Let nature determine the quality of our environment!

Toruń, Poland

A research of possibilities to increase the spatial quality by making use of ecosystem services.

Research report / graduation thesis

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Saxion University of Applied Sciences
Nicolaus Copernicus University
Research report / graduation thesis

A research of possibilities to increase the spatial quality by making use of ecosystem services.

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SUMMARY (ABSTRACT)

This research focuses on possibilities for the use of ecosystem services of the Vistula River in Toruń, Poland. According to a study about ‘river-based ecosystem services’ (Losco A., et al., 2012), ecosystem services around rivers have a remarkable role in many sectors of industry. According to Professor Adam Czarnecki of the Nicolaus Copernicus University in Toruń (personal communication, March 12, 2013), the city makes little use of this river: “Toruń in fact leaves the river”. In addition to that, Czarnecki also indicates that benefits from ecosystem services in Toruń are not very high. According to the Millennium Assessment (The United Nations Environmental Programme (UNEP), 2005), nature’s goods and services are the ultimate foundations of life and health, even though in modern societies this fundamental dependency may be indirect, displaced in space and time, and therefore poorly recognized. The reason for this research is to search for opportunities and possibilities to make more use of ecosystem services in Toruń. These ecosystem services are applied to the Vistula River so that the services will have relationship with increasing the spatial quality. The central question in the research is:

How can the local government of Toruń increase the spatial quality of the Vistula River in Toruń by making use of ecosystem services?

The client of the research is the Nicolaus Copernicus University led by Professor Adam Czarnecki, Faculty of Biology and Environmental Protection. Although the research will be made for the client, the local government of Toruń plays a significant role. For the purpose of this research, different methods are used to collect research data and to provide background knowledge of a fairly unfamiliar environment. During the collection of the data, different methods are used to obtain thorough analyses. The methods are applied in accordance with the method described in the literature (see page 22 for the different methods). The central question in the research was answered by preparing three scenarios (1 extrapolative scenario and 2 normative scenarios). These scenarios make use of the IES-approach, and various other methods (cause-effect analysis, Habiforum Matrix, etc.). The scenarios are designed so that they build on each other. The extrapolative scenario focuses on the planned developments and expected results (taking into account trends). The first normative scenario focuses on the link between the planned developments and ecosystem services. The latter scenario looks at additional potential opportunities to make use of ecosystem services beyond the planned developments and their link with ecosystem services.

This research focuses on two central concepts: ecosystem services and spatial quality. This research uses for the purpose of spatial quality the definition, which is most recognized. The subdivision of the concept in three values: use value, perception value, and future value. The values of spatial quality are determined by the economic, social, ecological, and cultural importance. On behalf of ecosystem services is also chosen to use the most recognized and applicable definition: the subdivision in four services (supporting, provisioning, regulation, and cultural). Ecosystem services are determined by the values: ecology, socio-culture, and economy. Because the determining (operationalization) units of the two concepts overlap, in this research use is made of the indicators: economy, social, ecology, and culture. Through these indicators, both concepts can be measured and can be controlled by the use of the Habiforum Matrix.

The Vistula River in Toruń is analyzed for its current use, trends and developments. The analysis formed according to the indicators as explained before. In this way, the analysis directly linked to the indicators of spatial quality and ecosystem services. Analyzing the data is done by making use of SWOT-analyses and confrontation matrices. The results of the SWOT-analysis (of the various indicators) are that currently there are a lot of opportunities to make use of ecosystem services. There are many strengths and opportunities to make use of ecosystem services. The confrontation matrix provides an overview of strategies, which makes efficient use of the SWOT-elements. It can be said that
the analysis of the Vistula River offers enormous opportunities for the local government of Toruń. In
addition to the current situation, the analysis found six relevant trends, which occur around the Vistula
River. The analysis also provided nine planned developments with a link with the Vistula River, which
the local government of Toruń wants to execute in the future.

The three scenarios are constructed according to the IES-approach and uses different methods. The
extrapolative scenario provides an overview of what the local government of Toruń has envisioned to
perform. This is not specifically focuses on ecosystem services or to increase the spatial quality. How-
ever, the implementation of the extrapolative scenario is already contributing to increasing the spatial
quality and makes already use of ecosystem services. Normative scenario I contribute to a greater
extent to ecosystem services and spatial quality and normative scenario II contributes the most to the
two concepts. Concluded it van be said that the awareness of ecosystem services play a very im-
portant role to make use of it. Normative scenario I and II provide possibilities to achieve more aware-
ness. The scenarios provide a picture of the future, which provides opportunities and possibilities (in
the form of steps) for the local government of Toruń.

The conclusion of the research consists of five sub-conclusions that can be seen as building bricks for
the overall conclusion. The following five sub-conclusions form part of the conclusion of the research
and the answer to the central question (How can the local government of Toruń increase the spatial
quality of the Vistula River in Toruń by making use of ecosystem services?):

1. Ecosystem services and spatial quality can be made measurable by the indicators: economy,
social, ecology, and culture.
2. The current situation of the Vistula River in Toruń provides enormous opportunities to make
use of ecosystem services.
3. Current (planned) developments of the local government of Toruń focus on the cultural ser-
vices of ecosystems.
4. Awareness of ecosystem services is an important key to the implementation of ecosystem
services in decision-making.
5. The planned developments of the local government of Toruń (unconscious) contribute to eco-
system services and spatial quality.

The local government of Toruń can make use of ecosystem services in order to increase the spatial
quality by linking planned developments to ecosystem services (normative scenario I) and to execute
new (potential) developments (normative scenario II). The building bricks of paragraph 7.1 play an
important role.

Recommended is to perform normative scenario II. This scenario contributes most to increasing the
spatial quality by making use of ecosystem services. By performing this scenario, the steps of the IES-
approach are considered important. Also can be recommended to make use of the concept of spatial
quality in policy in order to relate policy more to ecosystem services (by the indicators). An important
recommendation is also to focus on the awareness of ecosystem services, which functions as a key
for implementing it in decision-making.
PREFACE

In front of you lies the graduation research, which provides ways for the local government of Toruń to increase the spatial quality of the Vistula River by making use of ecosystem services. The research is conducted as part of the graduation of the Faculty of Urban and Regional Planning at the Saxion University of Applied Sciences in Deventer. The research is elaborated at the Nicolaus Copernicus University in Toruń (Poland) which, together with the local government of Toruń is the target group of the research.

My preference always goes to landscape, nature and the aesthetics of it. During my studies, I gathered great affinity of it and therefore it influenced my choice for the topic of my thesis. In addition, for me it always seemed to be a challenge to study a period abroad. Although I never got a real impetus to continue, I realized in my final year that I had to take the chance. I made this decision without any regrets. The choice for Toruń, Poland was partly based on my affinity with the landscape; the Nicolaus Copernicus University provides possibilities to do research within this interest. The second attraction was that I wanted to go to a country where I hardly know the culture. This seems to me an enormous challenge rather than go to well-known countries (Spain, France, Italy, etc.). By this decision, I went on 1 February 2014 as an Erasmus-student to Toruń, Poland.

In retro respect, I am proud of the fact that I took the challenge. Besides, the implementation of the research and the experience, insight and knowledge I have gained, the period also contributed greatly to my personal development. First, you are forced to speak and write the whole period in English (improvement of my English). Second, I had different conversations (meetings) with the local government of Toruń (operation of foreign politics, policy and decision-making). Third, you encounter new cultures (awareness of other cultures in Europe and their differences, both negative and positive compared to the Dutch culture). Last but not least, you live on your own and have to arrange and organize your life by your own (responsibility and independence). All this has contributed to a general contribution to the experiences and the perception of spatial planning and positioned me in a new perspective to the world.

For graduation, but especially when you do it abroad, you are very dependent on other people. I want to thank those people warmly. First, I want to express my thanks to those who helped me organize the graduation abroad. In particular: Bauke de Vries, Gerry Stegeman and Henk Blokland. They provided me with the necessary information, helped with the formalities and gave me advice. I also want to thank my supervisor at Saxion, Bert Groot. He supported me during the graduation process in giving advice and feedback. Thanking people of the Nicolaus Copernicus University cannot pass. First, I like to thank my supervisor, Professor Czarnecki, sincerely, for his hospitality, help and support during my graduation stage at the Nicolaus Copernicus University. I also want to thank ESN (Erasmus Student Network) for the wonderful time and all the interesting activities during the Erasmus-period. Last, but not least, I want to thank the people who were in any way involved in my research for their contribution and time. In particular, Ms. Karmienko, who supervised me and supported me during the research in a significant way.

Chiel Mensink
Toruń, May 2014
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1. INTRODUCTION

1.1 Inducement

It is becoming increasingly clear that population growth and economic development lead to rapid changes in our global ecosystems. The former Secretary General of the United Nations, Kofi Anan recognized these changes and came up with a report in 2000: "We the peoples: The role of the United Nations in the 21st Century". Requested in this report is to carry out the Millennium Ecosystem Assessment. They worked within this framework to assess the consequences of ecosystem change for human well-being. In addition to this, they established a scientific basis for the actions needed to enhance the conservation and sustainable use of those systems (The United Nations Environmental Programme (UNEP), 2005). According to the UNEP, ecosystem services are distinguished in four categories: provisioning services, supporting services, regulating services and cultural services. There is a growing interest in the science of ecosystems and landscape functions and services, especially since the release of the Millennium Assessment. The number of publications regarding to ecosystem services, increased strongly. However, the main problem is the fact that landscape services are still lacking in most policy-support tools (de Groot, Alkemade, Braat, Hein, & Willemen, 2009).

It must be clear that ecosystem services are indispensable to the well-being and health of people everywhere (The United Nations Environmental Programme (UNEP), 2005). Ecosystem services can also be financially attractive. For example, cities around the world spend billions of dollars on technology to produce drinkable water. In New York City, it was found that repairing ecosystems in the water supply catchment cost less than a fifth of the price of building new water filtration facility. It becomes clear that investing in ecosystem services may have many benefits (Ecosystem Services Project, 2013). Nevertheless, the complexity of biodiversity makes it unclear which elements should be protected and to which level. Ecosystems play an important role in maintaining all kinds of ecosystem goods and services. Not only are the provisioning goods of ecosystems important, but also the ethic elements. The ethical approach is an important argument for protection, although it remains difficult to assess the intrinsic value of biodiversity, which depends on cultural, ethical and individual values (Netherlands Environmental Agency (PBL), 2009).

This research focuses on possibilities for the use of ecosystem services of the Vistula River in the city of Toruń, Poland. According to a study about 'river-based ecosystem services' (Losco A., et al., 2012), ecosystem services around rivers have a remarkable role in many sectors of industry. Toruń is a Hanseatic city in the north of Poland. The city, with about 200,000 inhabitants, is located on the Vistula River. According to Professor Adam Czarnecki of the Nicolaus Copernicus University in Toruń (personal communication, March 12, 2013), the city makes little use of this river: "Torun in fact leaves the river". In addition to that, Czarnecki also indicates that benefits from ecosystem services in Toruń are not very high. According to The Millennium Assessment (The United Nations Environmental Programme (UNEP), 2005), nature's goods and services are the ultimate foundations of life and health, even though in modern societies this fundamental dependency may be indirect, displaced in space and time, and therefore poorly recognized. Since the publication of 'The Millennium Assessment', people worldwide are working on ecosystem services. Although it is known to the European Union, ecosystem services are not or hardly part of policy and implementation (The United Nations Environmental Programme (UNEP), 2005).

The reason for this research is to search for opportunities and possibilities to make more use of ecosystem services in Toruń. These ecosystem services are applied to the Vistula River so that the city can make more use of the river and benefit from its services. The application of ecosystem services will have a relationship with increasing the spatial quality. In this way ecosystem services in Toruń will be more recognized and Toruń will be making more use of the Vistula River. Also, will be searched in which ways ecosystem services can be incorporated into policy and decision-making.
1.2 Goal, central question and sub-questions

Prior to the elaboration of the research, a goal is established. In order to achieve this goal is examined which steps need to be set. In this research, these steps form the sub-questions together with a central question. The central question and the goal of the research should be goal-free. That is to say that the researcher set the central question and the goal of the research, independent and objective (free of the underlying objectives of the client) (Verhoeven N., 2010). This requirement is complied because underlying objectives of the client are excluded because of the fact there is not a client with prior requirements and guidelines, which influences the research (the research is objective). In addition, the research focuses on providing knowledge, information and opportunities independent of political affiliations or other predetermined requirements and desires.

**Goal and central question**

The goal of the research has a direct link with the central question. The goal of the research is:

- to chart out how the local government can increase the spatial quality of the Vistula River in Toruń by making use of ecosystem services.

The goal is achieved by providing insight for the use of ecosystem services and by applying ecosystem services specifically to Toruń in order to increase the spatial quality. The elaboration of this research has contributed to this goal.

Respecting the goal of the research, the following central question is formulated:

**Central question**

How can the local government of Toruń increase the spatial quality of the Vistula River in Toruń by making use of ecosystem services?

The central question focuses on the local government of Toruń. There are two central terms: spatial quality and ecosystem services. In chapter 4, these terms are translated into concrete measurable terms. This process is called ‘operationalization’. An operationalized term becomes a variable and can assume different values (Baarda, et al., 2012). Ecosystem services exert influence on the spatial quality because ecosystem services should increase the spatial quality. Model 1 indicates the relationship between the two terms.

**Model 1 - Terms and variables**

```
   Ecosystem Services → independent variable
                  ↓ influence
    Spatial Quality  → dependent variable
```

Within this research the variables of ecosystem services (independent variables) influence the spatial quality by increasing it (dependent variables).

**Sub-questions**

To answer the central question, dividing it into several sub-questions is necessary. The answers of those sub-questions together answer the central question. On the next page is shown which sub-questions were used to elaborate the research.
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Sub-questions
1. How can ecosystem services contribute to spatial quality?
   a. What is the meaning of spatial quality and ecosystem services?
   b. How do ecosystem services influence spatial quality?
2. What is the current situation of the Vistula River in Toruń in terms of usage, strengths, and weaknesses regarding to ecosystem services?
3. Which local trends and developments are occurring around the Vistula River in Toruń regarding to ecosystem services?
4. What are opportunities for the use of ecosystem services for the Vistula River in Toruń linked to spatial quality?
5. Which scenarios can be made which are applicable to the Vistula River in Toruń?

The research focuses on enhancing the spatial quality using ecosystem services. It is a way in which nature (ecosystem services) determines the quality (spatial quality) of the environment. Therefore, the research is titled with the slogan: “Let nature determine the quality of our environment!”

1.3 Relevance of the research

This paragraph looks at the relevance of the research in the society. In addition, it describes the possible side-effects. These effects go beyond the goal of the research.

Relevance to society
This research resulted in three different scenarios. These scenarios provide possibilities for making use of ecosystem services of the Vistula River in Toruń. These services contribute to the spatial quality. This is socially relevant because:

- there will be more awareness of ecosystem services and its values;
- it offers the community opportunities and tools to make more use of the Vistula River;
- it provides an overview of the steps required to achieve a higher spatial quality in a sustainable way.

In this way, the research contributes to decision-making matters and long-term sustainable developments.

Function and side-effects
The function of the research depends mainly on political decisions and priorities of the government of Toruń. The municipality of Toruń can make use of the research results to change policy in order to make more use of the Vistula River and to pay more attention to ecosystem services. The research results play a more underpinning role in policy formation (it provides input for strategic plans). The research results may also play a role in NGO’s (Non-Governmental Organizations) by creating more awareness to make use of ecosystem services. Eventually it is up to the government of Toruń what the function of this research will be (how they position the results).

In addition to the goal of the research and the possible function of the research, there could also occur side-effects. The following possible side-effects could occur:

- the research results could be used to elaborate pilot projects in other places in Poland;
- the research results could encourage entrepreneurs to seize opportunities and to take advantage of the possibilities;
- the research results could contribute to potential partnerships between NGO’s and the government.

1.4 Scope of the research

The scope of the research is divided into three elements. The scope of the research is as follows:

- it is about a part of the Vistula River (demarcation in space);
- the prepared scenarios are looking toward the future (demarcation in time);
- it is about public space where different organizations, citizens and interests play a decisive role (demarcation in population).

Within this research, the demarcation comes down to these three aspects. The following sections will discuss the three aspects in more detail.
Demarcation in space
The research is focused on a particular part of the Vistula River. This primarily concerns the Vistula River in Toruń itself. Here, the length and the width of the Vistula River are very important for the spatial demarcation. Regarding the length of the river is chosen to use the boundaries of the city district (Powiat Toruński). This is chosen in order to be able to take the whole length of the river in the city into account. Besides, in this way the length of the river will not be too long for elaborating the research. Regarding the width of the river is chosen to take floodplain and riverbanks including the land not belonging to urban areas as part of the research. Reason for this choice is to be able to make use of possibilities located further from the river as potential developments towards the river. Map 1 shows the spatial demarcation of the Vistula River in Toruń as is applicable in this research.

