful in the planning process. In this context, efficient means that parties that are involved in the planning process are not surprised by high extra costs or longer duration of a project. If flexibility and adaptivity are not included in an urban structure plan it is much harder to leave room for the uncertain context of an urban area.

There are three types of flexibility that can give structure plans guidance in different ways. These different types are: local flexibility, user-oriented flexibility and time-related flexibility (Bergevoet & Tuijl, 2013). Local flexibility is flexibility that emphasizes local qualities of an area. Local flexibility gives the opportunity to think from the basis of specific local conditions. User-oriented flexibility is flexibility that emphasizes concrete needs of the users of the area. In the teleocratic approach a team of professionals makes all the decisions in advance. Even if this team is excellent, the plan would still always be speculative because the citizens that live in the area are not consulted. Because of this, the chance is high that the plan is lacking the needs of the future users. By including user-oriented flexibility in an urban structure plan, the chance that the urban structure plan is lacking the future users' needs is reduced. Time-related flexibility is flexibility that emphasizes the stepwise design of an urban structure plan. In the teleocratic approach, it is difficult to change an urban structure plan after it has been approved by the municipality or state. With this kind of planning, it is hard to change anything during the process of implementing the urban structure plan. This shows the big problem: in reality, circumstances change. The teleocratic type of planning leads to high unpredicted costs. But, with these three types of flexibility, changes in the market and ideas of new parties that join the project can be included and high costs can be reduced. These different types of flexibility are very important for the success of urban structure plans.

Adaptivity can be interpreted in very different ways. In this study, adaptivity is seen as a way of creating conditions for collective action, and to improve the responsiveness of the urban structure plans to cope with these collective actions through rational techniques and evaluation (Folke et al., 2005; Hartman et al., 2011). In line with this definition, collective actions are seen as self-organisation and coevolution of the people and organisations that live in this complex urban system (Rijswick & Salet, 2012). In these processes tacit knowledge of those parties is very important. It shapes the collective actions in the area and, therefore, is the glue for the adaptive capacity of a complex urban system (Folke et al., 2005; Olsson et al., 2004). So, the adaptive capacity of a complex urban system comes out of the collective actions, and the role of an adaptive structure plan is to give space to these collective actions to self-organise and coevolve (Garnsey & McGlade, 2006).

Giving room is, as is described in the first part of the definition, a way of creating conditions. These conditions are the frameworks in which choices can be made. Important to keep in mind is that a structure plan is space specific and therefore is context dependent. In this sense, the space that is given (the framework) in a plan can vary in different circumstances. This is because problems and institutions are different all over the world. In the second part of the definition the responsiveness of a structure plan is mentioned as a way in which a structure plan should be able to change its conditions so that the collective actions can self-organise and coevolve. This is accomplished through the rational way of analyses of processes but also through evaluation about what went wrong (Hartman et al., 2011).

Thus, adaptivity creates room for collective actions. This can also be described as loose rules in which complex urban systems, with their collective actions, can make their own choices. A way to incorporate loose rules in planning could be the nomocracy approach to planning. The nomocracy way of thinking gives much decision-making power to the people with broad rules in which these people can act.

2.3.2 To a nomocracy approach

The nomocracy approach is a new way of thinking on how planners should arrange their spatial instruments in a complex urban system, and is first mentioned by Moroni (2010) in 2010. Three critiques on planning were central for constructing this approach. The first critique was that planners still wanted to plan a complex urban system, even when planners knew that it is impossible to get to know all the tacit knowledge in an area. Thus, planners alone cannot make an integrated plan because they can never possess all the relevant information to do so (Moroni, 2010). The second critique is that the teleocratic approach wants to centralize the tacit knowledge and wants to guide a complex urban system which leads to a drop in productivity, creativity and efficiency. This is the case because through the centralisation of knowledge, a lot of tacit knowledge that is still in the complex urban system would not be used (Moroni, 2010). The third and last critique is that of individual liberty. Wide ranged top-down planning infringes this fundamental right because planners are not chosen representatives. Planners act on a basis of knowledge and expertise, however, this does not give them the right to drastically change people's lives (Moroni, 2004). In this sense, the planner needs to look for ways to define the right city, without engaging questions of a happy life, where decisions easily can be made within the individual liberty of the citizens (Moroni, 2004). In this study, a nomocracy approach is chosen because urban structure plans include the three critiques that are described above. If this approach can help to make urban structure plans more aware of these critiques, and can help to change these critiques to the idea that it is both impossible and undesirable to plan a complex urban system, urban structure plans could make a big step forward.

Moroni (2010, 2014) combined the nomocracy approach with the urban codes of Alfasi & Portugali (2007). An urban code gives individual freedom and open competition, and is an indirect way of reaching order. This makes sense because in this way the citizens that live in the area can make their own choices and create their own ideas about the city development. With this

mechanism a lot of the tacit knowledge that is inside these citizens is used in developing the city and, therefore, the mechanism connects very well with the needs of the inhabitants. The rules that are part of the urban codes are (non-directional) rules that are simple, abstract, general, purpose-independent, long term oriented, and negative. Moroni (2010, p. 146) explains this as: "basic and plain rules that refer to general types of situations or actions, not to specific ones (they apply equally to everyone and thus contain no reference to a particular piece of land, landowner, etc.), and merely prohibit individuals from producing certain nuisances, rather than imposing some positive obligation; and all this without any specific purpose or spatial arrangement in mind, but merely to provide the means for realizing the varied and incommensurable separate purposes of the many different inhabitants of the city". These kinds of rules are locationally generic rather than locationally specific, and are an impartial framework of social activities. This relational set of rules of an urban code does not have a concrete trajectory and is, therefore, not a coordination mechanism.

So, to conclude, nomocracy is a way of thinking about planning that gives individual freedom and open competition within a framework (certain set of rules) that enables the complex urban system to be flexible and adaptive. To give an overview of the different ways of working and thinking between the teleocratic approach and the nomocratic approach **Fout! Verwijzingsbron niet gevonden.** is added to this thesis.

Nomocracy	Teleocracy
Indirect approach	Direct approach
Recognition of unavoidable ignorance	Presumption of knowledge
Spontaneous order (the set of public rules and order of actions do not coincide)	Made order (the set of public rules and the order of actions tend to coincide)
Policentricity	Hierarchy
Competition	Integration
Uncertainty as an opportunity	Uncertainty as an evil
Deontological ethics (intrinsic value of individual rights; entitlement theory of justice)	Consequentialist ethics (extrinsic value of individual rights; end-state theory of justice)
No idea of the good life	Preferred ideas of the good life
Non-instrumental view of law (law as a framework)	Instrumental view of law (law as a means to concrete ends)
Rule of law	Administrative state
Minimal discretionality (ex-ante and ex-post)	Ample discretionality (ex-ante and ex-post)
Urban codes as the principal means of land-use regulation	Urban plans as the principal means of land-use regulation
Relational rules (locationally-generic, purpose-independent and prevalently negative)	Directional rules (locationally-specific, purpose-dependent and not only negative)
Pattern-coordination	Coordination of detail
Catallactic efficiency	Allocative efficiency

Figure 2. Nomocracy and teleocracy as two ways of regulating private individual actions
Source: Moroni, 2010

The central aspect of nomocracy thinking is the urban codes that are the framework for urban development to evolve through collective actions. These codes are using knowledge of the experts, as well as knowledge of the citizens (tacit knowledge) (Moroni, 2014), and in this way can more fully support a complex urban system with development. The point is not to plan everything and that everything is written down and fixed, but to design the future through creating space for complex urban systems to develop by themselves (self-organisation and coevolution). This means that from a nomocracy point of view the framework gives guidance, and within this framework different choices can be made, that are not fixed in time, by local actors. If we bring the term of uncertainty into the

nomocracy approach, urban codes do not eliminate uncertainty but work with it in the most positive way (Moroni, 2014). For instance, a landowner that lives in a city cannot know what will happen to lot B that lies alongside his own land and where nothing is built upon. Different types of land-use and different activities can take place: the scale and impact of a development is uncertain. In urban codes these questions are not predictable. The only thing that is predictable is the that on lot B (as on other lots in the city), certain negative externalities are not permitted. These negative externalities can be noise levels, population density, etc.

So, nomocracy thinking shows us that urban codes gives us the broad frameworks that are needed to support a complex urban system in its development. Thanks to these urban codes, a structure plan is flexible and adaptive and can give rise more easily to the flourishment of local initiatives, creativity, innovations, and other processes of self-organisation and coevolution.

Over the past few years, a number of critiques have been raised on the nomocracy approach of Moroni (2010; 2014). This includes the lack of sensitivity to space specific characteristics and the history of land use rules (Alexander et al., 2012). With the lack of sensitivity to space specific characteristics, Mazza (Alexander et al., 2012) brings up an argument that the nomocracy approach is not place specific enough and that the urban codes that are general for a certain area are not fit for the needs of specific locations. An example of this is an urban code that says that the population density of an area cannot be larger than 20.000. This can be beneficial for the whole city, but is not always beneficial for an area within the city, where a lot of people want to live because it is close to their work and close to good infrastructure. With this code this is not possible and the place specific advantages are not met. Moroni (Alexander et al., 2012) counters this critique by arguing that the local community has the opportunity to form their own environment. But still, this critique is not confuted. The local community does not always have the capacity to know what is best for their own environment. In this case, a plan that supports the place specific opportunities to become place specific advantages is very useful. With only locationally generic rules this is often difficult. So, in this study a total nomocratic plan is not desirable. It is therefore that the concept of urban codes, that give room for the complex urban system to self-organise and coevolve, is combined with plans that have a locationally specific orientation to improve the space specific advantages.

The second critique is that of the history of land use rules. This critique includes that with the nomocratic approach the value of more top-down approaches to planning, such as blueprint planning or vision making, are discarded. This could be problematic for areas that do not need an approach for a complex situation. These areas could be a nature areas where the government has decided that more nature is needed, and in this situation there is no need for a general rule that leaves these choices to the local actors. Moroni (2010; 2014) refutes this critique with the argument that his urban codes are only useful for complex issues. But this brings the problem up again that urban codes and more top-down approaches should work next to each other, and this is, following the argumentation of Moroni (2010; 2014), impossible, because the fixed structure plans leave less space to the concepts of self-organisation and coevolution to flourish. It is therefore important to know that with the combination of the two approaches the concept of urban codes becomes less efficient, but that there is no other option if an urban structure plan wants to benefit from the local opportunities of an area as well. It is therefore that both the urban codes and top-down planning need to be combined to come to an final result that is supportive of a complex urban system in development.

To conclude, the main idea of the nomocracy approach is that it does not leave options open for the local government alone, but for both the government and the society. In other words, nomocracy is not thought of as 'to work with the flow' or 'to interact with the flow' but 'to permit the flow'. In the new design for urban structure plans this way of thinking is a key concept. But, on the other hand, the critiques about the nomocracy approach that are discussed in the section above are also taken

into account in order to come to a new design for urban structure plans that can more fully support a complex urban system with development.

2.3.3 A new design for urban structure plans?

In the new design that is created in this section, the idea of an urban code of Moroni (2010; 2014) is used. However, it is implemented with place specific elements to improve and benefit from the local specific advantages of an area. This way, the nomocratic idea that gives rise to collective spontaneous order to emerge (Holcombe, 2012) is included, but the critique from Maza (Alexander et al., 2012) is incorporated as well. As Maza mentioned, too much spontaneous actions can create problems because this does not include space specific qualities. This is the case, because it assumes that these collective actions always make the best decisions. As this is not always the case, space specific knowledge (tacit knowledge) can help with better understanding a specific area and making general rules/codes that do work with these place specific elements.

