Effective use of design research for national spatial planning policy

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Effective use of *design research* for *national spatial planning policy*

By

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PREFACE

This report presents my thesis as the final part of the MSc. Construction Management & Engineering at Delft University of Technology.

In my point of view, a master thesis can be described as the icing on the cake after years of studying, in which all experiences are bundled and brought to the highest attainable level. With this in mind, I started to compile my thesis research. Here, I tried to find the interface between my bachelor Architecture, my master Construction, Management and Engineering, and my experiences as a strategy consultant. Combining the building environment, engineering, and strategy resulted in a conversation with Marcel Hertogh, as an expert in this field.
I had the desire to dive into the implementation phase, without losing the discipline of abstract strategy. Because the various disciplines require a broad perspective, Marcel Hertogh suggested the National government, and specifically the National Strategy of the Environment and Spatial Planning (NOVI). This program is practically oriented, yet strategic, substantive, yet widely supported. And there Emiel Reiding appeared, as an expert in this field.
Looking for a specific topic, from collaboration between disciplines to design research, the conversation with Marcel Hertogh led to DIMI. DIMI is a funding agency of Delft University of Technology that is committed to multi- and interdisciplinary research in service or innovative, integrated solutions for social challenges concerning infrastructure and mobility. And there came Nikki Brand, as an expert on all these topics.
Within design research, an experienced designer with other views was missing. As a designer in heart and soul, but with a philosophical approach, Maurice Harteveld joined as the last member of my graduation committee.
I would like to thank you all for the guidance during the past months. The positive approach, the many 'feathers', but also the critical feedback and the continuous trigger to achieve the highest attainable. Marcel, I want to thank you for your constantly curious attitude and support, which motivated me to continue with processing more and more new information. Nikki, I want to thank you for your enormous goodwill and enthusiasm, despite your busy schedule. I was amazed by your way of analyzing, your writing-skills, and your pragmatic attitude. Emiel, I want to thank you for all the new insights you have given me, with the focus on the art of wicked problems. By this, I mean the totally different view of the world than the mainstream *Delftenaar*: the non-black-and-white thinking, creating nuance, and mapping the reality. You showed me the gap between science and practice, but also the synergy between both. And also, to dare to write an opinion that increases the significance of research many times.
Maurice, I also want to thank you for your broad approach. Sometimes I lost you in your inspiring philosophical views about the meaning for the greater, but after considering these views certainly took this research one step further.

Last but not least, I want to thank everyone who has given me joy in the past couple of years. I definitely not got this MSc. by myself. The *Kroeses* worked through generations from farmers, to village baker, from IT-worker to engineer, which alone shows a timeline of how special this milestone is. Family and friends, especially dad, mom, Huub, Anke and Jasper, thank you!

EXECUTIVE SUMMARY

The challenges of the national spatial planning system in the Netherlands are changing. To start with an example: a decision has to be made about the use of the green area named 'het Groene Hart'. On the one hand, preserving and maintaining the nature in this area, and on the other hand, to use the space of this area for housing and the energy transition. A single choice, or not? To what extent is a green residential area with sunroofs a solution? This solution is called an integral solution for an integral challenge. These kinds of integral challenges are much more complex than single sectoral challenges. Thereby, the Netherlands is increasingly confronted with a lack of space in our small and fully planned country. At the same time, it is increasingly confronted with challenges such as climate change and a circular economy, which in itself already reaching through functions, scales and interests. Due to these two developments, the Netherlands is increasingly confronted with complex integrated spatial challenges, as shown in figure 1.

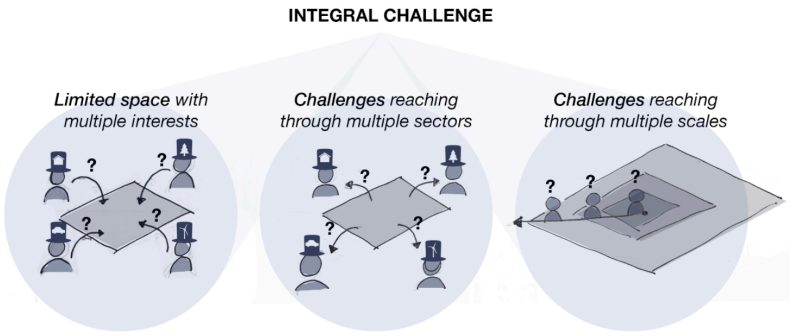

Figure 1: Integral challenge: three perspectives (own image).

These challenges call for more collaboration between different governments, departments, and society. This has consequences for the Dutch spatial planning system: the sectoral, top-down and systematic approach in which every square meter is planned, does not suit the complexity of these challenges anymore. To tackle these challenges more effectively, a change is requested towards a holistic, adaptive approach using a strong collaboration. In the Netherlands, this is also known as multi-level governance. Here, the role of the national government will change from a leading role to a coordinating role.

The demand for this new approach is currently addressed by the transition to a new spatial planning system, through the new Environmental and Planning Act. This Act consists of multiple instruments, including the development of a national spatial long-term strategy: the NOVI. The NOVI is also dealing with integral challenges. Hence, one of the current key challenges within the Dutch national spatial planning system is dealing with integral challenges.

For solving these integral challenges within policy-making, a designerly way of thinking is needed. The application of the designerly way of thinking with a research-purpose, it called design research. Theoretically, approaches within design research can be divided into a spectrum ranging from the engineering approach to the spatial design approach, each with their own characteristics. Furthermore, the outcomes of design research within policy-making are different as well. For example, a design research within the regional agendas, led by Urhahn, is focusing on clarifying the tasks of the NOVI within their region, by using frameworks. Or Panorama Nederland, a design research by the College van Rijksadviseurs, which was looking for inspiration for the spatial design of the Netherlands in the future, by using appealing images.
Design research has been used for decades within the Dutch national spatial planning system. Nevertheless, due to the variety of design research, there are different expectations from users and initiators with regard to the meaning of design research. This can result in conflicting expectations while applying a design research. Because of this possible mis-match, plus the urgency of using design research for tackling integral challenges, design research needs to be used more effectively within national spatial planning policy-making. Thus, the main question of this study is:

"*How can design research be used more effectively for national spatial planning policy?*"

Despite significant differences between design processes and outcomes, scientific literature mentions generic advantages of design research for policy-making. The positive contribution of design research for spatial planning policy can be summarized as connecting, inspiring, integrating, clarifying, and innovating.

As mentioned, reaching integrality is one of the key challenges for the Dutch spatial planning system, while integration is, at the same time, a fundamental role of design research. Therefore, it can be concluded that the significance of design research for national spatial planning policy lies in facilitating integrality.
However, integrality is often used as a catch-all concept, without a clear definition. In order to test the possible significance of design research for national spatial planning policy within the practice, integrality is operationalized in this study by four different variables: integration concerning time, scale, function, and interests.

Based on the theoretical study, a hypothesis has been formulated. It states that there are two types of design research, in which both follow a different path to an integrated outcome. The first type of research focuses on inspiration by using a single masterplan. The second type of research focuses on clarification by using frameworks. Both types consist of different design process characteristics. To validate this hypothesis, four cases have been studied within the design research "City of the Future." First of all, the design process and the outcomes, including the degree of integrality, are mapped per case. The specifications per element are displayed in figure 2.

PROCESS	
Phasing	Incremental or iterative
Character of approach	Analytical or experimental
Handling complexity	Increasing or reducing
Focus	Problem-oriented or solution-oriented
Form of collaboration	Interdisciplinary or multidisciplinary

OUTCOME	
Typology	Framework or Masterplan
Focus	Clarifying and Inspiring

INTEGRALITY	
Time	--/-/+/++
Scale	--/-/+/++
Interests	--/-/+/++
Function	--/-/+/++

Figure 2: Specifications of the three elements of design research.

After these elements have been mapped, a comparison is made to determine whether the composition of characteristics from the hypothesis corresponds to the composition of characteristics from the case studies. This comparison is shown in figure 3.

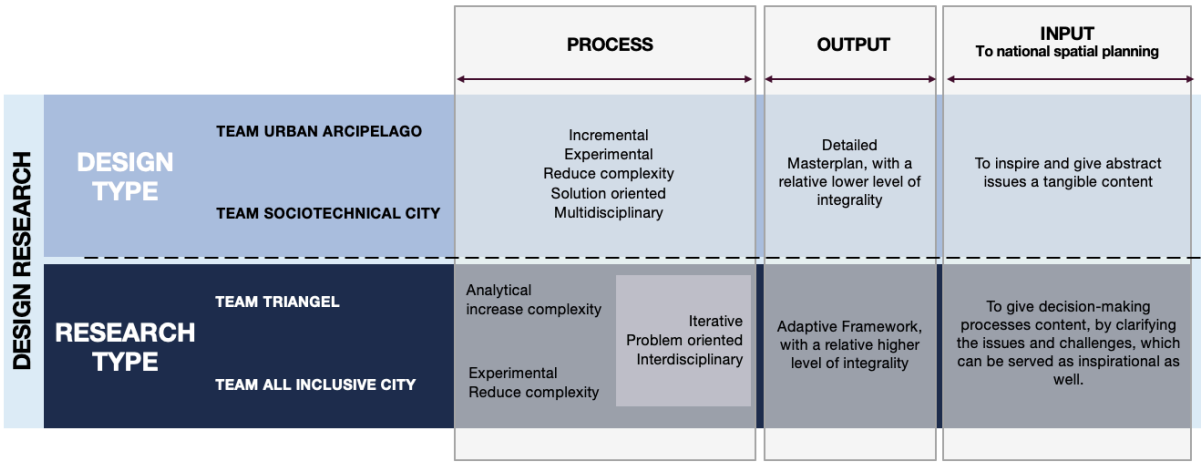

Figure 3: Summary of three analyses of the four case studies.

Figure 3 shows that there are indeed two types of design research.

1. The first type, named the **design-type**, is characterized by an incremental, experimental, solution-oriented process, in which the complexity has been reduced. The collaboration is multidisciplinary in nature and is led by spatial designers. Thereby, the outcomes are characterized as masterplans. Here, the combination between a solution-oriented process and a detailed masterplan are indicators for the focus on an inspiring contribution.
2. The second type, named the **research-type** is characterized by a different process, which is more iterative and problem-oriented in nature. The collaboration is characterized by an interdisciplinary approach, whereby the non-spatial designers also have a sense of responsibility. The outcomes are illustrated as frameworks. These guiding frameworks in combination with a problem-oriented approach indicate the focus on a clarifying main purpose.

One of the observations is the clear relationship between an iterative, problem-focused, and interdisciplinary way of working with achieving a higher level of integrality. These characteristics all suit the *clarifying research-type*.

Apart from the fact that the form of the research-type leads to a higher degree of integrality, it is not possible to draw the conclusion that the research-type is in every case more effective than the design-type for spatial planning policy-making. This depends on the intention of initiating a design research.

Ideally, both forms are applied, with the focus (in terms of time and intensity) on one form or the other, because each form has a different contribution to policy-making. When an assignment is rather concrete, more focus should be on the design-type, whereas a more abstract assignment demands more focus on the research-type. For Dutch spatial planning policy, this could mean the following. Because the NOVI creates frameworks at a high level, the clarifying research-type is initially more effective, to which the inspiring design-type can contribute. Because the Regional Agendas makes context-specific concrete choices, the inspiring design-type is more effective at first, to which the clarifying research-type can contribute. However, it is difficult to initiate the research-type of design research as a policymaker concerning an undefined and abstract task. However, this clarifying research-type suits the intended cyclical and adaptive character of the Dutch spatial planning system and the (new) facilitating role of the government, and advocates for the continuous use of exploratory and clarifying design research.

To conclude, because of the increasing complexity within spatial challenges and the transition towards a more adaptive and collaborative approach, design research will become increasingly important. Design research can be used more effectively within national spatial planning policy-making, if the appropriate form of design research is used that fits to the nature of the request.

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VOCABULARY

ENGLISH	DUTCH	EXPLANATION	SECTION
Multi-layered spatial challenge, or integral or integrated challenge	*Meervoudige ruimtelijke opgave, integrale opgave*	A challenge that reaches through sectors and scales, resulting in multiple challenges in coherence.	2.1.1
Design	*Ontwerp*	Purpose or planning that exists behind an action, fact, or object; give a new meaning to a sign (Harteveld, 2014)	2.3.1
Designerly way of thinking	*Ontwerpende manier van denken*	The manipulation of non-verbal codes in the material culture, using an abductive way of reasoning	2.3.2
Design research	*Ontwerpend onderzoek*	The application of the designerly way of thinking with a research-purpose; an umbrella definition used for design-based research, research-based design, design thinking, research by design, and others.	2.3.2
Complexity	*Complexiteit*	Detail complexity and dynamic complexity: Detail complexity focuses on the many components and high degree of interrelatedness, where dynamic complexity focuses on uncertain decision making and nonlinear development (Hertogh, 2010).	2.3.2
Multidisciplinary	*Multidisciplinariteit*	A multidisciplinary collaboration is a collaboration in which each expert contributes their own discipline-specific part to the project, while an interdisciplinary collaboration goes a step further by having each expert understand the methods of the other disciplines and contribute to a more coherent project.	3.1
Interdisciplinary	*Interdisciplinariteit*		3.1
Divergent process	*Divergerend proces*	The process of generating various and differing ideas (Williams, 2004) and thereby increase complexity by adding more information, knowledge, scenarios and syntheses, with the aim to developing a better understanding of the problem or assignment itself.	2.3.2
Convergent process	*Convergerend proces*	The process to find a single best solution, while reducing complexity, by making decisions on which information, knowledge and scenarios will be used, in order to come to one single coherent solution.	2.3.2
Iterative	*Iteratief*	A cyclical process in which a series of events happens again and again in the different orders; multiple feedback loops with an organic non-pre-prepared process.	3.1
Incremental	*Incrementeel*	A straight-forward process in which all steps are completed once and in chronological order; no feedback loops with a rigid predefined process.	3.1
National spatial planning policy-making	*Het opstellen van Nationaal Ruimtelijk Ordeningsbeleid*	Policy-making within spatial planning at a National level	2.3
NOVI – National Strategy on Spatial Planning and the Environment	*NOVI – De Nationale Omgevingsvisie*	Instrument of the Dutch (new) Environmental and Planning act in order to create a long-term future (spatial) prospect of the Netherlands	2.3
New Environmental and Planning Act	*Nieuwe Omgevingswet*	A new Dutch Act to maintain and achieve a healthy physical environment and high environmental quality.	2.3

1. Introduction

1. INTRODUCTION

The Netherlands has traditionally a strong spatial planning system (Stead & Nadin, 2012) and is internationally considered as a planner's paradise (Faludi & Van der Valk, 2013). Nevertheless, our spatial planning governance system is in transition, in order to make decision making Simpler and Better. This is mainly due to the fact that the Dutch spatial planning system is increasingly dealing with more complex spatial challenges, which requires different a governance model (chapter 2).
This new approach has been translated into the introduction of the New Environmental and Planning Act. This Act aims to maintain and achieve a healthy physical environment and high environmental quality, taking into account a multi-level governance. To do so, the Act consists of six types of instruments. One of these instruments is the mandatory Environmental Strategy for the National government, provinces, and municipalities. An environmental strategy is a coherent strategic plan relating to the physical environment. These are called the NOVI (National government), POVI (province) and GOVI (municipality).

The NOVI, National Strategy on Spatial Planning and the Environment, aims 'to achieve mutual cohesion' (Omgevingswet, 2019). While developing the NOVI, it faces major challenges during its development. Internally, it is already a challenge to make an uncertain future explicit, which is also integral, sustainable-proof, and widely supported. While, at the same time, taking all external trends and developments into account as well, such as the use of multi-level governance and the Europeanization. This complex position requires an all-embracing new approach, one that has never been used under these kinds of complex circumstances.

At the same time, design research is often mentioned as valuable for policy-making (Lee, 2011; Buchanan, 1992; Voorendt, 2017; Nijhuis, 2017; Mintrom and Luetjens, 2016). According to Mintrom and Luetjens (2016), design research can facilitate environmental scans, open-to-learning conversations and sensemaking. Or, according to van der Linden (2018), to imagine possible futures, to get familiar with hidden choices or/and to get a more complete picture of the assignments. Therefore, design research seems to be a perfect fit for current spatial planning policy-making.

1.1 RESEARCH SET UP

1.1.1 PROBLEM STATEMENT

However there has been written a lot about design research, there is still much confusion about the definition and its use. At this moment, the process of design research and how it results in integrated outcomes, has not systematically been studied and is therefore not yet sufficiently understood. In particular, there is no consensus about the process of design research for national spatial planning policy, resulting in different or even conflicting expectations from initiators and designers. Thus, it is not yet known how design research can be used effectively for spatial planning policies, such as the NOVI.

1.1.2 RESEARCH OBJECTIVE

Because of unfamiliarity about the specific significance of design research for spatial planning policies, *this study aims to clarify and specify the effectiveness of design research for national spatial planning policies.* In particular: the study aims to identify the key elements of the process and the outcomes of design research, to contribute more effectively to the current challenges of national spatial planning policy.

1.1.3 RESEARCH QUESTION

Based on the research objective, the main-question has been formulated and is answered at the end of this research:

"How can design research be used more effectively for national spatial planning policy?"

1.1.4 HYPOTHESIS

The current expectation is that design research can be used more effectively by focusing the research more specifically on the initial request, by using two different types of design research. I expect that these two different types of design research have a different design process, resulting in different outcomes, and thereby have a different contribution to national spatial planning policy.
I expect that the first type results in a futuristic masterplan where the narrative, the manageability and reduction of complexity are the main deliverables. The main contribution to national spatial planning policy is to inspire and give abstract issues a tangible content. This process focuses on converging towards one solution. These outcomes stem from a multidisciplinary process.
Furthermore, I expect that the second type results in a pragmatic framework with the focus on understanding and clarifying the issues and challenges as the main deliverables. The main contribution is to give decision-making processes content because the palette of possibilities is revealed. This process focuses on diverging towards the palette of solutions, in which the complexity is still rising. These outcomes stem from an interdisciplinary process.
A masterplan is a detailed plan design that represents a single scenario. A framework, on the other hand, is designed at a higher level: a schematic abstract plan which gives direction and where several scenarios fit in. In both, the complexity of societal challenges is unraveled, and integrality is achieved. Thereby, both directions are named 'design research', where the outcomes are entirely different and even conflicting with each other. This can result in conflicting perspectives, where the expectations of design research are not aligned.

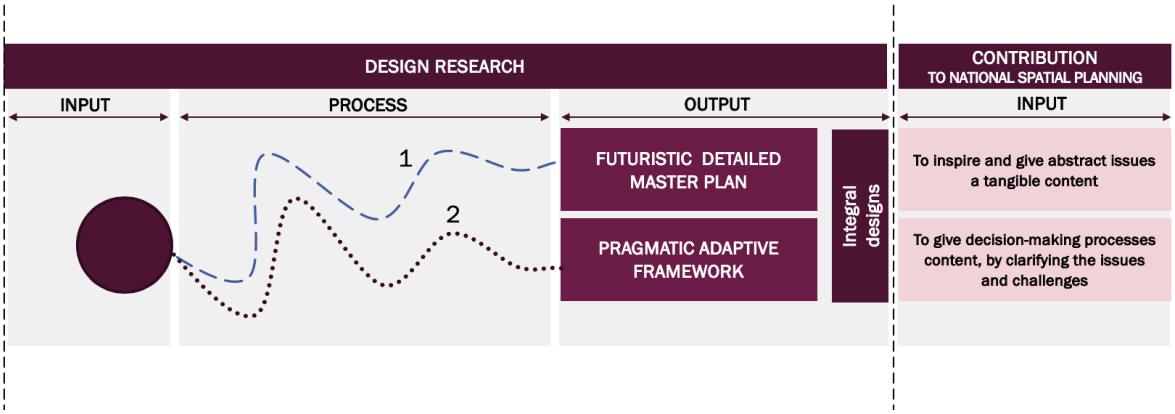


Figure 4: The hypothesis: two journeys of design research (own image).

1.1.5 SUB OBJECTIVES AND SUB QUESTIONS

To identify the possible two types of design research, this research explores the outcomes of these design research as input for Dutch national spatial planning policy and explores the processes of the research itself. According to the hypothesis, different outcomes are achieved through design processes. Because of this, the main question can be divided into three parts: the main challenge of Dutch national Spatial Planning policy, the significance of design research for national Spatial Planning policy, and the distinction between different types of design research in relation to different goals of national spatial planning policy-making.

Sub goal 1: To identify the main challenges and goals of the current national spatial planning policy system.
Sub question 1: What are the main challenges and goals of current national spatial planning policy?
This sub question consists of two parts: identifying the challenges, and identifying the goals of national spatial planning policy. This will first be done by giving an elaboration of new spatial planning challenges. Secondly, the process-based approach for these new spatial planning challenges will be described, by means of history and current practice. Lastly, to substantiate the main challenge, an explicit example will be used within spatial planning: the NOVI.

After having established the current challenges and goals of the Dutch spatial planning system from the perspective of the national government, the relationship with design research can be drawn up, in order to identify the significance of design research for national spatial planning policy.