Map 1 - Spatial demarcation (including boundaries of the city district Toruński)

The length of the Vistula River in this research involves about 12 kilometers. The width of the river varies from 870 meters to 2,500 meters. More detailed information about the Vistula River in general is shown in paragraph 2.2 (Vistula River) of this report.

Demarcation in time
Remarkably, the relevance of all ecosystem services for the long-term is estimated higher than the short-term environmental policy. It seems as if it is assumed that short-term goals are not achieved or restricted achieved. It is assumed that the long-term goals provide better guaranties for improved environmental quality (Tamis, van Esch, de Graaf, & de Snoo, 2008).

In order to make long-term policy possible and thus better guaranties for increasing the quality is chosen to make scenarios for a period of 10 years. In this way, the trends can be more accurately extrapolated so they become more realistic than looking beyond 10 years. The longer the period for looking into the future become, the more uncertain the situation arises. Important elements in the scenarios are provided with a view through to 15 to 20 years, including the high degree of uncertainty.
Demarcation in population
This research focused on policy-makers of the local Polish government of Toruń. Although they are an important actor in this research, it is not the only interest party. This research aims to identify opportunities to make more use of ecosystem services in order to increase the spatial quality. In this, policy, landowners and interests of stakeholders play a role (actors). This is the reason that the research does not only focus on the local government of Toruń, but also focuses on NGO’s and actors who have influence in the region.

What is disregarded?
In the research, the financial feasibility of the scenarios is not included. This is because the scenarios are too general to consider the financial matters. In addition, it cannot be identified with certainty and sincerity who should pay for which costs. That is the reason that this research focuses on the way to achieve more use of ecosystem services without considering financial matters (economic contribution).

The client of this research is the Nicolaus Copernicus University, Faculty of Biology and Environmental Protection (Professor Adam Czarnecki). Although the university is the client, they give no specific requirements for the purpose of the research. The university likes to gain insight into opportunities for the local government to increase the spatial quality by making use of ecosystem services. Personal communication with Professor Adam Czarnecki has just emerged that the city should take more advantage of the Vistula River and they can benefit more from ecosystem services. The research is designed in such a way that it fulfills the desire above. Furthermore, the research was designed in an own context, with the thought to assist the local government in the use of ecosystem services.

Scope and focus of the scenarios
In the scenarios, it is also important to look at the scope. The scenarios are selected on a so-called ‘moment of choice’. Trends, developments, and the current situation in combination with the possibilities, as they are analyzed in the research, are part of the moment of choice. The focus of the research depends on the results of the SWOT-analyses (including the confrontation matrix) and the trends and developments, which occurred. In order to test if the scenarios (by making use of ecosystem services) increase the spatial quality is going to be made use of the Habiforum Matrix (see theoretical framework). The scenarios provide steps for the local government to increase the spatial quality by making use of ecosystem services. The recommendations in this research provide an explanation of which scenario fits the best according to the prior research results and the desires of the local government. This means that the scenarios are based on the most relevant and desired changes.

1.5 Research method in brief (characterization)

The idea is that we have certain influence in future events. Although the future does not exist yet, it can be explored. In this research, the central issue is exploring and designing the future (how can the local government increase the spatial quality by making use of ecosystem services). Therefore, the research is characterized as a ‘future research’. Future research provides opportunities for policymakers and administrators to deal with the central challenge (making use of ecosystem services): it combines individual needs, knowledge and collective values into coherent images of the future. The characterization of the research can thus be designated as: dealing with a non-existing reality, where rational thoughts and intuitions are complementary to each other (Raessens B., 2011).

This research consists of various methods for data collection and data analysis. For the purpose of data analysis plays the SWOT-analysis and the confrontation matrix an important role. The results of these analyzes are used to elaborate scenarios. In this research, three scenarios are set out (1 extrapolative scenario and 2 normative scenarios) The way these are elaborated, is explained in paragraph 3.3. The IES-approach is used as a basis for the normative scenarios (multistage process to implement ecosystem services into decision-making and implementation. Appendix 2 shows in which way the IES-approach works.
1.6 Glossary

All terms in this report, which are important in the domain of knowledge, are listed below in an alphabetical list.

**Actors** - there are (groups of) individuals, institutions, or organizations, which have a significant impact on certain developments (Raessens B., 2011).

**Backcasting** - this is a future exploratory technique that helps people develop a clear vision of a desired future and then helps develop strategies to achieve this future. (Raessens B., 2011)

**Design research** - through design-orientated thinking make a projection, literally a ‘for image’ of what does not yet exist to reveal the opportunities and preconditions to achieve the futurity. (Raessens B., 2011)

**Ecosystem services** - benefits people obtain from ecosystems. Four categories of ecosystem services are distinguished: supporting services, provisioning services, regulating services, and cultural services. (The United Nations Environmental Programme (UNEP), 2005)

**Extrapolative scenario** - these scenarios try to explore the future through extrapolate the current trends. In this method, current trends, experiences and data from the past are used (trend-impact-analysis). (Raessens B., 2011)

**Future research** - the ability, the skill and art to describe, to explain, explore, predict and/or interpret and estimate future developments for decisions and other actions (including the consequences). (van der Duin & Stavleu, 2006)

**Local government of Toruń** - the authorities (officials) of the municipality of Toruń (Urząd Miasta Torunia).

**Non-Governmental Organization (NGO)** - an organization that is independent of the government and on somehow focused on the public interest. (Online Encyclopedie, 2014)

**Normative scenario** - these scenarios start with a typically desired future situation, and answer the question: how can a specific end situation be achieved? Using backcasting scenario, a plan can be made with measures to achieve the end situation. (Raessens B., 2011)

**Polish government** - the Polish government system including the decentralized government levels: provinces, districts, city districts and municipalities (also see paragraph 2.1).

**Scenario planning** - scenario planning is working with alternative futures. It is an iterative process, both in time and conceptual. (Raessens B., 2011)

**Spatial quality** - an overarching concept, including three values (use value, perception value and future value) which determine the quality of the space (also see paragraph 2.3)

**Trends** - a general, (fairly) independent line of development that is visible in the present and gives direction in the future. (Maenhoudt, 2002)

**Vistula River in Toruń** - the relevant part of the Vistula River as the spatial demarcation indicated (paragraph 2.2)
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2. THEORITICAL FRAMEWORK

The theoretical framework guides the research. It provides background in theories and forms a basis for the implementation of the research (it creates an overall picture of the situation). This chapter highlights the most important elements of theories for this research.

2.1 Government of Poland

2.1.1 Political system of Poland

The political system of the Republic of Poland is determined by the constitution of April 2, 1997. The constitution is the highest law in the Republic of Poland (Biuro Bezpieczenstwa Nardowego, 2013). The constitution indicates that the Republic of Poland is a democratic state ruled by law, the elaboration of rules of the social justness, the protection of the independency and the integrity of his territorial. In addition, it guarantees the freedom and rights of people and citizens and the security of citizens, the protection of national heritage and the guarantee of the protection of the natural environment in consultation with the principle of sustainable development (Biuro Bezpieczenstwa Nardowego, 2013).

The system of the government of the Polish Republic is based on the principle of separated (and the balance between them) legislative, executive and judicial powers. The Sejm and the Senate houses the legislative power. The executive power is vested in the President of the Republic of Poland and the Council of Ministers and the judicial power is vested in courts and tribunals (Biuro Bezpieczenstwa Nardowego, 2013).

2.1.2 Territorial government of Poland

As of January 1, 1999, a new, three-level territorial division of the state was introduced: municipalities (gminas), districts (powiats) and provinces (wojewodztwo). This division is still effective as of now. Model 2 shows the executive boards of the territorial government. A Gmina is the lowest unit of the local government, usually consisting of a single village (Biuro Bezpieczenstwa Nardowego, 2013).

Model 2 - Decentralization of the Polish Government

Toruń is designated as a district city (powiat) within the province of Kuyavia-Pomerania. Toruń, together with Bydgoszcz, operates as the provincial town of the province and houses the provincial government building.

Flag of Poland

Flag of the province Kuyavia-Pomerania

Flag of the city of Toruń
2.1.3 Relation government - society

In the years after the Second World War, Poland, like other countries in Eastern Europe, underwent a fast planned transition. This transition took place from an agrarian-based society to an industrial-based society. In 1945 came Poland under control of the communists. The Polish society was subjected to a series of rigid ideological theories. (Mongabay, 2013)

Under the enduring results of the communist ideology played the disappearance of landed gentry a distinctive role in the management and preservation of Polish culture and national consciousness. The disruption of traditional social hierarchies and barriers brought considerable mobility as a result. This brought the urban population in direct contact with farmers in the rural areas. Within the first decade of the communist takeover, the first waves of unrest came in 1956 across the country. Subsequent social and economic stagnation has put intellectuals and workers to organize effective protests. Eventually, the protests ensured the fall of the communist regime with its social diversity. Nevertheless, the 44-year of postwar communism left its marks on the Polish way of life, even after the state control structures crumbled in 1989. The end of the communist rule in Poland created new challenges for the Polish society and government decision makers. The concept of uniformity, where the state guarantees the protection of unemployment, sickness and poverty, was in Poland a step towards privatization and an open market economy. Although the society retained the benefits of the overall socialization, the post-communist governments could not think of social programs quickly enough to avoid bitter social unrest when the safety of the old system disappeared. (Mongabay, 2013)

Although young people seize opportunities in the new capitalist system, it is especially difficult for the elderly. This had led to tensions and contradictions. That is also the reason that some Poles are longing for the ‘safe’ communist times (Feenstra, 2013). The Polish government is working (2011) to reduce administrative impediments and to improve the relationship between citizens, entrepreneurs and public administration as well to reduce the costs of economic activities. (Polski Portal Finansowy, 2013) The theory of the Polish government is used to understand the context of the political system in Poland. This is important in order to respond to decision-making and policy considerations.

2.2 Vistula River

2.2.1 General information

The Vistula River is the largest River in Poland and belongs to the 30 largest rivers in the world. The river is located in Central Europe. The Vistula River is the second biggest river in the Baltic Sea Basin. The mountains in Southern Poland are starting point of the river (source). The river flows to the north after which it branches off to the east and flows through Krakow (the former capital of Poland). The river makes a big bend and flows westward through the current capital of Poland: Warsaw. The river continues its way towards the northwest and bends to the northeast where it passes Toruń. Eventually, the river flows into the Baltic Sea near Gdańsk. Around Warsaw, the river characterized itself as a lowland river. The estuary of the Vistula River consists of the Vistula Delta. This Delta is delimited by two branches the Nogat (which flows in the Vistula Lagoon) and the Leniwka (the mainstream of the Vistula River) which directly flows into the Baltic Sea. These two branches are navigable. The Vistula Delta (Zulawy) has a total surface of 1.740 m². (Laenen & Dunnette, 1997)

The Vistula River is 1.063 kilometers long and about 300 to 100 meters wide in the downstream part and the mid-stream part of the river. The drainage area of the river is about 194.424 km² (54% of the total surface of Poland). The bank slopes of the river are gentle. The stream varies from year to year. Dry weather circumstances in long periods cause a big effect on the river. The maximum springtime stream (March, April) may result in floods over the whole length of the river. In the fall (autumn) occur minimal floods as well in August, September and November, when the rainfall is low. In general, in the winter season the river is usually entirely frozen (from the second part of December to the end of February). (Laenen & Dunnette, 1997)

Maps of the Vistula River (location of river in Poland, river basin, and location of river in Toruń) you will find in appendix 1.

Chiel Mensink, 2014
2.2.2 The history of the river

The Vistula River played a prominent role in the old history of Poland. Since the early Stone Age, the river served as a trade route as a way of expansion. From the north to the south, different people and cultures used the trade route. Initially, raw materials and flint tools traveled to the north, while amber to the south. Much later, in the early period of the Polish State (10th - 13th century), the most important goods were shipped over the Vistula route: salt, timber and grain. The most intensive development of the trade route of the Vistula River came from the 15th until the 18th century. In this period diversity of hydraulic engineering appeared, such as embankments to provide protection against floods. Many granaries and warehouses, built in the 14th century, along the banks of the Vistula River appeared. (Encyclopaedia Britannica, 2013)

At the end of the 18th century, the distribution of Poland between Prussia, Austria and Russia made an end to the economic importance of the Vistula River. Small navigation improvements were undertaken only locally, in Prussia and Austria. From 1920 - 1939 not much was done to improve the River Channel. It was only after the Second World War that the concerted efforts were delivered to restore the historical function (navigable waterway) of the Vistula River. This was achieved by the construction of several water reservoirs and spillway dams in the river and her branches. The goal was to take advantage of the hydroelectric potential of the river and, at the same time, in order to adapt to the journey inland from the channel. Different institutions are engaged in research on the Vistula River and to retain the waterway navigable. The highest authorities coordinating activities in the field of the research and to decide to technical expenditures and on navigational improvements is the Ministry of Environment Protection and Natural Resources. In addition, hydrologic measurements and investigations as well as engineering studies are carried out by the Institute for Meteorology and Water Management. (Encyclopaedia Britannica, 2013)

2.2.3 Usage of the river

Climate fluctuations in the Vistula basin lead to a diversity in drain and thus influences it the fluctuations of the water level of the Vistula River. The average water level is 12 meters in the upstream, 25 meters in the midstream and 33 meters in the downstream. Long-term periods of low water (during the late summer until the spring) can obstruct or even completely interrupt the navigability of the Vistula River. Spring floods caused by the melting snow and ice in the whole river basin and the summer floods caused by the heavy rainfall in the foot of the mountain area are common characteristics. In the period 1951-1980, the average stream of the upstream of the Vistula River became about 64 square meters per second with extremes between 410 and 52.620 meters per second. Exceptional heavy floods occurred in 1924, 1934, 1947, 1960, 1962, 1970, 1997 and 2010. There are a number of reservoirs in the valley of the mountain tributaries, which are meant to prevent excessive floods. (Encyclopaedia Britannica, 2013) These floods provide opportunities for the use of ecosystem services: creating opportunities for the Vistula River in Toruń to create catchment areas (water storage).

The Vistula River is connected to the Odor River by the GOMB-River, the Bydgoszcz Canal and the Notec and Warta rivers. In 1960 the Soviet Union, East Germany and Poland agreed upon permanent shipping lines on these rivers. In 1963, a canal was opened to avoid the natural hazards at the confluence of the Vistula River and the Narew, improving the links between the Vistula River and the waterways system to the east. Despite the potential role of the Vistula River as a transport connection between heavy industrial centers in the south of Poland and the Baltic ports the hazards for navigability have restricted the traffic. Nevertheless, attracted by the water supply and by the possibilities of cheap freight rates, the amount of big industrial projects sprung up along the Vistula River. (Encyclopaedia Britannica, 2013) The theory of the Vistula River is used in this research as context (background information) for the analysis. It provided general knowledge about the river and its characteristics.

See also the maps in appendix 1.
2.3 Theory of spatial quality

2.3.1 What is spatial quality?
Since the introduction of the concept of spatial quality in the early 1980s, it has become a core principle in spatial planning in the Netherlands, especially from an environmental viewpoint (Assink & Groenendijk, 2009). Although spatial quality is mainly used in the Netherlands (and less outside the Netherlands), it offers possibilities and opportunities in Poland. Spatial quality is a container concept, under which everyone understands something else (Dauvellier/Alterra/Habiforum, 2003). Around 2009 the status of the spatial quality was surpassed. It grew into a sustainability concept and became an important aspect of competitiveness of cities and regions. It is assumed that a high spatial quality attracts economic activity (Assink & Groenendijk, 2009). On the internet, a lot of information could be found about spatial quality, most of which relate to policy. This confirms our impression that promoting the spatial quality of our environment often occurs as a central objective of policy. This reflects that people do not think sectoral, but integral (Dauvellier/Alterra/Habiforum, 2003).

Spatial quality includes use value, perception value and future value. This is the most recognized definition of the term ‘spatial quality’ (Dauvellier/Alterra/Habiforum, 2003). According to the 2009 report (Assink & Groenendijk, 2009), the spatial quality is since the ‘Vierde Nota over de Ruimtelijke Ordening (Dutch policy plan) divided into the three mentioned components (use value, perception value and future value). A higher use value occurs when space (used in a safe manner) can be used by several purposes (for living, work, recreation and to go through). The idea is that the different functions do not interfere with each other, but reinforce each other when possible. Perception value plays an important role in the environment of the people. Cultural awareness and diversity, the presence of characteristic properties (identity) and the beauty of history are all elements that belong to the perception value. Perception value also includes spatial diversity and variation. The future value includes characteristics such as sustainability, biodiversity, robustness and flexibility. This involves suitability of soils by creating new features for a new cultural and economic significance in use (Assink & Groenendijk, 2009).

Spatial quality in the Netherlands is considered the core concept in spatial planning as well as the main objective of spatial policy. The assumption is that the spatial quality is a normative concept with different interpretations by different disciplines, which changes over time (Assink & Groenendijk, 2009).