In the following section, a couple of general statements are made first, which designers of an urban structure plan should always be aware of, and secondly, for this new design, more specific rules will be discussed. The general statements that an urban structure plan should always be aware of are:

- Working with starting images instead of end images (Bergevoet, & Tuijl, 2013). This idea of setting up a framework in front with no goal in the end is completely consistent with the nomocracy approach. But as is also described in the previous chapters, an urban structure plan also needs a vision for a specific area (Ben-Joseph, 2005). With no vision, a plan loses a lot of its robustness which makes it hard to get any financial input and local or political support. This can be rectified by a strong visionary element in the starting image. An example of a starting image, is that of a certain area that needs to be redeveloped. The framework that is set means that it needs to be a residential area where citizens want to live in, by, for example, high quality standards as combinations of colours and heights of buildings. This starting image gives direction but does not give fixed ideas about what will be built in the area. In this way, the structure plan is still robust, because there still is a vision, and flexible, because within the framework a lot of changes are possible.

   Another important aspect of starting images is the connection between the visionary elements and the implementation measures in an urban structure plan (Rauws et al., 2014). This connection is crucial because if both elements are connected, mismatches will occur less often and the strategic and the operational side of the plan are in balance.

- The ability to cope with action, movement, emergence, relationships and creative experimentation (Albrechts, & Balducci, 2013). The inclusion of the concept of becoming to the urban structure plans is of great importance, because this idea shows planners that everything is always changing, and that a structure plan in its core is never finished. An example of this is that a neighbourhood always needs renovation in the end, because the material perishes. But, the wishes of the people change over time as well. In this process a new sort of language and way of thinking needs to be developed to bring the concept of becoming to the core of the urban structure plan. Besides the inclusion of becoming, working with uncertainty is an important aspect too (Albrechts, & Balducci, 2013). The argumentation for this awareness is almost the same as that of the concept of becoming. If planners know that not everything is certain, and uncertainty is present in our world, they can try to make different rules or designs to support complex urban systems more fully with their development.

- The ability to grasp the moment (Albrechts, & Balducci, 2013). In essence it says: a plan needs to have the freedom for spontaneous order to grasp the moment in a way that an area

benefits from that specific moment (Alfasi & Portugali, 2004). Creativity is very important in this process. It is necessary to see this window of opportunity, because without seeing it, it can never be grasped. An example of this statement is a change in political view, or a market party that wants to step in on a certain time.

The more specific rules for the new design are coming out of these central concepts and are divided in rules that are process oriented and content oriented. The more specific rules that are process oriented are:

- Include feedback loops. With feedback loops, a plan can be evaluated and the mistakes that are made can be prevented the next time (Armitage et al., 2008). In a structure plan that has more smaller scale plans, these feedback loops can be a very efficient way of improving the process of the urban structure plan during the implementation time.

- Include a learning framework that focuses on niche innovations. Niche innovations are innovations that are new and context depended (Raven et al., 2008). Through place specific circumstances, new ideas or innovations can be constructed. These new ideas could be very helpful for the implementation of an urban structure plan that is more supportive of a complex urban system. With introducing a framework of learning that focuses on these new ideas and/or innovations a next step could be made.

- Stimulate bottom-up initiatives. The last rule that is process oriented, is the stimulation of bottom-up initiatives. As also addressed in the previous chapters, planners need the people of an area to make a solid plan that can support the environment within a complex urban systems. This is the case, because they need the tacit knowledge of the people and the organisations to support the self-organising and coevolving processes.

The more specific rules that are content oriented are:

- The overarching structure plan should comprise multiple independent smaller scale plans. This idea has three beneficial effects: First, the smaller scale plans within a larger plan give the locals more space to use their tacit knowledge and to be adaptive. Second, these small scale plans give flexibility to the plan if circumstances change, something that will always happen in a complex urban system (Alfasi & Portugali, 2007). Third, the different small scale plans can function individually, and therefore are not intertwined with the other parts of the structure plan. This means that small plans can go on even when the other smaller plans are postponed. This gives the structure plan more flexibility. A big advantage of this idea is that big upfront investments can be limited, because the overall plan exists of multiple smaller plans and that the smaller plans can be put forward or postponed, depending on what is best for the overarching structure plan (Rauws et al., 2014).

- Apply incremental development strategies. Incremental development helps to support the coevolution and self-organising aspect of a complex urban system. This means that a structure plan can learn over time and adjust to the local needs (Rauws et al., 2014). This rule also leads to the support of synchronization of social and spatial organisations (Marshall, 2009), which leads to the benefit of self-organising and coevolution in the end.

- Install requisite carrying structures (Rauws et al., 2014). Carrying structures make small scale projects possible. It gives the opportunity for spontaneous order, and for the locals to fill the spaces with their own needs. This rule gives a structure plan flexibility because it gives the people and organisations room to make their own decisions, but also gives robustness because these decisions of the people and organisations are guided through the framework of the carrying structure. A downside of the rule is that a carrying structure can be very

expensive and it is therefore advisable to split the investment in several stages. This is because a large investment in front gives the structure plan less room to be flexible because certain paths are fixed.

- Define loose rules in how a certain area will be equipped, derived from the vision of the structure plan. Loose rules within a core framework are mainly made for an appropriate response to change. This gives actors enough flexibility to reshape their environment to their own needs. Loose rules see uncertainty as an opportunity and not as a risk (Rauws et al., 2014).

- Use of the buildings or infrastructure that are in place, if this is possible. With the use of buildings, or infrastructure that is still in place, the identity of the area is partially kept, and costs can be brought down too. With the use of the older buildings or infrastructure an area can be developed in different stages which makes it more flexible. This may help the loose rules of an area because these buildings and this infrastructure make it easier to implement loose rules because they are already in place.

This new guide for structure plans can help planning communities and urban planners to make an urban structure plan that can more fully support a complex urban system. Within this design planners should accept that uncertainty is central in complex urban systems, and that there always will be unexpected events or outcomes. But if the structure plan is right, unexpected events or outcomes are not a problem but an opportunity.
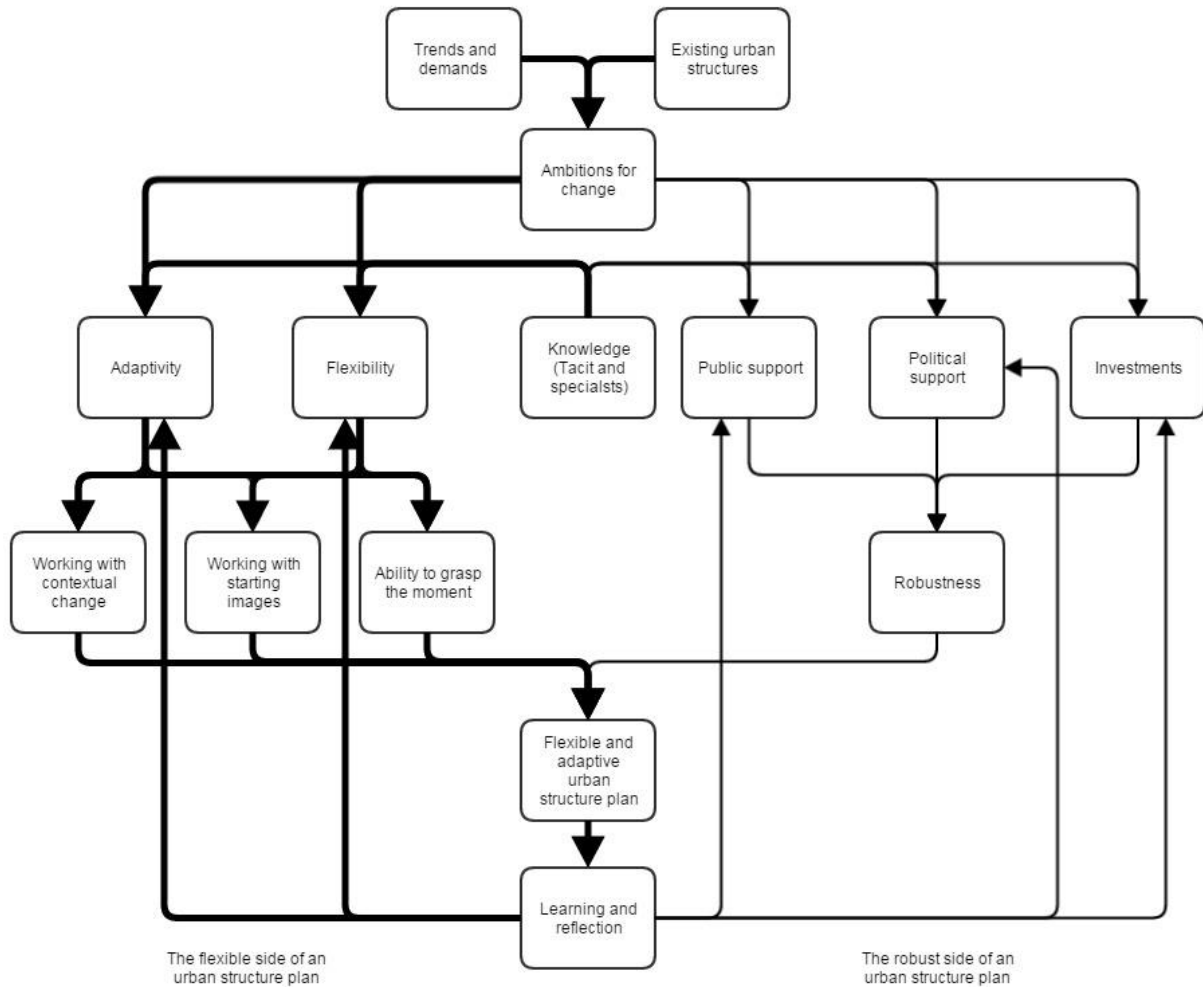
2.4 Conceptual model

Figure 3. Conceptual model
The bold arrows in this model are what this thesis is focused on.

In the conceptual model, the most important steps that are recommended in this chapter are visualized. On the top of the model the aspects, trends, and demands that are present in the world, and the aspect of existing urban structures influence the contextual aspects of an area. These contextual aspects lead to an ambition for change, because, for example, trends and/or demands change. Out of this ambition for change a urban structure plan is made that has a robust side and a flexible/adaptive side.

On the robust side of the model the ambitions for change lead to public support gathering, political support gathering, and gathering investments. Through public support, political support and investments, the planner creates a solid basis which can be built upon. On the flexible/adaptive side of the conceptual model, the ambitions for change influence flexibility and adaptivity. These concepts are added to the structure plan because this is the basis for the new rules and concepts to better support a complex urban system. Knowledge is included in the model because it gives guidance to how flexibility, adaptivity, public support gathering, political support gathering and gathering investments can function, and be used and formed.

Out of the concepts of flexibility and adaptivity three overarching rules come forward. These overarching rules are: working with contextual change, working with starting images and the ability

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to grasp the moment. With these three rules the adaptivity of an urban structure plan can be increased. But to make a successful urban structure plan for a complex urban system, both flexibility/adaptivity and robustness are needed in the right balance. At the bottom learning and reflection feeds back to the main drivers of an urban structure plan for complex urban systems to reflect and learn from the process that the urban structure plan is always in.

3. Methodology

In chapter three the methods that are used in this thesis are explained. First, the different methods that are used are elaborated. After this, the different forms of data collection are addressed. These forms are: a second hand literature study, first hand interviews, and a desk research. Third, the data analysis and interpretation is explained and at the end ethical issues are addressed. In all these paragraphs the advantages and disadvantages of each method are discussed, if this is possible.