Sub goal 2: To explore the significance of design research; to find the starting point, to create context, to get the current understanding and to find knowledge gaps. Simultaneously, find the relationship between national spatial planning policy and design research.

Sub question 2: What is the significance of design research for national spatial planning policy?

This sub question consists of two parts: what is design research, and what does design research contribute to national spatial planning policy? This will be done by finding the scientifically-based most appropriate (content-based) approach towards those challenges. Then, the specifications of the possible significance of design research can be mapped by identifying its advantages and disadvantages, with regard to the development of Dutch spatial planning policy.

After having established the significance of design research for national spatial planning policy, it can be determined how design research can be used (more) effectively, from the perspective of the design research. This main question is answered by means of a hypothesis-driven assessment.

Sub goal 3: Validate the hypothesis: to find out if design research consists of two different forms, and if so, what the differences consist of.

Sub question 3: Can a distinction be made between different types of design research with regard to meeting the challenges of national spatial planning policy-making?

According to the hypothesis, different outcomes of two forms of design research can be established through different design-processes. In this part, different elements of the design process will be identified in order to compare different processes. Thereby, the typologies of outcomes of design research will be elaborated on as well.

To summarize, Figure 5 shows the three sub questions that are derived from the main-question.

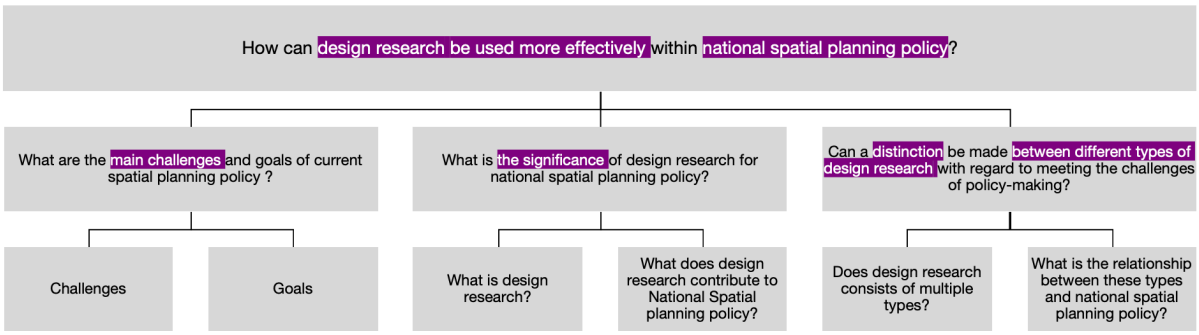


Figure 5: Three sub questions in relation to the main question (own image).

1.1.6 SCOPE

Five points of attention have been identified related to the scope of this study. First of all, this research is focusing on Dutch and national spatial planning policy. Forms of spatial planning systems in other municipalities, provinces, regions, countries or continents will be used for creating context, but are beyond the scope of this study.

Secondly, 'design research' is a concept that is used in many different ways, which is explained within section 2.2.3. It is an overarching concept which consists of research-types like 'design-based research, research by design, design science, design it selves' and uses all different types of designerly thinking: 'design-based learning, learning by design, reflective design-based learning, design thinking,'. Therefore, the sub questions will use the overarching concept of 'design research' (ontwerpend onderzoek), where after a more precise definition will be used in the end of this research.

Thereby, when 'design research' is mentioned in this research, it is always meant in a multidisciplinary group-setting. Multidisciplinary is when a group consisting of people with different backgrounds. Ideally, a multidisciplinary group consists of alpha, beta and gamma backgrounds. In practice, groups that consist of urban designers, architects and landscape designers are also be named multidisciplinary. In this research this will not be considered as multidisciplinary, because from the perspective of national policy these backgrounds are too similar. Thereby, a single person with a multidisciplinary background is not considered as 'multidisciplinary'.

Also, ‘design research’ can contribute to policy-making with or without an official client. Studies can be done, for example, out of curiosity or to contribute to science. However, in this research the scope has been laid on design research as a specific conscious request of a policymaker. Here the policymaker is therefore seen as the client, instead of a partner. This can be in combination with other clients, but with an explicit request in any case. The dilemma between whether or not a request is made explicit, is given in the recommendations.

Lastly, the scope of this research is overarching the disciplines of science, policy, and design. Therefore, this study was created by writing from an umbrella perspective. That is why this report is not attributed specifically to policymakers, or designers, or researchers. However, it does contain elements that can benefit professionals within the design discipline and spatial planning policy-making.

1.1.7 RESEARCH ORGANIZATION

This research was set up in collaboration with DIMI, the Ministry of the Interior and Kingdom Relations, and the research group ‘City of the Future’; Respectively, Marcel Hertogh and Nikki Brand, Emiel Reiding and Maurice Harteveld are members of the graduation committee.

In particular, this master thesis is part of a larger study of the Delft Deltas, Infrastructure and Mobility Initiative (DIMI). DIMI is a funding agency of Delft University of Technology that is committed to multi- and interdisciplinary research in service of innovative, integrated solutions for societal challenges concerning infrastructure and mobility, in particular in relation to flood risk mitigation. Multidisciplinary learning is used to identify these solutions, following the integrated ‘Delft approach’. The DIMI-study identifies strategies for multidisciplinary learning at three spatial scales: structures, districts and corridors, and deltas. Design research is part of the approach at all scales, for which the research process is reconstructed. This master thesis is about the middle scale: districts and corridors.

At the same time, the Ministry of the Interior and Kingdom Relations is currently working on the mentioned major transition: the transition to the new Environmental and Planning Act within the Spatial Planning department. One of the challenges is to combine different regulations into one Act, which is requiring an integrated collaborative approach. One of the instruments to achieve contingency and integrality is the instrument of the National Strategy on Spatial Planning and the Environment (NOVI). This NOVI is currently still in development. During this research, the researcher has done a full-time internship at this department. One of the incentives of the participation of the NOVI to this study, is that they are curious about the possible contribution of design research into the NOVI and the subsequent programs.

Simultaneously to the development of the NOVI, the study ‘City of the Future’ has been going on, in which the Ministry of the Interior and Kingdom Relations, the Delft University of Technology and BNA were the initiators. This study of designing the city of the future consists of ten multidisciplinary teams who are searching for ways in which the urban development can be combined with the energy transition, mobility innovations, a circular economy and other system and network innovations. The teams have been assigned to a location of 1 km2 to integrate their ideas into an existing structure. The set-up of this research was a design research. The study lasted nine months and ended on November 30, 2018.

1.2 RESEARCH STRATEGY

First of all, this study is exploratory in nature. The research moves at the interface of the technical design discipline, the spatial design discipline, and the discipline of policy-making, where characteristics such as unfamiliarity and no consensus have already emerged within the problem definition. Nonetheless, the application of design research within policy-making is far from new; it has been applied in practice for decades. Because of this exploratory character and shifting between practice and theory, a combination between a practice-oriented research approach and a theory-oriented research approach will be used. The sub questions will first be answered through theory-oriented research to set up a framework that can be validated within practice-oriented research.

Because of this twofold of theory-oriented research and practice-oriented research, the research strategy of each part has been set up separately. These strategies are constructed on the basis of the approach of Verschuren & Doorewaard (2010). Here, three key decisions will be taken into account

within the research strategy. The first decision is the choice between an in-depth research or a breadth research. The second decision is about a quantitative or qualitative research approach. The last key decision is about using empirical or unempirical data. These decisions have been made per part, which argumentation is presented in figure 6.

		THEORY-ORIENTED RESEARCH		PRACTICE-ORIENTED RESEARCH	
		CHOICE	ELABORATION	CHOICE	ELABORATION
DECISION 1	In-depth research or breadth research	Breadth research	Put National policy of spatial planning and design-based research collaboration in its context.	In-depth research	Validating different elements of the design process, the deliverables and the outcomes in depth.
DECISION 2	Quantitative or qualitative research approach	Qualitative		Qualitative	
DECISION 3	Empirical or unempirical data	Unempirical data	Gather existing facts and knowledge about National policy of spatial planning and design-based research collaboration in its context, to create context.	Empirical	Stick to reality as much as possible, to observe the elements of the design process and possible deliverables and outcomes in practice.
		+		+	
	RESEARCH STRATEGY	Grounded theory in combination with desk research- approach	Breadth, qualitative and non-empirical research are characteristics of a grounded theory approach.	Case study	In depth, qualitative and empirical research are characteristics of a case study approach. Other characteristics are: a small number of research units, intensive data generation, more depth than breadth, a selective sample and qualitative data and research methods.
	VARIANT	Secondary theoretical comparison, in combination with a literature survey.	A continuous process of comparing data and theoretical concepts.	Comparative case study	The triangulation of methods: combination of individual interviews as group interviews, together with a content analysis of visual and textual materials. Case studies are independently described from each other, where after a cross-analysis can be conducted.

Figure 6: Elaboration of the research strategy; a combination of grounded theory, desk research and the case study approach, with help of Verschuuren & Dooreveld (2010) (own image).

1.3 DATA GATHERING

This section consists of an elaboration on the proposed data gathering strategies. As mentioned in Figure 6, data will be gathered with the help of a grounded theory study in combination with a literature study and a case study.

1.3.1 LITERATURE STUDY

The first part of the literature study consists of a general explorative literature study that is conducted to explore the current knowledge about the related topics. After having established the problem statement and main question, in-depth literature study has been done in the second part of the literature study. This in-depth literature study explores specific topics. During the explorative literature study, a list has been made for the in-depth study, as can be seen in figure 7. During the in-depth literature study-phase, other literature has been added as well.

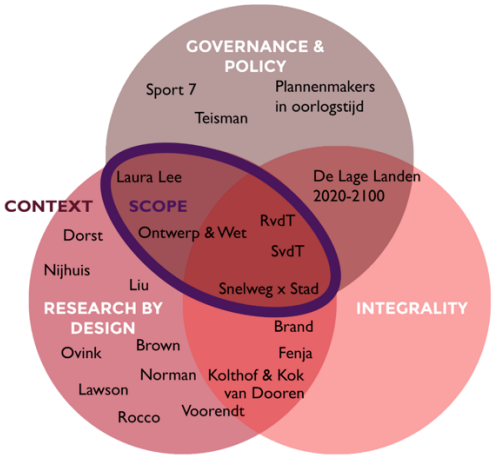


Figure 7: Proposed literature (own image).

1.3.2 CASE STUDY

After having chosen for the case study method, a selection has to be made about which case study, which teams, and which interviewees will be studied.

CASE STUDY SELECTION

As a result of the approach of Verschuren & Doorewaard in figure 6, a case study strategy is the most suitable form to identify how the deliverables and outcomes are achieved in a multidisciplinary design process. The case study strategy has the following seven main characteristics (Verschuren & Doorewaard, 2013) that complement the intended strategy for answering the sub questions. The research consists of a small number of cases, with intensive data gathering to have more in-depth research in order to do this. Thereby, a case study is relevant when you want to cover contextual conditions, where the behavior cannot be manipulated, where the boundaries between phenomenon and context are not clear and the question is a why and how question (Yin, 2006). Case studies have the ability to get an in-depth grasp on a project and obtaining more knowledge by focusing on certain aspects. However, case study research also has limitations. The validity or generalization of the results could be reduced because of the small number of cases studied. This makes the ability to apply results to a broader context difficult (Verschuren & Doorewaard, 2013).

CASE SELECTION

A decision has to be made about which case will be studied. The aim of the case study is to test the frameworks established by theory-oriented research in order to test the hypothesis. For this purpose, a case had to be selected in which a design research was conducted with the intention to contribute to policy-making of national spatial planning. Also, the case had to be conducted within certain boundaries with regard to time and location: most ideally, a case that was starting and ending during this thesis process, and which fit within the physical limitations of the researcher; within western Europe.

One of the cases which met the requirements mentioned above is the research of ‘City of the Future’. This design research aimed to contribute to the NOVI and was thereby fitting the main requirements. Unfortunately, it is already started on January 10th, 2018, which made it impossible to observe the design-processes directly. Though, the ‘City of the Future’ has additional added values. For example, multiple teams conducted one assignment (city), which makes the cases comparable with each other. Also, the initiators were BNA Research, Delft University of Technology, the Ministry of Infrastructure and Water Management (DGs Mobility and Rijkswaterstaat), Vereniging Deltametropool and Atelier X of the Ministry of the Interior and Kingdom Relations, which were all approachable due to connections with Delft University of Technology and the NOVI.

The study ‘City of the Future’ explores new ways of city making by using five test locations of 1 x 1 km in the cities of Amsterdam, Rotterdam, The Hague, Utrecht and Eindhoven. The question is about how we can interrelate urban development to upcoming challenges like shifts in transport, energy transition, circular economy and other system and network innovations, in times of the next generation of densification (Harteveld, 2018). According to Harteveld, the study is successful when scenarios and images of the future city have been developed, together with roadmaps to show how to get there. The study is set up as a ‘design research’, where a thoughtful and multidisciplinary team composition was a requirement. Also, the study consisted of ten teams divided over the five cities.

SUB-CASE SELECTION

Due to the limitations of this research, a selection had to be made between these ten sub-studies of ‘City of the Future’. Because the hypothesis suggests two fundamentally different outcomes and design processes, two cases were selected based on large differences at first sight. There was one team that consisted of 30 people, of which a large part was a non-spatial designer. This is in contrast to another team, which was led by a renowned international architectural firm, consisting of many spatial designers. The teams that also examined their cities, were used as control-group. Therefore, the cities of Eindhoven and the Hague were selected with their corresponding teams, as case studies. After having selected the these cases, the last selection has to be made about the interviewees. This decision will be made using the information from the theory-oriented research. Therefore, an elaboration of this selection can be found in section 3.1.

2. Theory study

2. THEORY STUDY

In general, the goal of this literature study is to have a better understanding of the research topic by getting the context, to reveal knowledge gaps and to locate this research within the context of existing literature. Thereby, the goal is to understand (the context of) topics like an integral challenge, the National Strategy of the Environment and Spatial Planning (from now on NOVI), the New Environmental Act and corresponding developments, wicked problems and design research.

More specifically, this literature study aims to identify the main challenges and goals of the current national spatial planning system, and to find the significance of design research to national spatial planning policy. Therefore, the following two sub questions will be answered: 'What are the main challenges and goals of the current national spatial planning policy system?' and 'What is the significance of design research for national spatial planning policy?

The structure of this literature study is as follows (figure 8). First of all, an elaboration of new spatial planning challenges will be given. Secondly, the governance approach for these challenges will be described. Third, to substantiate the main challenge, an explicit example will be used within spatial planning, namely the NOVI. Lastly, the term integrality will be explained. Finally, the key challenge of national spatial planning policy can be given.

Figure 8: Content and reading guide literature study (own image).

2.1 INTEGRATION AS MAIN CHALLENGE OF SPATIAL PLANNING

2.1.1 MULTI-LAYERED SPATIAL CHALLENGE

The Dutch Spatial Planning system has to do with a change in their spatial challenges. There are two reasons for these 'different' spatial challenges: increased pressure on current and limited space, and that new developments have changed in their nature (Ministry of Infrastructure and the Environment, 2017), such as technological innovations or climate adaptation. Both causes lead to multiple issues within a single spatial challenge: a multi-layered spatial challenge. These two causes are described in the following section, based on examples identified by interviews. Eventually, an explanation is given about the term multi-layered spatial challenge, and later referred to as integral challenge.

INCREASING PRESURE ON SPACE

According to forecasts from the Central Bureau of Statistics (CBS, 2019), the Dutch population continues to grow until 2030. This results in well-known news articles such as 'Miljoen woningen erbij in ruim tien jaar' (Volkskrant, 2018) and 'Files worden komende jaren fors langer' (ANWB, 2018). Given a constant surface area of the Netherlands, the space per inhabitant will, therefore, be reduced. In many parts of the country, this results in pressure on space and, therefore, pressure on the Dutch living environment. At the same time, it creates the urgency to share space; to make the space multifunctional.
Challenges within 'het Groene Hart', the Eemshaven, or highly urban areas are examples of *multi-layered spatial challenges*, and be seen as a problematic (Groene Hart, highly urban areas), or as opportunity (Eemshaven).

- *GROENE HART:* A decision has to be made about the use of 'het Groene Hart'. On the one hand, preserving and maintaining the open landscape in combination with necessary agricultural functions. On the other hand, to use the space for housing, the energy transition and climate adaptation (for example, regulation of the groundwater level). The solution of preserving open landscape results in the densification of existing cities, which results in turn for new problems, such as mobility problems or air quality problems. The decision to choose for wind farms can result in landscape pollution and, therefore, lower quality of the landscape, but also in new problems such as noise pollution among farmers. Thus, a clear answer is missing for this complex problem, due to multiple interests within the same area.
- *EEMSHAVEN:* A similar example is the Eemshaven. This spacious and green landscape consists of agriculture and has recreational purposes. At the same time, this area is also promising for generating wind energy due to its location and space. A solution has been found due to the opportunistic character of this multi-layered spatial challenge, as shown in figure 9.

Figure 9: Multi-layered challenge as synergy within the same area (BNSP, 2018).

- *DENSE URBAN AREAS:* There is also an urgency to approach areas in a multi-layered manner. This is reflected, for example, within highly urban areas. Due to the high demand for housing, inner-city densification is inevitable. At the same time, we want to live in healthy, livable and accessible cities, which means that the very limited space within cities must be filled with more greenery, more water, more accessibility and more facilities such as shopping centers and sports facilities, besides housing. There is simply not enough inner-city space to guarantee these wishes independently of each other, resulting in a necessary functional mix.

All these three examples describe the multi-layered nature of spatial challenges, due to the increasing pressure on current space.

MULTI-LAYERED TRENDS AND DEVELOPMENTS

In addition to the above-mentioned challenges from the perspective of the use of single space, there are also new developments that by definition already consists of several "layers". A difference can be made by challenges that extend through scales, and challenges that extend through sectors.
However, these *natures* are often overlapping each other. Two examples will describe the multiplicity: the transition to a circular economy and the hyperloop.

- *A CIRCULAR ECONOMY:* The transition to a circular economy not only affects our economy, but also sectors like mobility and real estate. A major challenge within the circular economy is to match supply and demand. If that is not the case, this will result in (a lot of) storage and (a lot of) logistics. Both consequences result in a spatial claim, both within the mobility sector and within the built environment sector. Because the transition to a circular economy only takes place when the challenges within multiple sectors (mobility, built environment) are addressed, the transition to a circular economy is seen as a complex multi-layered spatial challenge.
- *HYPERLOOP:* Another example is the Hyperloop. The implementation of the Hyperloop connects (figuratively and literally) the international, national, regional and local scale. Collaboration between Europe, the national government, the provinces and the municipalities is therefore necessary. This collaboration could involve merging different budgets in this single overarching mobility solution. The alternative in which each scale invests in its own form of mobility is often more expensive, which means that the collaboration can also mean significant cost savings.

Next to the multiplicity of such challenges, a characteristic of these types of challenges is that many stakeholders are involved, and these challenges have to do with a lot of regulations. All of these properties lead to the conclusion that multiple spatial assignments are complex in nature.

To summarize, the Spatial Planning system has to deal (increasingly) with a different kind of challenge: a multi-layered spatial challenge. This is due to the fact that a single limited space has to deal with multiple issues due to the increasing pressure on space, or that new challenges extend through multiple sectors and scales (figure 10). These complex multi-layered challenges are also referred to as "integral challenges".

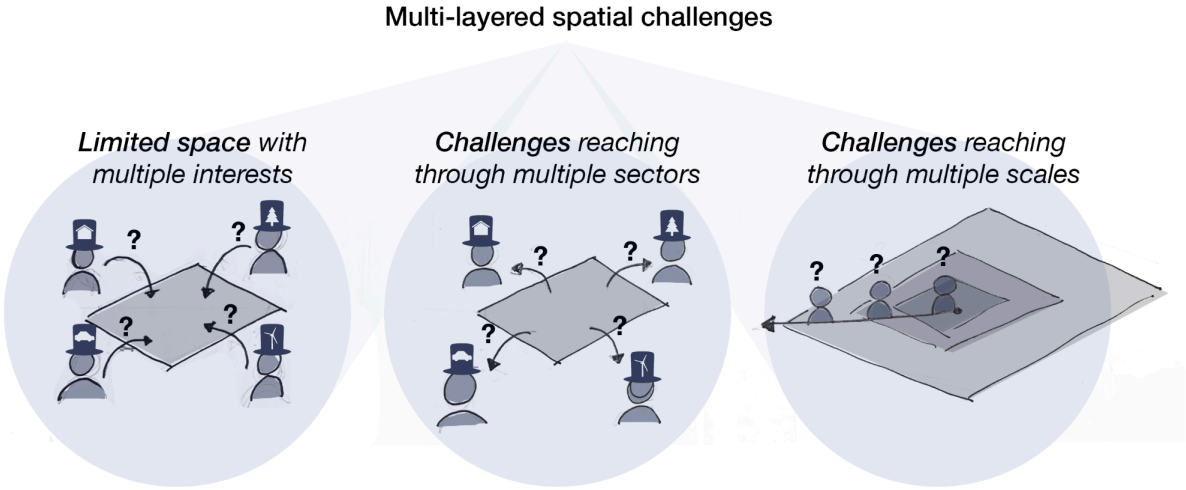


Figure 10: Multi-layered spatial challenges: three perspectives (own image).