2.3.2 Methodology of spatial quality
Spatial quality must be defined, again and again depending on the place, the people and the time perspective. The versatility of spatial quality is that we need a mental framework that not only stimulates the thoughts, but also organizes it. For that reason, the ‘Habiforum’ uses a ‘Habiforum Matrix’ as a framework for thinking about spatial quality. Spatial quality is composed of three values: use value, perception value and future value. These values are universal applicable (Town Net, 2012).

In addition to the three values, Habiforum also employs four interests: economy, social, ecology and culture. These interests provide a commonly used classification of aspects relevant to spatial considerations. In each situation, the matrix must be filled in with quality concepts (see Matrix 1). Depending on the situation, the quality concepts can be chosen. The shown quality concepts are indicative!

Matrix 1 - Habiforum Matrix

<table>
<thead>
<tr>
<th>MATRIX</th>
<th>Economic importance</th>
<th>Social importance</th>
<th>Ecological importance</th>
<th>Cultural importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use value</td>
<td>accessibility combined use</td>
<td>fair distribution possibilities to chose</td>
<td>external safety</td>
<td>freedom of choice cultural diversity</td>
</tr>
<tr>
<td>Perception value</td>
<td>image/appearance attractiveness</td>
<td>equivalence</td>
<td>beauty of nature</td>
<td>individuality culture</td>
</tr>
<tr>
<td>Future value</td>
<td>stability/flexibility agglomeration</td>
<td>social support everyone on board</td>
<td>ecological inventories healthy ecosystems</td>
<td>heritage cultural renovation</td>
</tr>
</tbody>
</table>

Source: (Town Net, 2012)
Spatial quality arises when the attention for it becomes a common thread through all phases of the planning process. Formulating clear quality objectives in the initiation phase does not automatically ensure quality. In the vision phase, objectives and guidelines should be translated into spatial structures. In the implementation phase, various projects tackled, all of which give shape to spatial quality. In the usage phase, the house rules and management measures should ensure that the quality actually is going to be used. In every phase of the planning process, different interests and other individuals and organizations are responsible. Every time again, in every phase investing in spatial quality is important. Summing efforts in every phase arises in high and sustainable spatial quality (Town Net, 2012).

2.3.3 Spatial quality in decision making
Spatial quality has an objective and a subjective dimension. The objective dimension sets limits on quality that can be achieved and provides insights into how different elements function which determine spatial quality. The subjective dimension of spatial quality tells how actors valuing quality. Besides, the actors also make clear that they have different demands to achieve spatial quality. In decision-making regarding to changes of landscapes, these dimensions come together (Habiforum, 2009).

A choice for an optimal spatial quality is accompanied by a troublesome conflict that enhances the complexity of spatial project. In most spatial projects, it is not so clear what criteria should be used to determine whether the outcome is good or not and to what extent it improves the spatial quality. Various actors within a project struggle with values as: quality of life, economic potential, and urban and architectural beauty. A discussion on quality is thus the question of what values are more important in planning processes. Besides, which weight to assign to those values? This also means that if you want to realize spatial quality, not only the various spatial functions are important. In addition, the actors in the process, representing the spatial functions, are of great importance. This means that it is crucial to facilitate during the process (which takes place during the decision-making phase of spatial processes) (Habiforum, 2009).

2.4 Ecosystem services

2.4.1 The context of ecosystem services
At the instigation of the United Nations, from 2001 about 1.300 experts from around the world worked on a project - The Millennium Assessment (The United Nations Environmental Programme (UNEP), 2005). This project describes the decline of ecosystem services around the world and commits goals to them. For decades, environmentalists and scientists discussed the ecosystem services, but the United Nations in ‘The Millennium Assessment’ formalized its definition. The United Nations describes the definition of ecosystem services by four categories:

1. **Provisioning services**
   Products obtained from ecosystems (food, water, timber, fresh water, genetic sources, etc.)

2. **Supporting services**
   Services needed for the production of all other ecosystem services (nutrient cycling, biodiversity, soil formation, etc.)

3. **Regulating services**
   The benefits obtained from the regulation of ecosystems (climate regulations, water purification, pollination, pest management, carbon sequestration, etc.)

4. **Cultural services**
   Non-material benefits obtained from ecosystems (cultural heritage, aesthetics, recreation, etc.)

Those four categories together form the collective name ‘ecosystem services’. The goals in ‘The Millennium Assessment’ are as follows: “An aim to improve human well-being by reducing poverty, hunger and child and maternal mortality; ensuring education for all; controlling and managing diseases; reducing gender disparities; ensuring sustainable development; and pursuing global partnerships” (The United Nations Environmental Programme (UNEP), 2005). In addition to this report, various agencies and organizations conducted research into the use of ecosystem services. One of those organizations is TEEB (The Economics of Ecosystems and Biodiversity). The goal of TEEB is: “to
sharpen awareness of the value of biodiversity and ecosystem services and to facilitate effective policy, as well as engaged business and citizen responses” (Witteveen & Bos, 2012). It has become clear that ecosystem services play an important role in the current and future governmental policies.

Many issues remain to be solved in order to fully integrate the concept of ecosystem services in everyday landscape planning, management and decision-making. The importance (the value) of ecosystems and their services are expressed in a variety of ways (Groot de, Alkemade, Braat, Hein, & Willemen, 2009). According to the report ‘ecological complexity’ (Groot de, Alkemade, Braat, Hein, & Willemen, 2009) there are three (value) domains: ecological, socio-cultural and economic (also according to The Millennium Assessment). The ecological value encompasses the health of a system, measured by ecological indicators such as diversity and integrity. The socio-cultural value is the importance people give, for example the cultural identity and the degree in which it is related to ecosystem services. The economic value recognizes two broad types of values: use values and non-use values. Use values include direct consumption, such as the value of timber, fish and other resources from ecosystems. Non-use values are values relate to recreation and aesthetic appreciation. Indirect use values relate to services such as air-, and water-purification, prevention of erosion and pollination of crops. Non-use values are the importance attributed to an aspect of the environment in addition to, or irrespective of its use values (Groot de, Alkemade, Braat, Hein, & Willemen, 2009).

In Poland, the Educational project of the Sendzimir Foundation focuses on ecosystem services for sustainable development of cities. This foundation sees ecosystem services as “the benefits that society and economy derive from the environment. The environment as a service provider becomes a more obvious partner for decision-makers at various levels, including at the local level. With this change in perception of the environment, the necessity to project it becomes clearer”. One of the goals the foundation wants to achieve is to increase awareness of policy makers and other stakeholders about the importance of ecosystem services in Polish cities. The Sendzimir Foundation indicates that the authorities in Polish cities are not aware of the value of ecosystem services and this provides the problem that Polish cities do not make use of urban ecosystems (Sendzimir Foundation, 2013).

2.4.2 River-based ecosystem services

Rivers and freshwaters in urban areas have many functions, including both positive and negative effects on urban society. These effects provide many ecosystem services. To understand the ecosystem services of water bodies, it is important how these ecosystems function. Water is a medium offering habitat for a wide variety of flora (fishes, microorganism) and fauna (algae, microorganism, water plants). Ecosystems interact between biotic and abiotic features of an environment, which makes the development of life possible. The different properties of the water are such that it protects the aquatic communities against some environmental features while providing the necessary energy and nutrients. This makes water a nice play to live (Losco A., et al., 2012).

River-based ecosystem services have a remarkable role in many sectors of industry. It is not only the industry and the economy, which makes profits from urban agglomeration around rivers. Several water ecosystem services play an incredibly important role for people (citizens of cities). Fresh water bodies and ground water are essential for drinking and essential for waste management, transportation, recreation, and values. Before the industrialization, rivers and estuarine deltas provide fertile farming and fresh water was crucial for agricultural irrigation. This explains why people (in history) have settled at rivers and from there grew the towns around water ecosystem services (Losco A., et al., 2012).

2.4.3 Ecosystem services in development planning

According to the World Resources Institute, recognizing the relation between development goals, human well-being and ecosystem services is very important. This makes the difference between successful developments and developments who fail (World Resources Institute, 2008). To integrate ecosystem services into development planning, the German organization (Deutsche Gesellschaft für Internationale Zulassungswerk) made six steps, the IES-approach, which is shown in appendix 2.
2.4.4 The importance of ecosystem services

The sections before suggests that ecosystem services are of great importance for the relationship between developments goals, human well-being, and ecosystem services. This makes the difference between successful developments and developments who fail. (World Resources Institute, 2008) In addition, spatial quality is a core concept in spatial planning as well as the main objective of spatial policy. (Assink & Groenendijk, 2009) Using ecosystem services in relation to spatial quality can thus be seen as an important step in future planning: assumed is that high spatial quality attracts economic activity (Assink & Groenendijk, 2009).

**Awareness of ecosystem services and decision-making**

Literature shows that awareness and implementation of ecosystem services in decision-making are very important for the use of ecosystem services. According to the Sendzimir Foundation (Sendzimir Foundation, 2013), the problem of lack in economic interest of areas, is that it is related to lack of awareness of the importance of ecosystem services to urban well-being. The United Nations Environmental Programme has therefore the objective to raise the awareness of the role of ecosystem services and biodiversity in creating a sustainable future. (United Nations Environmental Programme, 2012) This highlights the importance of ecosystem services in city development. Although the importance of ecosystem services is large, there is a clear lack of awareness. The Millennium Assessment says the following about it (The United Nations Environmental Programme (UNEP), 2005): ‘Nature’s goods and services are the ultimate foundations of life and health, even though in modern societies this fundamental dependency may be indirect, displaced in space and time, and therefore poorly recognized’.

However, many issues still remain to be resolved to fully integrate the concept of (ecosystem) services into everyday landscape planning, management and decision-making (landscape services are still lacking in most policy support tools). (de Groot, Alkemade, Braat, Hein, & Willemen, 2009) Although consensus on a coherent and integrated approach to ecosystem service assessment and valuation is still lacking, and empirical data is still scarce, efforts to fill these gaps have changed the terms of discussion on nature conservation, natural resource management, and other areas of public policy. It is now widely recognized that nature conservation and conservation management strategies do not necessarily pose a trade-off between the ‘environment’ and ‘development’ but that investment in conservation, restoration and sustainable ecosystem use generate substantial ecological, social and economic benefits. Several issues follow from the recognition of the potential of the ‘ecosystem service approach’ to transform priorities of environmental management and related policymaking. (Groot de, Alkemade, Braat, Hein, & Willemen, 2009)
3. METHODOLOGY

3.1 Design of the research

The research consists of several stages (phases) that ultimately lead to scenarios, which answers the central question. In this research, the phases respectively are: exploration, inventory, analyze and synthesis. Diagram 1 shows the divided stages in the research in relation to the sub-questions.

The client of the research is the Nicolaus Copernicus University led by Professor Adam Czarnecki, Faculty of Biology and Environmental Protection. Although the research will be made for the client, the local government of Toruń plays a significant role. The research, according to the local government of Toruń (Karmienko (1), 2014), is also considered important for the local government in relation with future developments/visions. The research has focused on opportunities for the local government of Toruń to use ecosystem services in order to increase the spatial quality. It was expected, during the execution of the research that the relationship with the local government would be close. In practice, this proved to be true beyond expectation. During the execution of the research has kept close contact with the local government of Toruń through numerous visits, exchange of information, research data and e-mail traffic. To confirm this close cooperation the university, local government and the researcher signed a ‘confirmation of cooperation’, see appendix 5. The opportunity to keep close contact is adopted in order to align the scenarios more to the current situation of the local government of Toruń (more applicable).

In addition to the local government of Toruń, NGO’s are approached to contribute to the research. Although they may play an important role, it was very complicated to obtain information from NGO’s. NGO’s could not speak English and they all refer to the local government for obtaining information. For this reason, the local government is approached to involve NGO’s by the formation of scenarios by ‘involvement of the public sector’. In this way, the NGO’s become a key actor for the scenarios (substantiation, support and implementation).

Diagram 1 - Research design

- How can ecosystem services contribute to spatial quality?
- What is the current situation of the Vistula River in Toruń in terms of usage, strengths and weaknesses regarding to ecosystem services?
- Which local trends and developments are occurring around the Vistula River in Toruń regarding to ecosystem services?
- What are opportunities for the use of ecosystem services for the Vistula River in Toruń linked to spatial quality?
- Which scenarios can be made which are applicable to the Vistula River in Toruń?
3.2 Accountability and research methods

For the purpose of this research, different methods are used to collect research data and to provide background knowledge of a fairly unfamiliar environment. The following methods are part of this research to gather information (data-collection):

- literature study and content analysis of reports, researches and literature;
- several interviews with Ms. Karmienko of the local government of Toruń;
- mail correspondence with the local government of Toruń;
- expert excursions with professor Czarnecki of the Nicolaus Copernicus University;
- personal communication with professor Czarnecki of the Nicolaus Copernicus University;
- visit of the National Maritime Museum in Gdańsk;
- visit of the Vistula River Museum in Tczew (Muzeum Wisły).

During the collection of research data, different methods are used to obtain thorough analyzes. The methods are applied in accordance with the method described in the literature. The following methods are used for the analyzes of data in this research (data-interpretation):

- scenarios planning (for the formation of the scenarios);
- SWOT-analysis together with the confrontation matrix (for analyzing, organizing, prioritizing and for relevant possibilities for the purpose of the current situation);
- Habiforum Matrix (measuring instrument for the spatial quality);
- IES-approach (for the organization and structure of the scenarios);
- cause-effect-consequences analysis (for the expected outcomes of developments).

For each sub-question, a research method is selected. Selecting methods are done carefully so that the method suites the best to the corresponding sub-question. Below, each question is provided with the chosen research method(s) including the accountability and reliability of the methods. The sub-questions with their methods together provide the answer to the central question (also see paragraph 3.3). In paragraph 3.3 is shown the research strategy (the main line through the research).

<table>
<thead>
<tr>
<th>Sub-question 1:</th>
<th>How can ecosystem services contribute to spatial quality?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. What is the meaning of spatial quality and ecosystem services?</td>
</tr>
<tr>
<td></td>
<td>b. How do ecosystem services influence spatial quality?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research method</th>
<th>Literature study / content analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>Professional literature</td>
</tr>
</tbody>
</table>

**Accountability**

This sub-question resulted in the operationalization of the two concepts ‘ecosystem services’ and ‘spatial quality’. Literature study has shown which definitions of the concepts exist. The choice in the definitions is based on the applicability and measurable of the concepts. To find the answer of this sub-question is through a content analysis examines how the two concepts relate to each other. Through this content analysis, a form of qualitative desk research, the concepts are analyzed and the relation between those concepts (Verhoeven N., 2010). This resulted in measurable ‘indicators’ which are used to measure ecosystem services and spatial quality (how ecosystem services influence spatial quality). Literature study has also shown that the Habiforum Matrix (see theoretical framework) plays a useful tool to measure the extent to which ecosystem services contribute to spatial quality.

**Reliability**

To increase the reliability of the combined methods, use is made of various professional literature. The professional literature is selected on literature from influential organizations (e.g. the European Union, UNEP, etc.). The choice of the concepts is based on the most commonly accepted concepts and to what extent they are measurable. In this manner, it connects better to existing interpretations and data in the relevant literature. The different literature is compared with each other in order to increase the reliability of choices.
**Sub-question 2:**
What is the current situation of the Vistula River in terms of usage, strengths, and weaknesses regarding to ecosystem services?

<table>
<thead>
<tr>
<th>Research method</th>
<th>Open interviews / expert excursions / literature study / content analysis (SWOT-analysis, confrontation matrix)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>local government of Toruń, professional literature, research data</td>
</tr>
</tbody>
</table>

**Accountability**

As indicated, by answering this sub-question, different methods are used. In order to give substance to the scenarios, it is important to discover the current situation. The current situation shows where strengths and weaknesses occur and provide possibilities and opportunities for the scenarios. The plan of approach describes that use would be made of semi-structured interviews and observations. However, during the execution of the research it appeared that the conversations with the local government of Toruń could not be termed as interviews. It was more a conversation in which progress was discussed, research data were discussed, and in which the government gave me information on the implementation of developments, decision-making and citizen participation. For that reason, the conversations are designated as ‘open interviews’ in order to keep it as widely as possible. In addition, the observations are not made. The reason for this is that Professor Czarnacki offered the opportunity for excursions along the Vistula River. This opportunity was seized because expected is that it provides better research data than (season dependent) observations.

The current situation is explored through literature studies of reports, policy documents and relevant studies. In addition, the interviews with the local government of Toruń and the expert excursions offered lots of information (data), see appendix 3 and 5. The collected data are organized and analyzed by the application of SWOT-analysis and the confrontation matrix. This indicates the most important elements of the analysis, which is input for the scenarios and the choices therein.

**Reliability**

The fact that information is used from various sources (literature, local government of Toruń and excursions) and this information is analyzed by a SWOT-analysis shows the reliability of the data. The SWOT-elements are approved by the local government of Toruń. This demonstrates the reliability of the data. In addition, the interviews are approved by the local government of Toruń as well. The analysis is based on indicators that connect the two concepts of ecosystem services and spatial quality. In this way, the relevance of the research data is ensured.