3.1 Approach

This study consists mostly out of qualitative data. This kind of data is chosen because the main question can be answered better by perceptions and ideas of different actors that are involved or know a lot about urban structure plans and complexity. This is the case because through perceptions and ideas (qualitative data), more in-depth knowledge can be produced (Saldana, 2011). An example of a perception is how the structure plan of Antwerp works with starting images and how well this has worked following the concerned actor. When using qualitative data, it is important to address that qualitative data depending on how the researcher views reality and what can be known about it (ontology), and how the researcher sees the nature of knowledge and how it can be acquired (epistemology) (Ritchie & Lewis, 2003). The ontology of this study centres around the ideas of complexity, that we can know certain aspects of the social world, but we cannot know or predict everything. This is the case, because different actors often interact differently due to the circumstances that they are in. The epistemology of this study arises from the idea that the world consists out of patterns which can be learned through observations, interviews, etc. This knowledge can be tacit or expert. Tacit knowledge can only be gathered by learning through doing, and the knowledge of the experts can be learned out of books or otherwise. The big difference is that tacit knowledge is space and time specific, and is very important for the actors that are involved in a structure plan. So, qualitative data is important for this research because it gives a lot of opportunities to answer the main question in a satisfactory way.

Within this framework of qualitative data, there is chosen to conduct this research on a case study. A case study is a way of doing research where a complete and exhaustive representation of the case, its complexity, and its nature is given (Bryman, 2012). This choice is made because this research's goal is to know more about how urban structure plans can support a complex urban system more fully with development. To look upon a case in depth, can give a good representation about how the relations between an urban structure plan and a complex urban system work (Saldana, 2011). Also, a case study links very well with research that has a 'how' or 'why' question (Yin, 2003). This is the case, because with in-depth information a better answer can be formulated to a 'how' or 'why' question. A critique on a case study is that it only contains what can be learned from just one case. This critique is not just, because it depends on the case which elements can be transferred to a concept that is generalizable (Flyvbjerg, 2006).

Now the basics of a case study are discussed, the type of case study needs to be addressed. For this research an exploratory case study is chosen. An exploratory case study is used for situations that are complex, where the intervention that is being looked upon has no clear outcome through the changes over time (Baxter & Jacks, 2008). The case of this research matches with this definition.

3.2 Data collection

In this section the different forms of data collection are explained. In Table 1 a schematic overview is created to know which method is used for which sub-question, and in which chapters of this research these methods return.

Chapter	The urban structure plan and complexity	Analysis and results	Conclusion and discussion
Questions	• What are the strengths and weaknesses of traditional urban structure plans in dealing with uncertainties? • How can a complexity perspective inform a city development plan to support the adaptive capacity of a complex urban system?	• Which elements that support the adaptive capacity of a city development plan can be identified in the structure plan of Antwerp of 2006 and how do these elements work?	• Which lessons can be identified on how public planners can strengthen urban flexibility and adaptivity?
Required data	• Knowledge about uncertainty and urban structure plans. • Knowledge about the complexity perspective, flexibility and adaptivity.	• For this question data is viewed that centralizes around the history behind the plan, key difficulties of the plan, and key structures that helped to support the adaptive capacity of the city of Antwerp.	• The aspects that are used for the other chapters are also used for this last chapter.
Methods and techniques	• Literature study	• Interviews • Desk research	• Literature study • Interviews • Desk research
Data collection from whom and where	• Different books, articles, rapports, policy documents and internet sites. • These sources are spread all over the world but are mostly centralized in Europe.	• With different specialists and participants of the structure plan of Antwerp, interviews are conducted. With policy documents, rapports and policy documents a desk research is conducted. • All these sources were mainly centralized in Antwerp, but some specialists were also living in other parts of Europe.	• The aspects that are used for the other chapters are also used for this last chapter. • Different articles from western Europe.
Analysis, how is this organised	• First, the structure plan is examined whereupon the complex urban system is further analysed. After this, the concepts of flexibility and adaptivity are added to the framework to see how an urban structure can be more supportive of a complex urban system.	• The different sources are coded, categorized, and analysed, following the structure of the new design of urban structure plans that is introduced in chapter two.	• The sub-questions and main question are answered, whereafter these outcomes are discussed with the theory of chapter two and other articles.

Table 1. Overview of the research structure focused on the methodology

3.2.1 Literature study

To gain more knowledge on the subject, and how the ways of thinking around urban structure plans, complexity, adaptivity, flexibility and nomocracy change, a literature study is conducted. Different academic papers and books, structure plans, websites, policy documents and rapports are consulted. The sources are found mostly through searching on the internet, through recommendations of the supervisor of this research, and the professionals that are interviewed. Out of these many documents, the most relevant ones are chosen so that the link between urban structure plans, complexity, adaptivity, flexibility and nomocracy could be made in the best way possible. This is done

by in-depth studying of the documents to see which elements of the different articles are relevant for this research. After this, combinations of elements are made in such a way that an urban structure plan could, hopefully, better support the adaptive capacity of a complex urban system. These elements are selected out of the Nomocracy approach that is elaborated in chapter two and are tested on the empirical study of the interviews. In this step, there is searched for similarities between theory and practice. So, a literature study is important because the researcher can gain knowledge quickly on a certain phenomenon, and the researcher builds on approved work from others to strengthen its own research (Neuman,2007).

3.2.2 Interviews

An interview is a good way to learn about experiences of actors (Dunn, 2010; Flowerdew & Martin, 2005). Through this process, respondents can show the complexity of a situation, the contradictions of a situation, different steps in the process, and where mistakes are made in the process (Flowerdew & Martin, 2005). Yin (2003) also says that interviewing is the most important data collection method that can be used for case studies. Interviews give a more complete view of a situation. But to accomplish this, the right actors need to be interviewed.

For this study, key actors within the case study of Antwerp are interviewed. These are: researchers that are experts on the subject of the structure plan of Antwerp, people that work for the municipality, people that work on the new version of the structure plan of Antwerp, people that are advisors of the municipality, and people that work for local initiatives in Antwerp. The respondents are selected through research on the internet, and via advice from my supervisor, who knew some of the people that are contacted. With these methods, a selection of people is made that could be beneficial to speak with. After the selection, the respondents are contacted through mail. To answer the main question in a reliable way, a complete view of the case study should be given (Flowerdew & Martin, 2005). By looking at the different backgrounds of the different people I think an illustrative set of respondents is found.

The interviews are based on the theoretical framework of this research and are conducted in the same way. This means that the interviews follow the structure of the different headings, but are adjusted to the respondent that is interviewed. The locations where the interviews are conducted are chosen by the respondent itself. In this way, all the preparations are made to make the interviews as pleasant as possible, so that the best data can be gathered.

3.2.3 Desk research

In this study, desk research is important, as can be seen in Table 1 where desk research is used to analyse the data and write the conclusion. Desk research is a way of working where different documents are selected and where, out of these documents, an analysis and conclusion can be written. In this research, different reports and policy documents are analysed to show new ideas on the subject of urban structure plans and complex urban systems. The documents that are used for this desk research are selected on relevance to the topic of the study and on how well it can provide the study with knowledge and new ideas. After the selection, these documents are analysed following the framework that came out of the theories that are gathered in chapter two.

So, in this research three different manners of data collection are used to get to know as much as possible about the different concepts of this research, as well as the structure plan of Antwerp, and how it supports the city. In this way, a reliable theoretical framework, analyses and conclusion could be written.

3.3 Data analysis and interpretation

All the interviews are recorded with permission of the respondents and are transcribed. The transcripts are not a part of the research, but through a request and permission of the respondent these can be viewed. After the transcription of the interviews, the text is coded. Coding makes it a lot easier for the researcher to find certain statements that are answers to the sub-questions of this research, because it classifies topics (Saldana, 2011). The coded interviews are analysed following the structure that is created in chapter two. In this way, hopefully, a clear structure is created.

After the transcribing and coding of the interviews, the data of the interviews and other documents are analysed. In Table 1 this is shown in an overview. The data is interpreted with the knowledge that is gathered in chapter two (the theoretical framework). With the nomocracy approach, and the concepts of flexibility and adaptivity, the documents and interviews of the structure plan of Antwerp are interpreted. This is all done in a way that contributes to the answering of the main and sub-questions.

3.4 Ethical issues

In this section, three different main ethical questions that are important for this study are addressed. First, the issue of confidentiality and anonymity is addressed, whereupon the issues of discrimination and differences in culture and context follow.

The first important ethical issue that comes forward when conducting interviews is that of confidentiality and anonymity (Longhurst, 2009). This consists out of three aspects. First, a researcher needs to guarantee that all the data that is collected is kept safe and that not everybody can access it. Second, the respondent stays anonymous unless the respondent wants it otherwise. Third, a respondent can always withdraw themselves from a research at any time. These aspects are important for this study because respondents can answer the questions more freely and are more willing to corporate with the study. An example of this is that some respondents of this study wanted to be anonymous.

Another important ethical issue is that an interviewee can have a discriminatory view on the respondent (Longhurst, 2009; Diefenbach, 2009). It is very important to think about this issue, because in this way information can be lost. This is the case, because respondents may not want to answer questions anymore, or they answer a question in a different way than they intended to because they do not feel comfortable anymore. Examples of this can be racist or sexist comments. In this study, there were some difficulties with the differences between Flemish and Wallonia's. This distinction must be made because of the differences in culture and rules. Speaking about Belgium in this research was not possible, because they are two totally different regions. To prevent this problem from arising, it is very important to know about which topic and to which people you are talking to.

The last important ethical issue is that of different cultures or contexts of an interviewee and the respondent (Longhurst, 2009). In this study, this emerges out of the different cultures between the Dutch and the Flemish people. That Belgium was not written there already illustrates this. Both regions have a different language, have different norms, and think differently about subjects. These differences are important to acknowledge and work with, so that both the interviewee and the respondent can talk to each other with respect. In this aspect, as well as in the other aspects, respect is very important for conducting a good interview. To prevent this aspect from causing a problem, it is very important to know the other culture and context. Only through this, an interviewee can understand the different habits and way of thinking of the respondents.

4. Analysis and results

In this chapter, the case study of the structure plan of Antwerp that is analysed for this research, is elaborated more in-depth. In this process, findings of the interviews with the different professionals that are listed in Table 2, and different documents, are analysed and researched following the structure that is constructed in chapter 2.3.3. (A new design for urban structure plans?). This is done with some overall concepts of adaptivity and flexibility in the beginning, whereafter more content and process oriented rules are analysed.

Name	Function
K. Apostel	Spatial director of the city of Antwerp
W.G. Diederiks*	Coach/chief first structure plan of Antwerp
L.B. Wind*	Advisor bureau Omgeving, professor at the University of Antwerp
P. van den Abeele	Advisor bureau Maat-Ontwerpers
K. Penalva	Advisor bureau BUUR
C. Salewski	Professor at the University of Zurich
L. Vanmaele	Guide 'Antwerpen Averechts'

Table 2. List of interviewed professionals
* Pseudonym

4.1 The strategic spatial structure plan of Antwerp

The strategic spatial structure plan of Antwerp is made because the city was in decline in the beginning of the 21th century (Fini & Pezzoni, 2011). In this last period, the city was in decay and a lot of people were moving away. To change this city in decay, the strategic spatial structure plan of Antwerp was created. The plan was created by Bernardo Secchi and Paola Vigano, who looked on the city as a city that had a metropolis capacity but did not do enough with this capacity (Lorquet, 2012). The city was separated, abandoned and had no vision. Bernardo Secchi and Paola Vigano wanted to change this with seven images that they made. Through these images, the structure plan of Antwerp gives direction to the different projects in the city. This direction should give the city of Antwerp the economic boost that the area needed to get out of this vicious circle of a city in decay.