2.1.2 CHANGING ROLE OF THE NATIONAL GOVERNMENT

These new spatial challenges are often difficult to solve within the current boundaries of single administrative layers. As mentioned above, these new spatial challenges are reaching through levels that are interacting with each other as well. Therefore, interventions within one level are affecting the others (Teisman, 2017).

The Dutch governance system is classified per level: municipalities, provinces, and the national government, in which different ministries deal with different sectors. That is why governments experience these integrated challenges only on one scale level and in one perspective (Teisman, 2017). However, the solution that is rational on one scale level and from that perspective, is not on a different scale level and from a different perspective. Sectoral solutions and regulations from the departments do not do justice to the complexity of the challenges as they occur between departments and at other scales (Fleurke et al., 1997; Boogers et al., 2008: 13). Overarching governing bodies on these levels are hardly present. These boundaries result in the fact that the nature of the current governance system makes it difficult for the Netherlands to deal with integrated challenges.

This results in the search for a different governance approach. Not just within Spatial Planning, but government-wide, there is a decade-old desire to achieve better cohesion between different layers. A more effective approach to integrated challenges often requires a multi-rational approach, where collaboration is necessary. This "integrated collaboration" is viewed by Teisman (2017) as a multi-level governance system. In this research, this is interpreted through three movements of collaboration: vertical collaboration, horizontal collaboration, and diagonal collaboration. All to be able to act more effectively to integral challenges.

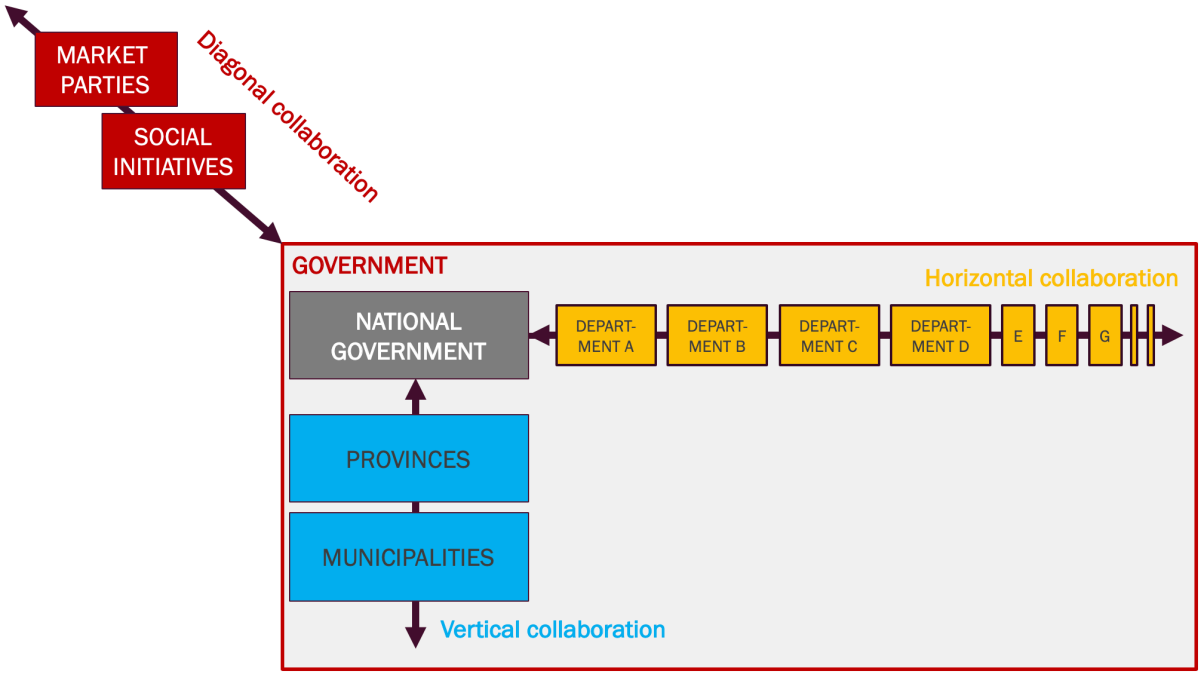


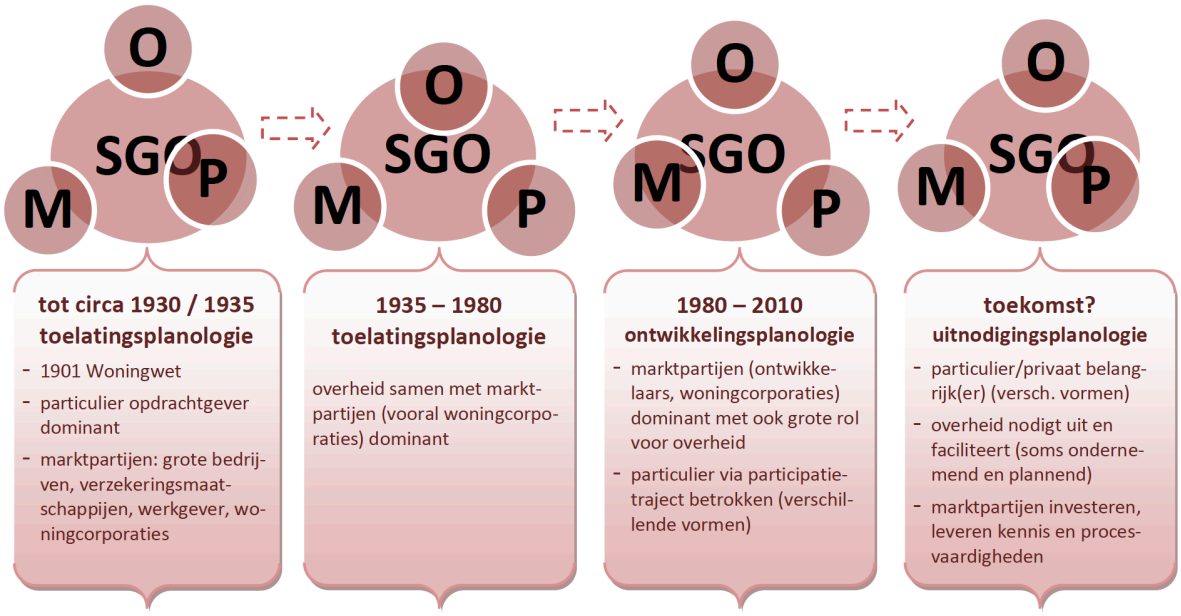
Figure 11: Horizontal collaboration, diagonal collaboration and vertical collaboration (own image).

VERTICAL COLLABORATION

An example of the search for better integration between scale levels is the fluctuating centralization and decentralization trend. During the reconstruction after the Second World War, the demand for a centrally regulated Netherlands was high. Large-scale decisions had to be made quickly, where the national government was regarded as the driving force. This centralized governance system also resulted in a strong hierarchy of regulations, which could only be followed by local authorities. However, since the reconstruction, there has been an emerging opposite and therefore decentralizing movement. One of the causes is, as mentioned earlier, that sectoral solutions and regulations from the departments do not do justice to the complexity of the challenges as they arise intersectoral and at other levels of scale. Local authorities can better come to more effective integrated solutions, because they can act more effectively. This because they can respond better to changed circumstances and make use of "customization." Decentralization is, therefore, a means with the aim of achieving integrated solutions to social problems (Fleurke et al., 1997; Boogers et al., 2008: 13).
An example of this trend is the conclusion of the policy 'Vierde Nota'; from striving for regional equality (distribution policy) to the principle of 'regions in their own strength.' Also, the national government has a tradition of having a dominant role within national spatial planning policy: a typical top-down structure, or a linear process.
At the same time, in contrast to the advantages of decentralization, there is a need for a leading and coordinating party to continue to steer on several themes. Thus, the demand for a nationally driven governance system remains. So, a balance between the top-down and bottom-up principle must be found, where the solutions are clearly not in the extremes, but in an intermediate form of cooperation, or a more cyclical process.

DIAGONAL COLLABORATION

This shift of the role of the national government does not only takes place within vertical collaboration, but also between the government, market parties and social initiatives themselves. Within the spatial planning system, the perspective shifts from admission planning, to developmental planning to invitational planning (Groot Jebbink, 2012), where the role of the government between market parties and social initiatives is sought (figure 12). With the rise of integrated challenges that also go beyond these three perspectives, collaboration between the three parties must be increased as well. Also, within this kind of collaboration, the government has to step back from a linear top-down approach to a more cyclical an collaborative approach.



Figuur 2.2 Historisch perspectief stedelijke gebiedsontwikkeling (O = overheid, M = marktpartijen, P= privaat / particulier (maatschappelijk initiatief), SGO = stedelijke gebiedsontwikkeling) (mede gebaseerd op Dekker e.a., 2010; Post, 2011; Wicherson, 2011; Trip, 2011)

Figure 12: Historical perspective of diagonal collaboration within spatial planning (Groot Jebbink, 2012).

HORIZONTAL COLLABORATION

Horizontal collaboration is about the collaboration between sectors. Within the Dutch governance system, this means integration across different departments. In order to be able to tackle integrated challenges together with all ministries, it is necessary to work beyond the known boundaries of ministries. However, in practice this turns out to be difficult, mainly because people are used to drawing up interests from their own department. However, a transition has been started to start thinking from one government. This transition is driven by the new Environmental and Planning Act, which aims to speed up and improve the decision-making process within spatial planning. This is done, for example, by approaching challenges in coherence by increasing the stakeholders' scope.

Besides the example of horizontal collaboration within the new Environmental and Planning Act, this act is all about integration. Scale and time levels are also connected by, for example, allowing the NOVI to flow into 'Regional Agendas,' or to offer more space for market and social parties by only setting frameworks that are flexible for context-specific decisions. Hence, from a linear top-down approach, in which the national government has a dominant role, towards a cyclical collaborative approach. In this approach, the national government has the role to coordinate, giving other governments or parties space to develop their own interests. Therefore, this new Environmental and Planning Act is seen as a means to collaborate through layers, in a multi-level governance manner, in order to deal more effectively with integrated challenges.
To summarize, integrated challenges require integration between different layers of governments; a multi-level governance. Horizontal, vertical, and diagonal "layers" will be combined and approached in a holistic way, which is currently done within Spatial Planning by the New Environment Act.

2.1.3 THE NEW ENVIRONMENTAL AND PLANNING ACT, NOVI AND REGIONAL AGENDAS

Officially, this new Environmental and Planning Act aims to maintain and achieve a healthy physical environment and high environmental quality. This transition focuses on simplification and improvement through a stronger cohesion in legislation, by for example reducing the current legislation of 26 laws and 120 AmvBs to 1 law and only 4 Amvb's (Platform31, 2018; Ministry of Infrastructure and the Environment, 2013).
To do so, the Act consists of six types of instruments. One of these instruments which reaches through horizontal, vertical, diagonal layers and different time-scales, is the mandatory Environmental Strategy for the National government, provinces and municipalities. An environmental strategy is a coherent

strategic plan with regard to the physical environment. These are called the NOVI (of the national government), POVI (of the province) and GOVI (of the municipality). To describe the major challenges of integration in the Dutch national spatial planning system in a concrete and explicit way, this section will elaborate on the NOVI and its challenges.

NATIONAL STRATEGY ON SPATIAL PLANNING AND THE ENVIRONMENT (NOVI)

As mentioned, one of the plan instruments of the new Environmental and Planning Act is the National Strategy on Spatial Planning and the Environment (NOVI). The NOVI is not a written physical 'bible', but an adaptive website (figure 13). To explain the NOVI, first the reason behind the NOVI (WHY) will be elaborated on. Then, the content of the NOVI (WHAT) will be described, and lastly, the implementation (HOW) of the NOVI will be discussed as well.

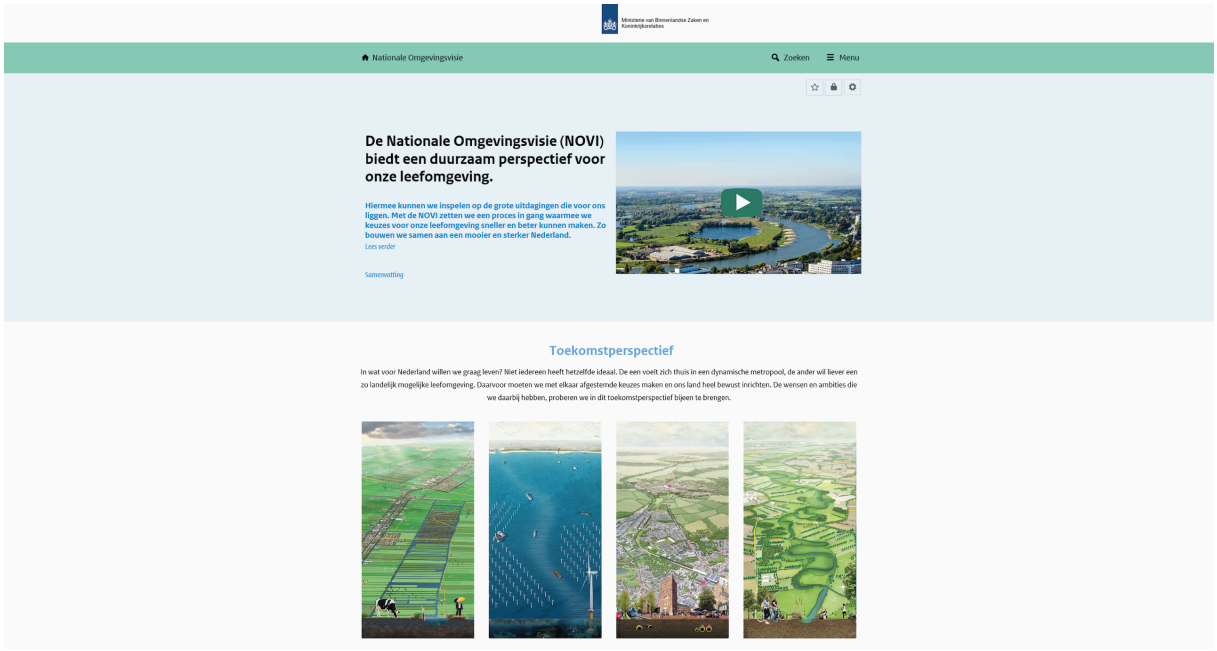


Figure 13: Homepage of the draft version of the NOVI (NOVI, 2019).

WHY THE NOVI?

At the moment, there are plenty of major trends in the Netherlands. To name a few: the population may grow to 20 million in the next 10 years, the transition to a sustainable and circular economy is happening and the Netherlands is facing the effects of climate change and therefore has to protect itself. These developments do not only have to be seen as problematic, but also as promising and opportunistic. This is exactly the reason for the NOVI: to set up an overarching strategy and approach in which choices can be made faster and better about our living environment. In other words, with this planning instrument, the national government provides a long-term vision for the future of the living environment in the Netherlands to set the course to meet future challenges and strives to maintain the quality of the living environment and to strengthen it as much as possible (NOVI, 2018).
At the same time, the vertical collaboration must also be taken into account. The NOVI has the role to inspire and to provide a framework for effective decision-making for other authorities on different scale levels. Also, issues of the NOVI are often about the lack of space and the consideration of different (even conflicting) interests, which results in the inability to solve individual and sectoral problems. Therefore, one of the central themes within the NOVI is integrality. One of the mottos of the NOVI is: "to offer more space in cohesion".

The official aim of the NOVI
'..with the focus on a sustainable development, the habitability of our land and the protection and improvement of the living environment, the aim is to achieve mutual cohesion: (a) to achieve and maintain a safe and healthy physical environment and good environmental quality and (b) efficient management, with the use and development of the physical living environment for the fulfillment of social needs'. (Omgevingswet, 2019)

WHAT DOES THE NOVI CONSISTS OF?

The strategy of the future is a future prospect to strive for, and is not a blueprint. It sets frameworks where choices can be made, and which can be adapted to new developments over the years. Thereby, that future prospect is not the same for everyone. According to the NOVI: "*One feels at home in a dynamic metropolis, the other prefers a living environment that is as rural as possible*." Hence, the strategy focuses on the challenges and prospects in coherence, and has been translated into four main challenges, which are called priorities:

1. Space for climate adaptation and the energy transition,
2. Sustainable economic growth potential,
3. Strong and healthy cities and regions,
4. Future-proof development of the rural area.

On these priorities, in combination with national interests, policy decisions have been made by means of three assessment principles (Dutch: *inrichtingsprincipes*):

1. Prefer combination of functions instead of single functions,
2. Focus on the characteristics and identity of a region,
3. Prevent to shift problems.

Examples of results of policy choices are; moving the majority of new sustainable energy sources to the sea, preference for large-scale clustering of sustainable energy production, developing cities integrally (contrary to the previous 4th Note), and densifying the city instead of building outside the city, to meet the housing demand. A summary of this content can be found in figure 14.

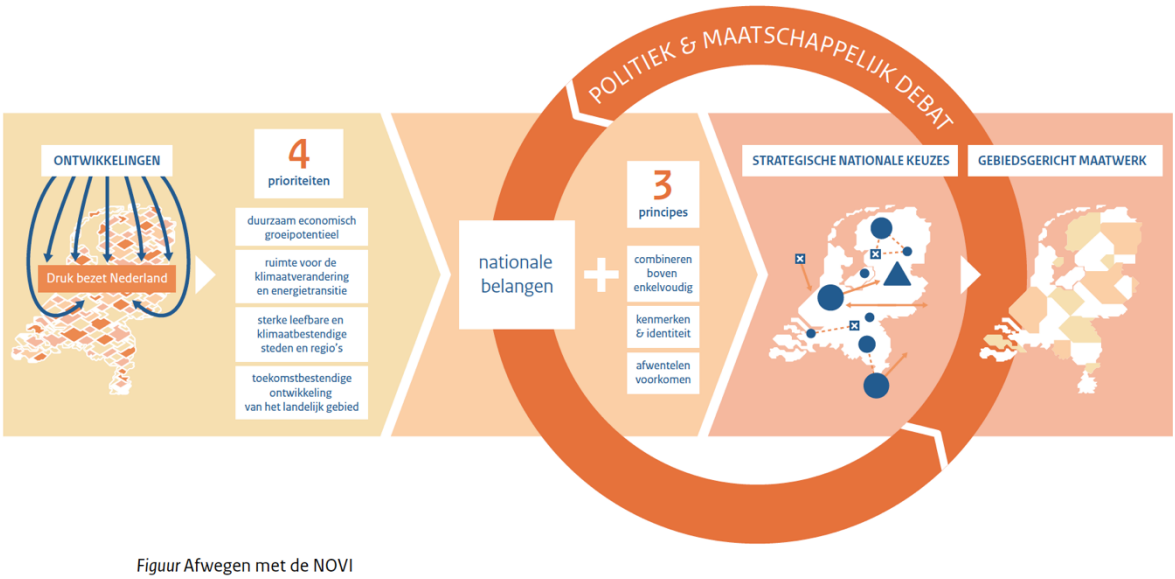


Figure 14: Overview of the principles of the NOVI (NOVI, 2018).

HOW WILL THE NOVI BE IMPLEMENTED?

The NOVI will only be legally binding for the national government, while it will give (noncommittal) direction to other parties like other governments and society. In both aims, the content of the NOVI requires a collective approach. In order to provide coherence in the implementation of the strategies (POVI, GOVI & NOVI), an Administrative Agreement (Dutch: *bestuursakkoord*) and Regional Agendas (Dutch: *Omgevingsagenda's*) are being used (figure 15).

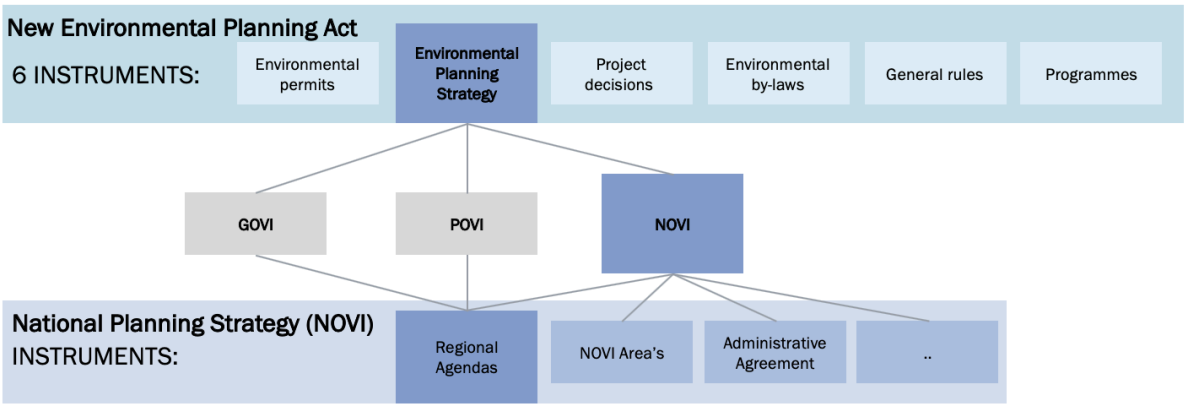


Figure 15: Overview of the Act, its instruments, and the instruments of the NOVI.