**Sub-question 3:**
Which local trends and developments are occurring around the Vistula River in Toruń regarding to ecosystem services?

<table>
<thead>
<tr>
<th>Research method</th>
<th>Literature study (gray literature) / open interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>Professional literature, local government of Toruń, expert excursions</td>
</tr>
</tbody>
</table>

**Accountability**

To create extrapolative and normative scenarios, it is important to take current trends and developments into account. These both give direction to scenarios and help predict the future. This sub-question is, therefore, an important step toward creating the scenarios. Through literature study the gray literature (policy documents, reports and books) was analyzed to find already imaged trends. This concerns mainly trends in the context of ecosystem services and developments in the context of policies and visions. In order to get a view on the context of trends and planned developments, is also through open interviews (conversations) with the local government of Toruń information obtained about developments and trends. Informed is how developments are implemented, the involvement of the public sector and how citizens influence developments. This information is considered important for the IES-steps in the scenarios (decision-making). The trends are also used in the SWOT-analyses and the confrontation matrices.

**Reliability**

Reliability of the methods used is based on the use of several resources of information that have been compared with each other. The local government of Toruń also approves the analyzed trends, which are supplied with substantiations from literature. To increase the reliability of the planned developments, many conversations with the local government of Toruń took place in order to understand the context and by selecting the most relevant developments.
**Sub-question 4:**
What are opportunities for the use of ecosystem services for the Vistula River in Toruń linked to spatial quality?

<table>
<thead>
<tr>
<th>Research method</th>
<th>Content analysis (SWOT-analysis) / open interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>Research results, local government of Toruń</td>
</tr>
<tr>
<td>Accountability</td>
<td>To select the opportunities for the use of ecosystem services, is chosen to use the SWOT-analysis. The SWOT-analysis provides a clear picture of the different indicators and their strengths, weaknesses, opportunities and threats. The SWOT-analysis is also converted into a confrontation matrix. The confrontation matrix indicates the relation between the SWOT-elements. By prioritizing the SWOT-elements by the local government of Toruń, can be specifically focused on what the local government considers most important. In this way, the choices made in the scenarios are based on the most up-to-date situation with the most actual importance. Paragraph 3.3 illustrates the steps for the possibilities for the use of ecosystem services.</td>
</tr>
<tr>
<td>Reliability</td>
<td>The reliability of the visualization of the possibilities has been shown because the local government of Toruń approved the SWOT-elements and prioritized them. The analysis is based on indicators in order to connect the analysis data as close as possible to ecosystem services and spatial quality. In this way, the analysis data became more useful and more relevant for making use of ecosystem services in order to increase spatial quality.</td>
</tr>
</tbody>
</table>

---

**Sub-question 5:**
Which scenarios can be made which are applicable to the Vistula River in Toruń?

<table>
<thead>
<tr>
<th>Research method</th>
<th>Scenario planning (IES-approach / cause-effect-consequences analysis / Habiforum Matrix)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>Research results (based on methods from literature)</td>
</tr>
<tr>
<td>Accountability</td>
<td>In this research is chosen to work with scenarios (according to the IES-approach). The IES-approach is a proper way to create scenarios. The reason for this is to provide insights into a way in which the local government of Toruń can make use of ecosystem services without blueprinting. Normative and extrapolative scenarios, not only provide future images which are desirable (normative scenarios), but is also important for looking what happens when no action is taken on the current situation (extrapolative scenario). These scenarios provide opportunities (steps) which are relevant for the local Polish government of Toruń. The images of the future will not specifically be determined. In this way, it creates space and flexibility for the Polish government. This is also important for political decision-making that really may fluctuate. The scenarios provide opportunities for the local government to make more use of ecosystem services. Scenario planning is a method that enables organizations to increase control over their environment and increases the possibilities to take decisions in an uncertain and dynamic environment (Raessens B. , 2011). The scenarios not only provide opportunities in developments to make use of ecosystem services in order to enhance the spatial quality, but also looks at how it can be implemented in decision-making and how the public sector have influence and can get involved in developments in the city.</td>
</tr>
<tr>
<td>Reliability</td>
<td>The reliability of the scenarios is based entirely on the previous research results. Literature will also be consulted to provide supplemental charge to future images. The scenarios are as much as possible based on trends, developments and on the data obtained from the interviews and literature. The use of different methods creates focus and provides structure for the scenarios, which enhances the reliability. In addition, the fact that it is a relatively short period (10 years) makes the extrapolation of trends and developments reliable and realistic. Using the existing method of the IES-approach confirms that ecosystem services will be integrated properly.</td>
</tr>
</tbody>
</table>
3.3 Research strategy

<table>
<thead>
<tr>
<th>Research question</th>
<th>Outcome / result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sub-question 1</strong> How can ecosystem services contribute to spatial quality?</td>
<td>Overview of the meaning of the concepts, including the demarcation. It also provides an overview of the relationship between ecosystem services and spatial quality. (measurable indicators)</td>
</tr>
<tr>
<td>Method: Literature study / content analysis</td>
<td></td>
</tr>
<tr>
<td><strong>Sub-question 2</strong> What is the current situation of the Vistula River in Toruń in terms of usage, strengths, and weaknesses regarding to ecosystem services?</td>
<td>Picture of the current use of the Vistula River in Toruń, including strengths and weaknesses (the SWOT-analysis). It also provides strategies for utilizing SWOT-elements. (confrontation matrix)</td>
</tr>
<tr>
<td>Method: Open interviews / expert excursions / literature study / content analysis (SWOT)</td>
<td></td>
</tr>
<tr>
<td><strong>Sub-question 3</strong> Which local trends and developments are occurring around the Vistula River in Toruń regarding to ecosystem services?</td>
<td>Overview of the most relevant trends, planned developments and relevant policy and opportunities.</td>
</tr>
<tr>
<td>Method: Literature study / open interviews</td>
<td></td>
</tr>
<tr>
<td><strong>Sub-question 4</strong> What are opportunities for the use of ecosystem services for the Vistula River in Toruń linked to spatial quality?</td>
<td>Insight into opportunities and possibilities to make use of ecosystem services matched to the most relevant and realistic possibilities (applied to the Vistula River in Toruń).</td>
</tr>
<tr>
<td>Method: Content analysis (SWOT) / open interviews</td>
<td></td>
</tr>
<tr>
<td><strong>Sub-question 5</strong> Which scenarios can be made which are applicable to the Vistula River in Toruń?</td>
<td>Different scenarios (extrapolative and normative) with possibilities for the local government of Toruń to make more use of ecosystem services.</td>
</tr>
<tr>
<td>Method: Scenario planning (IES-approach / cause-effect-consequences analysis / Habiforum Matrix)</td>
<td></td>
</tr>
</tbody>
</table>

Answer to the central question (results research)

Chiel Mensink, 2014
analysis (SWOT-analysis, confrontation matrix, trends) serves as input for

EXTRAPOLATIVE SCENARIO

serves as the basis for

NORMATIVE SCENARIO I

serves as the basis for

NORMATIVE SCENARIO II

IES-step 1
- establishing the objectives and design process

IES-step 2
- imaging prioritized SWOT-elements
- imaging prioritized SWOT-strategies
- determining aim of ecosystem services

IES-step 3
- linking planned developments with ecosystem services
- drafting cause-effect-consequences analysis

IES-step 4
- screening scenario on the contribution to policy goals

IES-step 5
- implementation of possibilities in decision-making
- strategy for implementation of ecosystem services
- imaging the contribution of the scenario to ecosystem services
- application of Habiforum Matrix (the added value)

planned developments

extrapolating planned developments
extrapolating trends and policy
drafting cause-effect-consequences analysis
application of Habiforum Matrix
imaging contribution of the scenario to ecosystem services

IES-approach

extrapolating planned developments
extrapolating trends and policy
drafting cause-effect-consequences analysis
application of Habiforum Matrix
imaging contribution of the scenario to ecosystem services

Let nature determine the quality of our environment!
4. CONTRIBUTION OF ECOSYSTEM SERVICES TO SPATIAL QUALITY

4.1 Spatial quality

During the prior research (theoretical framework), the term ‘spatial quality’ already been thoroughly investigated. The theoretical framework emphasizes the fact that there are different definitions of spatial quality in circulation. The most accepted definition is the subdivision of the concept into three values: use value, perception value, and future value. According to Assink & Groenendijk (2009) it is assumed that high spatial quality attracts economic activity. This is also an important element in this research and provides opportunities for the content of the scenarios.

This research uses the definition as Assink & Groenendijk (2009) proposed. The reason for this is that this definition is the most accepted for the term ‘spatial quality’. In addition, this concept can be measured better (operationalized) by using the Habiforum Matrix (also see the theoretical framework). Model 3 provides the definition of the concept of ‘spatial quality’ in relation to the Habiforum Matrix as it is used in this research.

Model 3 - The concept of ‘spatial quality’

<table>
<thead>
<tr>
<th>Use value</th>
<th>Perception value</th>
<th>Future value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space used in a safe manner by several purposes without interfering each other (like: living, work, recreation, etc.)</td>
<td>Culture awareness and diversity, the presence of characteristics properties (identity) and the beauty of history.</td>
<td>Characteristics such as: sustainability; biodiversity; robustness, and flexibility.</td>
</tr>
</tbody>
</table>

Bringing the four interests of Habiforum in relation to the three values, form a (more) measurable concept. These four interests determine the three separate values. The four interests are expressed in quality concepts (see Habiforum Matrix in the theoretical framework).

4.2 Ecosystem services

The theoretical framework shows that many definitions exist for the term ‘ecosystem services’. For the purpose of this concept is chosen to use the most used and recognized definition. This definition is from the United Nations. Not only it is the most recognized definition, it can be deemed as a uniform definition because it is from the United Nations. The definition of ecosystem services consists of four services: provisioning services, supporting services, regulating services, and cultural services. To make this concept (more) measurable, there are three values determinative. These values are accepted by different organizations (including the report of The Millennium Assessment) in measuring ecosystem services. The three values are: ecological, socio-cultural and economic. Model 4 (on the next page) shows model based the definition of ecosystem services, including the relationship between the different services and the three values.
4.3 Relation spatial quality - ecosystem services

The two concepts now have a clear meaning and are made measurable. This paragraph unravels how the use of ecosystem services can increase the spatial quality. To determine the influence, it is important to look at the current situation, trends and developments. Model 5 (on the next page) shows the relationship between the two concepts. The two concepts are expressed in the same interests/values. They overlap and are called ‘indicators’.

Ecosystem services influence the spatial quality because the different services of ecosystems (provisioning, regulating, supporting and cultural) express itself in three values: ecological, socio-cultural and economic. These values are directly linked to the values of spatial quality (see model 5). By giving the indicators a value, can be measured how ecosystem services (independent variable) exert influence on the spatial quality (dependent variable). The current situation (SWOT-analysis including the confrontation matrix), trends and developments are analyzed, see chapter 5. The SWOT-analysis provide different opportunities and possibilities. These opportunities and possibilities provide direction for possible developments to make more use of ecosystem services. By analyzing (content analysis) the results (SWOT-analysis), it becomes clear which services of ecosystems (provisioning, supporting, regulating and cultural) are most applicable specific to the situation in Toruń (in compliance with the relevant trends and developments). This research looks from the ecosystem services point of view at how the spatial quality can be increased.

The strategic application of this model can be used to make use of the most potential and necessary developments. According to the report (Czarnecki, Lewandowska-Czarnecka, & Zielinska, Changes in preferences for the use of ecosystem services and the effects in a city localized along the river on an example of Torun, Poland., 2013), which focuses specifically on the situation in Toruń, the biggest challenge of the 21st century for cities and towns is to make them environmentally, economically and socially sustainable. This study contributes indirectly to this challenge by giving values to the indicators. This paragraph indicates the different indicators: economy, social, ecology and culture. This contributes to the challenge emphasized in the mentioned report.
Let nature determine the quality of our environment!

Model 5 - Relation ecosystem services - spatial quality

The SWOT-analysis is based on the current situation and additionally the trends and development are analyzed as appendix 3 shows. As mentioned, the SWOT-analysis together with the trends and developments determine which services should be deployed. Ultimately, goal is to increase the spatial quality. To test whether this actually happened, use is made of the Habiforum Matrix. By filling in the Habiforum Matrix, it is possible to reason back, which values of spatial quality have been increased. This test is important to demonstrate the increased values of spatial quality.

The analysis of the current situation (SWOT-analysis) is divided into three themes: economic analysis, socio-cultural analysis and ecological analysis. Because the influence of ecosystem services on spatial quality is determined by the four indicators (economic, social, ecological and cultural), is chosen to analyze the current situation, trends and developments according to those indicators. In this way, is forced to analyze the project area more specifically on the themes (indicators) to gather more precise and more useful data. See also the ‘method of use’ in the analysis report (appendix 3).
5. ANALYSIS OF THE VISTULA RIVER IN TORUŃ

5.1 Current situation / SWOT-analysis (confrontation matrix)

5.1.1 Economic situation
It can be said that the local government in Toruń has enormous potential and a lot possibilities to make use of the Vistula River in Toruń in an economic point of view. The opportunities, including the awareness of the possible opportunities, provide a wide range of possibilities for economic ecosystem services. This is also emphasized by the range of potential developments, which the Landscape Management Plan (LMP) provides (see analysis report, appendix 3). It can be concluded that the Vistula River in Toruń is making too little use of the river in an economic point of view. Although there are a lot of possibilities and opportunities for economic use of the river, it is not yet deployed. The available opportunities are very high and the increasing awareness of the local government in Toruń to make more use of the Vistula River in Toruń provides many chances for future economic use of the river. As a conclusion, it can be assumed that Toruń should make more use of the opportunities in the future together with the possibilities linked to the current strengths, which the Vistula River offers.

The analysis (appendix 3) shows that in the past, the economic function of the Vistula River was very high. The Vistula River was in use for inland shipping and had additionally to this, a cultural and defensive role. This is mainly the reason that the Old City Center in Toruń, in the past, had a strong connection with the Vistula River. A long time (especially in the 16th century), the Vistula River serviced as one of the most important navigable waterways in Europe. (Majewski, 2013) Nowadays, the Vistula River is neglected and is not anymore economic important. Not only the river itself, but also the surrounding lands have lack in expansions and developments. In the past, the city of Toruń made use of the Vistula River and her ecosystem services (wood, fish and the transportation options). However, because of the time generation of trees, the production of wood and transport of wood over the Vistula River became restricted. Finally, the benefits of the location of Toruń were not sufficient to deploy economic developments along the Vistula River in Toruń. (Czarniecki, Lewandowska-Czarnecka, & Zielinska, Changes in preferences for the use of ecosystem services and the effects in a city localized along the river on an example of Torun, Poland., 2013)

Picture 1 - The Vistula River in Toruń

Nowadays the economic function of the Vistula River in Toruń is very low. However, the economic function is very low, it has big potential for social and economic use. Currently, the Vistula River is only slightly in use as a water supplier (water resource). Along the Vistula River in the lower basin (Toruń is part of the lower Vistula basin), are located many industrial areas: Płock, Włocławek, Toruń, Bydgoszcz, Grudziadz, Tczew, Elblag and Gdańsk. The lower Vistula basin provides half of the potential

Chiel Mensink, 2014
economic waterpower in Poland. Besides, the river is important for the inland shipping (it connects central Poland with other economically important cities). The Vistula River contains two international waterways (E-40 and E-70). The allocation of international waterways increases big opportunities for developments in the region. (Majewski, 2013) In conversation with the local government of Toruń (Karmienko (1), 2014), it became clear that not many developments are possible currently (due the lack of financial resources), but that the local government is trying to bring back the economic function of the Vistula River in Toruń. It also became clear that there are lot areas along the Vistula River in Toruń, which provide enormous potentials for developments. (Czarnecki P. , Expert Excursion 1, 2014) The analysis shows that it seems that the local government in Toruń had not focused much on the Vistula River for years, but nowadays become more aware of the possibilities of the river.

In fact, it can be said that the city of Toruń is losing more and more the connection with the Vistula River since the lost of economic functions along the river and its transportation options. In addition, facilities for recreation and water sports are lacking. It is also notable that new residential areas are located on the higher terraces because here the soil is better for the construction of houses. (Majewski, 2013) It is also notable that the Vistula River in Toruń is not everywhere accessible. People could not enjoy the river on every spot because the accessibility of it is often blocked (areas often belong to private owners). (Czarnecki P. , Expert Excursion 2, 2014) Residence (including their infrastructure) along the Vistula River in Toruń could attach great value to the river and its surrounding areas (as if the new residential area of ‘Winnica’ indicates). (Majewski, 2013) According to professor Czarnecki (Czarnecki P. , Expert Excursion 2, 2014), the local government has little eye for details in developments/plans, whereby these developments do not always lead to success.