The structure plan of Antwerp came from the background of a city that was, and still is, connected very well with the water, and of which the city profited a lot from in the middle ages (Lorquet, 2012). In the beginning of the 20th century the harbour activities had grown a lot and the city population grew and grew. But, in 1970 and 1980 the decline of the city of Antwerp started. In 1984 the municipality of Antwerp already took an ambitious attempt to turn this process around. This attempt included the "Globaal Structuurplan Antwerpen" which consisted out of concepts and visions that are still used today. The plan was built around the river and should have given the area an economic boost. Unfortunately, due to political struggles, the plan was never implemented. At the end of 1980 inhabitants and experts wanted to attract the attention of the municipality with the organisation "Stad aan de stroom" (city next to the river). This organisation pleated for the renovation of the 19th century belt port areas. Unfortunately, this plan was not implemented as well (Lorquet, 2012). In the middle of 1990 the lack of implementing pans changed because Europe and Belgium were giving attention to the problems in big cities. Thanks to these funds a chance was created for the city of Antwerp to take the next step towards implementation of an urban structure plan.

Another movement in the history of the structure plan of Antwerp is the change of thinking in urban planning in Flanders. In the 70s, a group of experts was searching for new methods and systems that could really intervene in the spatial environment: something that the zoning plans that were used in this time could not. These plans were more a system of checking, instead of focusing on real change. This group of people came up with strategic urban planning, and the structure plan of

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Antwerp is an example of this. They developed a whole new planning system on three different levels: the Flemish level, the provincial level, and the municipal level. Within these three levels there are two sorts of plans: the structure plan and the implementation plan. With this combination, the implementation plan is always checked against the strategic structure plan. Through this, the strategy for the future is established. But as Diederiks argues, this idea does not work everywhere. A lot of municipalities nowadays want to change back to the zoning plan only, because most municipalities only want to look to the legal framework and not to a strategic framework. This is the case because it is easier and quicker, and the more liberal municipalities of today mostly think out of a legal background, while the rest will sort itself out.

The last important aspect of the background of the structure plan of Antwerp is that in 1996 the city decided to install a review committee called the GEKORO, and a "stadsbouwmeester" (city architect). They are supposed to guard the spatial quality of the city (Lorquet, 2012).

So, out of these backgrounds the idea, implementation, and control of the strategic spatial structure plan of Antwerp was born. In the next section the content of the strategic spatial structure plan of Antwerp is further elaborated.

To cope with all the complex problems that a city like Antwerp has, a strategic view is taken in the development of the city of Antwerp. This is also why the structure plan of Antwerp is called a strategic spatial structure plan. This name is given because the structure plan of Antwerp consists out of three spatial strategies. These strategies are: a generic policy, a specific policy and an active policy (Lorquet, 2012). Within the generic policy, seven inspiring images are created. These images represent the collective memory of the inhabitants and the visitors of the city. With these images, one should not think of a map with some areas that are collared, but of a whole story about how the city of Antwerp could be. A couple of examples are the water city, the eco city, and the mega city that give ideas about how the city could evolve.

The specific policies are more focused on the space specific advantages of an area and are connected through the seven images (Interview: Salewski). These specific policies are divided in five different strategic areas that form the basis for a sustainable vision of the city. Examples of this are shown in figure 4. The left figure is an image of the "Harde Ruggengraat". This strategy is a strong structuring element of the plan and focuses on the recovery of the connection between the water and the city due to the improvement of public space. The right figure shows an image of the "Groene Singel". This strategy focuses on the connection between the inner city and the parks that lie outside the ring road. By making the ring road a more green space and passible for bikes and pedestrians the strategy needs to become successful.
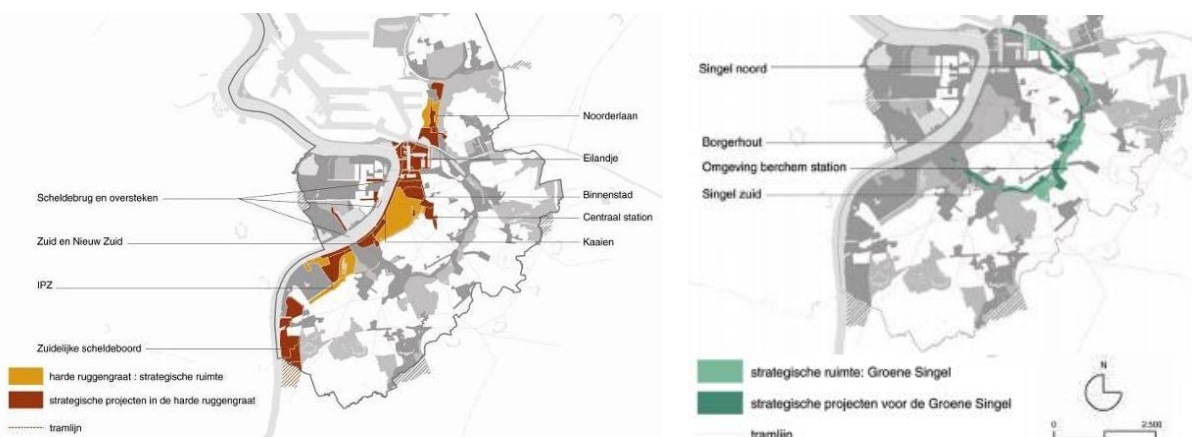

Figure 4. The "Harde Ruggengraat" and the "Groene Singel"
Source: Municipality of Antwerp, 2006

The active policy is focusing from different angels on the implementation of changing sites, green space, streets, and buildings. This policy is on a project level, and with this level the ideas and visions of the other two policies are implemented through budgeting and agreements. A couple of examples are on the areas of living, public space and mobility. As Diederiks explains it too, the three strategies work together to give direction to the city in such a way that the city can develop in the best way possible. It is not only a vision for the future, but it is also connected with the budgeting and the programs.

In the last four years, different studies from different consulting bureaus have looked on the structure plan of Antwerp with the thought of how it could evolve in the future to help the city with its problems. Four different bureaus have looked on the 20th century belt of the city and how this place could evolve to a real urban structure (BUUR, 2014). These studies were commissioned and led by the city of Antwerp. The bureau of BUUR (2014) came with the solution of a new mobility line through the 20th century belt that should give rise to this change. This mobility network is a tram line that should give these areas an extra impulse for development. The bureau of Maat-Ontwerpers (2014) took a different approach. They think micro-centrality can make the big difference for the 20th century belt. Micro-centrality includes that people of the city of Antwerp should look into places that are good for a strategy of urbanisation, but at the same time give space for city renewing. Within this idea the necessary extra buildings for the growing population can be combined with development of more high quality public spaces or services. These ideas, with two others that are not mentioned in this study, give guidance to the city of Antwerp in how to handle problems that will unfold themselves the coming years. The goal of these new ideas and concepts is to be prepared as well as possible for the problems of the future.

To conclude this section, the structure plan of Antwerp came from a background where something needed to be done with the city in decay. This is done in a different way than what is normal in Flanders or the Netherlands, because a strategic view is developed to analyse the problems of the city. This strategic view is a lot more flexible and adaptive then other structure plans that are, often, only robust and static. In the next sections this flexibility and adaptivity of the structure plan of Antwerp are discussed in more detail.

4.2 The adaptivity and flexibility of the structure plan of Antwerp

In this section more overarching rules and concepts are addressed that make the structure plan of Antwerp a more adaptive and flexible structure plan, than the urban structure plans that are most commonly created. The concepts and rules are discussed following the aspects of: how are they constructed, how do they work, and what are the advantages and disadvantages of these concepts? These aspects are addressed because, through the answering of these questions, adaptive plans can hopefully be implemented easier. Also, opportunities and disadvantages in implementing flexible and adaptive urban structure plans can be looked on in more depth.

4.2.1 Changing along with the society

The first overarching rule for adaptive urban structure plans is that the content of a urban structure plan should be capable of changing with its society. As is also addressed in chapter two, this is necessary because society changes faster and faster. If the content of an adaptive urban structure plan can change with its society, the changes in the society can be incorporated in the plan.

In the structure plan of Antwerp this is done with the seven images. These images include ideas about how the city could evolve, and are not fixed. Through these images, the benefits of the place specific opportunities can be grasped and it leaves room for the changing society to make their own choices. The images form a framework within which different choices can be made (Interview: Wind, Apostel). This shows that the plan can change along with its society. How this is done is elaborated more in the next section.

Another aspect of the structure plan of Antwerp are the strategic areas that are more time-bound. This means that the strategic areas are not that open for changes over time, because it is more project bound and thus more fixed (Interview: Van den Abeele and Salewsk). Still, on the other hand, there are also some blank spaces in the strategic map of which nothing has been said. These blank spaces leave room for changing perceptions to evolve in the way the society wants it to on that specific moment in time (Interview: Apostel).

Through the strategic character of the structure plan of Antwerp, the plan is overall much more open to changes over time than traditional structure plans. This is because strategies are not fixed, and therefore leave space for changes to occur. In the structure plan of Antwerp these strategic aspects, that are addressed above, are evaluated very positively (Vloebergh et al., 2014). The independent advisory bureau 'Omgeving' made this evaluation, as commissioned by the Antwerp city council that wanted to know how the different actors that worked with the structure plan of Antwerp experienced the plan. Out of this evaluation came forward that most actors could work with the strategies and had good results for so far (Vloebergh et al., 2014).

The advantage of this strategic approach is that it is easier to include changes over time, but, on the other hand, there is a significant disadvantage as well. This is the implementation of the plan. For such a plan to work, a lot of skilled people need to work with the plan, because without them a plan that has a lot of room to interpret is not going to work, because less skilled people would not understand it (Interview: Salewski). In Antwerp, this was the case because the administration of the city was focused on control only. Partick Jansen, the mayor of Antwerp in that time, changed the administration so that it could handle this new responsibility and that the plan could work (Interview: Diederiks).

So, there are some downsides to the strategic approach, but this does not add up to the positive sides. With a strategic approach, changes in the society can be included better, and therefore an urban structure plan can be made that better supports complex urban systems.

4.2.2 Working with starting images

The second overarching rule is working with starting images. The city of Antwerp did this, but have these starting images given the right inputs? The different starting images that the structure plan of Antwerp have are: the water city, the eco city, the harbour city, the rail city, the porous city, the mega city, and villages and metropoles (Lorquet, 2012). The image of the water city has the starting point that the old and new water structure in the city should be central. Within this image, "de Schelde" is a central aspect. The image of the eco city includes the open space and the ecological infrastructure. Parks and growing nature is central. The image of the harbour city refers to the meaning of the harbour for the city in the past and in the future. In this image, the connection between the city and the harbour, and the expansion of the harbour is central. The image of the rail city is focused on an attainable city. Within this image new tram and bike lines are central. The image of the porous city is that the city should be as efficient as possible with its space. Antwerp does not has that much space left, so if the city wants to expand within its borders this needs to be done in an efficient way. The image of villages and metropoles refers to the polycentric character of the city. The connection with the surrounding villages and neighbourhoods needs to be worked on. The last

image is that of the mega city. This image refers to Antwerp as a whole and that it lays in one of the most densely populated areas in Europe.

The seven images are made by Bernardo Secchie: he did this by walking through the city for a long time. After a couple of months he had visited so many interesting places and gained so many great impressions, that he wanted to make images of these impressions. His idea was that through these images the city could further evolve because these impressions include the strong potentials of the city. Bernardo Secchie chose for images because he believed in the strong influence of visual and story aspects. With this he took a totally different approach than was normal in Flanders, something that was really innovating and well found, because the citizens really liked these images (Interview: Wind).