- The Administrative Agreement is to consolidate agreement and is a start for an action plan. This agreement consists of three elements: the way in which we protect the national interests, the way in which we achieve shared ambitions and priorities for areas, and the preconditions for being able to tackle challenges as one government.
- A Regional Agenda is a new spatial, integral steering instrument that provides long-term support for decisions by governments and society about developments in a specific area. In this way, the content of the strategies is addressed in a joint area-oriented manner. In the Regional Agendas, national, provincial, regional and local strategies and goals are combined. This requires new and complex form of collaboration.
- NOVI-areas are exemplary areas where multiple complex issues come together, and which have national interests.

In this way established collaboration principles (Dutch: *samenwerkingsprincipes*) are being implemented. These principles are: focus on the assignment, be area-oriented, use a cyclical and adaptive way of working and act as one government together with society. The meaning of a cyclical character also implies that the NOVI is periodically updated.

CHALLENGES DURING THE ESTABLISHMENT OF THE NOVI

During the decision-making journey to establish a national strategy as the NOVI, there are a number of difficult challenges to deal with. They all have to do with the obtaining integrality. Through concrete examples, the challenge with regard to integration within the Dutch spatial planning system will be substantiated.

VERTICAL INTEGRATION: NIMBY

Often, the NOVI deals with conflict of interests and political influence. Even though the interests of national vision (the vision of the Netherlands as a whole) and the interests of the national government appear to be the same, it can be conflicting as well. The national government should in principle represent the interests of 'the Dutch'. However, bringing together interests to form a single national interest requires a great deal of consideration and is often a difficult and time-consuming process. This issue is in line with the 'NIMBY' principle.
For example, one of the national interests is to have a nuclear power plant aimed at generating nuclear energy. However, Dutch municipalities have other interests. They share the opinion that areas should be planned for this function but disagree if this should be done in their municipality. Particularly because this consideration greatly limits the functions and plans of surrounding areas. Also, citizens don't want nuclear power plants in their neighborhood. On the other hand, nuclear companies and their clients do want to expand. To summarize; the difference in interests prevents the achievement of an unanimously supportive solution, which makes it difficult for a national point of view to decide.

HORIZONTAL INTEGRATION

The problem of thinking 'sectoral' has already been mentioned several times, resulting in the solution of approaching issues from an integral perspective. However, these integral issues are more complex than sectoral assignments, because by definition several problems come together. Departments are not used to let their own interest flow, in the interest of the joint profit.

For example, in Flevoland, various spatial plans have been drawn up. One department is aiming for the installation of wind farms, the other for the expansion of the Flevoland airport and yet another with a development plan for housing. After completing these separate plans, it became clear that these plans are conflicting.

DIAGONAL INTEGRATION

The NOVI is dealing with a lot of social issues where there is no single, right and optimal solution; there is no right or wrong but only better or worse solutions. For example, water quality can be improved by purifying contaminated water, as described in the National Water Plan. Additional use of spatial instruments (via the SVIR or land use plans) in combination with setting environmental requirements (via the Nationaal Milieubeleidsplan) and looking for innovative solutions together with industries (Innovation policy) can together make the water quality policy more effective, which can be described within the NOVI (Ministry of Infrastructure and the Environment, 2017). In this example, diagonal collaboration find place through the collaboration between industries and governments to look for innovation.

The challenges of the NOVI correspond to super wicked problems, mainly because of their complex integral character. This makes the (decision)process uncertain, time-consuming and difficult.

2.1.4 SUB CONCLUSION: THE INTEGRAL CHALLENGE OF NATIONAL SPATIAL PLANNING POLICY

The spatial planning system is increasingly confronted with integral challenges, which extend through scales and sectors. These challenges call for collaboration between different governments, departments, and society. Hence, this has enormous consequences for the spatial planning system. The sectoral, top-down and systematic approach in which every square meter is planned, does not suit the complexity of these challenges. To tackle these challenges more effectively, a change is requested towards a holistic adaptive approach using a strong collaboration. In the Netherlands this is also known as a multi-level governance. Here, the role of the national government will change from a leading role to a coordinating role. Therefore, the spatial planning system is in transition to achieve this new approach, through the new Environmental and Planning Act. This Act consists of a number of instruments, including the National Strategy on Spatial Planning and the Environment (the NOVI). The biggest challenges within the NOVI also correspond to the approach to integral challenges. Thus, one of the key challenges within the national spatial planning system is dealing with these complex integral challenges.

2.2 THE VALUE OF DESIGN

In the previous chapter, an introduction has been given about the transition of the Dutch national spatial planning system, due to a new governance perspective in combination with increasingly complex challenges. These challenges can be conceived as issues or problems, or more specifically spatial planning or social issues. This section will approach these challenges from a scientific perspective.

2.2.1 WICKED AND TAME PROBLEMS

The first scientific articles about complex social challenges were written during the 60's and 70's. One of the most appealing articles about characteristics of these complex challenges was written by Rittel and Webber in 1973, called "Dilemmas in a General Theory of Planning". In this article, Rittel and Webber distinguish tame problems and wicked problems, where social problems are perfect examples of wicked problems.

TAME PROBLEM

'Tame' problems are issues that can be resolved with a definite solution under finite and localized circumstances and can be resolved through trial and error. In other words, these problems are definable and separable and may have solutions that are findable. These types of problems are typical of scientists and engineers. For example, the problem of solving equations in mathematics: the problem is well-specified, all the information to solve the problem is available in the problem itself, the same set of techniques is likely to be effective on all equations, and it has a clear and single solution.

WICKED PROBLEM

However, in contrast to tame problems, wicked problems are unique, ambiguous and have no definite solution. Those problems are broad and cannot achieve finite true or false outcomes. Therefore, these problems are also named complex problems (Conklin, 2005; Rittel and Webber, 1973; Moore, 2011). Churchman defines wicked problems in a more elaborated version: 'a class of social system problems which are ill formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing (1967)'. These kinds of problems have also been referred to as 'ill-defined problems.' To fully define a wicked problem, Rittel and Webber set up ten characteristics of these wicked problems:

1. A lack of definitive formulation.
2. No stopping rule that determines when a solution has been found.
3. Good or bad solutions rather than true or false solutions.
4. Lack of immediate and ultimate tests of solutions.
5. Solutions are "one-shot" operations rather than trial and error.
6. Lack of criteria that indicate all solutions have been identified.
7. The uniqueness of every wicked problem.
8. Any wicked problem could be viewed as a symptom of another problem.
9. Any discrepancies in wicked problems can be explained in multiple ways.
10. Planners have no right to be wrong in that they are responsible for outcomes that result from the actions they take.

A comparison of both types of problems can be found in figure 16.

Tame/benign problems (well-structured)	*Wicked problems (ill-structured)*
• very easy to identify what the problem is • very easy to decide when the problem has been solved • all of the knowledge necessary to solve the problem is available • only one correct or true 'answer' is possible/appropriate • not particularly contentious – pretty much anyone would come to the same conclusions regardless of their political affiliation	• problem cannot be easily defined so that all stake holders agree and it is likely to involve quite a bit of negotiation even to get started • never clear when the problem has finally been solved (ongoing issue) • have better or worse (rather than right or wrong) solutions • have no objective measure of success • require constant revisiting and reformulation • often have strong moral, political or professional dimensions which makes them contentious

Adapted from Buckingham Shum, 2003; van Bruggen *et al.*, 2003

Figure 16: Comparison of tame and wicked problems.

In addition to wicked problems, Levin, Cashore, Auld and Berntstein (2012) introduced super wicked problems. Super wicked problems have four more characteristics, namely: time is running out to solve the problem, there is no central authority, those who are seeking to solve the problem are also causing it, and policies discount the future irrationally. The latter means that, despite the knowledge about the severity of the long-term consequences, the translation to the short-term action is underestimated or neglected. For example, despite the knowledge that smoking can be fatal in the long term, a smoker still chooses the cigarette (Levin, Cashore, Bernstein, Auld, 2012). All the characteristics of wicked problems, and even super wicked problems, corresponds to the complex integral challenges within the national spatial planning system.

SCIENTIFIC TAME PROBLEMS VERSUS SOCIAL WICKED PROBLEMS

One of the characteristics of a social wicked problem which is noticeable at the NOVI, is the plurality of objectives held by pluralities of politics which makes it impossible to pursue unitary aims. This is partly because the classical paradigm of science and engineering is not applicable to the problems of open societal systems. Rittel and Webber (1973) suggest that, for a long time, the social professions were misled somewhere along the line into assuming they could be applied scientists; that they could solve problems in the way scientists can solve their sorts of problems. This is also acknowledged by Lee (2011): *"We have become aware that pure scientific thinking in combination with a problem-solving strategy based on the traditional 'cause–effect approach' is inadequate to obtain satisfying solutions (in policy-making) and becomes more and more counter-productive. It results in long, tedious and often frustrating decision-making processes, which are 'too little, too late' to effectively address the significant challenges at stake".* The problems that scientists and engineers have usually focused upon are mostly "tame" or "benign" ones. Wicked problems, in contrast, have neither of these clarifying traits (Rittel & Webber, 1973, p. 160). Rittel and Webber argue that science cannot resolve problems that have open and evolving variables. The rigidity of science fails when attacking and resolving 'wicked', ambiguous problems (Rittel & Webber, 1973, p. 160). Their justification is that science is only equipped to deal with 'tame' problems. This idea is related to Herbert Simon's theory of satisficing through optimization. All three writers confess that wicked problems cannot come to any kind of true/false agreement (like in science), but problem solvers can only 'satisfice' or resolve to the best of the solutions available.

To summarize, using the explanation of wicked and tame problems, it may be concluded that the kind of problems that planners deal with (societal problems) are inherently different from the problems that scientists and engineers deal with, because planning problems are inherently wicked (Howlett, 2010). Thereby, because of the difference in nature of these types of problems, social 'wicked' problems require a different approach in order to be (re)solved than the typical scientific 'tame' problems. Most importantly, the characteristics of integral challenges within the national spatial planning system correspond to the characteristics of (super) wicked problems.

2.2.2 ALTERNATIVES FOR THE SCIENTIFIC PROBLEM-SOLVING APPROACH

The finding that wicked problems cannot be solved by a scientific approach is raising the question about how these problems can be solved. Therefore, alternatives to this scientific approach have been sought for. Unfortunately, this does not provide a unilateral answer in literature, but several perspectives apply to an alternative to this scientific approach. In general, three perspectives can be described: alternatives for the way of thinking which are related to different areas in education, the forms of reasoning and the types of research.

The first perspective is about different ways of thinking. According to Lawson, in general there are two different approaches for solving problems based on two different ways of thinking: the scientific way of thinking and the designerly way of thinking. In his study of 1980, Lawson compared the problem-solving strategies of designers and scientists. In this study, the scientists used a strategy of systematically exploring possible combinations in order to discover a fundamental rule which would allow a permissible combination, while the designers used a strategy of first proposing series of solutions, then eliminating solutions until they found an acceptable one. This designerly way of thinking is also in line with the earlier mentioned theory of Simon about satisficing through optimization.
During the 80s, these two problem-solving strategies resulted in the discussion about a third area of education. Beside sciences and humanities, Bruce Archer and Nigel Cross took up the argument of adding the area of 'design'. Cross argued in his paper "Designerly ways of knowing" (1982), that this 'third' culture is not so easily recognized, simply because it has been neglected and has not been adequately named or articulated. Cross (1982) distinguishes a designerly way of knowing from scientific and humanity-based ways of knowing as follows: "*designerly ways of knowing works with non-verbal codes which translate 'messages' either way between concrete objects and abstract requirements; they facilitate the constructive, solution-focused thinking of the designer, in the same way that other (eg verbal and numerical) codes facilitate analytic, problem-focused thinking."*
The essential difference between these two strategies is that while the scientists focused their attention on discovering the rule, the designers were obsessed with achieving the desired result. The scientists adopted a generally problem-focused strategy and the designers a solution-focused strategy to solve the problem (Lawson,1980).

The second perspective is about different methods of reasoning, which is related to the above-mentioned perspective. March (1976) is explaining this designerly way of thinking as an abductive way of reasoning, in contrast to the generally acknowledged and used deductive and inductive ways of reasoning which are characteristics of the scientific approach of problem solving.
According to Voorendt (2017) '*abduction differs from deduction, because it cannot be replaced by an algorithm that step by step, with certainty, generates solutions for problems. Innovative abduction also differs from induction, because it aims at the totality of the entity that has to be created and not only one certain aspect of the considered reality'.*

Lastly, the perspective about the research typologies will be explained. According to Faste (2012), the various domains of research can generally be divided across two axes: the scientific- versus the practice-based research, and the theoretical- versus the empirical-based research (figure 17). An important example of practice-based research is design research (Zimmerman et al. 2010).

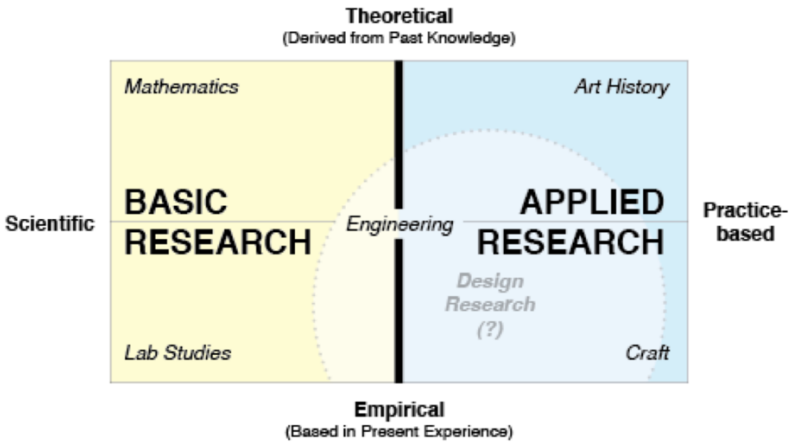


Figure 17: Kinds of researches (Faste, 2012).

When these three perspectives are juxtaposed, a clear agreement emerges. The empirically practice-based design research, the designerly way of thinking and the abductive way of thinking all have to do with design. This observation is not groundbreaking and far from new, because a lot of research has been done about the relationship of wicked problems with the designerly way of thinking. Thereby, a clear reasoning line has been drawn up by various scientists about the contribution of design to solve wicked problems.

For example, where the deductive and inductive ways of reasoning strive to get an optimal answer, the abductive way of reasoning is striving for the most desired result, which is completely in line with characteristics of wicked problems. Therefore, this abductive way of reasoning or this designerly way of thinking is perfectly suitable for solving wicked problems. Additionally, the difference between a scientific way of thinking and the designerly way of thinking is using (relatively) a problem focused strategy and a solution focused strategy as means of solving problems. Thereby, a scientific way of thinking is looking for that one exact optimal solution, whereas the designerly way of thinking is looking for the most satisficing solution which is, again, in line with wicked problems (Cross, 1982; Simon, 1969; Lawson, 1980). According to many theorists, a designerly way of thinking can resolve complex, wicked problems, in contrast to the scientific method which is more suitable for tame problems (Buchanan, 1992, Rittel and Webber, 1973).

2.2.3 ELABORATION ON THE DESIGNERLY WAY OF THINKING

As stated, the designerly way of thinking is suitable for dealing with wicked problems. In this section, the meaning and different perspectives and developments of the designerly way of thinking is discussed.

HISTORY AND MEANINGS

According to Di Russo (2016), design research theories can be split up in twofold: a first generation and a second-generation design-theory. The first-generation design theorist (like Simon, Rittel and Webber and Archer) laid the fundamentals of design research. The second-generation design theorists (like Rowe, Buchanan, Schon and Cross) focused on re-evaluating the scientific-centric groundwork laid during the first generation of design theory (Cross, 2007). They focused on the cognitive aspects of the design process: intuition, a divergent way of designing and human characteristics. According to Harteveld (2014), the term *design* is derived from the meaning of de'sign'. Take three ingredients: 1) the connotations for a model, precedent or in abstraction so-called ‘sign’, 2) the observers and 3) their subsequent denotations in ‘sign’; design. The precedent could connote many things, but it would be up to the observer to indicate these and to covey meaning. It might seem obvious, but the designer designated these in the design. Furthermore, designer gives meaning to signs within their own interpretation using the design process of memory, reason and imagination. In addition, Harteveld (2014) states that the ‘design of space is made by people, that designers make their own interpretation.’ Thus, in general, designs are determined by many actors, not only the designer. In this research, the definition of Harteveld will be used with regard to design: to give a new interpretation to certain signs; to redefine signs.

CHARACTERISTICS OF A DESIGNERLY WAY OF THINKING

The question remains what a ‘designerly way of thinking’ is. While analyzing literature about the designerly way of thinking, three elements stand out: the role of intuition, divergent thinking and human characteristics.

INTUITION - The first generation design-theory was convinced of the predetermined systematically process of design, which is based on the earlier mentioned forms of reasoning, where logic plays an important role (Buckminster Fuller,1957; Simon, 1969). In contrast to them, Papanek (1985) introduced the focus on the intuitive nature of design. Eventually, it was Cross (1999) who stated clearly that the process of design is intuitive instead of systematically predefined. ‘*Expert designers tend to emphasize the role of intuition in the generation of solutions, and creativity is regarded as an essential element in design thinking.*’ He saw the potential added value of intuition in design thinking and studied the topic of creative leaps as part of intuition in the design process. He found that the mysterious creative leaps were not so elusive after all: it was creative bridges which connect ideas to form solutions. This process relies heavily on analogical thinking and abductive leaps (Cross, 1991). On the other hand, Voorendt

(2017) sees the role of intuition differently: *"The intuitive character of the design process is helpful for novice designers and relatively 'simple' design tasks, but for more advanced and complex problems, designers need skills, knowledge and understanding as well".* The recognition of the role of intuition had consequences for the follow-up studies of design research: the nullification of the scientific, systematic representation of the design process, which is discussed in the next chapter.

DIVERGENT THINKING - The recognition of the wicked nature of design issues is increasing during the studies of the second generation. Schön (1984) describes wicked problems as swampy lowlands. He defines that designers who involve themselves with wicked problems deliberately involve themselves in messy but crucially important problems which they handle with experience, trial and error, intuition, and 'muddling through'. He is the first one who introduced 'the use of divergent thinking' as a way to solve those wicked problems.
Divergent thinking is the process of increasing the amount of information, data and ideas, which results in a higher level of complexity, uncertainty, uniqueness and conflicts (Schon, 1984). To quote Schon: "*Let us search, instead, for an epistemology of practice implicit in the artistic, intuitive processes which some practitioners do bring to situations of uncertainty, instability, uniqueness and value conflict" (p. 49). "This result of a higher level of complexity can be seen as an added value, or on the other hand as a task to solve".* For example, Papanek (1985) is seeing the design process only as simplifying complexity and reducing uncertainty. This in contrast to Marcel Hertogh (2010), which states in his book 'playing with complexity', that it will bring added value to increase complexity. However, according to Hertogh (2010), there is no universally accepted definition of the phenomenon of complexity.
According to Joel Moses (2010), a complex system is composed of many parts that interconnect in intricate ways. In other words, the complexity of a system is related to the number of interconnections and to their nature. In addition, he argues that the amount of information in a system can be used as a proxy for its degree of intricateness. Sussman (2002) is describing complexity as a group of related units for which the degree and nature of the relationships is imperfectly known. Their suggestions differ on the basis of the *amount of information* with the *degree and nature of their relationship*. These differences are combined within the theory of Hertogh (2010). He distinguishes two perspectives on complexity in Large Infrastructure Projects (LIPs); detail complexity and dynamic complexity. Detail complexity focuses on the many components and high degree of interrelatedness (a combination between the interpretation of Moses and Sussman), where dynamic complexity focuses on the uncertain decision making and the nonlinear development of LIPs. They can occur both in the same process or project, which can be explained by figure 18. Even though those terms are related to LIPs, they are still useful for clarifying the term of complexity in this research.