A more detailed analysis of the economic situation, including the potential economic developments is provided in the analysis report in appendix 3 and on map 1 in appendix 4. The analysis data is through a content analysis analyzed for strengths, weaknesses, opportunities and threats (SWOT-analysis). Matrix 2, shows the economic SWOT-analysis of the Vistula River in Toruń according to the analysis report, appendix 3.

**Matrix 2 - Economical SWOT-analysis**

<table>
<thead>
<tr>
<th>INTERN ANALYSIS</th>
<th>EXTERN ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths</strong></td>
<td><strong>Weaknesses</strong></td>
</tr>
<tr>
<td>S1 - In the past, the Old City Center of Toruń had a strong connection with the Vistula River</td>
<td>W1 - Nowadays, the Vistula River is neglected and does not have economic importance/functions anymore</td>
</tr>
<tr>
<td>S2 - The Vistula River provides big potential for social and economic use</td>
<td>W2 - The surroundings of the Vistula River are lacking expansions and developments</td>
</tr>
<tr>
<td>S3 - Many areas along the Vistula River in Toruń provide enormous potentials for developments</td>
<td>W3 - The Vistula River in Toruń is not everywhere accessible</td>
</tr>
<tr>
<td>S4 - Public spaces along the Vistula River in Toruń (with the view on the river) is considered, by the local government of Toruń, as important</td>
<td></td>
</tr>
<tr>
<td>S5 - The lower Vistula basin provides half of the potential economic waterpower in Poland</td>
<td></td>
</tr>
<tr>
<td>S6 - The allocation of international waterways increases the big opportunities for developments in the region</td>
<td></td>
</tr>
<tr>
<td><strong>Opportunities</strong></td>
<td><strong>Threats</strong></td>
</tr>
<tr>
<td>O1 - Residence areas along the Vistula River in Toruń could attach great value to the river and its surroundings</td>
<td>T1 - Due the lack of financial resources, there are not many developments elaborated along the Vistula River</td>
</tr>
<tr>
<td>O2 - Nowadays the local government creates more awareness of possibilities around the Vistula River</td>
<td>T2 - The city of Toruń is losing more and more connection with the Vistula River since its lost of economic functions</td>
</tr>
<tr>
<td>O3 - The local government is trying to bring back the economic function of the Vistula River in Toruń</td>
<td>T3 - New residential areas are located on higher terraces (away from the river) because here the soil is better for building houses</td>
</tr>
<tr>
<td>O4 - The number of cyclists in Toruń is increasing, as</td>
<td></td>
</tr>
</tbody>
</table>
The SWOT-analysis indicates strengths and opportunities. These possibilities offer economic opportunities to make use of ecosystem services. The power of a SWOT-analysis is to use the strengths by seizing opportunities (attack). A strength can also be used to hold threats (defend). The weaknesses provide possibilities by strengthening the weaknesses before responding to opportunities (strengthening). The last possibility is to respond on a weakness in order to ward of a threat (withdraw). (Confrontatiematrix, 2014) To create a clear view on the relations between the four options, an economic confrontation matrix has been made (matrix 3). The confrontation matrix shows to what extent the different points are related to each other in order to create a better situation.

Matrix 3 - Confrontation matrix

<table>
<thead>
<tr>
<th>Attack</th>
<th>Strengthen</th>
<th>Defend</th>
<th>Withdraw</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>S2</td>
<td>S3</td>
<td>S4</td>
</tr>
<tr>
<td>S5</td>
<td>S6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
</tr>
<tr>
<td>O5</td>
<td>O6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>T2</td>
<td>T3</td>
<td></td>
</tr>
</tbody>
</table>

Remarkably, the confrontation matrix indicates that *attack* offers the most possibilities for optimal use of the SWOT-analysis. In order to respond to the economic opportunities for the use of the Vistula River, it is important to utilize opportunities to make use of strengths. It is also important, according to

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O5 - The local government of Toruń does not only want to focus on the Old City Center (as attraction point for recreation and tourism), but wants also to focus on qualities outside the Old City Center

O6 - More projects/plans are elaborated around the Vistula River in Toruń because this area is considered important

* = more detailed 'potential developments' as a part of the opportunities are shown in tables 1 - 3 of the analysis report (appendix 3).
the confrontation matrix, to strengthen weaknesses in order to respond to an opportunity. This is logical, given the fact that there are many opportunities for economic possibilities. In addition to attack and strengthen, the confrontation matrix shows that also defend and withdraw provide possibilities. Essentially an optimal situation will mean that: it is necessary to attack, strengthen, defend and withdraw of the various relationships according to the confrontation matrix. It is also important for the elements, which do not have a relation (S1-T1), to look individually what possibilities they have to make use of ecosystem services along the Vistula River. Important conclusion is that there are many possibilities for the economic usefulness of the Vistula River in Toruń.

5.1.2 Socio-cultural situation
In general, there are many opportunities for socio-cultural possibilities to make use of ecosystem services. The present parts could form an important part in further developments and could be used in linking developments and ecosystem services along the Vistula River in Toruń. The range of potential developments, which the Landscape Management Plan (LMP) provides (appendix 3), emphasizes this as well. There are several important socio-cultural facilities in the vicinity of the Vistula River:

- Old City Center with its historical values;
- Philadelphia Boulevard;
- Wiślana Trasa Rowerowa;
- Sightseeing platform;
- Construction of the cycling paths in and around Toruń;
- Park Miejski;
- ROD-areas (Rodzinny Ogród Dzajkowy) (English: Family Garden Allotment);
- Cruise trips on the Vistula River.

All these elements form an important basis for developments in order to increase the use of ecosystem services of the Vistula River. Concluded can be that the current situation of the Vistula River provides a lot possibilities and opportunities for developments in the future (in relation to ecosystem services). Although the current situation provides many opportunities, they do not make use of the Vistula River and its values enough. There is potential to make more use. The elements can reinforce each other and can be used together to generate synergy and to make more use of the possibilities and opportunities, which are available.

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The analysis (appendix 3) indicates that although the Old City Center of Toruń is not located in the spatial demarcation of the research, it is important. The history of the city is very important for recreation and tourism in the city and in the past, it was an important part of the growth of the city and the benefits of the location close to the Vistula River. The in 1568 established academic high school formed an important center for intellectual activities. The cultural awareness of the city is increased when in 1600 the old town hall was reconstructed. The city is also provided with fortifications around the Old City Center. These fortifications have recreational and touristic potentials. (Wydawnictwo VIA,
2013) Cities are distinguished by making the city attractive in different ways. Nowadays tourism and recreation is an important part of the economy of cities. Recreational areas express the quality of life and the development of tourism. The green areas in and around the city of Toruń are appreciated by the inhabitants because of its microclimate and the reduction of noise. (Majewski, 2013)

Emphasized by the analysis is that the use of ecosystem services in Toruń is focused on private demands. (Majewski, 2013) Nowadays, the local government of Toruń wants to focus more on the Vistula River in relation with recreation and tourism. Although the tourism in Toruń is increasing, there is still a lack in green infrastructural and recreational facilities. In addition, facilities for water sport are lacking. (Kamienko (1), 2014) A good initiative for the recreational and touristic use of the Vistula River is the construction of (which is currently in development) the Wiślana Trasa Rowerowa. This cycling route (along the whole length of the Vistula River) connects the river with important and interesting places (like cities, sights in the rural areas, etc.). (Polska Agencje Rozwoja, 2014) The development of those routes can be seen as an important step into the right direction. According to a 2005 research, improving the cycling routes in Toruń will lead to more cyclists in the city. (Backiewicz, Fabirkiewicz, Nawrol, & Niedbaia, 2005) The city of Toruń also features a sightseeing plateau. This plateau is located on the southern river embankment (in the nature reserve of Kepa Bazarowa), see also map 1 in appendix 4. This plateau provides a beautiful sight on the Old City Center of Toruń (perceptual value). The reflection of the lights (by night) of the Old City Center in the water of the Vistula River provides an exceptional perception. (Biuletyn Informacji Publicznej, 2014) A way of cultural service of ecosystem services of the Vistula River.

The city also has plans for the construction of an advanced cycling network. Although the plans are ambitious, they seem not to make use of the perception values of the Vistula River. Most of the routes are planned in the Old City Center, the surrounding urban areas, in parks, and along other sites. However, a route along the Vistula River is not part of the cycling network; it provides opportunities for link it to the Vistula River. From 2007 until 2015 a lot of cycling routes are established, it can be concluded that the cyclists in Toruń has increased the last years. Toruń currently has a cycle network of 61 kilometers. The construction of this network is part of a cycling program for the period: 2007-2015. It is part of ongoing road projects, which is approved by the local government of Toruń. The goal of the construction of the cycling network is to encourage the use of bicycles (school and work) for the inhabitants of Toruń. (Rady Miasta Torunia, 2007) Additionally to this, the Miejski Park provides many opportunities. The park has recently been revitalized and provides many possibilities and facilities for tourists and for inhabitants of the city. (Biuletyn Informacji Publicznej, 2014) Because the areas along the river (between the Miejski Park and the Vistula River) are designated as Natura-2000 areas, developments are hardly possible because of the many requirements from the European Union. (Czamecki P., Expert Excursion 2, 2014)

Within the spatial demarcation of the research are located three ROD-areas. These areas consist of a high values for ecosystem services. People can maintain an allotment in these areas, are supervised in methods, and are provided with courses to make more use of natural products. (Rodzinny Ogród Działkowy, 2014) Although it is a source of ecosystem services, it does not have a link (reis threatened the river and it is threatening by developers wanting to bribe the grounds. (Czamecki P., Expert Excursion 2, 2014) The most popular form of recreation after seeing the Old City Center is a perception trip on a boat on the Vistula River. This trip provides for people a perception of the ‘waterfront’ of the city. From the boat, the view on the city is magnificent and people can enjoy the view of the Old City Center from the sightseeing plateau. (Projectowanie stran Torun, 2014)

A more detailed analysis of the socio-cultural situation, including the potential socio-cultural developments are provided in the analysis report in appendix 3 and on map 1 in appendix 4. The analysis data is through a content analysis analyzed for strengths, weaknesses, opportunities and threats (SWOT-analysis). Matrix 4, shows the socio-cultural SWOT-analysis of the Vistula River in Toruń according to the analysis report, appendix 3.
The SWOT-analysis indicates that the socio-cultural situation of the Vistula River in Toruń provides many strengths and opportunities. The SWOT-elements (as mentioned in paragraph 5.1.1) could be related to each other by (Confrontatimatrix, 2014):

- **Attack**: use strengths by seizing opportunities;
- **Strengthen**: strengthen weaknesses before responding to opportunities;
- **Defend**: use strengths to hold threats;
- **Withdraw**: respond to weaknesses in order to ward threats.
To create a clear view on the relations between the four options, a socio-cultural confrontation matrix has been made (matrix 5). The confrontation matrix shows to what extent the different elements are related to each other in order to create a better situation.

Matrix 5 - Confrontation matrix

<table>
<thead>
<tr>
<th>(1)attack (2)strengthen (3)defend (4)withdraw</th>
<th>Extern</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Opportunities</td>
</tr>
<tr>
<td></td>
<td>O1 O2 O3 O4 O5 O6</td>
</tr>
</tbody>
</table>

Intern

Strengths

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10

Weaknesses

W1 W2 W3

Conclusion of the SWOT-analysis (including the confrontation matrix) is that there are many strengths present in the area of socio-culture along the Vistula River in Toruń. In contrast, there are relatively few weaknesses and few threats. This offers many opportunities to make use of ecosystem services in the field of socio-cultural services. The confrontation matrix indicates that most of the opportunities (for the use of socio-culture) express themselves in attacking. The use of the strengths by seizing opportunities is an important conclusion of this SWOT-analysis. In addition, there is also an opportunity to defend, namely by using the high values of the ecosystem services of the ROD-areas to ward off the threat “the ROD-areas are threatened by developers who wants to bribe the ground”. Concluded can be said that it is a positive outcome of the SWOT: many strengths and opportunities which are could be related to each other and on the other hand few weaknesses and few threats.

All SWOT-elements can be used according to the four strategies of the confrontation matrix. This means that there is high potential to make use of the SWOT-analysis to create a better situation.
5.1.3 Ecological situation

The ecological analysis of the Vistula River in Toruń indicates that there are many ecological values present and that these values may constitute an important part to developments. Although ecological values are important for the use of ecosystem services, it can also pose constraints (such as the restrictions from the European Union for Natura-2000 areas). The main ecological components in the project area of this research contain the Martówka and the nature reserve Kepa Bazarowa. They may because of their position, play an important role in future developments. In addition, these areas are appropriate to combine them with recreation and tourism (in terms of ecosystem services). It also provides opportunities to connect the Martówka with the Vistula River (for example by making use of the view on the river, etc.). This is also emphasized by the range of potential developments, which the Landscape Management Plan (LMP) provides (see appendix 3).

According to the analysis (appendix 3) is the landscape around Toruń characterized by its terraces. The city of Toruń is located in the deeply incised valley of the Vistula River. The terraces contain different heights from the moraine plateau (in the north) to the Vistula River in the south. The height differences could get as high as 40 meters. The location of Toruń is, during the establishment of it because of this reason chosen. The city is located close to the Vistula River, but at the same time located on a high terrace, which protects the city from floods. (Czarnecki, Lewandowska-Czarnecka, & Zielinska, Changes in preferences for the use of ecosystem services and the effects in a city localized along the river on an example of Torun, Poland., 2013) On the higher located terraces are mainly forests located. The soil on these higher terraces are good for the growth of trees. On the higher terraces are also more establishments of houses. This is because the soil here is better for house construction than closer to the river. Mainly the expansion of the city is based on the different terraces, which presents itself. (Czamecki P., Expert Excursion 1, 2014)

In the past, the water of the Vistula River was for 93% polluted. About 56% of it was not in accordance with the European standards. (Majewski, 2013) Since decades, the pollution of the Vistula River reduced enormously by making use of vegetation in the river. (Czamecki P., Expert Excursion 2, 2014) Nowadays, the regulating service of ecosystem services plays an important role in protecting the water and the air quality as well as the landscape and recreational values. (Czamecki, Lewandowska-Czarnecka, & Zielinska, Changes in preferences for the use of ecosystem services and the effects in a city localized along the river on an example of Torun, Poland., 2013) Along the Vistula River are located many areas which are designated as Natura-2000 areas (including Kepa Bazarowa). These areas are limited to the use of their opportunities and possibilities in developing. Martówka, a waterway southern of the Miejski Park, plays an important role in the sustainable developments of the city and improves the quality of life of residents, shown from the perspective of ecosystem services. The Vistula River can be seen as an important ecological connection zone. (Majewski, 2013) Kepa Bazarowa is an important nature reserve, located on the southern river embankment. It has an important historical value as well its services as an ecological string on a European scale, according to the “In-water” project. (Rada Miasta Torunia, 2010)

A more detailed analysis of the ecological situation, including the potential ecologic developments is provided in the analysis report in appendix 3 and on map 1 in appendix 4. The analysis data is through a content analysis analyzed for strengths, weaknesses, opportunities and threats (SWOT-analysis). Matrix 6, shows the socio-cultural SWOT-analysis of the Vistula River in Toruń according to the analysis report, appendix 3.
Matrix 6 - Ecological SWOT-analysis

<table>
<thead>
<tr>
<th>INTERN ANALYSIS</th>
<th>EXTERN ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengths</td>
<td>Weaknesses</td>
</tr>
<tr>
<td>S1 - The city of Toruń is located</td>
<td></td>
</tr>
<tr>
<td>close to the Vistula River, but at</td>
<td></td>
</tr>
<tr>
<td>the same time located on a high</td>
<td></td>
</tr>
<tr>
<td>terrace which protects the city</td>
<td></td>
</tr>
<tr>
<td>from floods</td>
<td></td>
</tr>
<tr>
<td>S2 - The regulating service of</td>
<td></td>
</tr>
<tr>
<td>ecosystem services plays an</td>
<td></td>
</tr>
<tr>
<td>important role in protecting the</td>
<td></td>
</tr>
<tr>
<td>the water and the air quality as</td>
<td></td>
</tr>
<tr>
<td>well as the landscape and</td>
<td></td>
</tr>
<tr>
<td>recreational values</td>
<td></td>
</tr>
<tr>
<td>S3 - Along the Vistula River in</td>
<td></td>
</tr>
<tr>
<td>Toruń are located many areas which</td>
<td></td>
</tr>
<tr>
<td>are designated as Natura-2000 areas</td>
<td></td>
</tr>
<tr>
<td>(including Kepa Bazarowa)</td>
<td></td>
</tr>
<tr>
<td>S4 - Kepa Bazarowa is an important</td>
<td></td>
</tr>
<tr>
<td>nature reserve, located on the</td>
<td></td>
</tr>
<tr>
<td>southern river embankment</td>
<td></td>
</tr>
<tr>
<td>S5 - Martówka improves the quality</td>
<td></td>
</tr>
<tr>
<td>of life of residents, shown from</td>
<td></td>
</tr>
<tr>
<td>the perspective of ecosystem services</td>
<td></td>
</tr>
<tr>
<td>S6 - The Vistula River can be seen</td>
<td></td>
</tr>
<tr>
<td>as an important ecological connection</td>
<td></td>
</tr>
<tr>
<td>zone</td>
<td></td>
</tr>
<tr>
<td>S7 - Kepa Bazarowa contains</td>
<td></td>
</tr>
<tr>
<td>important historical values as well</td>
<td></td>
</tr>
<tr>
<td>its services as an ecological string</td>
<td></td>
</tr>
<tr>
<td>on European Scale</td>
<td></td>
</tr>
<tr>
<td>S8 - Public spaces along the</td>
<td></td>
</tr>
<tr>
<td>Vistula River in Toruń (with view</td>
<td></td>
</tr>
<tr>
<td>on the river) is considered, by the</td>
<td></td>
</tr>
<tr>
<td>local government of Toruń, as</td>
<td></td>
</tr>
<tr>
<td>important</td>
<td></td>
</tr>
<tr>
<td>- - no weaknesses found</td>
<td></td>
</tr>
<tr>
<td>Opportunities*</td>
<td>Threats</td>
</tr>
<tr>
<td>O1 - Martówka plays an important</td>
<td></td>
</tr>
<tr>
<td>role in the sustainable developments</td>
<td></td>
</tr>
<tr>
<td>of the city</td>
<td></td>
</tr>
<tr>
<td>O2 - The local government of Toruń</td>
<td></td>
</tr>
<tr>
<td>does not only want to focus on the</td>
<td></td>
</tr>
<tr>
<td>Old City Center (as attraction point</td>
<td></td>
</tr>
<tr>
<td>for recreation and tourism) but</td>
<td></td>
</tr>
<tr>
<td>wants also to focus on qualities</td>
<td></td>
</tr>
<tr>
<td>outside the Old City Center</td>
<td></td>
</tr>
<tr>
<td>- - no threats found</td>
<td></td>
</tr>
</tbody>
</table>

* = more detailed ‘potential developments’ as a part of the opportunities are shown in tables 10 - 12 of the analysis report (appendix3).