So, the seven images took the role as visioning aspects in the structure plan of Antwerp. These visions provided five main inputs in the city development. First, through this the place specific advantages of the city were addressed again (Interview: Salewski, Vanmaele). It was not the case that these images were new. They already existed, but through the plan attention was brought to these aspects again. Second, these visions gave rise to discussion on how different actors in the city thought about the visions and how they should be implemented (Interview: Vanmaele, Apostel, Diederiks). This was the case because these images are relatively vague and, as a result, open for interpretation and discussion. The third input was that of a framework that all the different projects were tested on. Even if a project was in a different strategic space, it still was tested upon the visions (Interview: Apostel). This shows the big influence of the images on the implementation of the city development. The fourth input is that of the coupling between the images and real projects. Through the vagueness of the images this was open for interpretation and did not work out very well every time, but in the image of the porous city this was done very efficiently with the money of AG VESPA (a real estate company). They bought old building blocks that were in decay so renovation could start (Interview: Wind). The fifth input was that of learning by studying. Through a lot of research projects the city of Antwerp wanted to learn before they implemented a project or process (Apostel & Smits, 2016).

Next to the advantages of the images that are addressed above there is one big disadvantage of the images. This disadvantage is that the different images are not all used in the same quantity (Vloebergh et al., 2014). Because everybody can choose which images he or she wants to use, some images are used less than other images and this disrupts the plan. For example, the eco city and the water city are underexposed compared to the other images (Interview: Apostel, Wind). This shows that nature has a weak profile, but within the plan there is no mechanism to prevent this kind of disruption and this weak profile keeps existing.

So, to conclude, it can be said that the starting images had some well thought input for the development of the city of Antwerp. The images build further upon the space specific advantages that the city already had, and partly through this the images had the right input.

4.2.3 The ability to bring forward or postpone

The third principle of a more flexible structure plan is that of the possibility to bring forward and/or postpone certain decisions. In the structure plan of Antwerp there is room for this due to the flexibility of the plan. There is room to discuss certain processes or aspects, and within this discussion the time table can be discussed as well, something that is necessary to make changes. An example of this is a project like "Frederik van Eederplein linker oever". This project includes a green area that can be brought up by the city council because they want green space to get a more dominant role in Antwerp (Interview: Apostel).

So, the ability to bring forward or postpone comes out of the flexibility of the plan, but is dependent on the long term and short term budgeting of the city (Interview: Diederiks, Wind). In the formalizing process of these budgets, the different projects, and when each project needs to be implemented, are discussed. Within this process, discussion is possible but control is of essential value too. This is the case because through control the budgets are more likely to be met, but also that the projects are in the right order and are implemented at the right time (Interview: Diederiks). Something that is important for the robustness of the structure plan. As Diederiks puts it:

"Within the discussion these questions are asked and conceived. Is it necessary that this topic can be implemented next year, or should it be a year later? This is no problem. But it is essential that within the budgeting there is control and that all the choices can be discussed."

(Interview: Diederiks)

Advantages of this ability are that the projects and processes that need to be implemented in Antwerp can move in time. The first advantage is that like this a project can be implemented within the best possible contextual circumstances. With this it's meant that a project or a process works the best when it picks up on a dynamic that is developing in the city. The problem, however, is that you can never know when a certain dynamic is on the right level for a project (Interview: Van den Abeele). It is therefore that you need to have the possibility to bring forward or postpone certain projects. An example of this are demographic changes that can occur faster or slower. On this subject extra services can be brought forward or postponed according to the population growth of a certain area. A second advantage is that this movement in time can give the city council of Antwerp more time to gather more local support for a project. With more local support, the citizens will more easily accept certain changes that in the first place were not that beneficial for them, for example.

On the other hand, this structure also has a disadvantage. This disadvantage is that the structure plan gives room for movement in time, but that this real movement depends on the different actors that make these budgets. If they do not want to use this mechanism, it will not happen (Interview: Wind). This shows that without an administration that thinks in certain patterns, the plan will not be used to its maximal potential.

So, the administration can bring forward or postpone projects and processes to be implemented. But in that case, all the different actors must feel that this is the right decision to make. When this is not the case, it will not happen. In the case of Antwerp, the intention to do this is present, but if this happens often or not is questionable (Interview: Diederiks).

4.3 Rules that are content oriented within the structure plan of Antwerp

In this section the more content oriented aspects of the adaptivity and flexibility of the structure plan of Antwerp are addressed. These content oriented aspects are discussed following the structure of: how are they constructed, how do they work and what are the advantages and disadvantages of these aspects? By better understanding the content oriented rules, steps for improving these aspects in urban structure plans that still need to be developed are implemented more easily.

4.3.1 Coevolution and self-organisation

The first content oriented aspect that could make a structure plan more adaptive are the concepts of coevolution and self-organization. First, the concept of coevolution is discussed, whereafter the concept of self-organization is elaborated. In the structure plan of Antwerp the concept of coevolution is more or less included. This is because a couple of aspects of the structure plan of Antwerp use this concept to develop a certain area. But, this was not the case in the beginning of the plan. The structure plan is made in 2006 and at that time the concept of coevolution was not that well known and developed. Because of this, the concept was not really included. If such a plan would be made nowadays, this concept would likely be included a lot more (Interview: Wind). This is probably also the case because planners and makers of urban structure plans think way more about bottom-up initiatives nowadays. These initiatives can help an area, and the area can help them, so it is mutually beneficial. So, the concept of coevolution could be used a lot more, but due to the timeframe in which the plan was made, this was not possible.

The strategic map, for example, uses the concept of coevolution to develop the city as a whole. It does this by stimulating certain areas, which other areas will follow up on (Interview: Apostel). Some areas fall outside of the strategic map. The city administration believes that these areas can be developed by input of other actors, and together with the strategic areas, will grow faster and develop better. By giving input for certain areas, take for example "de Groene Single": the city administration believes that with input of parks and other green space places surrounding these, areas will also come up with ideas and plans about this topic, and, in this way, help each other further in achieving the common adjustment of a more green city.

Another part of the plan where coevolution is noticeable, is that of the revision of the structure plan of Antwerp. In the LABOXX studies, coevolution is central in the concept of micro-centrality of the bureau of Maat-Ontwerpers. This concept shows that through impulses that are given in certain areas, following certain rules, other dynamics in this area will grow as well, with these dynamics that are more organized (Interview: Van den Abeele). An example of this is the compression stroke in the housing market. With input of new buildings, other local initiatives came with new ideas and implemented these ideas by themselves as well. Examples of these implementations are the raising of houses and extending of houses.

The concept of self-organization is more or less used in the same way as the concept of coevolution in the structure plan of Antwerp. The concept is mostly used on a project level but also, as already addressed, in the strategic map where an actor like "Ringland" organizes itself to develop "de Groene Single" area. On a project level this concept is often used by the advisory bureau Buur who works a lot with pop-up companies that change the image of a street in decay, and show that in this way the renovation of a street begins (BUUR, 2014). These examples show that these concepts are worked with more and more in the structure plan of Antwerp and are of more and more importance to developing a complex urban system.

The biggest advantage of these concepts in a structure plan like Antwerp is that more local initiatives help with thinking about spatial problems in their city. With initiatives like "Ringland", that via crowdfunding are executing research that can contribute to the further development of the city, a broader input in the discussions surrounding difficult aspects of city development is created. But the coevolution part that two actors commonly adjust, and in this way create a better area to live in, is a very positive development as well.

On the other hand, disadvantages of these concepts are present as well. With more actors that discuss a project or process, the communication of both parties needs to be good and efficient. Otherwise it could be the case that process uncertainties rise and this can have negative effects instead of positive ones because then the concepts slow the development of an area.

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Thus, both concepts have a great positive effect on the flexibility and adaptivity of the structure plan of Antwerp, because through these new ideas and initiatives different choices can be made that are more logical in that specific timeframe. It has to be said that these concepts are now used in the structure plan of Antwerp, but that this was not so much the case when the plan was implemented in 2006.

4.3.2 Fewer rules

The second content oriented aspect is that of fewer rules and more use of processes in the structure plan of Antwerp. The city administration did not want to install a lot of rules surrounding, for example, green space or building regulations. There are no regulations that prescribe building hides or minimal square meters of green space in projects. This gives the structure plan of Antwerp its big flexibility because the city administration, companies and citizens can make their own choices (Interview: Apostel, Diederiks, Wind).

With this room for making choices, the city administration wants to support and increase the system that a dialog between neighbors and companies about the street order is conducted more often (Interview: Apostel). This follows the idea that if people have respect for their surroundings, rules are not needed because order in the street will not be disrupted. Apostel addressed it in this way:

"I do not think you should install rules to prevent the worst. Because every rule you install, also has a backfire. So this always is the question: what is the goal of the rule, and which mechanisms and effects are blocked because of this rule, and which effects exist when no rule is installed?"

(Interview: Apostel)

With this way of thinking, rules have the advantage that they can prevent actors of doing certain things that the city council thinks are not beneficial for the spatial development of an area. As Apostel argues as well, rules can have a disadvantage on flexible and adaptive processes. This is the case because rules prescribe things, whereas flexibility and adaptivity are processes where changes should be possible. The question that then arises is, how is the spatial quality then secured? This is where the city administration steps in. The building plans need to pass the administration to get permission to get build. This administration is, in the case of such a flexible plan, responsible for the spatial quality. But, with a change of administration, the ideas on the spatial quality of the city can change drastically. Something which the structure plan in this case cannot do anything about.

So, to conclude, fewer rules give room for flexible and adaptive processes to work better. But, with this, the responsibility for the spatial quality lays in the hands of the city administration. Something of which the flexibility can be questioned.

4.3.3 Existing buildings and infrastructure

The third aspect includes the existing buildings and infrastructure and how this can help the flexibility of the structure plan of Antwerp. In Antwerp there is a tradition that something is not demolished very easily. This has two reasons. History shows that Antwerp always had big reactions from it civilians. When a big area was planned to be demolished and the civilians did not liked it, the civilians came in action (Interview: Diederiks, Van den Abeele). The second point is that the owner structure in Antwerp is really shredded (Interview: Apostel). This makes it very difficult to demolish a big area of houses because you need to by all the different plots from different owners. So, in Antwerp there are a lot of existing buildings and infrastructure where projects and ideas need to learn to work with.

These aspects of working with existing buildings and infrastructure can help to enhance the flexibility and adaptivity of the structure plan of Antwerp. This is the case, because with this, the local specific advantages of an area can be met better and more quickly. The flexible view that is included in the structure plan of Antwerp leaves room to argue, and uses these buildings in such a way that the local areas meet the local needs in the best possible way. With the use of existing buildings and infrastructure, this is mostly done much easier than when everything is built from scratch because in this way the identity of the area is lost less often.

The advantages of this aspect are already addressed above, but there is also a downside. With the old buildings and infrastructure in place it is much harder to develop a new area. The ideas are harder to develop because not everything can be drawn from scratch. This makes it more challenging than other blueprint plans, but with a more flexible and adaptive result in the end.

4.4 Rules that are process oriented within the structure plan of Antwerp

In this section the more process oriented rules within the structure plan of Antwerp are addressed. These process oriented rules are discussed following the structure of: how are they constructed, how do they work, and what are the advantages and disadvantages? As is addressed in the previous chapters as well, by understanding the process oriented rules of urban structure plans more, a better urban structure plan for complex urban systems can be developed.