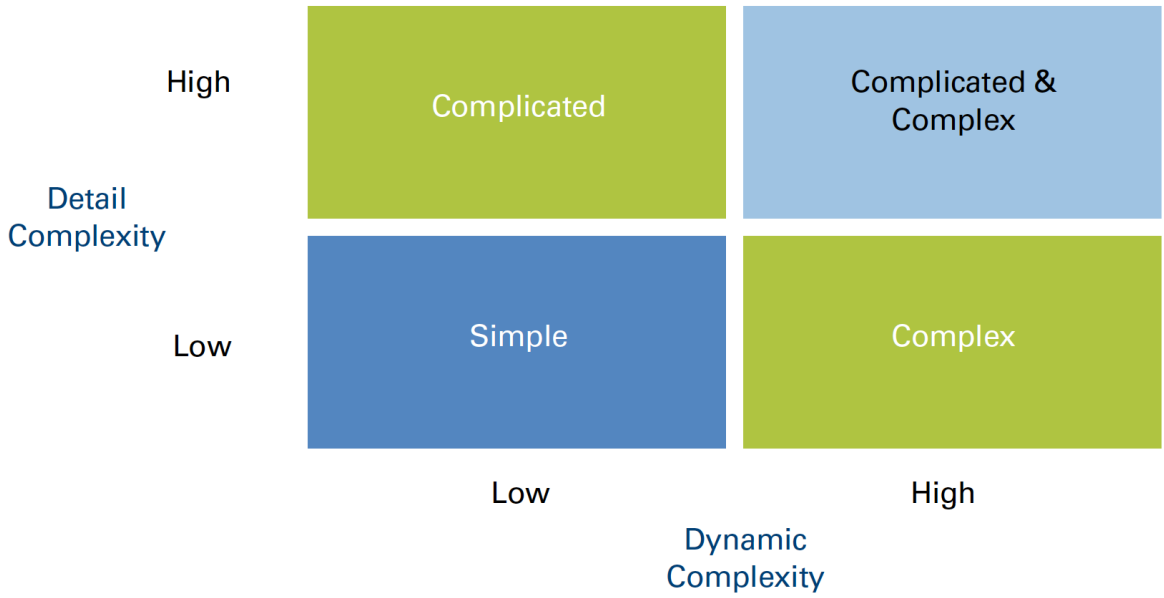


Figure 18: Forms of complexity (Hertogh & Westerveld, 2010).

HUMAN CHARACTERISTICS - Another important topic of the second generation is the increasing focus on the human aspect of design. Papanek stated: “Recent design has satisfied only evanescent wants and desires, while the genuine needs of man have often been neglected.” He also advocates that designers need to take into account wider moral responsibilities, by involving more ‘stakeholders’ to their process.
But not only the involvement of the human aspect is important, the activity itself is also human-based. “Designing is something that people do. Animals do not do it, and machines (so far) do not do it. The ability to design is a part of human intelligence, and that ability is natural and widespread amongst the human population” (Cross, Dorst & Roozenburg, 1992, p.3). Furthermore, Archer suggests that design is human-centered, arguing for the account of using “human values” (Archer, 1965, p.75; Archer, 1967, p.48)

SCATTERED TERMINOLOGY OF THE DESIGNERLY WAY OF THINKING

During and after the second generation, 'the designerly way of thinking' was rolled out on a large scale. Rowe (1987) was one of the initiators with his book, but also Buchanan gave meaning the designerly way of thinking in his paper of 1992. He identified four orders where design thinking inhabits: 1) symbolic and visual communication; 2) the design of material objects, 3) the design of activities and organized services; and 4) the design of complex systems of environments for living, working, playing and learning (Buchanan, 1992, p. 9). Voorendt (2017) is describing the fields of application of design as industrial, urban, engineering and product engineering.
Hence, besides different perspectives from scientists on the designerly way of thinking, also different industries developed their own application of the designerly way of thinking. From this point on, the terminology around ‘the designerly way of thinking’ evolved greatly. Wihtin research purposes, terms like design thinking, research by design, design-based research, design science, user-centered design and service design evolved (figure 19). Thus, design research is scattered with theorists whom each have their own favorite models, techniques and jargon (Archer, 1965). This resulted in confusion, different views and therefore different expectations of design and the designerly way of thinking.

Figure 19: A mind web: terminology around the designerly way of thinking (own image).

2.2.4 THE SPECTRUM OF DESIGN

Clearance has been made by Taura and Nagai (2009), who present a stricter division of design categories: drawing, problem solving and ideal pursuing. The category of drawing differs fundamentally from the other two because it cannot create a truly new output. It was Voorendt (2017) who developed this theory further. He mentioned that the problem-solving approach could be recognized in the general *engineering approach*, and ideal pursuing is related to the *spatial design approach*.

ENGINEERING APPROACH

Since the early 1960s, engineering design models have been developed in a systematic and scientific way towards a generally excepted model. This model describes the process as a sequence of activities: the clarification of the design objective, the conceptual design, the embodiment design and the detailed design. This process is mostly consisting of five phases: the analysis, the synthesis, the simulation, the

evaluation and the decision phase. This typically results in performance specifications, function structures, principal solutions and documentation. Those results are often bundled in a report that includes technical drawings and material specifications, but it can also be a software model or a prototype model. Characteristics of this engineering method of design are: the focus of analyzing the problem, setting up objectives, requirements and boundary conditions in advance, the use of innovative abduction, developing concepts which are optimized, evaluated and compared, and it is typically a sequential process, with few iterations (Voorendt, 2017). Three commonly used models of the technical based design process are the waterfall model, the V-model and a representative of a staged-based design process (figure 20, 21, 22). Schuylenburg (2018) elaborated on these three models according to literature theories. However, Voorendt (2017) is also stating that this engineering design method is most suitable for simple design problems. This in contrast to, for example, research by design, which is only useful for wicked problems.

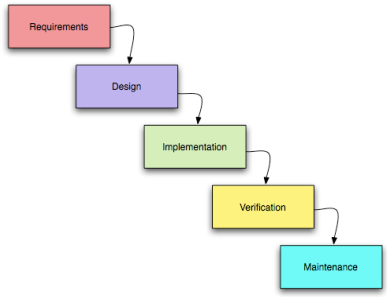


Figure 20: The waterfall-model.

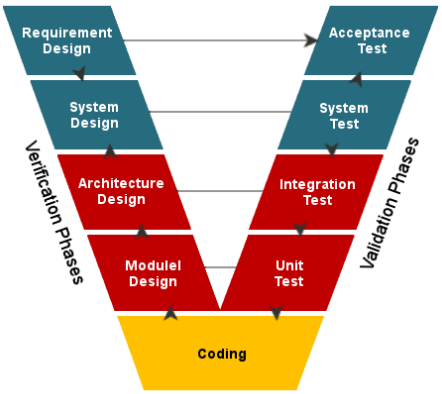


Figure 21: The V-model.

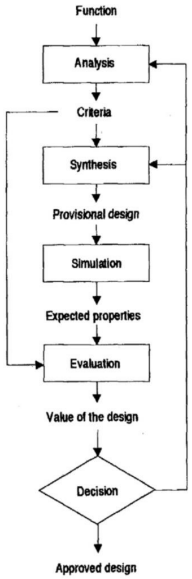
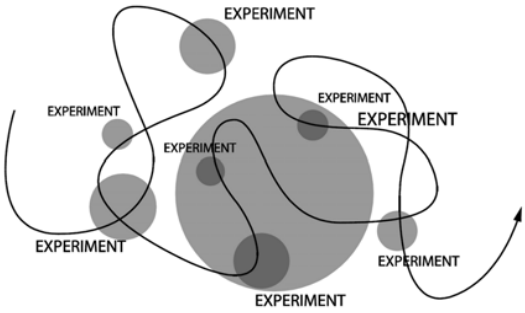


Figure 22: A representative of a staged-based design process.

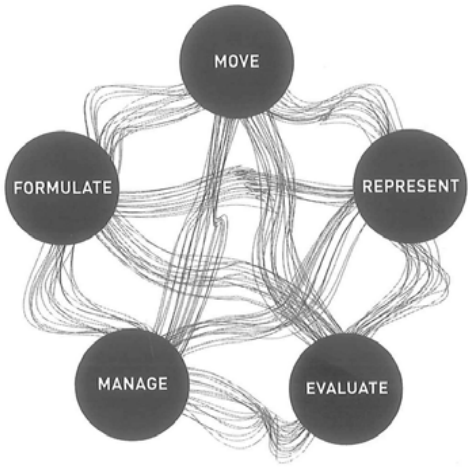
SPATIAL DESIGN APPROACH

The spatial design approach is the design approach used in, for example, landscape architecture and urbanism (Voorendt, 2017). Nowadays, theorists are scattered in perspective of the process of the spatial design approach. Some reject the role of sequence, systems and patterns, where others do acknowledge those elements. In figure 23, an overview is given of six spatial design processes. Early spatial design methods were much alike to engineering design methods, but then have been opposed to critics about the subordinate role of creativity and intuition and the overvalued role of the systematic sequential approach. The conjecture model was (further) developed by Darke (1984), which focusses on the own input of conjectured solutions. According to Roozenburg and Cross (1991), the result of all these criticisms has been a general rejection of any linear sequential analysis-synthesis-evaluation scheme. Examples are the design process models of Schon and Van Dooren (Figure 23.1), where the interwoven process is shown without a fixed step-by-step sequence. Also, according to Lawson and Dorst (2009), their model (figure 23.2) does have five main design activities in no specific order: move, represent, evaluate, manage and formulate. These processes are not sequential but iterative.

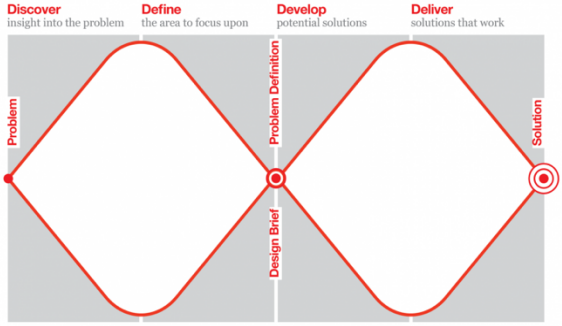
Even the processes are differing, there are five characteristics according to van Dooren which are suitable for the spatial design approach in general. First of all, they all consist of phases of experimenting, exploring and deciding. Secondly, often, a guiding theme or qualities have been used. Third, the inclusion of different domains or work fields has been applied. Fourth, the design is embedded in a broader context, and lastly, a visual language has been applied.



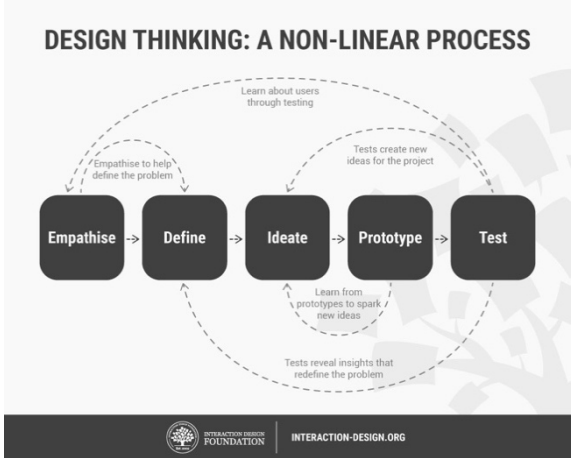
1. The spatial design process of Schön (1983) and Van Dooren (2014).



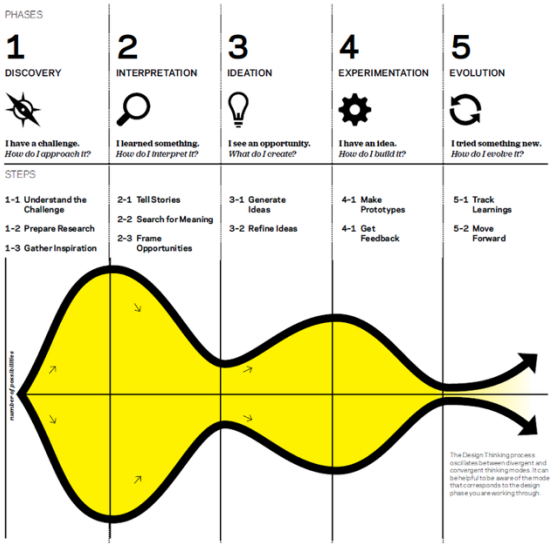
2. The spatial design process of Lawson and Dorst 2009.



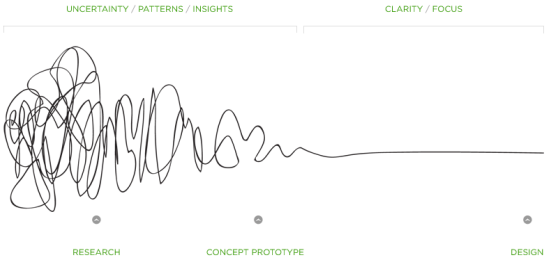
3. Design Council's double diamond (2014).



4. Stanford D.School bootcamp (2011).



5. IDEO Design thinking process for educators (2011).



6. Damien Newman design squiggle (2004).

Figure 23: Common spatial design processes.

INTERMEDIATE FORMS

The last decades, a lot of intermediate forms have been developed. They exist in two forms: the combined form where consciously characteristics and strengths have been carefully synthesized, and the more unconscious form where the design process has been naturally evolved by means of leaning into the other design approach.

CONSCIOUS COMBINED FORM: Examples of the conscious combined form are the method of Roozenburg and Cross (1991), the integrated design method of Voorendt (2017) and the integrated design process of Laura Lee (2011). All models were developed to maintain the strengths of both existing approaches, but avoid their weaknesses (Voorendt, 2016).

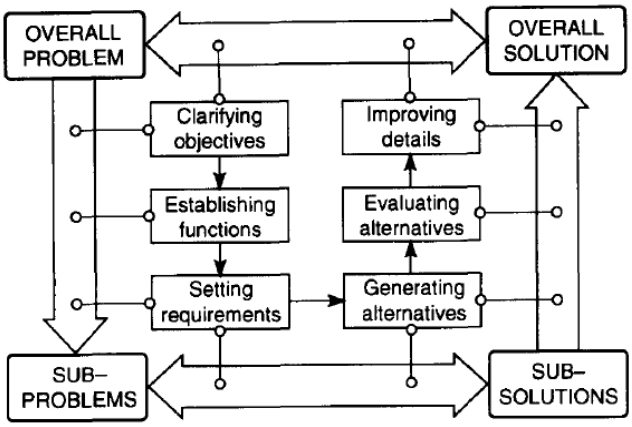


Figure 1

Figure 24: The integrated model of the design process of Roozenburg and Cross, 1991.

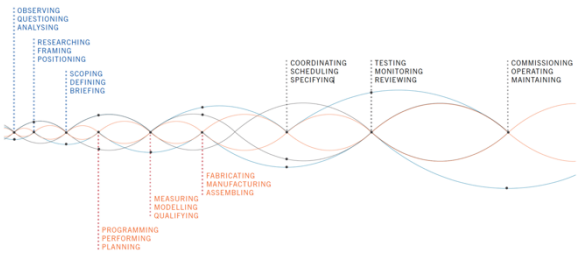


Figure 25: Integrated design process, Laura Lee (2011).

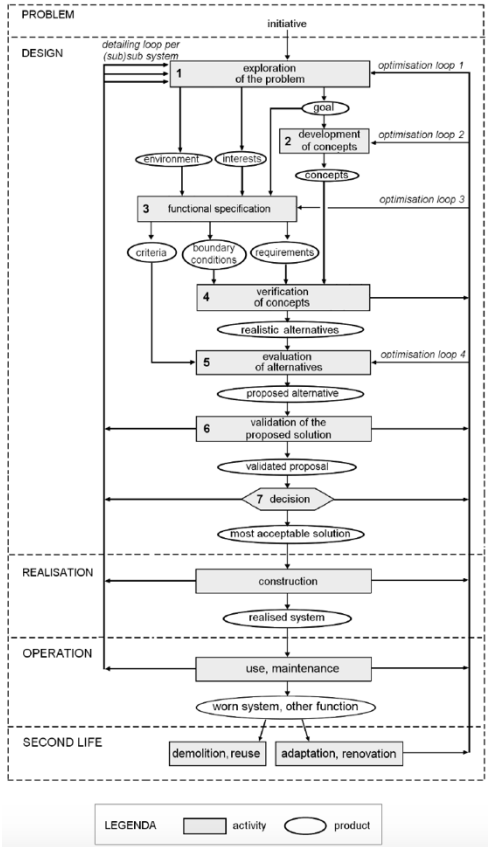


Figure 26: Integrated design process of Voorendt (2017).

UNCONSCIOUS COMBINED FORM: An example of the unconscious combined form came up during an interview with Hans ten Hoeve (2019). He mentioned the situation of a design research consisting of a team of spatial designers. The analysis phase went without mentionable conflicts and consisted of scientifically based analysis based on factual information. During the translation of analyses to a design, one spatial designer drew his own path and made decisions based on his own interpretation and personal preference, which resulted in conflicts with the other spatial designers. When he was asked why he chose his design, it was because of his intuition, imagination and solution focused-approach. The other spatial designers felt that only a design could emerge on the basis on earlier analyses, with understatements and rational way of reasoning. This corresponds with the two approaches, where the two types of designers work on the same project, but conflicts exist between the two approaches.

The theory of Voorendt about the engineering approach and the spatial design approach of design can also be regarded to as ‘scientific approach’ and the ‘applied approach’ (Stolk, 2015). At the same time, researcher Egbert Stolk (researcher at TU Sydney) also wants to put the differences between the two

in perspective. During the design process, engineers can be just as confused as the designers, but the engineers are far less open about the chaos in their own research process. They *present* it as systematic. Other critics like Christopher Alexander (1964, 1971) and Christopher Jones (1977), are criticizing steadfastly about the way in which design methodologies have been explained. They suggest that the design method is so complex and diverse, it cannot be captured by a single method. Jones (1977) stated that he disliked "the machine language, the behaviorism, the continual attempt to fix the whole of life into a logical framework". Cross, Dorst and Roozenburg wrote in 1992 that we seem to have a fairly rich picture of design processes, but we lack a successful, simplifying paradigm of design thinking. Those simplifying paradigms which have been attempted in the past - such as viewing design simply as problem-solving, or information-processing, or decision-making, or pattern-recognition - have failed to capture the full complexity of design thinking.

2.2.5 COMPARISON OF BOTH APPROACHES

To clarify the differences between both approaches, the engineering approach and the spatial design approach of the design process, a comparison will be made in this section.

To compare elements of the two design processes, the categories will be identified first. According to Brand (*to be published soon*), the design process can be described on the basis of five issues:

1. Phasing of different design stages
2. Evolution of design requirements
3. Task distributions & responsibilities
4. Encountered (unforeseen) challenges
5. Randomness determining the outcome

In addition to Brand, Stolk (2016) compared the design process on the basis of six issues:

1. Phasing: linear or cyclic and sequential or iterative
2. Use of languages: prescriptive or descriptive
3. Nature of the problem: well-defined or ill-defined
4. Decomposability of parts of the problem: decomposable or not
5. Character of approach: analytical or experimental
6. Way of reasoning: normal abduction (in relation to deduction and induction) or the design abduction.

There are also characteristics which are of importance according to theorists, but which are not mentioned in the list above. Four characteristics have been identified in the previous chapters: the characteristic of the use of a guiding theme (van Dooren, 2013), the characteristics of working divergent or convergent (IDEO, 2011; Design Council, 2014) related to the way of working with complexity (Hertogh, 2010), and the level of intuition (Papanek, 1985). However, this last characteristic can also be allocated to randomness determining the outcome or the experimental character of the design approach. Therefore, this characteristic is not explicitly added to the comparison.

All characteristics combined, the comparison between the engineering approach and the spatial design approach is made in figure 27. This table can also serve as a framework to compare design processes, for example during the case study of this graduation research project.

	ENGINEERING APPROACH	SPATIAL DESIGN APPROACH
PHASING	Sequential	Iterative
	Linear	Cyclic
TASK DISTRIBUTION	Decomposable into parts	Not decomposable into parts
FORM OF REASONING	Normal abduction	Design abduction
CHARACTER OF APPROACH	Analytical	Experimental
HANDLING COMPLEXITY	Reduce	Increase and dealing with
GUIDING THEME	Not used	Strongly used
USE OF PROTOTYPES	Less	Much
USE OF DESIGN REQUIREMENTS	Much	Less
ENCOUNTER UNFORESEEN CHALLENGES	Disruptive	Opportunity
FOCUS	Problem oriented	Solution oriented
DIVERGENT AND CONVERGENT IN TIME	Convergent oriented	Divergent oriented

Figure 27: Comparison of engineering approach versus the spatial design approach of the design process (own image).

However, the examples of the design processes mentioned in the previous chapters cannot be allocated to one approach while all characteristics are checked. This indicates a grey area which consists of intermediate forms of engineering and spatial design approaches. Even the most likely forms of the engineering process (waterfall model) and the spatial design process (the model of Van Dooren), cannot completely be allocated to one approach. When adding the grey area in between, the following bandwidth appears:

	ENGINEERING APPROACH	SPATIAL DESIGN APPROACH
PHASING	Sequential	Iterative
	Linear	Cyclic
TASK DISTRIBUTION	Decomposable into parts	Not decomposable into parts
FORM OF REASONING	Normal abduction	Design abduction
CHARACTER OF APPROACH	Analytical	Experimental
HANDLING COMPLEXITY	Reduce	Increase and dealing with
GUIDING THEME	Not used	Strongly used
USAGE OF PROTOTYPES	Less	Much
USAGE OF DESIGN REQUIREMENTS	Much	Less
ENCOUNTER UNFORESEEN CHALLENGES	Disturbing	Challenging
FOCUS	Problem oriented	Solution oriented
DIVERGENT AND CONVERGENT IN TIME	Convergent oriented	Divergent oriented

Figure 28: The bandwidth of design processes, identified using the comparison method of figure 27 (own image).