The SWOT-analysis indicates that the ecological situation of the Vistula River in Toruń provides only strengths and opportunities. The fact that the SWOT-analysis contains only strengths and opportunities indicates that the current situation provides many potentials and opportunities without obstacles (threats or weaknesses).

The related SWOT-elements are shown in matrix 7 on the next page.
The conclusion of the ecological SWOT-analysis and confrontation matrix is that only strengths and opportunities could be found. This is very positive and provides many possibilities to exploit opportunities to use the strengths. According to the confrontation matrix, is the only possibility for the ecological indicator to attack. The strong SWOT-elements can be used to exploit the opportunities. The strengths that are not related to opportunities can be used to provide support / direction of individual developments.

The confrontation matrix also indicated that quite a few of the strengths are could not be linked with opportunities. For these strengths, it is important to look individually to what extent these strengths could be used in the scenarios. Although they have no relation with other SWOT-elements, they could play an important role in new developments to make use of ecologic ecosystem services around the Vistula River.
5.1.4 Trends and developments

In addition to analyzing the current situation, as described above, are also trends and developments analyzed. The trends and developments are part of the scenarios and provide direction for the scenarios. The Polish government makes too little use of the Vistula River, according to Professor Czarnecki of the Nicolaus Copernicus University in Toruń. (personal communication with Professor Czarnecki, February 4, 2014) In conversation with the local government of Toruń (Karmienko (1), 2014), it became clear that the main reason for not elaborating many developments along the Vistula River in Toruń, is that those projects are expensive. The elaboration of projects depends on availability of the co-finance of the European Union. Nowadays, the local government of Toruń is busy with getting co-finance from the European Union for the period of 2014-2020. Although there are not many projects along the Vistula River in Toruń, there are several projects planned for elaboration in the future. The local government of Toruń is aiming to make more use of the Vistula River in terms of recreation and tourism. One of the goals of the local government of Toruń is to develop the Philadelphia Boulevard (about 500 meters long) into a valuable area for recreation and tourism. (Karmienko (1), 2014)

The current (planned) developments are detailed in the Landscape Management Plan (LMP) and in a list of future developments. The LMP provides a detailed analysis of the areas in the city district of Toruń and provides insight into opportunities (as they are used in the analysis of the indicators and the SWOT-analysis). The local government of Toruń has their vision for Toruń described in a vision 2020. The next most relevant objectives are described in the period to 2020 (Rada Miasta Toruń, 2010):

1. Toruń as a safe city with an active and healthy community
   1.1 The development of numerous and active non-governmental organizations and their activities
   1.2 Activation and integration of groups at risk of social exclusion
   1.3 Support of people with disabilities in social and professional integration
   1.4 Improving the technical and equipment urban public health care facilities
   1.5 The development of school sports, qualifications and urban recreation
   1.6 Improving the security and public order in Toruń

2. Toruń with a strong modern economy based on innovative enterprises, developing the technical infrastructure for the needs of residents, economy and tourists
   2.1 Development of local business environment
   2.2 Economic promotion of Toruń - active acquisition of investors
   2.3 Support innovative actions based on economy knowledge
   2.4 Improving the environment in the city
   2.5 Improving the conditions of communication in the spatial system of Toruń
   2.6 Development of housing

3. Toruń, a city of education and academic center of international importance
   3.1 Strengthen its position as a regional center of Toruń for the education of youth
   3.2 Enhancing the quality of the educational services
   3.3 Developing the international dimension of the university
   3.4 Toruń city of international scientific meetings

4. Toruń with the protection of cultural heritage and developing sphere cultural and touristic economy
   4.1 Strengthening the institutional activities in the sphere of culture
   4.2 Strengthen and expansion of the cultural offer of the city
   4.3 Revitalization of historic buildings and degraded sites
   4.4 Development of brand and competitive tourist products
   4.5 Preparation of the social basis for the development of tourism in Toruń
   4.6 Toruń the city of international business meetings

The planned developments of the local government of Toruń are based on these policy goals.
The local government of Toruń has a list of developments, which it intends to carry out in the future. Important side-note is that the local government of Toruń (Karmienko, 2014) indicates that these developments are dependent on the co-finance of the European Union. The following table (table 1) shows the relevant developments that are located within the project boundaries of the research (Urzedem Miasta Torunia, 2014):

<table>
<thead>
<tr>
<th>ID</th>
<th>Type of project</th>
<th>Year of elaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Park Fortress on the scarp - sport, recreation and tourism in Fort I and the Jana III Sobieskiego.</td>
<td>2014-2020</td>
</tr>
<tr>
<td>2</td>
<td>Creating a network of residential space integration for the residents of Toruń based on the natural resources of urban green infrastructure.</td>
<td>2015-2020</td>
</tr>
<tr>
<td>3</td>
<td>Land use of Kepa Bazarowa. + with the reconstruction of the Majdany street.</td>
<td>2017-2019 2014-2015</td>
</tr>
<tr>
<td>4</td>
<td>Reclamation of the Martóówka water body to the suburbs of Toruń with the implementation of the water supply.</td>
<td>2018-2020 2014-2015</td>
</tr>
<tr>
<td>5</td>
<td>Protection of natural heritage by protecting, grooming, and marking protected objects of nature.</td>
<td>2016-2018</td>
</tr>
<tr>
<td>6</td>
<td>Environmental education actions shaping Toruń’s residents pro-ecological attitudes and relevant behavior.</td>
<td>2016-2020</td>
</tr>
<tr>
<td>7</td>
<td>Development of the Philadelphia Boulevard in Toruń, between the railway bridge and the Pilsudski bridge.</td>
<td>2016-2018</td>
</tr>
<tr>
<td>8</td>
<td>Development of Park Miejski and the surroundings.</td>
<td>2016-2018</td>
</tr>
<tr>
<td>9</td>
<td>Modernization of the stream Toruńskiej with the revitalization of the environment.</td>
<td>2018-2020</td>
</tr>
</tbody>
</table>

A more detailed description of the various developments is reflected in the analysis report (appendix 3).

When an organization wants to get a view on future opportunities and threats, it is important to study the current trends. In this case, it is important to extrapolate trends into the future. For the short-term, trends and time series can be used: the extrapolation of developments to the future. This assumes stability. (Raessens B., 2011) In order to create stable scenarios, a trends analysis is elaborated. The current trends are shown below. The substantiation of trends, including the underlying data can be found in appendix 3 (analysis report). All the trends are confirmed and substantiated by the local government of Toruń in order to increase their reliability. The trends are included in the SWOT-analysis and the ensuring confrontation matrices.

**Trend (1): Number of cyclists in Toruń is increasing, as well as the cycling facilities.**

**Trend (2): The local government of Toruń creates more awareness to make the city attractive.**

**Trend (3): Public places along the Vistula River in Toruń (with view on the river) are considered, by the local government of Toruń, as important.**

**Trend (4): The local government of Toruń does not only want to focus on the Old City Center (as attraction point for recreation and tourism) but wants also to focus on qualities outside the Old City Center.**

**Trend (5): The use of the Old City Center, in an economic point of view, is decreasing.**

**Trend (6): More projects/plans are elaborated around the Vistula River in Toruń because this area is considered important.**
5.2 Aim of scenarios

In the preceding sections, the three indicators (economic, socio-cultural, and ecological) are (rough) described. They form an important basis for future developments and for designing the scenarios. Although it concerns the current situation of the three indicators of the Vistula River in Toruń, it is not yet specifically related to the use of ecosystem services. The scenarios are arranged (and based on) so that the SWOT-elements and the four strategies (attack, strengthen, defend and withdraw) are optimally used in connection with the use of ecosystem services (dependent on the type and aim of scenarios). It can be concluded that the SWOT-elements form the basis to respond to the relation between the current use of the river and use of ecosystem services.

Overall conclusion

The following elements of the analysis form an overall conclusion:
- there are enormous potentials to make more use of the Vistula River in Toruń;
- there are many strengths present within the three indicators: economy, socio-culture, and ecology;
- ‘attack’ is the strategy which provides the most opportunities for the three indicators;
- the local government of Toruń is focusing more on the Vistula River in Toruń as an important area in the city district of Toruń;
- the local government of Toruń consists of many goals and planned developments for the Vistula River in Toruń, but these are dependent on co-finance of the European Union;
- the SWOT-analysis provide opportunities and possibilities to make use of the three indicators in relation to each other;
- in fact (through the implementation of the planned developments and objectives), the local government of Toruń increases the spatial quality of the Vistula River and make use of ecosystem services in a certain way (indirectly);
- there are opportunities to link existing qualities (strengths and opportunities) and future (planned) developments with ecosystem services of the Vistula River.

An important side-note is that the confrontation matrixes are performed for each indicator. This provides for each indicator an overview of important relations and possibilities. However, this also means that the relations between the different indicators remain unexposed. It was decided to conduct the confrontation matrixes per indicator in order to create a more profound analysis of the indicators. In the scenarios (when a more specific goal has been put down), the relationships between the indicators will be more visible in order to link the different indicators to each other. The relationship between the indicators and to what extent is dependent on the scenarios and the aim of it. Although the SWOT-analysis in this report focuses on the three indicators, appendix 3 provides the SWOT-analysis of the indicators together (including the confrontation matrix). During the creation of the scenarios, specifically is looked at the relations between indicators in order to respond to them.

The challenges of the future are the trends and developments that are translated from strategy to innovation. A trend analysis is the basis for future scenarios. A trend is often already seen as an overall, fairly independent line of development, which is visible in the past and provides direction in the future. Trends may occur by certain combinations of trends or may directly lead to a new trend. (Raessens B., 2011) As the methodology indicates, this research focuses on three scenarios. This is one extrapolative scenario and two normative scenarios. The extrapolative scenario is considered important because it provides insight of the future and the planned changes. It forms an important part in the reflection of the (probable) future (extrapolative scenario) in contrast to the ideological future (normative scenarios). This reflection is considered important for future decision-making and for the awareness of opportunities for making more use of the ecosystem services of the Vistula River.
Extrapolative scenario - Desired future vision by the local government

The extrapolative scenario consists of the current situation, trends and planned developments. This is also indicated by the model in paragraph 3.3. The current situation provides an overview of the elements present. The planned developments give direction to the future. The trends affect both the current situation and the planned developments. The design of the scenario focuses on the planned developments together with the present trends. The current situation forms a base and provides insight into the situation. The most favorable situation is assumed, which means that all the planned developments and trends are included (regardless of possible lack of finance) in the scenario. This provides a better view on what the local government wants to achieve in Toruń (desired future vision of the local government). In this way, the ‘probable’ future can be better reflected to the normative scenarios. Model 6 presents a model, which shows where the scenario is based on.

Model 6 - Extrapolative scenario

Model 7 - Normative scenario I

Normative scenario II - Optimal desired future of the Vistula River and their ecosystem services

For the second normative scenario is chosen to respond as well to the opportunities to order planned developments (along with the trends) in relation with ecosystem services. Additionally to that, this scenario aims at the optimum situation for the use of ecosystem services in order to increase the spatial quality. This means that in addition to the ‘planned’ developments is going to look at ‘possible’ (new) developments. These together should result in: optimal desired future of the Vistula River and their ecosystem services. Model 8 presents a model, which shows where the scenario is based on.
6. PRESENTATION OF THE SCENARIOS

6.1 Strategy of scenarios

The ‘moment of choice’ for selecting the scenarios is based on the most logical steps to provide the local government of Toruń possibilities to make more use of ecosystem services to increase the spatial quality. The ‘moment of choice’ is determined in accordance with the local government in Toruń. Scenarios are several conceivable but sometimes initially also unthinkable representations of the future, which provides insight into possible developments. (Raessens B., 2011) These developments offer opportunities for the local government of Toruń to make more use of ecosystem services in order to increase the spatial quality (the main objective of the research).

According to a 2013 report (Czarnecki, Lewandowska-Czarnecka, & Zielinska, Changes in preferences for the use of ecosystem services and the effects in a city localized along the river on an example of Torun, Poland., 2013), important measure is that the total value of ecosystem services consists of a sum of ecological, socio-economic and economical benefits (as the three indicators of the research indicates) These benefits show impact on human well-being. If effect is poor, it may cause consequently migration of people to unique places of cultural and recreational potential, what enlarge city space and exacerbate air conditions and efficiency of energy use. The strategy for the scenarios is aimed at combining the indicators in order to increase the use of ecosystem services. By combining the possibilities within the indicators, is contributed indirectly to combine the three values of spatial quality (use value, perception value, and future value). Assumed is that this result in a substantial increase of the spatial quality by ecosystem services. By testing the scenarios (in particular, the normative scenarios) through the Habiforum Matrix, can be confirmed to what degree the spatial quality is increased. The Habiforum Matrix is also applied to the extrapolative scenario in order to see how current trends and developments already contribute to the enhancement of spatial quality. This provides an important basis for the recommendations of the research aimed at increasing the spatial quality by making use of ecosystem services. These developments offer opportunities and possibilities for the local government of Toruń to make more use of ecosystem services.

The choice of strategy (aim of scenarios) to focus on the planned developments and the possibilities the current situation provides in addition to these planned developments, is to provide the local government of Toruń insight (and awareness) of possibilities for the use of ecosystem services. According to the Sendzimir Foundation (Sendzimir Foundation, 2013), problems of urban ecosystems in Poland show that authorities of Polish cities are not aware of their value. Meanwhile, in more developed countries the value of urban ecosystem services is increasingly often estimated and taken into account in decisions concerning urban development. This translates into higher quality of life in cities, as well as savings from not having to make some investments. (Sendzimir Foundation, 2013). The goal of the foundation is to increase awareness of policy makers and other stakeholders about the importance of ecosystem services in Polish cities. This research contributes to that goal by the aim of scenarios and its strategies.

As the methodology indicates, the scenarios are based on the steps of the IES-approach. Appendix 2 provides an overview of the steps of the IES-approach. The strategies of the normative scenarios are based on those steps (according to the IES-approach). The extrapolative scenario is not based on the steps of the IES-approach. The reason for this is that this scenario exists of extrapolating trends and developments into the future. The IES-approach is focusing on how ecosystem services could be integrated in development planning (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 2012). Because the scenario is based on planned developments, integrating ecosystem services into development planning is not an issue. That is the reason that the IES-approach for the extrapolative scenario is not usable.
6.2 Extrapoloative scenario - Desired future vision by the government

Note
The complete elaboration of the extrapolative scenario can be found in appendix 6. Below is only focused on the outcomes (results) of the scenario. Use has been made of the data from the appendices (in headlines) to present the most important elements of the scenario. For an overview of all the steps together with the methodology of the extrapolative scenario, please refer to appendix 6. This appendix provides a more in-depth and elaborated view of the scenario.