4.4.1 Support of local initiatives

The first process oriented aspect that helps a structure plan with becoming more adaptive, is the support of local initiatives. Different experts think differently about how the structure plan of Antwerp is supporting local initiatives. Diederiks and Apostel say that the structure plan of Antwerp in the beginning had some bottom-up initiatives, and that this was quite a lot for the time that the plan was made in. This also comes out of the history of much civilian participation in the city of Antwerp. A good example is "Parkspoor Noord". The board of the city of Antwerp wanted to develop this area into a big neighbourhood and a big road, but the civilians in this area did not want that. They wanted to have a park in an open space. Through demonstrations of the civilians, the project of the neighbourhood was cancelled, and after this the board was working with the civilians for the development of the park. The support of the local initiatives is done by a lot of collaboration between the city administration and the civilians. This is done with plan days where both the city administration and civilians are included (Interview: Diederiks). Other supportive elements that are created by the administration of Antwerp are loose and attractive rules for pop-up stores. This is done because a couple of areas were in decay and this was one of the options to get new stores in these areas (Interview: Penalva).

The plan days include a collaboration between the administration of Antwerp and its civilians (Interview: Apostel, Diederiks). They have discussions, share ideas about the design, and work on public support. This did not always go as everybody wanted it to, but mostly these planning days were of good and relevant support of these local initiatives to help develop the spatial structure of the city of Antwerp further. The other supportive element of loose and attractive rules works following the principle that these new stores need low rent to start. Through new rules this is made possible, and these new stores had a positive influence on the spatial quality of an area.

An important aspect to mention is that these processes of supporting local initiatives decreased after the change in board of Antwerp in 2012. After this, the social aspect of these processes went more and more lost (Interview: Diederiks).

A second aspect in which the support of local initiatives is very important, is by the revision of the plan and the LABOXX studies. The board sets its attention on research and pilot projects so that the new board in 2018 can begin with the new structure plan (Interview: Wind). This is done with a lot of bottom-up researches to discover what the people want to see their city evolve into. The LABOXX studies and the spatial planning department is focusing on city debates and city labs. The city debates are think days who are organized with the city departments and civilians. These days include 20 to 30 people who are thinking and arguing about a topic concerning the structure plan of Antwerp. The city labs are experiments within the city for a vision of 2050. Within these visions coalitions are formed who really perform these experiments when the government steps back (Interview: Apostel).

The advantages of supporting these kind of local initiatives are huge because it stimulates the local influence on the spatial quality of Antwerp. It can also be seen that this kind of supportive mechanisms really work in the city of Antwerp because the civilians are actively involved. Downsides of the story are present too. These supportive processes cost more time and money which makes it hard sometimes to handle quickly (Interview: Penalva, Van den Abeele). But in the end there is an idea or concept that works better with more political and local support.

So, to conclude, the support of local initiatives started a little bit slow in the structure plan of Antwerp, whereafter this increased. In 2012 this process decreased again, but with the new LABOXX studies the city department of planning wants to go in a direction where there is more support for local initiatives again.

4.4.2 Learning from mistakes and processes

Within the concepts of flexibility and adaptivity, the process of learning from your mistakes and admitting that you made mistakes, is very important. In the beginning of the structure plan of Antwerp these processes were incorporated very well in the plan. There was an open communication between the different actors and this process evolved over time. Through the change of the board of the city this has changed. Also, with the new board, the spatial planning department has been lifted (Interview: Wind). With this a lot of knowledge was lost. Some people of the planning department were transferred to other departments to do their work from there, but that is not that easy because the connection distance between the different actors became bigger. There are still some strong learning processes within the university of Antwerp, but these connections are declining too (Interview: Diederiks).

Within the process of revision of the structure plan of Antwerp the learning process is very open. This is also changed because all the experts that work on this topic are working in one building now. A few years ago, this was not the case. Nowadays, the different experts can tell each other that something is going wrong, but this does not always happen due to the busy schedule that everybody in the department has (Interview: Apostel). Within the LABOXX studies, the learning process was very well evaluated. The city had arranged meetings and workgroups where the four advisory bureaus could talk with each other about the different topics, but also learn from each other in this process (Interview: Abeele).

Overall can be concluded that the learning and reflection processes started well in the structure plan of Antwerp, but that this decreased a bit in 2012 because the administration that implemented the structure plan of Antwerp was lifted. Via the LABOXX studies, the city council wants to improve the capacity to learn and reflect again.

5. Conclusion and discussion

In this last chapter, a couple of aspects are addressed. In section 5.1 the sub-questions and the main question are answered and linked to each other. Subsequently, these answers are discussed on the theory of this thesis in section 5.2. In section 5.3 the reflection on the process of the thesis closes this chapter. In the reflection, two aspects are central: what could have gone better in the processes of this thesis, and by whom, and what are follow-up questions for future research on this topic?

5.1 How can a more flexible and adaptive urban structure plan be developed?

This thesis focuses on the question: how can the adaptive capacity of city development plans be increased to more fully support a complex urban system in a Western European context? This question is answered following the theoretical and the empirical part of this study. In the sub-questions that are answered in this chapter, a difference is made between the first two and the last two questions. The first two questions are based on the theory, and the last two on the empirical study of the case of the structure plan of Antwerp.

In the next sections the following sub-questions are answered:
- What are the strengths and weaknesses of traditional urban structure plans in dealing with uncertainties?
- How can a complexity perspective inform a city development plan to increase its adaptive capacity and in this way be more capable of supporting a complex urban system?
- Which elements that support the adaptive capacity of a city development plan can be identified in the structure plan of Antwerp of 2006 and how do these elements work?
- Which lessons can be identified on how public planners can strengthen flexibility and adaptivity in city development plans?

Traditional structure plans have two main advantages that are still very important nowadays. These advantages are certainty (robustness) and a visioning capacity. First, Robustness is important for an urban structure plan because it gives certainty to the civilians, investors and other actors that are involved with the plan. In this way, the urban structure plan can provide; political support, public support and investments. Examples in practise can be found in the structure plan of Antwerp. An example is that of investments. Because the structure plan had enough certainty, AG VESPA, a real estate company, was interested to buy a whole neighbourhood where new developments could take place. Without this kind of investment, the municipality of Antwerp would never have been in the position to undertake such a big project.

Second, the visioning aspect of an urban structure plan can inspire, trigger and motivate actors. This helps to get to a common goal more easily by the shared values. But, innovative ideas that match with the plan can be created as well and used much more and more quickly. A good vision can really help in overcoming problems by redefining them and strengthen the link between process and content. In the structure plan of Antwerp, this visioning element can be seen in the seven images that are created. Not all the images are equally strong, but overall it can be concluded that these images have given the right input, so that different actors began to think and work together in the planning process.

On the other side of the story, there are also disadvantages of traditional urban structure plans in supporting a complex urban system. These disadvantages fall under the core disadvantage that urban structure plans struggle with: the uncertainty of our changing society. Due to the top-down view of urban structure plans, and the little inclusion of local knowledge in urban structure plans, this

struggle keeps existing. This is because these two processes are not well equipped for a changing context. But, by introducing concepts from a complexity perspective, maybe a change can take place.

A complexity perspective on city development plans (structure plans) shows us that uncertainty in planning practise is accepted and that planning tools need to include uncertainty to be more supportive of a changing environment. Out of this acceptance three concepts come forward that are essential in this process. With this, maybe it is possible to decrease the top-down view of urban structure plans and increase the inclusion of local knowledge in urban structure plans. The three concepts that can do this hopefully are: self-organisation, coevolution and flexibility. Self-organisation and coevolution are process concepts that include local knowledge more in a urban structure plan where flexibility is more focussed on the content of an urban structure plan. Out of the theory in chapter two, it is learned that flexibility can help an urban structure plan to be less top-down in the sense that the way of thinking is more focused on user oriented needs from the area. In this way, local actors are more involved in the implementation process. These three concepts work with uncertainty because a planner cannot always know which changes will happen where in the future. If these concepts are included in an urban structure plan, an urban structure plan can most likely be more supportive of a system where uncertainty is included per definition.

In the structure plan of Antwerp, a couple examples of these concepts can be seen. "Ringland" as an organisation that organised itself, and rules that are interpretable by the citizens in, for example, building heights or green space in an area. These interpretable rules make an urban structure plan flexible and, thus, user oriented. Something that is important to mention in the case of Antwerp is that these concepts worked so well because the citizens of Antwerp are very active on the topic of public space. In history, this activity can be seen for a long time with a lot of initiatives and pressure groups that are openly debating and discussing about the mapping of their public space. For other cities it is possible that these concepts work less efficiently because the citizens want to be involved less.

The structure plan of Antwerp shows that a couple of aspects that are mentioned in chapter two are also used in reality. Aspects that are used a lot in this plan and also worked well are: starting images, the ability to bring forward or postpone, using fewer rules and using smaller scale plans. How these aspects work is discussed in chapter five, but here can be said that these aspects worked well in the context of Antwerp. This is because of three main aspects: different actors were willing to discuss the different issues; the citizens took the responsibility in this process; and the government structure was changed in favour of the structure plan of Antwerp.

First, many different actors, such as companies and civilians, were willing to discuss choices that the city department of planning wanted to make. In these think days different subjects were addressed which the different actors talked about. Through this system, the implementation of the plan mostly went by the way that the actors more or less wanted as well. This brought harmony between the city department of planning and the different actors: something that gives more certainty to the structure plan.

Second, the citizens took the responsibility to be active in a plan that needs actions from local actors. With this responsibility it is much easier to work with the freedom that is given by the structure plan of Antwerp. If this responsibility is not present, it is very hard for a planning department to make a flexible and adaptive structure plan like Antwerp a success.

The third aspect includes the change in governmental structure in favour of the plan. In Antwerp, a department of planning was created to implement the structure plan. This was done because the political parties were convinced that this was the correct step for the development of Antwerp and ensured that the plan was implemented in the most correct way possible. However, it must be said that this planning department is closed down already, and that this makes the implementation of the structure plan of Antwerp a bit more difficult.

Other aspects that are used are: requisite carrying structures and learning processes. The requisite carrying structures are used most in the LABOXX studies of the city. For example, in these studies cheap rent for pop up stores was introduced as a structure that could help a street in decay with development. In the remainder of the plan this aspect is not really found, but it could very well be that these structures are included on a lower scale. Certainly with the background that the citizens of Antwerp are very active, this can be seen as a positive and strong mechanism.

The aspect of learning was already used a lot, but this was, and is, in this structure plan of Antwerp not always easy to implement. This comes mainly through time pressure. A solution could be a protocol that through feedback loops, more learning mechanisms can take place. This could be the case with smaller scale plans within the structure plan of Antwerp, but also if there is time reserved for this aspect in the projects.

So, the requisite carrying structure and the learning processes are used in the structure plan of Antwerp, but could have been used more and better to help the structure plan of Antwerp to be more supportive of complex urban systems.

Concluding on the aspects that are found in the structure plan of Antwerp there must be said that within these aspects the concepts of self-organisation and coevolution are intertwined. The aspects that are mentioned are the operationalized effects of these abstract concepts in reality.

5.1.1 Lessons for public planners

Out of the results and conclusions of this thesis, four lessons for public planners can be identified in how city development plans (urban structure plans) can become more flexible and adaptive. The first lesson is that it seems like the design of an urban structure plan needs to give space to uncertainty because it is always a part of a complex urban system. To do this, the design of an urban structure plan could be equipped with these aspects: using fewer rules, bringing forward or postponing, and working with starting images. This is something that is also done in the structure plan of Antwerp. These aspects give space to uncertainty because it gives input to an urban structure plan in the way that it can better support a complex environment.

The second lesson is that within an urban structure plan it is also possible that flexibility and adaptivity work against the plan. If a plan is too flexible, a change in power can disrupt the plan quite easily. This has the effect that the intention of the plan can change because rules are multi interpretable. So, by implementing a flexible and adaptive urban structure plan the administration of the city is very important. They need to know the plan and know in which direction the city wants and needs to develop. In this way a flexible and adaptive urban structure plan can work in the best way possible. If the administration is not equipped to implement such a flexible and adaptive structure plan, it is hard for the administration to implement the urban structure plan with success.