DESIGN RESEARCH

According to Voorendt (2017), one of the best options for solving wicked problems is using design research. However, definitions of design research are differing as well. Even though the two approaches of design have been identified, it is still vague what design research is, and what the relation is to the two approaches.

Research by design is, generally seen, research using the designerly way of thinking. In other words: *research by design,* which is a expression developed from the Dutch practice at The Faculty of Architecture in Delft (V.A., 2000). In theory, this includes the whole spectrum, from the engineering approach towards the spatial design approach. However, in practice, the interpretation of design research is within the grey area of the spectrum.

Researchers claim design research differs from design because it is: (a) research driven: it addresses research questions, references literature, produces theoretical claims, and seeks to generalize beyond a specific context; and (b) involves a more systematic evaluation, including formative data collection, documentation and analysis (Bannan 2007; Edelson 2002; Easterday & Gerber 2014).

Another perspective, the one according to Nijhuis (2017), defines design research as to research and define the assignment, connect different stakeholders and to explore and imagine possible futures. This indicates a problem-oriented approach (engineering approach), while the term ‘imagine possible futures’is more common at the spatial design approach. Also, Roggema (2016) states that the design process is based on a philosophical and normative nature, which underlines the spatial design approach. Another argument for the spatial design approach of design research comes from Palmboom, 2016. He states that, within the design process, drawing is used as a way to investigate and conceptualize spatial phenomena, rather than a technique to express solidified ideas (Palmboom, 2016). On the basis of these arguments, Voorendt assigns design research to the spatial design approach.

To conclude, design research cannot be aligned to the one or the other design approach: it consists of both characteristics and therefore uses both approaches. This leads to the placement of the ‘design research’ in the grey area between the two approaches, where the engineering approach has a bit more leverage because of the explicit ‘research’ characteristics of design research (Bannan 2007; Edelson 2002; Easterday & Gerber 2014), as shown in figure 29.

Figure 29: Design research within the gray area of the engineering design approach and the spatial design approach (own image).

2.3 DESIGN RESEARCH FOR DUTCH SPATIAL PLANNING POLICY

As discussed, the challenges of the national spatial planning policy are inherently wicked, which can be approached by the designerly way of thinking, especially using design research. Over the last decades, design research has already been applied within Dutch policy-making. However, because of the increasing complexity within spatial challenges and the transition towards a more adaptive, cyclical, multi-governance system, (explorational) design research will become increasingly important.
This chapter will describe more general the advantages and disadvantages of design research for Dutch spatial planning policy-making. Thereafter, the role of integrality within design research will be explained, in order to answer the sub question 'what is the significance of design research for national spatial planning policy?'

2.3.1 ADVANTAGES

Even if the value of design research is difficult to measure given that the benefits of using it depends on how the concept is understood and put into practice. However, an attempt has been made by Mintrom and Luetjens (2016). In this section, seven advantages of design research to Dutch spatial policy are identified based on literature and observations.

1. EARLY STAKEHOLDER INVOLVEMENT

According to Howlett and Mukherjee (2018), policy-making incorporates consultation with stakeholders late in the process. Often, after problem definition has already occurred, solutions are analyzed and explored. Involving stakeholders at this late stage is reducing the risk of policy work being subjected to change and being sent back to the drawing board. Simultaneously, this is increasing the risk that the demand for consultation is being perceived as a formality and that it is not taken seriously.
The inclusion of citizen or end-user perspectives in early-stage problem definition is said to enable a richer understanding of the problem and direct attention to more nuanced solutions (Chambers 2003; Fung 2006). Design research provides the opportunity to involve stakeholders in an early phase and to align different interests in a realistic way in a safe and non-competitive arena. Thereby, design research encourages stakeholders to work in a collaborative and iterative way, and by involving stakeholders in early phases the quality of the final result will increase (Mintrom and Luetjens, 2016). Design research can reveal hidden or latent issues that parties can (re)connect.

2. BUILDING INTEGRAL BRIDGES

As a second advantage, spatial designers are capable of connecting different scale levels and connecting local knowledge, for example about history and subsurface, with ambitions and economic carriers. In other words, according to KEER (2018), the social benefit of design research is mainly in bringing together tasks in the spatial domain and connecting them with other local ambitions. Also, design research holds the promise of bridging the common gap in public administration between the goals of policy-making and the experiences of citizens as they interact with government services (Mintrom and Luetjens, 2016). Van der Linden (2018) is explaining this as the place where politics, public support, financial feasibility and concepts come together. To summarize, design research is a suitable method for working in an integral way, resulting in integrated solutions.

3. MULTIPLE SYNTHESIZED SOLUTIONS

The most important skill for a design thinker is to imagine the world from multiple perspectives - a current and prospective view in the perspective of colleagues, clients, end-users and customers. In this way, different perspectives emerge. In the end, design thinking requires the ability to negotiate between the ideal and the real, to maximize consideration of often competing agendas (Lee, 2011).
Designers are concerned with several possible futures and have experience with exploring solution directions in complex practical situations. Scientists are more oriented towards probable futures, leaders at desirable futures and users (such as residents) for a realistic future; a future that is recognizable and does not deviate (too much) from the present (Jong, 1992). Designers are all combining those kinds of futures to a combined pallet of solutions. These models can inspire and can show guidance to the ultimate solution, using the red thread through the pallet of solutions.

4. INNOVATION THROUGH IMAGINATION AND CREATIVITY

According to Rhodes and Tiernan (2014), ministers say the imagination and creativity are missing in the contemporary public service. This lack leads to the same decisions which have been made over the years. Design research is able to innovate, using imagination and creativity. According to Roel Teeuwen (2019), this could be an important topic related to the Dutch spatial planning policies to diverge from the well-worn paths, especially with the transition of the new Environment Act to new policy forms in a more complex environment, where innovation through imagination and creativity is a must. Also, the Dutch Chief Government Architect, Floris Alkemade, is stating that design research is challenging conventional planning ideas and providing them with a fresh view (Van der Linden, 2018). Thereby, also Laura Lee (2011) is acknowledging creativity and innovation as a contribution to policy-making.

5. LEARNING FROM OTHER DISCIPLINES BY MULTIDISCIPLINARITY

The scaling up of design work in the public service would undoubtedly contribute to the diversity of skills required to more adequately acquire and analyze policy-relevant information. This has been observed as a significant current gap (Shergold, 2015).
A multidisciplinary composition increases the chance of linking different issues by combining each other's knowledge. Different disciplines are often also involved in different scale levels, so also connections can be made between these scale level (Van der Linden, 2018). This multidisciplinary not only provides more knowledge because participants learn from each other's field, but also results in more integral solutions.

6. USE OF A COMMON LANGUAGE

Various stakeholders within a design research set up, like the government, professional associations, advocacy groups, the built environment industry, educational institutions and community groups, use their own professional language and terminology (Lee, 2011). This can be disadvantageous because of the change of misinterpretation and thereby misunderstanding.
Therefore, another important advantage of design research is the use of all kinds of communication forms. It not only involves written language and speech, but it covers the total spectrum of media, such as drawings, physical models, computer animations, photographs, calculations, diagrams. In particular, the use of graphics can serve as a universal language, to get all stakeholders on the same page. Jacob Kohlbrenner (2019) has named the advantages of Graphic Facilitation in figure 30. Hence, design research makes processes and solutions comprehensive and transparent, because it uses an understandable universal clear language without jargon.

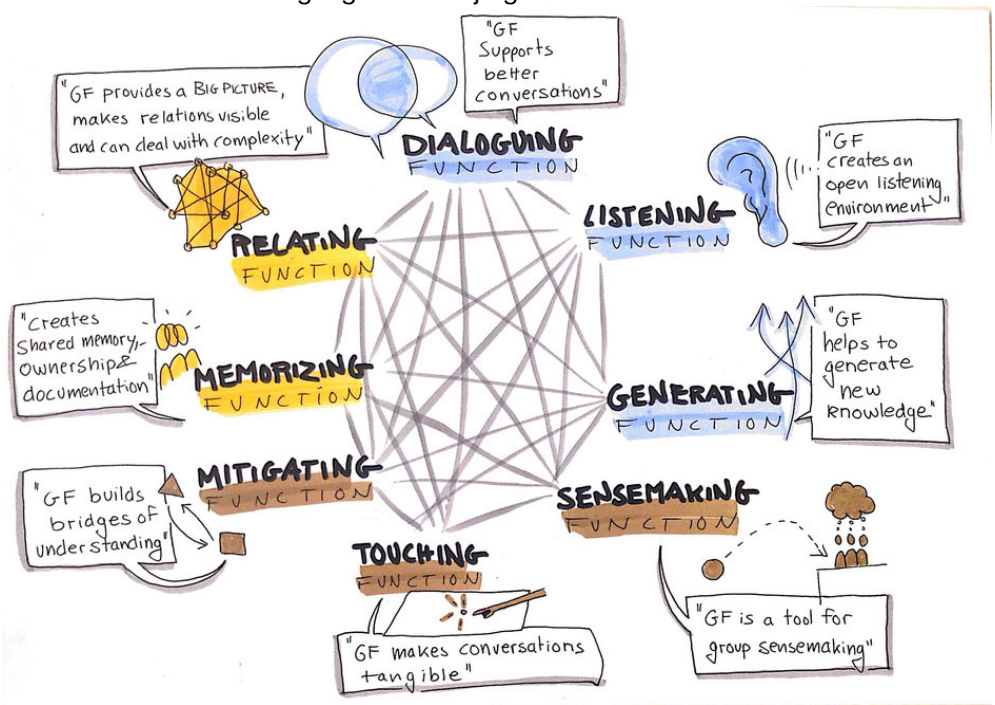


Figure 30: The advantages of graphic facilitation (GF), by Jacob Kohlbrenner (2019).

7. REDEFINING ISSUES: A DIVERGENT APPROACH

The last identified important characteristic of design research is to use solution conjectures as the means of developing an understanding of the problem (Cross, 2001), or to (re)define the assignment (Nijhuis, 2017). This problem-oriented characteristic is associated with the divergent process: the process of generating various and differing ideas (Williams, 2004) and thereby increase complexity by adding more information, knowledge, scenarios and syntheses, with the aim to develop a better understanding of the problem or assignment itself. In many policy-making activities, convergent work is being used: requirements, boundaries and directions of solutions are set, often hypothesis driven. Design research, on the other hand, makes use of the combination of convergence and divergence. This leads to a better understanding of new undiscovered issues (Ter Haar, 2016).

To conclude, based on literature, seven advantages of the use of design research for national spatial planning policy have been identified (as shown in figure 31):

1. Early stakeholder involvement
2. Building integral bridges
3. Multiple synthesized solutions
4. Innovation through imagination and creativity
5. Learning from other disciplines by multidisciplinary
6. Use of a common and universal language
7. Redefining issues: a divergent approach

Figure 31: Advantages of design research to Dutch spatial planning policy (own image).

These advantages can be split into means, functions and goals. For example, the use of a common language with early stakeholder involvement in which multiple disciplines can learn from each other creates together an integrating function. The relationships are identified in Figure 32. To summarize, the advantageous contribution of design research for national spatial planning policy can be summarized as *connecting, inspiring, integrating, clarifying and innovating.*

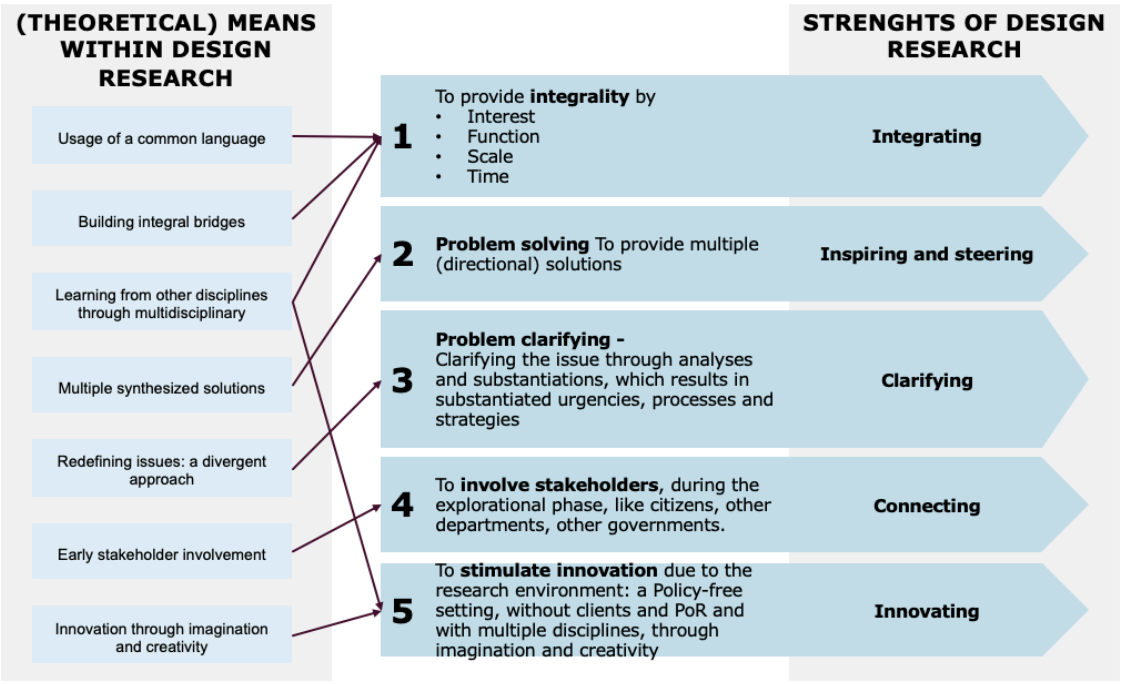


Figure 32: The relation between theoretical advantages versus the eventual strengths of design research (own image).

THE VALUE OF COLLABORATION

One important comment when combining all the seven advantages, is that the advantages are most likely to appear in a team- setting and a collaborative atmosphere.
The collaboration between multiple disciplines can be divided in two forms: the multidisciplinary collaboration and the interdisciplinary collaboration (Hooijmeijer, 2018). The definition of a multidisciplinary project is a project in which each expert contributes their own discipline-specific part to the project, while an interdisciplinary project goes a step further by having each expert understand the methods of the other disciplines and contribute to a more coherent project (Hooijmeijer, 2018). According to INTREPID Cost Action (2018, as cited in Hooimeijer, 2018), the definition of interdisciplinarity is a synthesis of knowledge, in which understandings change in response to the perspective of others.
Because of the reinforcing nature of collaboration on the advantages, the empirical study will focus on the characteristics of an interdisciplinary design research collaboration as well.

2.3.2 OBSTACLES AND DISADVANTAGES

Besides the advantages of design research to Dutch spatial planning policy, there are still obstacles for and disadvantages of implementing design research. Two disadvantages and two obstacles have been identified. Here, disadvantages are more about internal weaknesses, about design research itself. Obstacles are more about current external weaknesses, but they also have the potential to disappear.

DISADVANTAGE I - LACK OF EFFICIENCY

An often-discussed issue of design research is the lack of efficiency. According to theorists, design research can be time consuming, not evidence based, focused on the long-term and the necessary scale-level translation.

TIME-CONSUMING - As identified, (super)wicked social issues of Dutch spatial planning can be characterized by a limited time span. In particular, the NOVI has to deal with strict deadlines according to the bigger picture of the transition of the Environmental and Planning Act. This limited timespan results in an urge for efficiency within their process. Unfortunately, design research is a time-consuming process and should not be undertaken for gains in efficiency (Mintrom and Luetjens, 2016). This is mainly due to the divergent abductive way of reasoning within design, which takes more time to analyze multiple solutions than doing research using a single hypothesis driven approach focusing on converting.

EVIDENCE BASED - Another element of policy-making in which efficiency is also a key criterion is the use of evidence-based policy-making (Peters, B., Capano, G., Howlett, M., Mukherjee, I., Chou, M., & Ravinet, P., 2018). According to Hoogerwerf & Herwijer (2014), good policy-making is characterized by legitimacy and rationality. The (Dutch) decision-making process in national government is based on more knowledge and information and less ideology and partisanship (Botterill & Hindmoor, 2012). Thus, intuition and personal imagination, ideology and partisanship are not suiting an evidence-based policy-making manner, which are characteristics of the spatial design approach. Therefore, the analytical way of working is important to consider within the design process, and therefore the engineering approach is possibly more suitable.

SHORTERM VERSUS LONGTERM - There is, which results in the consideration of design researches as a failure as many intended effects are realized in the long term. Design research is sometimes considered as ineffective, because it is often focused on the long-term gain while policymakers have often expectations for short-term gain. Because of this long-term focus point, a result can be that results of design researches can quickly disappear from the table, for example the project of 'Schaalsprong Almere' (van der Linden, 2018). According to Latour (2008), this can be prevented by means of changing the expected achievements of specific policy targets to more in terms of creating a frame for action that may shape a range of policy responses.

WAY OF DELIVERING - Another inefficiency has to do with the required translation from deliverables to policy. Design research is mostly done on regional or local scale-level, or even smaller. This level of detail is differing from the intended national scale-level (Mintrom and Luetjens, 2016). Thereby, deliverables in the form of models or graphics with explicit and tangible solutions, differs from the textual and strategic elements of policy (Mintrom and Luetjens, 2016). Both requires a translation of the final designs to the intended goals.

DISADVANTAGE II - LACK OF FACTUAL PROVE

Also, in the context of the evidence-based policy-making approach, most clients expect objective evidence for the form of design research. As with most forms of social innovation, it is a concept that relies on practice to give it meaning (Mintrom and Luetjens, 2016, Kimbell, 2015). Thereby, as mentioned above, the value of design research is difficult to measure given that the benefits of using it depending on how the concept is understood and put into practice in each setting. The uncertainties with regard to design research are not consistent with the certainties of policy-making with regard to the evidence- based approach and the rational and legitimate nature of policy.

OBSTACLE I – POSSIBLE DISRUPTIVE CHARACTER

Within traditional design commissioning in the physical environment, a closed question is often used. For example, a list of requirements or measurable policy objectives is often used for designers as well as for policymakers (Van der Linden, 2018). In this form, a critical success factor is meeting the expectations of the client, which differs from commissioning design research. Here, it is possible that outcomes are considered as disruptive and unexpected, and therefore initially delaying (van der Linden, 2018), due to three reasons. First, because of the divergent approach, which is essential for the purpose of innovation or to sharpen the problem. Secondly, because of a Program of Requirements is not being used on beforehand and lastly, the research-part is per definition focusing on innovation and broad exploration. This disruption and unexpecting answers are often experienced as negative, disturbing and disadvantageous, while innovation and disruption can at the same time be the power of design research.

OBSTACLE II - REQUIRES A CHANGE IN THE WAY OF WORKING FOR ARCHITECTS AND POLICYMAKERS

The way of working within a design research is different than most parties are used to. In addition to the traditional use of a list of requirements, other skills are missing as well.
Design thinking calls for specific skills that are not always present in public sector environments (Mintrom and Luetjens, 2016). However, design skills are currently well understood, and trainings have been developed over the years. This makes it easier to let the policymakers adapt to the way of working within a design research environment.

Thereby, spatial designers have to learn to incorporate real interests from many parties instead of working for one client with own and single interests or to use roleplaying. This is derived from the book Interior Public Space of Harteveld (2014). Here, he states that the meaning of design is shaped by three elements: 1) *the connotations for a model, precedent or in abstraction so-called 'sign', 2) the observers, and 3) their subsequent denotations in 'sign', design. The precedent could connote many things, but it would be up to the observer to indicate these and to convey meaning. It might seem obvious, but in each study case the designer designated these in the design*. In other words, the design process and their outcomes are constantly subjected to different interpretations, which increases the changes of misinterpretation between stakeholders. To reduce this risk, the designer has to search for the real interpretations of real stakeholders, instead of using fictive roleplaying which is based on, again, personal interpretation. Beside the theoretical value, also the new Environmental and Planning Act is relaying on the principle of participation and collaboration, which has been extensively discussed in chapter 2.1.
Thereby, spatial designers need to change their spatial design-approach towards a bit more of the engineering design approach, which is strongly related to the 'evidence based' advantage of design research. This has possibly to do with the fact that designers in the Netherlands are mostly being educated with the spatial design approach, which is inherently different as the required 'gray area' approach belonging to design research, as discussed before. For fitting the underlaying principles of policy-making, like legitimacy and rationality, the use of intuition has to be applied in a substantiated way.

Despite the theoretical nature of the above-mentioned advantages, obstacles or disadvantages, they all have multiple perspectives, and are therefore invalidated or put in a different light by many a man. This will be explained later, in Chapter 5. In this chapter the obstacles and disadvantages are only identified on the basis of literature, without any value judgment.