In this extrapolative scenario, the planned developments of the local government of Toruń along with the trends are extrapolated. Here, arises a picture of the future, which provides an overview of changes and impacts. Paragraph 5.2 indicates the ‘aim of scenarios’. The predicted image of the extrapolative scenario is based on the expectations and goals from the planned development by the local government of Toruń (Karmienko (2), 2014) and the Landscape Management Plan (European Union (Euroscapes), 2012). The planned developments (as shown in sub-paragraph 5.1.4) are part of the extrapolation. The developments are all applicable to the Vistula River in Toruń (part of the spatial demarcation of the research). This predicted image should be seen together with Map 2 in appendix 4. This map provides an overview of the location of all planned developments.

The planned developments focus on the upgrading of the areas in terms of:
- the construction of recreational facilities, together with the construction of bicycle and walking paths;
- revitalization and modernization of the areas;
- protection of natural heritage and valuable natural areas (such as nature reserves);
- use of educational facilities to create awareness of the environment;
- promotion of social security through the use of monitoring and lighting;
- improving the aesthetics of nature and its surroundings.

To get a better image of the developments and their implications, use is made of an assumed cause-effect analysis. This analysis provides insight into the direct effects (immediately), and the expected impact on longer-term. Model 9 indicates how the cause-effect analysis is made.

Model 9 - Method cause-effect analysis

![Cause-effect diagram]

Model 10, on the next page, shows the cause-effect analysis, which is based on expected effects and their consequences. Displaying the cause-effect analysis is important for the local government of Toruń. This provides the opportunity for the local government to anticipate and perhaps to adopt a proactive attitude in order to respond to possible effects and consequences. As a result, they provide possibilities to customize policy and their vision in order to focus on more oriented policy. The cause-effect analysis is based on the elements of the developments (grouped in more general appellation) and is housed in the three indicators: economy, socio-culture, and ecology.

Expected is that the effects will be visible when the developments are completed (such as model 9 indicates). The consequences, as a sequel of the effects, are expected to take place after 2020 (on long term). The cause-effect analysis shows that the developments make a significant contribution to the attractiveness of Toruń. It is clear that the government is currently mainly focused on recreation and tourism and their link with education, culture, and ecology. The predicted effects and consequences show that the planned developments are an improvement of the spatial areas in the city. Although developments individually create an improvement, it can be concluded that it gives a fragmented view of the development of Toruń. The developments are not aligned with each other in order to benefit from each other grades in this way. Professor Czarnecki (personal communication, March 12, 2013) also emphasizes this.
Let nature determine the quality of our environment!

Model 10 - Cause-effect analysis (assumed)

**Economy**
- recovery and increase of attractiveness of area for potential investors
- construction of cafes on the Philadelphia Boulevard
- prevent of valuable nature and aesthetics

**Ecology**
- relief, recovery, protection and care of natural and cultural objects
- improvement of Martówka water tank and its protection from degradation
- revitalization of stream Toruński

**Socio-culture**
- promotion of social ties, the tourism and recreation, and sport diversity
- development of health education based on natural resources of green infrastructure
- integration of leisure and recreation in the natural environment
- construction of educational paths along natural heritage
- promotion of climate change adaptation, risk prevention, and risk management
- creation of safer and more attractive space for users of the Philadelphia Boulevard

**CAUSE**
- responses to the spatial infrastructure and initiatives for individual investments
- increase of the access to sport and recreation infrastructure
- support of different forms of physical activity of the local community
- improvement of the accessibility of attractive tourists places
- expansion of environment education
- improvement of the functionality and quality of the natural environment
- increase the functional relationship between the city and its surroundings
- improvement of access and aesthetics of Martówka
- improvement of aesthetics as well as marking natural and cultural objects
- extension of recreation and creation of new technical infrastructure of the Philadelphia Boulevard
- improvement of the environment and proper management of stream Toruńskie
- more economic use of the Philadelphia Boulevard

**EFFECT**
- better social and economic situation
- more use of sport and recreational facilities
- more sustainable awareness of health, natural resources, and climate adaptation
- increase of knowledge and awareness of the citizens in Toruń on the environmental and the natural heritage of Toruń and its region
- more use of qualities of green spaces and their environment
- city is connecting more to the Vistula River
- increase of the use of the attractions by tourists
- instability of the water tank Martówka will be solved together with the improvement of the water quality, living conditions and aquatic organisms
- protection of the environment, including solving the problem of the lack of comprehensive unified protection and care
- improvement of the waterfront of the city on the Philadelphia Boulevard
- increase of the aesthetics and attractiveness of using larger number of facilities of recreation for stream Toruńskie and his functional link with Toruń

**CONSEQUENCES**
The developments also contain components connected to the use of ecosystem services. This is evident by the expected impact and consequences of the local government of Toruń. For example, in response to the experience (aesthetics) of green spaces, recreational opportunities and the protection of cultural heritage: cultural service of ecosystems. Additionally, use is made of the regulating service of ecosystems: climate adaptation, cleaning water, etc. The expectations are contributing to different goals of the vision for Toruń 2020.

Although the planned developments are not specifically focused on the relationship with ecosystem services, it does not mean that the planned developments do not contribute to ecosystem services. As the cause-effect analysis indicates (and also the objectives of the government), focuses the local government of Toruń with its planned developments on upgrading and revitalizing green spaces in the city. Research had shown (published in the journal of “Environmental Science & Technology”) that urban green space improves the mental health. According to this research, green spaces in towns and cities lead to significant and sustained improvements of mental health. (University of Exeter, 2014)

According to the report “Ecological Complexity” (Groot de, Alkemade, Braat, Hein, & Willemen, 2009), it becomes clear that this scenario focus on the non-use values of ecosystem services. Non-use values relate to recreation and aesthetic appreciation. Indirect use values relate to services such as air-, water-purification, and prevention of erosion and pollination of crops. Non-use values are the importance attributed to an aspect of the environment in addition to, or irrespective to its use values. The objectives of the local government of Toruń and the effects together with the consequences focus on recreation, tourism, and the aesthetics of green areas. Concluded can be said that the extrapolative scenario contribute the most to the non-use values of ecosystem services. The non-use values are part of the economic value of ecosystem services and housed in the cultural services of ecosystems. Table 2, appendix 6 indicates in which way the planned developments contribute to the use of ecosystem services. This is important to understand that the cultural service of ecosystems plays an important role in the extrapolative scenario (they make use of ecosystem services even when they do not focus on ecosystem services).

The extrapolative scenario looks at the result of the planned developments in the context of spatial quality and ecosystem services. This means that the planned developments already improve the spatial quality and that they already make use of ecosystem services. The planned developments, as can be seen in the Habiforum Matrix (see matrix 1, appendix 6), improve the spatial quality of the different values. In addition, use is made of ecosystem services as can be seen in table 2, appendix 6. The horizontal axes in the Habiforum Matrix show how the planned developments contribute to the corresponding value (use value, perception value, and future value). The vertical axes in the Habiforum Matrix indicate for each indicator (economy, social, culture, ecology), which value has been achieved for the relevant indicator. According to the report about the spatial quality in practice (Habiforum, 2009), spatial quality is the result of a good balance between the use value, perception value, and future value. This interaction between them is important. Habiforum Matrix displays crossings between the horizontal axes and the vertical, which indicates the interaction with the values. This scenario, in this study, indicates what the planned developments in these two areas (spatial quality and ecosystem services) entail in order to increase the awareness.

The normative scenarios examine how the planned developments can make more use of ecosystem services in order to increase the spatial quality (normative scenario I) and in which way the local government of Toruń can make more use of potential values that currently exist (normative scenario II). According to the report by UNEP (United Nations Environmental Programme) ecosystem services are unknown to many governments. The aim of UNEP is to raise awareness of the role of ecosystem services and biodiversity in building a sustainable future. (United Nations Environmental Programme, 2012)
6.3 Normative scenario I - Desired future in combination with ecosystem services

Note
The complete elaboration of normative scenario I can be found in appendix 7. Below is only focused on the outcomes (results) of the scenario. Use has been made of the data from the appendices (in headlines) to present the most important elements of the scenario. For an overview of all the steps together with the methodology of normative scenario I (IES-approach), please refer to appendix 7. This appendix provides a more in-depth and elaborated view of the scenario.

Normative scenarios start with a typical desired future situation, and answers the question: how can a specific end situation be achieved? (Raessens B., 2011) In accordance with the local government of Toruń is decided to build on the planned developments of the local government to connect to possibilities to capitalize opportunities offered by the analyses. This results in the following objective for this scenario:

**View on the future (2024) in which planned developments along with trends are linked with the use of ecosystem services in order to increase the spatial quality of the Vistula River.**

To create more focus and to respond to the most relevant parts of the analysis, is the local government of Toruń asked to prioritize the SWOT-elements (including the trends). Prioritizing the SWOT-elements are done for each indicator (economic SWOT, socio-cultural SWOT, and ecological SWOT). For each indicator, the local government of Toruń indicated the priority of each SWOT-element (strengths, weaknesses, opportunities, and threats). In this way, the SWOT can be used more efficiently in respond to the priorities given by the local government of Toruń. By linking ecosystem services to the planned developments, there are needed three steps. In the first step indicates the SWOT-elements, which is prioritized by the local government of Toruń. The SWOT is based on three indicators (economy, socio-culture, and ecology). In this way, the SWOT-elements are in line with the values of ecosystem services. Step 2 consists of the strategies of the prioritized SWOT-elements, according to the confrontation matrices. Step 3 examines how the strategies can be used by the services of ecosystems. From those services, the potential developments are examined and filtered. For a detailed elaboration of the three steps, please refer to appendix 7.

The strategies (rolling from the SWOT-analysis) focus primarily on recreation, tourism, and the relationship between city and river. As a conclusion, for the purpose of the strategic application, it can be said that the cultural service of ecosystem services the basis forms for making use of ecosystem services. The cultural service of ecosystems consists of "non-material benefits obtained from ecosystems (cultural heritage, aesthetics, recreation, etc.)" (The United Nations Environmental Programme (UNEP), 2005) The third step (see appendix 7, table 2) indicates which service of ecosystems fits the best to the priorities of the local government of Toruń and how the strengths can be utilized, weaknesses can be strengthened, use can be made of opportunities and to respond to threats. It becomes clear that the results are aimed on the cultural service of ecosystems. The result is not entirely unexpected, given the objectives of the local government of Toruń in the field of recreation and tourism. The possibilities that the table (table 2, appendix 7) provides in order to respond to the cultural services, can be seen as starting points for bringing the planned developments in relation with ecosystems services. Based on these starting points is examined which potential developments contribute to these starting points in order to respond to the cultural service of ecosystems.

The contribution to ecosystem services is translated into potential opportunities (developments) to link the planned developments to ecosystem services (see the frameworks in appendix 7). In this way, the prioritized SWOT-elements are used as basis for the use of the relevant ecosystem services. From this relevant ecosystem services is then looked at how the planned developments can contribute to relevant services in order to increase the spatial quality. Use is made of the exploitation of potential developments within the Landscape Management Plan (European Union (Euroscapes), 2012). The relevant ecosystem services (displayed per development) in the developments, do not include the options
already recorded in the planned developments (see the extrapolative scenario, appendix 6). This scenario focuses on the deployment of ecosystem services additional to the planned developments. That means that the extrapolative scenario, including the contribution to the spatial quality in principle already forms the basis under this scenario. The main focus is aimed on the prioritized SWOT-elements, but in addition to that, the developments are also linked with potential developments beyond the prioritized SWOT-elements.

Expected is that the effects will be visible when the developments are completed (such as model 9 indicates). The consequences, as a sequel of the effects, are expected to take place after 2020 (on long term). The cause-effect analysis shows that the development makes a significant contribution to the attractiveness of Toruń. It is clear that the government is currently mainly focus on recreation and tourism and their link with education, culture, and ecology. The predicted effects and consequences show that the development is an improvement of the spatial areas in the city. The developments are based on the cultural service of ecosystems. However, implementing developments that are based on cultural services is not only an obvious added value to the cultural services. It may also indirectly contribute to other services of ecosystems. For example, the recreational use of Kepa Bazarowa and other natural areas contribute to the cultural service (perception, recreation, and aesthetic), but also indirectly to the supporting service (maintaining and safeguarding biodiversity) and the regulating service (cleaner air and climate regulation).

Model 11 - Cause-effect analysis (assumed)

**CAUSE**
- upgrading and uncovering stream Toruńskie and the development of its recreation
- bringing recreational areas in relation with the Wiślana Trasa Rowerowa
- creating more visibility spots on the river and on other natural areas

**EFFECT**
- more coherent network of green spaces
- increase of the economical function of the Old City Center
- improvement of the identity and recognition of the city and the Vistula River
- better relation between city and river
- extensive network of recreational facilities
- increase of aesthetics and perception of the landscape along the river
- increase of the awareness of values of nature and the Vistula River

**CONSEQUENCES**
- more use of recreational facilities and opportunities
- more appreciation and awareness about the benefits of greenery and nature
- increase of the number of tourists and recreationists in Toruń as well as their time spending in the city and the areas along the Vistula River
- more interests and initiatives to maintain, preserve, and develop greenery

Chiel Mensink, 2014
The implementation of the various steps of the IES-method made clear that the additional link with ecosystem services leads to a contribution to more goals of the local government of Toruń (vision of Toruń 2020). Additionally, there are several possibilities for ecosystem services to be included in decision-making. It became clear (in this fifth step of the IES-approach) that awareness plays a significant role in the implementation of ecosystem services in decision-making. Paragraph 2.5 of appendix 7 provides more detailed information (together with the risks, opportunities, and recommendations regarding to decision-making). Concluded the following entry points for decision-making processes can be formulated:

- creating the developments in accordance with the Landscape Management plan;
- provide accountability of the financial feasibility of the developments;
- ensure of all permits and exemptions for the developments;
- establishment of an approach to minimize the risks;
- exploit the opportunities offered: developments linking with ecosystem services before they are approved by the major of Toruń (city council); and the use of the qualities and benefits of ecosystem services for the substantiation and accountability of the developments.

Although the planned developments and its link with ecosystem services focus on the cultural services (on behalf of the SWOT-analysis), it does not mean that they do not contribute to other services. According to the Millennium Assessment (The United Nations Environmental Programme (UNEP), 2005), the supporting services are services needed for the production of all other services. This emphasizes that services are linked together. As the cause-effect analysis indicates (and also the objectives of the government), focuses the local government of Toruń with its planned developments on upgrading and revitalizing green spaces in the city. Research had shown (published in the journal of “Environmental Science & Technology”) that urban green space improves the mental health. According to this research, green spaces in towns and cities lead to significant and sustained improvements of mental health. (University of Exeter, 2014)

According to the report “Ecological Complexity” (Groot de, Alkemade, Braat, Hein, & Willemen, 2009), it becomes clear that this scenario focus as well on the non-use values of ecosystem services. Concluded can be said that the extrapolative scenario and this normative scenario contribute the most to the non-use values of ecosystem services. The non-use values are part of the economic value of ecosystem services and housed in the cultural services of ecosystems. Table 4, appendix 7 indicates in which way the planned developments together with their link with ecosystem services contribute to the use of ecosystem services. From ecosystem services, the developments are selected. Table 5, appendix 7 indicates the effect of the application of these services to ecosystem services. The items displayed in green are those of the extrapolative scenario (which is used as a basis for this scenario). The blue items indicate how the additional link with ecosystem services results in contributing to ecosystem services.

An important part of this scenario is the awareness of ecosystem services. Concluding it can be said that this scenario contributes to raising awareness about the implementation, operation, usefulness and value of ecosystem services. This awareness is important for decision-making and future policy on and around the Vistula River in Toruń. The public awareness also plays a major role. To summarize it comes down to the following added values:

- more awareness among the local government of Toruń regarding to ecosystem services;
- opportunities for implementing ecosystem services in decision-making;
- greater use of the Vistula River and its values by applying ecosystem services;
- better network of recreational facilities and their link with ecosystem services;
- a significant contribution to the increase of the spatial quality within different values;
- government with a more sustainable approach to urban development.
6.4 Normative scenario II - Optimal desired future of the Vistula River and their ecosystem services

**Note**
The complete elaboration of normative scenario II can be found in appendix 8. Below is only focused on the outcomes (results) of the scenario. Use has been made of the data from the appendices (in headlines) to present the most important elements of the scenario. For an overview of all the steps together with the methodology of normative scenario II (IES-approach), please refer to appendix 8. This appendix provides a more in-depth and elaborated view of the scenario.

Normative scenarios start with a typical desired future situation, and answers the question: how can a specific end situation be achieved? (Raessens B., 2011) In accordance with the local government of Toruń is decided to aim this scenario to the optimum use of ecosystem services based on the prioritized SWOT-elements. This results in the following objective for this scenario:

**View on the future (2024) in which developments are based on ecosystem services in order to increase the spatial quality of the Vistula River.**

To create more focus and to respond to the most relevant parts of the analysis, is the local government of Toruń asked to prioritize the SWOT-elements (including the trends), just like happened in normative scenario I. In order to establish developments, which are based on ecosystem services, use is made of the prioritized SWOT-elements. In normative scenario I, use is made of the prioritized SWOT-elements, which are priority number one. In this normative scenario II, use is made of the priority number one SWOT-elements (which are shown in table 2, appendix 7) and SWOT-elements of priority number two. The priorities provide direction for the possibilities to respond to ecosystem services. Examined is which strategies the confrontation matrix provides in order to increase the efficiency of the prioritized SWOT-elements. The strategies, as a result from confrontation matrices, provide direction for new developments. For this reason, the developments in normative scenario II are based on the SWOT-strategies. The SWOT is based on three indicators (economy, socio-culture, and ecology). In this way, the SWOT-elements are in line with the values of ecosystem services (also see model 5). Table 2, appendix 8 provides an overview of the prioritized SWOT-elements of priority number two. The SWOT-elements of priority number one together with their strategies and the way they give meaning to ecosystem services is shown in table 4, appendix 8. The individual SWOT-elements and strategies of priority number one is shown in normative scenario I (appendix 7).