The third lesson is that planners need to take in consideration that with developing a flexible and adaptive urban structure plan, the robust side of an urban structure plan should not be forgotten. The balance in an urban structure plan always needs to be right between the robustness side and flexible and adaptive side. This is the case because the steering capacity and the capacity to give certainty is also important in making an urban structure plan successful.

The last lesson is that public planners should look more into the different types of uncertainties, in combination with the uncertainties that are present in complex urban systems. In the structure plan of Antwerp can be seen that by including more local knowledge in the urban structure plan, more environmental uncertainties can be reduced. But, on the other hand, process uncertainties can rise with this change because more local actors are involved with the plan. The question is which uncertainties are the worst in your context.

So, through the answers of these questions it seems that a city development plan (urban structure plan) can be better equipped to support the adaptive capacity of a complex urban system in a western European context. Most likely this can be done by giving space for uncertainty through the implementation of: starting images, ability to bring forward or postpone, using fewer rules and using smaller scale plans. These aspects, and a couple more that are mentioned in this chapter, give space where spontaneous order (self-organisation and coevolution) can emerge. At last, the lessons that are learned are probably also important in developing urban structure plans, because they indicate how urban planners should think about this matter when developing a complex urban system.

5.2 A discussion about the conclusion

In this section the conclusion is further developed upon theory. This is done with the same structure of the conclusion section and gives a more theoretical basis upon which the conclusions are given. If this is not possible, it is also addressed and discussed how these conclusions should be interpreted. So, the goal of this section is to better understand what the conclusions in the section before really mean, and which aspects public planners can learn to keep in mind for future research. Only the first two sub-questions are not mentioned in this part because these questions are already answered based upon the literature of this study.

Important to notice is that the flexible and adaptive aspects that are found in the structure plan of Antwerp are used on different levels. This is important to notice, because connections between the different levels are quickly overlooked because people see flexible and adaptive aspects and immediately think that an urban structure plan is supportive of a complex urban system, but this is not the case. That the different types of flexible and adaptive aspects are used in the different levels is important to develop a structure plan that is flexible and adaptive as a whole, and like this can better support complex urban systems (Van Vliet, 2016). These different levels are included in the dynamic planning pyramid of Van Vliet (2016) as can be seen in Figure 5. In this pyramid the strategic level interacts with the program level, and the program level interacts with the project level. In this way the strategic level has influence on the projects that are implemented. Out of the interviews came forward that this is not always true in the case of the structure plan of Antwerp, because the projects in Antwerp are directly checked against the starting images (the strategic level). The structure plan of Antwerp shows that there are also different ways of how flexible and adaptive planning tools are used. In this case, the strategic level of the structure plan of Antwerp has a double check both on the program level and the project level.
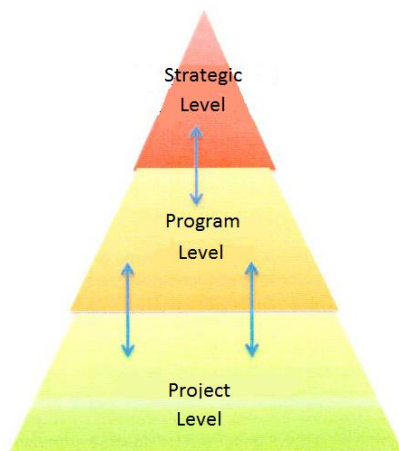

Figure 5. The Dynamic planning pyramid for complex spatial planning
Source: Van Vliet, 2016

Concluding, it can be said that the structure plan of Antwerp shows that connections between the different levels are important, but that theory can always be differently implemented in different situations. This change in the use of the idea of the Dynamic planning pyramid can maybe even be a better model for the situation of Antwerp.

This thesis shows that in the theory about nomocracy (Moroni, 2010), a gap with practise is present. The nomocracy way of thinking is hidden in almost all the tools and concepts that are central when thinking about giving more space to uncertainty and change. Only in theory, this is never said that specifically. Of course, theory is an abstraction of reality, but there could be some more research done on the nomocracy approach and real tools that planners can use to implement this way of thinking. This is missing in the approach as it is known today.

From the different lessons for public planners that are addressed in the conclusion, the first and the third are grounded on literature and the case of the structure plan of Antwerp, the second and the fourth are not. I am addressing these lessons for public planners because the questions arises: what can be learned about these lessons without any theoretical background? The second lesson that within an urban structure plan it is also possible that flexibility and adaptivity work against the plan, is not grounded on literature. This gives the opportunity for researchers to look further into this aspect, because a couple of professionals that are interviewed talked about this aspect. The different interviews show that it is possible that flexibility and adaptivity can also work against an urban structure plan in another context and a different plan.

  The fourth lesson shows that with the inclusion of different types of uncertainty, maybe some uncertainty can be avoided because public planners know the area better through, for example, local knowledge. This idea is based on the structure plan of Antwerp, but not on theory. Again, this could mean something for different contexts, but it could also be the case that in different circumstances this way of thinking does not work. This is something to think about carefully.

Thus, in this section the different conclusions that are given in the previous section are checked against literature where this was possible. This shows that a lot of conclusions need to be further developed in theory, and that it seems that the theory of nomocracy could be sharpened following the findings of the case study of Antwerp.

5.3 Reflection on the research

The reflection consists of two parts. First the literature study is addressed, whereafter the methodology and results are discussed. At the end this section closes with recommendations for future research.

5.3.1 Subjects of improvement

Literature study
In the literature study that is conducted, a couple of aspects could be improved. In the first place, the robust side of the structure plan has got minimal attention in the literature study. Only a couple of small things are said to let the reader know that this is also a very important aspect of an urban structure plan. The small amount of attention on this part of an urban structure plan, comes out of the lack of time that is reserved for this thesis. If this aspect was also included, the study could most likely not be finished in time. But, to have a complete view on structure plans, this aspect should certainly be included.

  The second aspect of the literature study that could use some improvement is the strategic aspect of planning. In the other chapters, a lot of the time strategic planning pops up, but in the

literature study this is not addressed. If this was included, the literature study would be more complete and a better background on the theories about urban structure plans would be given.

Methodology
In the methodology of this study, there could have been more interviews with key actors of the structure plan of Antwerp. For example, Katlijn van der Veken who is responsible for the implementation of the plan, could not find any time to have an interview. By missing such an important actor in the structure plan of Antwerp, it is harder to gather relevant results and write a relevant conclusion. Also, the more market based parties that work with the structure plan of Antwerp, did not respond to my invitations to contribute to this research. If this was the case, a much broader base of information gathering could be made. On the other hand, it also must be said that I started a little bit late with searching for professionals to interview. Maybe if I had started earlier, the response would be different.

Results
In chapter four of this study, one aspect should be considered carefully. By studying one urban structure plan the contextual circumstances of this study are very important. The conclusions and results are. due to this, based on one specific area and need to be interpreted with care if one wants to use the information for different contexts. It is possible that in other cases different results emerge.

5.3.2 Recommendations for future research

In this research a couple of conclusions and lessons for urban planners are given. But after this, a lot of questions still remain as well. The main topics that can be addressed in future research are the following:

- What can the robustness of an urban structure plan trigger to help a structure plan be more successful? We know that robustness is important for investments, but how do these processes that trigger investments really work?
- For future research it should be very beneficial to research more urban structure plans in different contexts. This gives a broader view of urban structure plans and their support for complex urban systems.
- Another very interesting aspect that this study encountered, is that of the negative effects of planning rules. Which effect do rules have on processes that help an area with developing itself in a right way?
- A very interesting topic as well, is that of the different types of uncertainties and how they work in the context of a complex urban system. Is it possible to develop a better urban structure plan for supporting a complex urban system, by knowing more about these different types of uncertainty?
- The last topic is that of self-organisation and how this concept is really stimulated by urban structure plans. In the structure plan of Antwerp this is done by leaving room where nothing is coordinated, but are there also other tools that stimulate self-organisation?

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7. Appendix

Appendix 1: Interview guide

Naam interviewer:
Naam respondent:
Datum:
Plaats:

Introductie:
- Vraag of het interview opgenomen mag worden. De informatie die verstrekt wordt zal alleen gebruikt worden voor dit onderzoek en als de persoon dit wil anoniem verwerkt worden.
- Vraag hoe lang het interview mag duren.
- Vertel iets over jezelf: Wie ben je, welke studie doe je.
- Vertel wat het doel van het onderzoek is:
  Om er achter te komen of er elementen in het structuurplan van Antwerpen en zijn herziene versies zijn die de adaptiviteit van de stad vergroten. Dit wordt gedaan door interviews te houden onder meerdere specialisten, gemeentelijke ambtenaren en adviesbureaus.
- Uitleggen dat in het onderzoek gekeken is naar een aantal punten van adaptiviteit en flexibiliteit en dat gekeken gaat worden of deze punten ook terug komen in het structuurplan van Antwerpen.

Inhoudelijke vragen:
Vragen over de persoon:
- Wat is uw professionele achtergrond?
- In welk gedeelte van het structuurplan van Antwerpen bent u betrokken geweest en in welke periode?

Vragen over de adaptiviteit en flexibiliteit van het structuurplan van Antwerpen:
Eerst een paar algemene statements:
- Het structuurplan van Antwerpen is zich bewust van de veranderende samenleving. Kunt u een hiervan een voorbeeld geven? (het vermogen om op veranderingen in te spelen)
  - Vindt u dat het structuurplan van Antwerpen hier genoeg aandacht aan heeft besteed of had dit nog meer gekund?
  - Waarom?
  - Is dit ook veranderd in de tijd, in de verschillende revisies?

- Het structuurplan van Antwerpen werkt met start-beelden en minder met eind-beelden.
  - Kunt u hier een voorbeeld van geven?
  - Hoe zijn deze beelden ontstaan?
  - Hebben deze start-beelden de verwachte resultaten opgeleverd?
  - Welke moeilijkheden zijn hier achter weg gekomen?
- Geeft het structuurplan van Antwerpen de mogelijkheid om beslissingen te laten nemen wanneer deze relevant zijn?
- Zo ja:
  - Hoe zijn deze mogelijkheden ingebouwd?
  - Wat heeft dit opgeleverd?

Nu komen een aantal vragen over meer specifieke regels die inhoud georiënteerd zijn:
- Het structuurplan van Antwerpen bestaat uit meerdere kleinere plannen.
    - Zit er ook nog een verschil tussen de kleinere plannen in hoe adaptief en flexibel deze zijn?
    - Waaraan is dit te zien?
    - Waarom is hier voor gekozen?
    - Heeft dit gewerkt?
- Zijn er incrementele ontwikkelingsstrategieën in het structuurplan van Antwerpen?
- Zo ja:
    - Welke zijn dit?
    - Hoe zijn deze strategieën ontstaan?
    - Hebben de strategieën de gewenste gevolgen opgeleverd mbt adaptiviteit?
- Is er in het structuurplan van Antwerpen ook sprake van ondersteunende mechanismen die het makkelijker maken voor kleine partijen om initiatieven op te starten?
- Zo ja:
    - Welke zijn dit?
    - Op welke manier hebben deze kleine initiatieven volgens u een positieve bijdrage gehad op de adaptiviteit en flexibiliteit van het structuurplan van Antwerpen?
    - Een nadeel van deze ondersteunende mechanismen is dat deze ook heel duur zijn. Denk u dat deze mechanismen vergeleken met hun kosten het waard zijn om geïnstalleerd te worden?
- Is er in het structuurplan van Antwerpen sprake van regels die flexibel zijn? (regels die kunnen omgaan met veranderingen over de tijd)
- Zo ja:
    - Welke zijn dit?
    - Hoe zijn deze regels ontstaan?
    - Hebben ze tot nu toe gewerkt?
    - Is dit volgens verwachting gegaan?
- In het structuurplan van Antwerpen wordt veel gebruik gemaakt van bestaande infrastructuur of bebouwing
    - In hoeverre heeft dit de identiteit van de stad behouden? Is dit altijd noodzakelijk?
    - Zijn er door deze aanpak meerdere opties binnen het plan open gebleven?