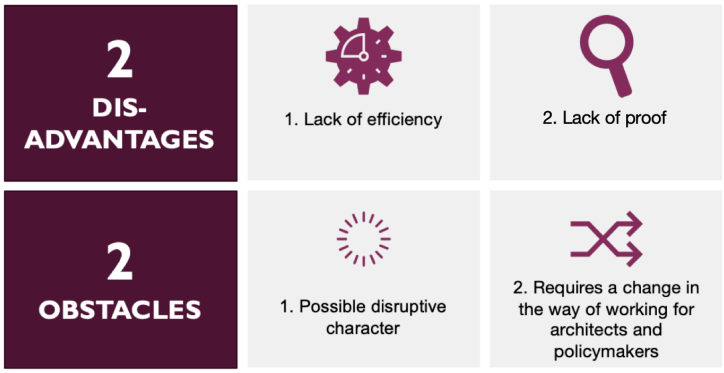


Figure 33: Disadvantages and current obstacles of design research to Dutch spatial planning policy (own image).

2.3.3 THE ROLE OF INTEGRATION WITHIN DESIGN

Because one of the sub conclusions concerning 'integrality as challenge' in section 2.1, the role of integrality within design research has to be defined. This chapter will elaborate on the use of the term 'integrality' and will set up a framework to describe integrality within the case studies.

WHAT IS AN INTEGRAL OR INTEGRATED DESIGN?

The adjective 'integral', or conjugations like integrality and integrated, is widely used in policy documents related to the NOVI (Ministry of Infrastructure and the Environment, 2017). However, the explanation of what is meant by integrality in those policies does often not go beyond "approach the subject incoherence". This is in line with the Dutch and English dictionaries which also describe integrality as "whole or complete" or "made up of parts forming a whole" (Ministry of Infrastructure and the Environment, 2017; Ministry of the Interior and Kingdom Relations, 2019). Some argue there are even differences between integral and integrated, but within this thesis, the terms are considered as interchangeable.

To study how design research can contribute to the demand for integrality by the NOVI, a more specific definition of integrality is needed. Specifically, this thesis focusses on the specifications of an integral design. When is a design considered as integral? Yet, by definition a design can be considered as integral according to the definition of the Business Dictionary (2019): "a design is a realization or a concept or idea into a configuration.". Here the word "configuration" states that a design is always a composition. So, in this perspective, the term ‘integral design' is a form of pleonasm.

Nonetheless, it is possible to state that designs can be comparatively more or less integral. A design that, for example, connects different scales, time zones, different interests and carries different functions, is more integral than a design that does not.

As mentioned, policy documents related to the NOVI do often not go beyond "to approach the subject’s incoherence". A few exceptions can be made. In a (concise) publication of *Agentschap NL,* part of the Ministry of the Interior and Kingdom Relations (Agentschap NL, 2012), the term ‘integral designing’ has been described by the three means of *abstractions*, *lifespan* and *disciplines* (figure 34).

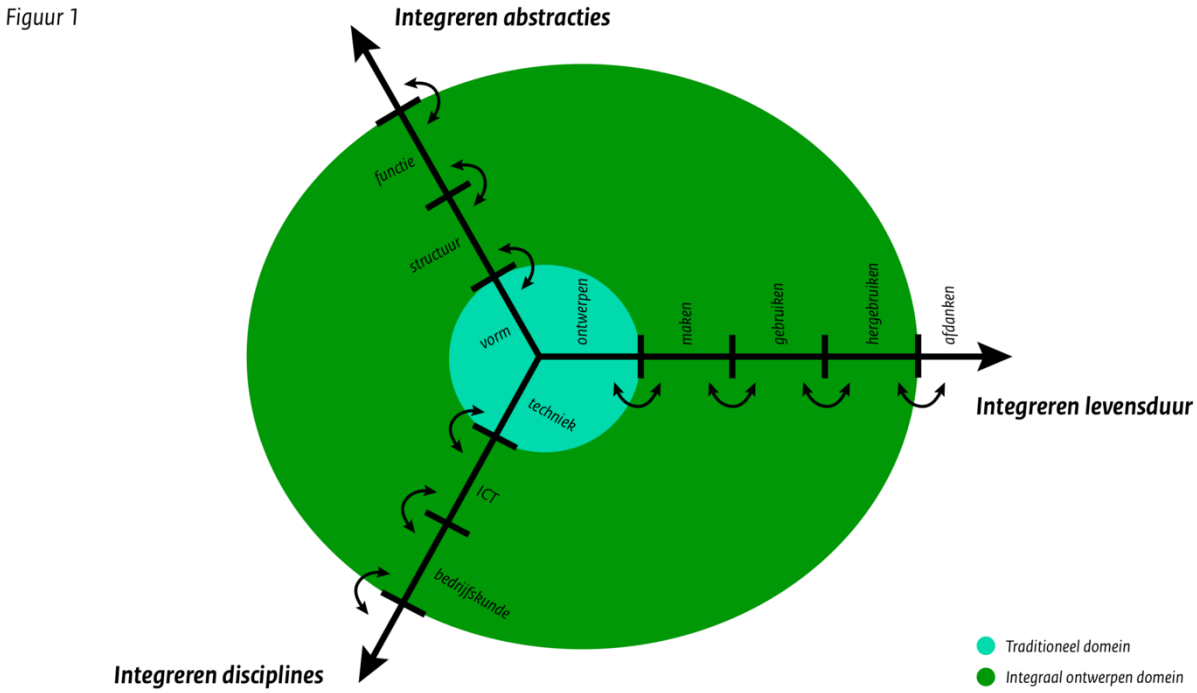


Figure 34: Explanation of the verb ‘integral designing’ (Agentschap NL, 2012).

Unfotunately this model is mainly focused on the verb integral designing and the process of designing, instead of the noun ‘integral design’. Also, instead of a general approach, the model is focused on energy and climate only. The concise publication is unable to give a generic understanding of how to assess the level of integrality within a single design. To the best of my understanding, with the exception of Dutch policy documents, literature about this specific topic is scarce if not non-existent. Therefore, this thesis proposes its own classification to assess the characteristics of an integral design, using the model of *Agentschap NL* as a point for departure, and adding four guidelines from different fields of design theory (see section 2.2).

A GUIDE TO DESCRIBE THE LEVEL OF INTEGRALITY

The following four qualitative measurement values will be taken into account: scale, interests, time and function. On the basis of those four values, a form has been set up to make it possible to assess the case studies with regard to integrality. This form can be found in appendix A.

1 INTEGRALITY REGARDING SCALE:
Integrality in scale means, bridging different levels of scale. Scaling is also key in design theory from the fields of landscape architecture and urban design (Meyer, Nijhuis, 2016). These spatial 'bridges' between levels of scale can be explicit and implicit. Explicit bridges are for example mobility structures: a highway can connect urban scales to regional scales. Implicit bridges can be for example universities which make cities known worldwide: the Delft University of Technology which puts a small city in the context of the whole world. The level of integrality over time can be described by means of two characteristics.
First of all, the characteristics of the range of bridges. The main levels of scale can be defined as, household, street, neighborhood, urban, regional, national, subcontinental, continental, intercontinental and Mondial. All levels and relationships between these scales have been shown in the movie of 'Powers of ten' (1997).
Secondly, the level of integration over scale within a design can also be described as follows: a difference can be made between A) having the ambition to connect scales, B) to be able to see and explain current or possible relationships between scales, and C) to have impact with spatial interventions by creating or strengthening relationships between scales.
The latter can also be seen as 'embedded in the location', using characteristics of the location within the design. See figure 35 for a table which enables a description of the level of integration over scale.

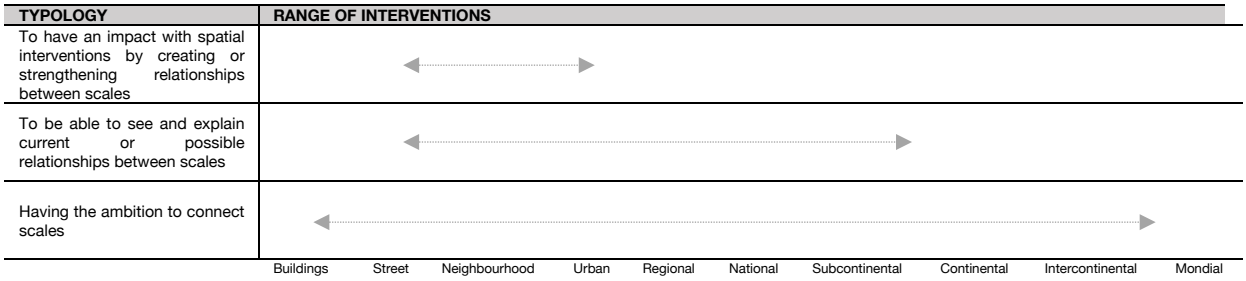


Figure 35: A Table to enable a description of the level of integration over scale.

2 INTEGRALITY REGARDING INTERESTS:
Integrality with regard to interests is about identifying, involving and implementing different interests of different stakeholders. In traditional design tasks, often the client and the designer are involved. In other more advanced models, other stakeholders are involved as well, for example the neighbours, surrounding companies, contractors, sustainability advisors, and so on. This results in gaining broader support for the design, and therefore a design can be more integrated into society. An example of the application of engaging stakeholders within design is the Rebuild by Design-competition, where engaging stakeholders was one of the key objectives (Ovink and Boeijenga, 2018).
The level of integrality over interest can be defined by three elements: A) the way of involving stakeholders, for example the choice between involvement through fictional role play or real people. B) the moment of involvement and C) the way in which different interests are weighed, combined and eventually been used. For example, used as wishes and inspiration input, or used as hard requirements.

3 INTEGRALITY REGARDING TIME:
Spatial interventions don't affect the upcoming years, but can affect decades or even centuries of spatial development. Therefore, the entire lifespan of designs is often taken into account during the design phase. An example may be that the decommissioning phase is already taken into account during the design of an oil platform, or that the foundations of buildings may be over-dimensioned to be able to add multiple floors in the future. Taking the principle of time into account can be done in two different ways:

- First, to create a design at one point in the future, to subsequently reason the design back through time to the present. In this thesis, this will be referred to as 'to rewind'.
- The other way is to make a contemporary design, and then reasoning how it could adapt and/or develop over time. This is referred to as 'to fast forward'. In both ways, the principle of time is taken into account, but the extent to which can differ.

The level in which a design is combining different times zones in a single plan will be named in this thesis as ‘the level of integrality over time’. The level of integrality over time in a design can be described as A) what time frame is considered, and B) how to deal with uncertainties, which by definition belong to the unknown future. This is often referred to as "adaptability": how a design adapts over time taking into account these uncertainties. Meyer (2015) has developed designs and design-methods which are able to deal with these uncertainties. Their designs provide answers for short-, mid- and longterm questions, which are explored using scenario-thinking. Besides the design-perspective, Haasnoot et al (2013) describes an adaptive planning design from the policy-perspective, using adaptation pathways. Adaptation pathways describe a sequence of policy actions or investments in institutions and infrastructure over time to achieve a set of pre-specified objectives under uncertain changing conditions. Both, Meyer and Haasnoot, are taking the factor of time and uncertainty into account in their designs, resulting in more integration with regard to time.

4 INTEGRALITY REGARDING FUNCTION:
The last and probably the most typical and recognizable description of an integral design is the level of combination of functions. A striking example of an integral design based on functions is the multifunctional flood defense in Katwijk (figure 36). Here, the designer has combined the functions of flood safety, nature preservation, and underground parking in a single design, by making clever use of, for example, shape, structure and material.

Figure 36: Multifunctional Flood Defence (Voorendt, 2017).

Because the full range of possibilities of functional combination can be extensive (Voorendt & Van Veelen, 2015), this thesis is limited to examples from the *City of the Future*-case study. The main objective for *City of the Future* was to include the following transitions and issues in the designs: accelerating urbanization, the energy transition, shortage and waste of materials, accessibility and mobility, quality of life, sustainability, air quality, noise hindrance, economic vitality, and social inclusiveness.

There are two ways to deal with these transitions and issues in designs. First, it is possible to prioritize transitions and issues and therefore selecting the dominant factor(s). This is a form of integration can be associated with the Dutch verb ‘koppelen’ – linking, or combining, where one factor is the leading one. The second possibility of integrating with regard to functions considers the transitions and issues in a more equal way and aims to include as much transitions and issues as possible. It is important to note that even if the second approach of integrating seems to be ‘better’ and more equable than the first approach, this is not necessarily the case. This is strongly context-dependent: some situations require a strong form of integration, where other situations ask are more suitable for use the ‘koppel’-approach. Therefore, to assess the level of integrality regarding function, only the number and extent of involved transitions and issues will be taken into account.

REMARKS TO THIS GUIDE

In the application of these guidelines to assess an integral design, three rules are taken into account:

1) Some features outweigh other characteristics in the assessment of integrality. For example, if a design is combining 10 different functions, but does not take time and scale into account, the majority may still consider this design as integrated, while at the same time a design that is integrated over time and scale but carries a single function, the majority will not consider this as an integral design. This implies that the feature of combining function outweighs the feature of time and scale in the assessment.
2) Although the four properties of integrality have been independently described, relations between properties are possible. For example, to integrate the function 'preservation of nature', elements of the integration of scale can be used (embedding in the location). Another example could be, to integrate 'living' and 'flood defenses' into a design instead of just 'living', more interests have been satisfied as well.

For practical reasons, and the added complexity of correlation between the features in the design, no concluding assessment of full integrality of the designs are given. Rather, the case studies will be assessed on the four different features. Within these categories, a comparison can be made.

A final remark with regard to the assessment of different characteristics of integrality:

3) The above-mentioned characteristics will be used to assess the case studies on the basis of explicit examples from interviews and the final publication of City of the Future. Therefore, it could be that the abovementioned features have been taken into account by the designers, but that they have not been explicitly shown or mentioned in the interviews or final publication. Then, this will not be included in the assessment.

2.4 SUMMARY THEORY-ORIENTED RESEARCH

To eventually answer how design research can be used effectively for national spatial planning policy, this theory-oriented research aimed to identify the key challenges of the Dutch national spatial planning system and the ability of design research in order to find the significance of design research for national spatial planning policy. These three parts have been dealt with, and a summary of these parts will be given in this section.

Figure 37: Overview of the theory-oriented research.

1. INTEGRALITY AS KEY CHALLENGE

The challenges of the Dutch national spatial planning system are increasingly complex, because they reach through sectors, scales and various interests (figure 38). Within this thesis, these challenges are referred to as multilayered spatial challenges or integral challenges. These challenges call for collaboration between different governments, departments, and society. Hence, this has consequences for the spatial planning system. The sectoral, top-down and systematic approach in which every square meter is planned, does not suit the complexity of these challenges. To tackle these challenges more effectively, a change is requested towards a holistic adaptive approach using a strong collaboration. In the Netherlands this is also known as a multi-level governance. Here, the role of the national government will change from a leading role to a coordinating role.

The demand for this approach has been addressed by the transition to a new spatial planning system, by means of the new Environmental and Planning Act. This Act consists of multiple instruments, including the development of a national spatial long-term strategy: the NOVI. Also, within the NOVI, the integral challenges are recognizable. Hence, one of the key challenges within the Dutch national spatial planning system is dealing with these complex, integral challenges.

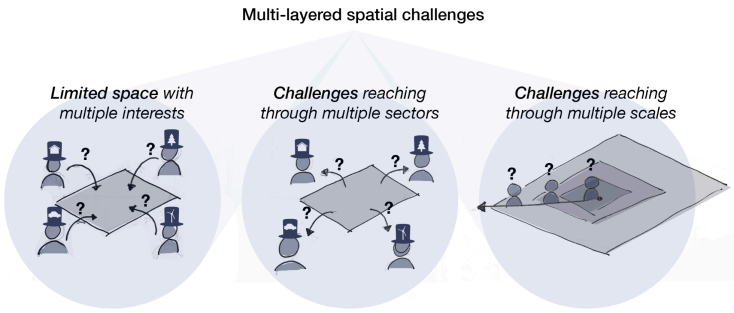


Figure 38: Explanation of multi-layered spatial challenges.

2. DESIGN RESEARCH CAN ADDRESS 'WICKED' MULTI-LAYERED SPATIAL CHALLENGES

Theorists describe social challenges as "wicked problems". Wicked problems are unique, ambiguous, broad and have no definite right or wrong solution, in contrast to tame issues. Tame issues are definable, have a clear problem-solving process and their solution is singular and clear in nature. Rittel and Webber argue that science cannot resolve problems that have open and evolving variables. Their

justification is that science is only equipped to deal with 'tame' problems. Therefore, (re)solving social 'wicked' problems requires a different approach than resolving typical scientific 'tame' problems.

Three possible perspectives can be used to look for alternatives for solving these problems. These alternatives are regarding to the way of thinking, the form of reasoning, and the type of research. When these three perspectives are juxtaposed, a clear agreement emerges. The empirical practice-based design research, the designerly way of thinking and the abductive way of thinking are all related to design. Hence, the designerly way of thinking can be a suitable approach for solving wicked problems. This approach has been broadly studied, with similar findings: the designerly way of thinking has the ability to resolve complex, wicked problems, mainly because the designerly way of thinking means looking for the most satisficing solution using the abductive way of reasoning, instead of trying to find a single clear-cut solution as is the practice within the scientific way of thinking.

With regard to the designerly way of thinking, two approaches can be distinguished: the engineering design approach and the spatial design approach (Voorendt, 2016). The engineering approach is a sequential, linear, convergent process based on requirements, which reduces complexity and is problem-oriented. Also, the (objective) analytical way of reasoning is of importance. On the other hand, the spatial design approach is an iterative cyclic, divergent-focused process, which uses intuition, creativity and imagination and is solution-oriented. However, well-known design processes as examples could not be allocated to one approach while ticking the boxes for all characteristics. This indicates a grey area which consists of intermediate integrated forms of engineering and spatial design approaches.
Because of the different nature of the two design approaches, it is possible that the two approaches are handling wicked problems differently, which means that they could have a different contribution to policy-making in the end. To clarify this difference, the design processes have been mapped on the bandwidth of the design approaches, on the basis of eleven identified characteristics of the design process. These characteristics will be used as a framework for mapping design processes during the case study of this study to collect empirical data about the possible differences.

3. THE SIGNIFICANCE OF DESIGN RESEARCH FOR NATIONAL SPATIAL PLANNING POLICY
Over the last decades, design research has already been applied within Dutch policy-making. However, because of the increasing complexity within spatial challenges and the transition towards a more adaptive and collaborative approach, design research will become increasingly important. Literature sheds little light on the contribution of the different forms of design research. However, general advantages of the application of design research have been identified. These advantages are shown in figure 39, and can be summarized as *connecting*, *inspiring*, *integrating*, *clarifying* and *innovating*.

Figure 39: The advantages of design research collaboration to Dutch policy-making of spatial planning.

As mentioned, integrality is one of the key challenges for the Dutch spatial planning system, while integration is, at the same time, a fundamental role of design research. Therefore, it can be concluded that the significance of design research for national spatial planning policy lies in facilitating the achievement of integrality, by means of connecting and clarifying in an inspiring and innovative way.

Within this theory-oriented research, the variety of forms of design research becomes clear through their different design processes. The question remains how design research can be used (more) effectively within national spatial planning policies, taking into account this variation. The next chapter will specify this variation and thereby specify the effectiveness of design research.

3. Empirical study

3. EMPIRICAL STUDY

This chapter elaborates on the relationship between processes, outcomes and the significance with regard to integrality, in order to specify the significance of design research for national spatial planning policy. This because, within the theory-oriented research, it has been established that the level of specification of the significance of design research for national spatial planning policy does not go beyond the general advantages and disadvantages.

First the refined methodology is discussed, consisting of frameworks that has been established on the basis of the theory-oriented research. These frameworks can be validated by means of the case studies, in order to test the hypothesis. Thereafter, four single analyses of case studies are given. Third, a cross-analysis of the case studies is discussed, in which all the findings of case studies will be combined per theme. Lastly, the results are presented, and the hypothesis is validated.

3.1 RESEARCH METHODOLOGY

In chapter 1, an elaboration has been given about the case selection and subcase selection. What remains is the selection of the interviewees and the frameworks, on the basis of the theory-oriented research.

3.1.1 INTERVIEW SELECTION

As described in section 1.3.2, the cities Eindhoven and the Hague are selected for the case studies. Due to the limitations of this graduation research, a selection is made concerning the interviewees within the four selected teams of the two cities. Figure 40 shows an overview of the construction of City of the Future, with regard to selecting the interviewees. Because of the difference between the spatial design approach and the engineering approach emerged in the literature study, plus the value of collaboration between multidisciplinary teams' members, the selection is made on the basis of a mix between spatial designers and non-spatial designers, whereby the variety of disciplines is taken into account as well. These differences can, for example, lead to different interpretations of processes or contributions so that a better picture can be obtained. In addition, the team captains were selected as interviewees as well, due to their coordinating and representative role. Figure 41 shows the selected team members for the interviews based on both selection criteria.

One interesting note: while contacting non-spatial designers to ask them if they were willing to participate as an interviewee, their answer was often "You can better call another team member because my share has not been large." This response is an indication of how the teams were collaborating.