To establish the developments, use is made of the same three steps as in normative scenario I. The first step (table 2, appendix 8) indicates the SWOT-elements, which are prioritized by the local government of Toruń as priority number two). Step 2 consists of the strategies of the prioritized SWOT-elements, according to the confrontation matrices (table 3, appendix 8). Step 3 examines how the strategies can be used by the services of ecosystems (table 4, appendix 8). From those services, the developments are established. The contribution to ecosystem services is translated into new potential developments. In this way, the prioritized SWOT-elements are used as basis for the use of the relevant ecosystem services. From this relevant ecosystem services is then looked at how new potential developments can contribute to relevant services in order to increase the spatial quality. Use is made of the exploitation of potential developments within the Landscape Management Plan. (European Union (Europeiscapes), 2012) The relevant ecosystem services (displayed per development) in the developments do not include the options already recorded in the planned developments and the link with ecosystem services (see the extrapolative scenario, appendix 6 and normative scenario I, appendix 7). This scenario focuses on the deployment of ecosystem services additional to the planned developments and their link with ecosystem services. That means that the extrapolative scenario and normative scenario I, including the contribution to the spatial quality in principle already forms the basis under this scenario. The main focus is aimed on the prioritized SWOT-elements, but in addition to that, the developments are also linked with potential developments beyond the prioritized SWOT-elements.
Model 12 shows the cause-effect analysis, which is based on expected effects and their consequenc-
es. Displaying the cause-effect analysis is important for the local government of Toruń. Expected is that the effects will be visible when the developments are completed (such as model 9 indicates). The consequences, as a sequel of the effects, are expected to take place after 2020 (on long term). The cause-effect analysis shows that the development makes a significant contribution to the attractiveness of Toruń. It is clear that the government is currently mainly focus on recreation and tourism and their link with education, culture, and ecology. The predicted effects and consequences show that the development is an improvement of the spatial areas in the city. The developments are based on services of ecosystems. However, implementing developments that are based on cultural services, is not only an obvious added value to the cultural services. It may also indirectly contribute to other services of ecosystems. For example, the recreational use of Kepa Bazarowa and other natural areas contribute to the cultural service (perception, recreation, and aesthetic), but also indirectly to the supporting service (maintaining and safeguarding biodiversity) and the regulating service (cleaner air and climate regulation). The side-effects (contributing to other services) is clarified in chapter 3, appendix 8.

Model 12 - Cause-effect analysis (assumed)
The implementation of the various steps of the IES-method made clear that the additional link with ecosystem services together with the potential developments lead to a contribution to more goals of the local government of Toruń (vision of Toruń 2020). The first normative scenario discusses the raising of awareness. This is highlighted by extending the planned developments with a link with ecosystem services where the increasing the awareness is emphasized. Additionally, the scenario discusses opportunities for the local government of Toruń to organize information meetings where the usefulness of ecosystem services is explained in order to increase the awareness among organizations, citizens and NGO’s. This second normative scenario, in addition to increasing awareness, also discusses how the local government can create more awareness for entrepreneurs in the city of Toruń. This is important for the deployment of future developments and the support of organization in developments of the local government of Toruń. First is discussed the decision-making of the developments and their risks and opportunities (paragraph 2.5.1, appendix 8), then a paragraph (paragraph 2.5.2, appendix 8) is dedicated to raising awareness among entrepreneurs and the impetus to develop initiatives. Concluded the following entry points for decision-making processes can be formulated:

- creating the developments in accordance with the Landscape Management plan;
- provide accountability of the financial feasibility of the developments;
- ensure of all permits and exemptions for the developments;
- establishment of an approach to minimize the risks;
- exploit the opportunities offered: developments linking with ecosystem services before they are approved by the major of Toruń (city council); and the use of the qualities and benefits of ecosystem services for the substantiation and accountability of the developments.

Tables 5 and matrix 1 in appendix 8 show in which way the potential developments contribute to the use of ecosystem services and spatial quality. Increasing cultural services of the Vistula River in Toruń is important for the use of ecosystem services. It results in synergies of spaces and to contribution of enhancing the spatial quality. This appears from a report, which emphasized the contribution of the cultural service to ecosystems. (Daniel, et al., 2012)

The added value of ecosystem services is indicated by the increased quality of the space. Thus is can be concluded that the planned developments with the link with ecosystem services together with the potential developments increased the use value of the space tremendously. The natural areas are used in a variety of ways where the economic interest plays an important role. In addition, the use of cultural services of ecosystems results in opportunities for the aesthetics of green areas, the Vistula River and the waterfront of the Old City. Applying ecosystem services, thus makes a significant contribution to increasing the spatial quality of the Vistula River in Toruń on the three different values (use value, perception value and future values by focusing on the indicators economy, socio-culture, and ecology. An important part of this scenario is the awareness of ecosystem services. Concluding it can be said that this scenario contributes to raising awareness about the implementation, operation, usefulness and value of ecosystem services. Increasing the awareness is the guided part (leading part) in this scenario. By increasing the awareness of the use of ecosystem services in decision-making, the scenario contributes to future developments and the involvement of ecosystem services in future policy of the Vistula River in Toruń but also for other areas in and around Toruń. The public awareness also plays a major role. To summarize it, it comes down to the following added values:

- more awareness among the local government of Toruń regarding to ecosystem services;
- more awareness among the public sector regarding to ecosystem services;
- opportunities for implementing ecosystem services in decision-making;
- more attention of ecosystem services in policy and entrepreneurship;
- encouraging the public sector (citizens, NGO’s, and entities) to make use of ecosystem services in order to increase the spatial quality;
- greater use of the Vistula River and its values by applying ecosystem services;
- optimum network of recreational facilities and their link with ecosystem services;
- a significant contribution to the increase of the spatial quality within different values;
- government with a more sustainable approach to urban development.
7. CONCLUSION AND DISCUSSION

7.1 Building bricks of the conclusion

The conclusion provides the answer to the central question: ‘How can the local government of Toruń increase the spatial quality of the Vistula River in Toruń by making use of ecosystem services’. Before giving a clear answer to the central question, it is considered very important to pay attention to several sub-conclusions. These sub-conclusions can be seen as the building bricks to make use of ecosystem services in order to increase the spatial quality. All sub-conclusions have a direct link to the central question and can be seen as part of the answer to this central question. The building bricks provide the local government of Toruń opportunities for focused, efficient and structured possibilities. Below are five sub-conclusions formulated (all indicated by the relationship to the sub-questions).

Sub-conclusion 1 - relation between ecosystem services and spatial quality
Explored is how ecosystem services may affect the spatial quality (chapter 4). The conclusion is that the indicators, economy, social, ecology and culture can relate ecosystem services and spatial quality. By valuing the indicators from ecosystem services point of view, the spatial quality of an area can be measured (based on ecosystem services). The Habiforum Matrix is hereby an important tool. In this way, a measuring instrument occurred in which the use of ecosystem services of ecosystem services can be measured in relation to spatial quality. (answer to sub-question 1)

Sub-conclusion 2 - current situation of the Vistula River in Toruń
The conclusion is that the SWOT-analysis and the confrontation matrices offer many possibilities and opportunities for development of the Vistula River in Toruń. There are many strengths and opportunities present within the indicators in which the local government of Toruń can make use of ecosystem services. As a conclusion, it can be said that these conclusions form an important basis for the aim of scenarios and the application of the various services of ecosystems. More specific conclusions of each indicator can be found in chapter 5 of this report and in appendix 3. As an overall conclusion, it can be said that there is tremendous potential for the use of ecosystem services. (answer to sub-question 2, 3 and 4)

Sub-conclusion 3 - current developments (planned)
The conclusion of the analysis of current developments is that the local government of Toruń currently focuses on the cultural service of ecosystems by focusing on recreation and tourism in and around Toruń. In addition, it was concluded that the local government is depending on the co-finance of the European Union and developments may not be executed due the lack of financial resources. (answer to sub-question 3)

Sub-conclusion 4 - awareness and decision-making
Important sub-conclusion is: the awareness of ecosystem services is an important key to the implementation of ecosystem services in decision-making. The research shows that awareness contributes to the value people attach to ecosystem services. It is also expected that more awareness results in more developments focused on ecosystem services. In conclusion, the following entry points (in headlines) are important for decision-making:

- creating the developments in accordance with the Landscape Management plan;
- provide accountability of the financial feasibility of the developments;
- ensure of all permits and exemptions for the developments;
- establishment of an approach to minimize the risks;
• exploit the opportunities offered: developments linking with ecosystem services before they are approved by the major of Toruń (city council); and the use of the qualities and benefits of ecosystem services for the substantiation and accountability of the developments.

In conclusion, the local government of Toruń can increase the awareness by informing the public sector about the importance of ecosystem services and the added value of it. Here, the government should respond to important entities, NGO’s and other organizations, which influences entrepreneurship (see model 3 in appendix 8). In addition, as a second conclusion for raising awareness, the government can respond to private developments with governmental support, as explained in subparagraph 2.5.2 of the analysis report in appendix 5.

Sub-conclusion 5 - unconscious contribution of ecosystem services and spatial quality
Important conclusion is that it must be clear that the planned developments already contribute to the spatial quality and the use of ecosystem services (even if they are not based on ecosystem services). This also highlights sub-conclusion 4; awareness is very important. As a conclusion, it can be said that the contribution of ecosystem services takes place integrally. This means that the use of a particular service of ecosystems indirectly and unwittingly may contribute to other services. This is the same for spatial quality. The indicators are related to each other and influence each other. This conclusion is also important for the local government of Toruń for the purpose of raising awareness of ecosystem services and their impact on developments.

7.2 Conclusion of the central question

The central question can be answered using the collected data. The central question is as follows:

How can the local government of Toruń increase the spatial quality of the Vistula River in Toruń by making use of ecosystem services?

The goal behind answering the central question is to chart out how the local government can increase the spatial quality of the Vistula River by making use of ecosystem services. The local government of Toruń can make use of ecosystem services in order to increase the spatial quality by linking planned developments to ecosystem services (normative scenario I) and to execute new (potential) developments (normative scenario II). The building bricks of paragraph 7.1 play an important role. In carrying out a scenario, the awareness and the implementation of ecosystem services in decision-making play an important role. As a conclusion may also be emphasized that the current planned developments already (indirectly and unconsciously) contribute to the use of ecosystem services and increasing the spatial quality.

The possibilities for the local government of Toruń to make use of ecosystem services in order to increase the spatial quality (answer to the central question of the research) are presented in the scenarios (normative scenario I and normative scenario II) in respectively appendix 7 and appendix 8. The results are consistent with the theoretical framework. The theoretical framework indicates that awareness is an important element for the implementation of ecosystem services in decision-making. In addition, the concepts and methods of the theoretical framework are used in the elaboration of the research.
7.3 Discussion

The discussion of the research focuses on the interpretation of the results (expectations and findings) and the limitations of the research (caveats and limitations).

Interpretation of the results

The research results show that ecosystem services are of great importance to society. This is confirmed by ESA, an American research institution, which indicates that ecosystem services are communities of living things and the environment features that support them. They claim that ecosystems are essential for human life, providing us with innumerable and invaluable services. (Ecological Society of America, 2012) This study provides a picture of how the local government of Toruń can make use of these ecosystem services. The research results emerged that ecosystem services are not explicitly included in policy and decision-making. In addition, the literature shows (in a general way) this lack of implementation. The results provide possibilities to ensure the implementation of ecosystem services. The methods used for the implementation are logic and applicable. First, literature study showed that ecosystem services and their implementation in policy and decision-making is lacking. In conversations with the local government of Toruń became clear that they do not explicitly include ecosystem services in policy and decision-making. Through the IES-method (a method to implement ecosystem services in decision-making explicitly), a way has been found to utilize ecosystem services in Toruń’s policy and decision-making.

The expected outcome of the research was that the local government has several ways to make use of ecosystem services. Although the theoretical framework indicates that there is a lack of policy implementation, it was not expected that this would be such an important element in future developments based on ecosystem services. Expected was that there are many possibilities to use ecosystem services in order to increase the spatial quality. The three scenarios offer opportunities for increasing the spatial quality in different ways. It must be clear that this is not the only way to increase the spatial quality and to make use of ecosystem services. The possibilities, and their arguments, in this research are the most desired ones (for the local government of Toruń) and the most appropriate in the current situation (policy, decision-making, SWOT). Own opinion about the research is that awareness of ecosystem services can be seen as the key to make use of it and to the value, people attach to it.

Limitations of the research

This research contributes significantly to possible changes in future policy and developments of the local government of Toruń and thereby offers them opportunities to make use of ecosystem services in order to increase the spatial quality. Certain limitations serve as a declaration of the research results. The research is focused (and based on) the local government of Toruń. That means that the results are seen from the perspective of the government. In the research is attempted to engage NGO’s and other organizations in the research. However, because they could not speak English, or simply referred to the government, their contribution was little. Via a model (for public participation) of the government, they could be engaged in future possibilities, but remain out of the explicate data collection. In addition, this research does not address the financial feasibility of future developments. This is the declaration for the extensive and perhaps optimistic developments. In this stage of research, it is too early to indicate the financial feasibility (developments not detailed yet). In further elaboration of the developments (step 6 of the IES-approach) the financial feasibility should be ensured. The financial feasibility is not included in this research, but the planned developments are elaborated in such a way that they can apply for co-finance at the European Union. Nowadays, the local government of Toruń is trying to obtain co-finance from the European Union for the period 2014-2020. Limitation is that it will be uncertain in which way the planned developments will obtain co-finance of the European Union.
8. RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

8.1 Recommendations

Regarding the research results and conclusions, the following can be recommended:

As the scenarios indicate and as the conclusions suggest, it is recommended to perform normative scenario II. This scenario contributes most to increasing the spatial quality through the use of ecosystem services. It is recommended to bring as many developments in progress and to align them to each other. It is important that the steps of the IES-approach will remain the main guideline in making use of ecosystem services. It is recommended that these steps (such as the scenarios indicate) will be utilized explicitly and adequately. It can be recommended that the elaboration of the normative scenario should take place in a joint venture with stakeholders in the area in order to implement more interests in developments and to make sure no obstacles will occur. When this is financially or legally not possible, it can be considered to implement the most important elements, which contribute to the spatial quality.

Spatial quality in the Netherlands is considered the core concept in spatial planning as well as the main objective in spatial policy. The assumption is that the spatial quality is a normative concept with different interpretations by different disciplines, which changes over time. (Assink & Groenendijk, 2009) Recommended is to base the policy of the local government of Toruń on this concept in order to let the quality of the space function as starting point in policy. In addition, this also facilitates the implementation of ecosystem services, since the same indicators determine them.

A key recommendation is that the local government, in the use of ecosystem services, primarily should focus on raising awareness of the use of ecosystem services. Awareness plays an important role in the use of it and the value that people attach to ecosystem services. Starting with raising awareness should take place quickly in order to realize effects on short term. It is also recommended to evaluate the execution of the developments whether the expected results actually appear. Evaluation of the implementation also provides an opportunity to respond to unexpected problems (to anticipate to changes, adopt a proactive attitude).

In addition to the recommendations mentioned above, related to this research, the following additional recommendations are given:

- focus policy reports more on the indicators (economy, social, ecology, and culture) in order to rely policy on the concepts of spatial quality and ecosystem services;
- make use of ecosystem services as spatial substantiation of developments;
- promote developments (which are based on ecosystem services) among the citizens of Toruń in order to make the attitude of the local government clear;
- make use of new opportunities and possibilities that arise in the future.

8.2 Suggestions for further research

For further research, the following suggestions can be given. The suggestions are related to the research results and the (future) use of it:

- research into the financial possibilities (feasibility) of developments;
- research into ways to make use of ecosystem services in other parts of the city of Toruń;
- research on how the local government of Toruń can base its policy on the concepts of ‘spatial quality’.
BIBLIOGRAPHY

The list below provides the consulted literature (according to the APA-guidelines)


ATTACHMENTS

Appendix 1: Maps of the Vistula River
Appendix 2: IES-approach (steps)
Appendix 3: Analysis report
Appendix 4: Map directory
Appendix 5: Bundle of interviews and excursions
Appendix 6: Extrapolative scenario
Appendix 7: Normative scenario I
Appendix 8: Normative scenario II