Nu komen er een aantal vragen over specifieke regels die proces georiënteerd zijn:
- Is er in het structuurplan van Antwerpen sprake van processen die aansporen tot het leren van gemaakte fouten?
- Zo ja:
    - Welke zijn dit?
    - Hoe zijn ze ontstaan?
    - Hebben ze gewerkt?

Afsluitende vragen over de inhoud van het interview:
- Zou u zelf nog extra inhoudelijke aspecten of proces aspecten aan willen dragen die u tekenend vindt voor de adaptiviteit en/of flexibiliteit van het plan van Antwerpen?
- Zo ja:
  - Welke zijn dit?
  - Waar zitten deze aspecten in het structuurplan van Antwerpen?
  - Waarom zijn deze aspecten belangrijk?
  - Hebben deze aspecten gewerkt naar de verwachtingen?
- Als u nog een keer aan een groot structuurplan als Antwerpen zou meewerken zou u dan wat anders doen?
  - Waarom?

Afronding:
- Wat vond u van het gesprek?
- Heeft u alles wat u wou zeggen gezegd?
- Zijn er nog documenten die interessant zijn om te raadplegen voor mijn onderzoek?
- Heeft u suggesties wie ik nog meer zou kunnen spreken?

Bedankt voor het meewerken aan dit onderzoek. Als u wil stuur ik mijn scriptie graag naar u toe als deze af is.

Voor de interviewer
Als een vraag met een negatief antwoord beantwoord wordt doorvragen of deze aspecten of processen volgens de geïnterviewde een positief effect zouden kunnen hebben gehad op de adaptiviteit en flexibiliteit van het structuurplan van Antwerpen.

Appendix 2: Date and location interviews

Name	Date and time	Location
K. Apostel	Tuesday 19th of May 2016 11:00	Den Bell, Antwerp
W.G. Diederiks*	Tuesday 19th of May 2016 17:00	Antwerp
L.B. Wind*	Wednesday 20th of May 2016 10:30	University of Antwerp, Antwerp
K. Penalva	Wednesday 20th of May 2016 16:00	Bureau BUUR, Louvain
P. van den Abeele	Monday 23th of May 2016 9:00	Groningen/Ghent via Skype
C. Salewski	Tuesday 12th of July 2016 11:00	Groningen/Zurich via Skype
L. Vanmaele	Thursday 14th of July 2016 15:00	Groningen/Antwerp via Skype

Table 3. Date and lcation of the interviews
* Pseudonym

Apendix 3: Example of coding and categorizing data

Het structuurplan van Antwerpen werkt met start-beelden en minder met eind-beelden.
Kunt u hier een voorbeeld van geven?

Diederiks
Omdat dat de mogelijkheid gaf om mensen er over na te laten denken en die in te vullen wat er essentieel was van dat beeld en dan weer te vergelijken. Dus dat werd een kader wat relatief flexibel was. Dat gaf aanleiding tot discussie. Hoe moeten we dat nu interpreteren. Antwerpen een poreuze stad of Antwerpen een spoorstad. Hoe moeten we dat nu interpreteren en hoe moeten we nu dat terugplaatsen in het kader. Dat gaf een kader wat niet vast was. Wat wel een duidelijke richting aangaf maar wat niet heel concreet op tafel met lijnen bezig was. Het gaf een visie weer en het is ons zeer goed gelukt om daar aan te toetsen. Het was in die zin, is dat een hele goede manier om te werken eigenlijk. Dus geen harde, hele concrete visies maar een betekenis, wat is de betekenis van ruimtes die mensen ter discussie stellen. En dat men er over met gedachten kan wisselen, maar wel een bepaalde richting gaf.

Apostel
Ja je hebt de water stad, de poreuze stad, de eco stad. Maar het is ook zo dat elk plan dat wij maken ook al valt hij niet in de strategisch ruimte toch zullen wij het toetsen aan de visie, aan de zeven beelden. Eigenlijk is dat het eerste hoofdstuk in elk plan. Hoe het zich verhoudt tot het structuurplan. Dus de visie moet echt doordringen in elk project dat wij realiseren.

Salewski
Op een bepaalde manier als je kritisch over de RSA zal spreken, als je het negatief wil uitdrukken is het eigenlijk expliciet maken van wat er sowieso was. Op een manier is het mooier gemaakt geëxpliceerd wat er belangrijk is. Dat je het ook lezen kan, anders is het. Hoe noem je dat. Weten dat het binnen de hoofden zit en dan zet je het op papier. Een soort van visualiserings strategie. Maar dat was, dat hebben we geprobeerd een beetje te beschrijven. Het is, je moet bediscussiëren wat nu nieuw is en wat nu niet.

Vanmaele
Dus het is niet zo dat alles opnieuw is uitgevonden van begin af aan maar dat men heel handig heeft ingespeeld op een aantal dynamieken die er ook al bezig waren.

Hoe zijn deze beelden ontstaan?

Wind
Wel dat is een vraag die ik zelf ook heb gesteld aan de ontwerper. Bernardo Secchie die we geïnterviewd hebben toen we aan die evaluatie zijn begonnen. Die helaas al overleden is en zijn interpretatie daarvan was, ik ben dagen, weken, maanden gaan wandelen door de stad en ik heb eigenlijk zoveel interessante plekken en indrukken opgedaan van die stad, dat ik vooral die beeldwaarde wilde gebruiken om de toekomst waar we met die stad heen wilden die eigenlijk zo visueel mogelijk uit te drukken. In tegenstelling tot de bestaande andere voorbeelden van ruimtelijke structuurplannen die meer werken met deelstructuren, met deelruimtes en hij heeft daar eigenlijk een andere kijk op gegeven. Hoewel dat de inhoudt als je het anders zou structureren ook perfect past binnen een andere structuur maar door te werken met die beelden heeft hij eigenlijk toch een andere dimensie gegeven aan zo'n structuur visie op lange termijn. En dat was eigenlijk en vernieuwend en goed gevonden door hem. Omdat dat dat aansprak bij de mensen.

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Hebben deze start-beelden de verwachte resultaten opgeleverd?

Wind

Dat zie je dus in die evaluatiestudie dat een aantal van die beelden sterker hebben doorgewerkt op het beleid dan anderen. De waterstad en alles wat met groen en dergelijke te maken had ja daar zijn veel minder strategische projecten uit voorgekomen dan de poreuze stad waar men echt ingezet heeft op via ontwerpend onderzoek op verloederde bouwblokken hoe moeten we die nu aanpakken. Men heeft hier een instrument van het vastgoedbedrijf AG VESPA op ingezet. Men heeft die middelen gegeven in die wijken in die bouwblokken ga je nu krotten opkopen, we gaan daar nieuwe projecten met enzovoort. In dat soort van projecten zat er een hele andere dynamiek dan in andere beelden. Ook de havenstad bijvoorbeeld was een moeilijk beeld omdat de haven heeft haar eigen structuur, haar eigen administratie, is wat een figuurlijke muur ontstaan tussen die haven en de stad waarbij de stad zich in het havengebied dat moet de haven maar regelen. En de haven zegt dit is ons gebied. Stad u moet hier zich niet komen bemoeien wij weten wel hoe het hier gepland moet worden. Maarja tussen de stad en de haven heb je heel veel raakvlakken en gebieden die aan het transformeren zijn zoals het eilandje. Zo eenvoudig is dat niet. En dat maakt dus dat sommige van die beelden eigenlijk sterker hebben doorgewerkt richting een strategisch project en realisatie dan andere beelden. Dus dat is een beetje een verschillende evaluatie geweest. Dat is wel duidelijk naar voren gekomen.

Apostel

De zeven beelden beschrijven de visie. Dus waarbinnen dan, dus je hebt enerzijds de visie en anderzijds de projecten om de visies te realiseren. Dus dat is de strategische kaart bepaald de projecten en die visie formuleert dan de uitganspunten om de projecten te gaan vormgeven en ik weet niet of je ze kent.

Alle misschien zijn we te positief over het plan maar we gebruiken da vaak om dingen tegen te houden die wij niet wensen in onze stad. Maar verbazend genoeg kunnen we ons daar wel verschuilen achter het structuurplan en dat is wel prettig. Bij een ongewenste ontwikkeling halen we het boek erbij en alle het staat er in dat we het niet willen. Alle men vind altijd wel iets maar het wordt zelden tegen ons gebruikt.

Welke moeilijkheden zijn hier achter weg gekomen?

Wind

Moeilijkheden is misschien een groot woord. We hebben bijvoorbeeld bij de evaluatie, hier in Vlaanderen heeft elke stad en gemeente en advies commissie in zake ruimtelijke ordening. Dat heeft GECORO. Gemeentelijk commissie ruimtelijke ordening een afkorting. Dus in Antwerpen heb je ook zo'n GEKORO die samengesteld is uit deskundigen en alle geledingen van de maatschappij zitten daarin en die moeten in de loop van de opmaak van plannen adviezen geven. Dus dat is zo gebeurd met de opmaak van het structuurplan van de stad maar ook later bij de opmaak van bestemmingsplannen in uitvoering van dat structuurplan. Want ons secreet schrijf voor, kijk als je voor een bepaald gebied een bestemmingsplan opmaakt dan moet je aantonen hoe dat dat plan zich verhoudt tot die je hebt in uw structuurplan. En die GEKORO is eigenlijk het orgaan dat daarop evalueert. Dus die gaan kijken is dit plan in lijn met waar we naartoe willen. Dus wij hebben alle verslagen van die GEKORO geanalyseerd over een periode van ik denk 7 of 8 jaar en we hebben daar in vastgesteld dat, ik denk dat meer dan 95% van de adviezen gunstig waren. Dus dat er echt een afstemming was tussen de visies we hebben dat bedacht en we gaan dat nu ook zo uitvoeren. Er waren maar twee adviezen waar de advies commissie van idee verschilde met het idee van het beleid

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maar dat ging eigenlijk om hele projectjes maar op hoofdlijnen is dat wel uitgekomen dat er echt een positieve evolutie is van visie naar uitvoering.

Diederiks

Nee ik heb er zeer positieve indruk van. Ik weet niet wat Katalijne er van denkt maar. Ik denk ook dat de administratie voldoende elementen heeft om telkens terug te kunnen naar de visie over plannen.

Niet te. Nee, nee. Want het werd vanaf die kant goed ingevuld maar zonder dat dat wet was. Dat werd niet goedgekeurd als wet en als concrete lijnen en voorschriften. Het waren denkbeelden, het was een kader. De echte betekenis van een kader.

Apostel

A goed ja dat is wel belangrijk. Daaruit is gebleken dat bepaalde beelden dat die heel veel aandacht hebben gekregen en andere beelden weer heel weinig en dat kan ik enkel maar beamen. Bijvoorbeeld zijn de waterstad en de ecostad zowaar onderbelicht gebleven. Terwijl dorpen en metropolen erg veel aandacht heeft gekregen. Ik denk dat u zo ook doelt op perverse effecten van het plan en dat denk ik eigenlijk niet.

Vanmaele

Nadelen niet. Maar sommige zijn wel moeilijker. Ecostad gaat over de ecologie in de openbare ruimte en de poreuze stad is heel moeilijk uit te leggen. Dus dat, ja ik kan wel een deel van respons uitleggen maar dat is te veel een abstract idee. En sommige werken daar goed mee en andere begrijpen dat niet.