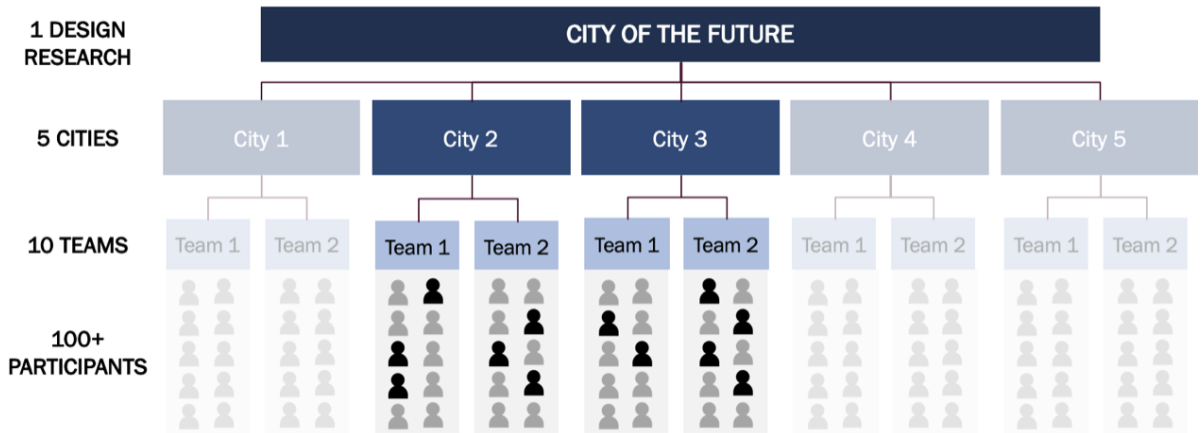


Figure 40: Overview of the construction of City of the Future, with regard to selecting the interviewees.

	TEAM	NAME	DISCIPLINE	FUNCTION TEAM	CLASSIFICATION
1	The Sociotechnical City	Lars van Hoften	Urbanism	Team captain	Spatial designer
2		Tamara Streefland	Sustainability consultancy	Circular economy expert	Non-spatial designer
3	All Inclusive City	Wilfried van Winden	Architecture	Team captain	Spatial designer
4		Wilfred Hoogerburg	Urbanism	Area developer	Non-spatial designer
5		Martijn de Kievit	Mobility	Mobility expert	Spatial designer
6	Urban Arcipelago	Mauro Parravicini	Architecture	Team captain	Spatial designer
7		Marcel van Lieshout	Mobility	Mobility expert	Non-spatial designer
8		Maurice Hermens	Civil Engineering	Structural engineer	Non-spatial designer
9		Michiel Visscher	Civil Engineering	Structural engineer	Non-spatial designer
10	Triangel	Bart Mispelblom Beyer	Architecture	Team captain	Spatial designer
11		Ben van de Ven	Urbanism	City maker	Spatial designer
12		Aeisso Boelman	Real estate consultancy	Financial and economy expert	Non-spatial designer

Figure 41: Selections of interviewees.

3.1.2 METHODOLOGY ANALYSES

According to the hypothesis, the following elements are identified within the case studies: the design process, the outcomes, and the level of integrality. In the upcoming sections, the frameworks are elaborated on in order to assess these three elements.

1. PROCESS	
Phasing	Incremental or iterative
Character of approach	Analytical or experimental
Handling complexity	Increasing or reducing
Focus	Problem-oriented or solution-oriented
Form of collaboration	Interdisciplinary or multidisciplinary

2. OUTCOME	
Typology	Framework or Masterplan
Focus	Clarifying and Inspiring

3. INTEGRALITY	
Time	--/-/+/++
Scale	--/-/+/++
Interests	--/-/+/++
Function	--/-/+/++

Figure 42: Overview assessment of the case studies.

PROCESS

During the theory-oriented research, a framework to describe the approach of the design has been set up. Because of duplications (handling complexity and divergent versus convergent), differences of importance (using a guiding theme is less striking for an approach than elements such as 'problem or solution orientation' or 'incremental or iterative') and limitations of this research (one-hour interviews), the four most appealing elements of the design process are analyzed within the case studies, as indicated in figure 43.

Figure 43: Selection of elements of the design process within the case studies.

These characteristics have been made measurable, after which a form has been drawn up which can be filled in per case study. The analysis is based on interviews, the publication, and an own interpretation. The form is shown in figure 44.

	QUOTES										
	INTERVIEWEE 1	INTERVIEWEE 2	INTERVIEWEE 3	PUBLICATION	OWN INTER-PRETATION		A	B	C	D	
PHASING						Incremental	Incremental	Mostly incremental	Mostly iterative	Iterative	Iterative
CHARACTER OF APPROACH						Analytical	Strongly analytical	More analytical than experimental	More experimental than analytical	Strongly experimental	Experimental
HANDLING COMPLEXITY						Reduce	Reducing complexity	More reducing than increasing	More increasing than reducing	Increasing complexity	Increase
FOCUS						Problem oriented	Mostly problem oriented	More focused to the problem than to a solution	More focused to solutions than to the problem	Mostly solution oriented	Solution oriented

Figure 44: Form to assess the design process based on interviews, the publication and an own interpretation.

PHASING

According to the Interaction Design Foundation (IDEO, 2011), there are different ways to follow the design process. The first form is a direct and linear process in which one stage seemingly leads to the next stage. This form is often set up in advance of the process. This process can be clarified with the waterfall model. This model follows the following steps: requirements (1) – design (2) – implementation (3) – verification (4) – maintenance (5), as shown in figure 45.a. This process is in contrast to a more

flexible and non-linear fashion, as shown in figure 45.d. This process is formed more organically and during the process itself. For example, different groups within the design team may conduct more than one stage concurrently, or the designers may collect information and prototype during the entire project, instead of just during the ideation-stage. Also, results from the testing phase may reveal some insights, which in turn may lead to another ideation session.
The first approach is more common within the engineering design approach, while the second approach is based on the practice of spatial design-processes. However, both forms do not exclude each other. An incremental iterative design process can also occur, which is even common in practice. Almost every design-process has iterations on a detailed scale level. But, when looking at a higher scale level, the level of phases it selves or themes, these combined processes lean more on an iterative basis or an incremental basis. Therefore, during the case studies, the following four characteristics will be used, using this higher scale level where iterations over details are not taken into account.

A – Incremental: a straight-forward process in which all steps are completed once and in a chronological order; no feedback loops with a rigid predefined process.
B - More incremental: straight-forward process in which all steps are completed and in a chronological order, but with a few feedback loops.
C – More iterative: A cyclical process of multiple incremental processes. Here, clear steps are followed and pre-defined, but these incremental processes are occurring multiple times with new information.
D – Iterative: A cyclical process in which a series of events happens again and again in the different orders; multiple feedback loops with an organic non-prepared process.

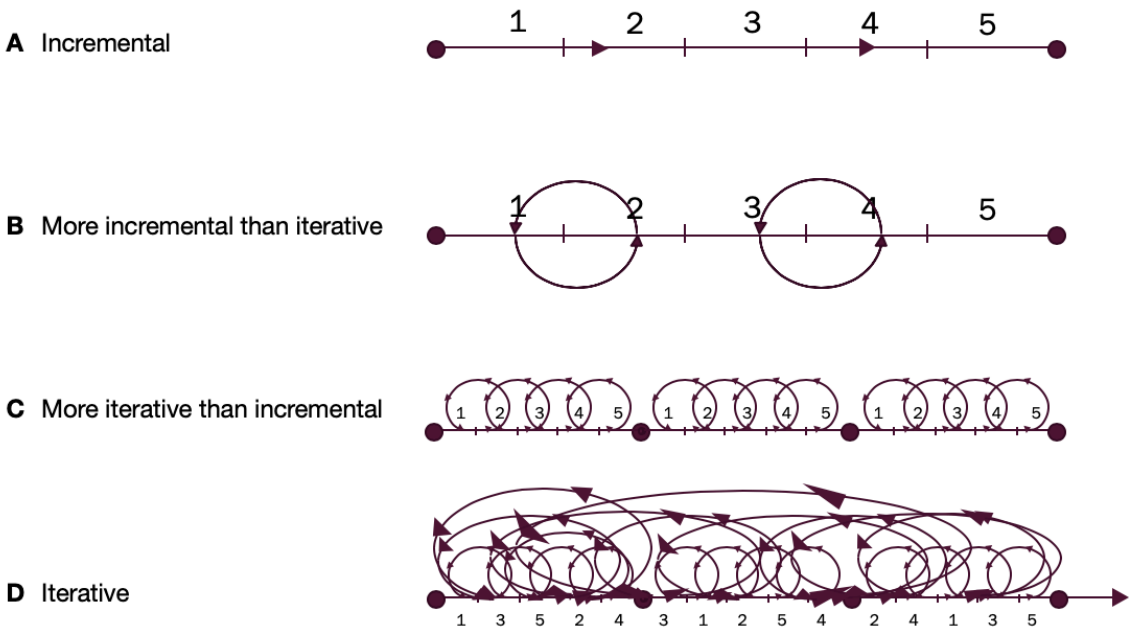


Figure 45: Explanation differences incremental and iterative, using the 5 phases of IDEO (own image).

CHARACTER OF APPROACH
The approach during the design-process can be based on two different forms of reasoning: The two extreme forms are analytical-based and experimental-based. An analytical character of approach is using deduction and induction using facts, data and/or literature. The experimental character of approach is based on abduction using intuition, experience and creativity. An explanation between deduction, induction and abduction can be found in appendix B. Again, both forms do not exclude each other. In practice, a combination of both forms is most common. However, the approach is leaning more into an analytical character or an experimental character. Therefore, during the case studies, the following four characteristics will be used:

A - Analytical: Decision-making based on deduction and induction, using facts, data and/or literature.
B – More analytical than experimental: Decision-making based on deduction and induction, using facts, data and/or literature, but at some points in time, intuition, experience, creativity and testing by making prototypes are used as well.
C- More experimental than analytical: Decision-making based on abduction, using intuition, experience, creativity and testing by making prototypes, but at some points in time, facts, data and/or literature are used as well.
D - Experimental: Decision-making based on abduction, using intuition, experience, creativity and testing by making prototypes.

HANDLING COMPLEXITY

As discussed in section 2.3.2, this research uses the definition of complexity of Hertogh (2010). Because elements of dynamic complexity have already been described within phasing and collaboration of the design process, this part focusses on handling detail complexity: many components with a high degree of interrelatedness. Within design-processes, teams can use two approaches to handle this complexity. The first approach is to reduce complexity, where complexity is experienced as negative and threatening. The second approach is to increase complexity, where complexity is experienced as positive and challenging. Again, also intermediate stages are possible.

A – Reduce complexity: a strong focus on limiting the number of components and interrelatedness, by specifically adding components (such as information, stakeholders, scale-levels) based on an already chosen direction to ultimately achieve a manageable final outcome.
B – More reducing complexity than increasing complexity: a small focus on limiting the number of components and interrelatedness, by specifically adding components (such as information, stakeholders, scale-levels) based on an already chosen direction to ultimately achieve a manageable final outcome.
C - More increasing complexity than reducing complexity: a small focus on exceeding the number of components and interrelatedness, by adding components which could be useful (such as information, stakeholders, scale-levels) without assessing their relevance on beforehand, to get a as complete as possible overview of the problem.
D – Increase complexity: a strong focus on exceeding the number of components and interrelatedness, by adding components which could be useful (such as information, stakeholders, scale-levels) without assessing their relevance on beforehand, to get a as complete as possible overview of the problem, where complexity is being valued.

FOCUS

A clear difference between the two design approaches (spatial-design approach and engineering design-approach), is their problem-solving approach (section 2.2.4). Here, the solution-oriented approach is solving a problem by testing different solutions. The problem-oriented approach is solving problems by exploring the nature of the problem itself, and thereafter, attacking the bottlenecks. Both approaches start with exploring the problem, and thereafter connect findings to solutions. However, the focus with regard to the whole project can differ significantly.

A – Problem-oriented: mainly focused on looking for conflicts, meanings, challenges and problems within the task itself, where after (multiple) solutions may appear.
B – More problem-oriented than solution-oriented: a tie, but more focused on the problem
C – More solution-oriented than problem-oriented a tie, but more focused on the solution
D – Solution-oriented: mainly focused on finding a possible solution, by constantly making decisions towards a solution.

OUTCOMES

Besides mapping the different processes, also the deliverables are mapped. Here, a difference is made between the final overarching outcome as a framework or a masterplan. Within the hypothesis, the

following definitions have been used. A masterplan is a detailed plan design which represents a single scenario. A framework, on the other hand, is designed at a higher level: a schematic abstract plan which gives direction and where several scenarios fit in. This difference can be seen in the design research of Highway x City and Urhahn. Figure 46 shows a masterplan form the Highway x City study where a single scenario is fully worked out, including details. This in contrast to Figure 47, which shows a framework where boundaries and requirements have been specified and have been allocated to specific locations. This framework could also be made spatial by allocating volumes and connections on lower scale level. It also enables a large possibility of scenarios. Important is that it is not determined what something might look like, but that it is all about the possible systems behind.

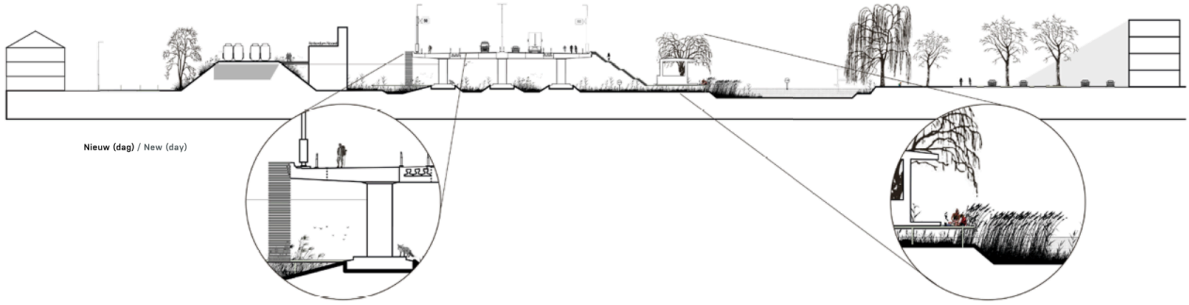


Figure 46: Example of a Masterplan from a team from Highway x City.

Figure 47: Example of a design framework, made by Urhahn.

After this allocation, more specific strategic or spatial key points of the deliverables are explained. Thereafter, both descriptions of the deliverable are used to define the contribution as inspiring or clarifying, as both or as none of the contributions. This all is based on the interviews and the official publication.

INTEGRALITY

As explained in section 2.4, a framework to assess the level of integrality have already been set up. This framework is used for the case studies.

3.1.3 SEMI STRUCTURED INTERVIEWS

To study the above-mentioned elements, an interview guide has been set up. Because of the explorative character of this study, a semi-structured interview approach has been selected, to allow new ideas to be brought up during the interview as a result of what the interviewee says. However, a general framework of themes with a guideline of interview questions has been drawn up, based on the three above-mentioned analyses. This interview guide can be found in appendix D. The interviews are, with permission from the interviewees, recorded and transcripted. These transcripts can be found in appendix E. After the individual transcripts per interviewee, the transcripts have been processed to one document per team, sorted by subject. From this document, data was processed for the coming chapters.

3.1.4 LIMITATIONS & BIASES

Inability of a general statement: Due to the limitations of this research, only 4 cases can be studied. This small amount suits the explorative character, but has the constraint and disability of making a final general statement.
Indirect way of data gathering: Because the City of the Future-study was already going on during the start of this research, it was not possible to make direct observations during the collaborative meetings of teams. The alternative was to request experiences and results through interviews, and to make assumptions based on the official publication. However, these are indirect ways of testing, rather than the direct way of observing. This could lead to bias due to, for example, interpretation differences.
Bias due to socially acceptable answers: Because design research is a well-known method, participants knew the characteristics of design research. Within some of the interview questions, a socially acceptable answer has been given, probably because they expected to give answers about 'how it should be' instead of answers 'how it went in reality'. To minimize this effect, multiple interviewees within a team has been interview (functioning as control-group) and answers are compared to the factual publication.

3.2 SINGLE CASE STUDIES

This chapter consists of four case studies. Each case study begins with an introduction, which refers to a summary of the case in the appendix. Thereafter, the design process will be described by means of the typology and the form of collaboration. Then, the design outcomes will be described, by means of the typology and the level of integration. To conclude, an overview will be given of the identified characteristics of the case studies, in order to study the relation between the setup of the design research and the outcomes. This structure per (single) case study can be found in figure 48.

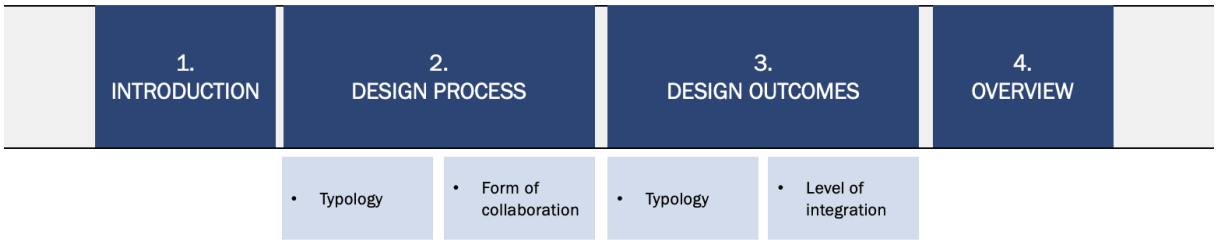


Figure 48: The structure of a single case analysis (own image).

3.2.1 CASE DESCRIBTION 1 - TEAM TRIANGEL

INTRODUCTION

A summary of the outcomes of team Triangel can be found in appendix F.

DESIGN PROCESS

To describe the design process of team Triangel, the way of collaboration and the characteristics of the design process will be elaborated on.

Characteristics of the design process

The design approach consisted of five iterations which each a clear order, namely going through the cycle of the data/policy/design model. Thereby, the process was strongly analytical and little room was left for intuition during the design-stage. The amount of information and the involvement of stakeholders was constantly growing; thus, the team was challenged all the time to deal with the growing complexity. By the use of various instruments (algorithms, Fellenopoly) they succeeded in dealing with complexity, but the translation into a spatial design, also known as the converting phase, was experienced as difficult. This also resulted in the fact that the design is not yet finished during the final presentations; they needed more time to reduce the enormous complexity towards a spatial design. Due to the tight deadlines of City of the Future and expectations for the BNA, a final design had to be made, which many participants didn't support. They didn't value solutions and masterplans, they just wanted to make the real-estate market more transparent and at the same time exploring and developing the potential of data within area-development. So, their focus was clearly problem-oriented. The full analysis of the design process of team Triangel can be found in appendix C.
To summarize, the design process of team Triangel can be described by an iterative, analytical, problem-oriented process where complexity has mainly been increased (figure 49).

TEAM TRIANGEL		**A**	**B**	**C**	**D**	
PHASING	Incremental	Incremental	Mostly incremental	**Mostly iterative**	Iterative	Iterative
CHARACTER OF APPROACH	Analytical	**Strongly analytical**	More analytical than experimental	More experimental than analytical	Strongly experimental	Experimental
HANDLING COMPLEXITY	Reduce	Reducing complexity	More reducing than increasing	More increasing than reducing	**Increasing complexity**	Increase
FOCUS	Problem oriented	**Mostly problem oriented**	More focused to the problem than to a solution	More focused to solutions than to the problem	Mostly solution oriented	Solution oriented

Figure 49: Design process of team Triangel (own image).

Form of collaboration

The form of collaboration will be described by means of the team composition and the process of collaboration.

Team composition - The team is compiled on the basis of four areas: social, economic, cultural and physical (figure 50), which resulted (in the end) in a team consisting of two spatial designers and six non-spatial designers. Although, at the beginning of the research, the team existed of more than 30 team members. During the research, multiple non-spatial designers dropped out the team, where other non-spatial designers joined. The eventual team consisted of spatial designers, as well as non-spatial designers like economists, a philosopher and a historian. One remarkable note is that the respected data miners have not been named in the final publication or presentation, which looks like they are not been acknowledged as final team members in the end.

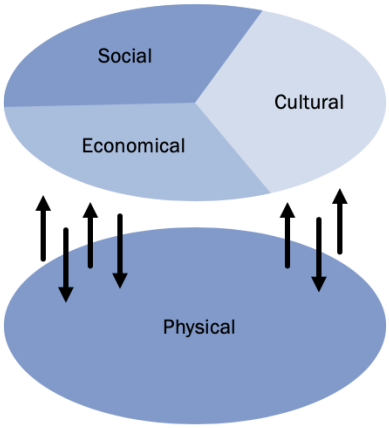


Figure 50: The basis of the team composition of team Triangel (own image).

Process of collaboration - Team Triangel went through a remarkable process, in comparison with other teams. First of all, the spatial designers were definitely not the leading characters. Even the other way around: the system and process-oriented team members were leading the project.
Secondly, they tried to let go their own discipline and looked into the bigger picture with one clear goal: to make the real estate world more transparent. By means of their model of data, policy and design, they integrated multiple interests and functions. Therefore, they worked during three quarters of the project in an interdisciplinary way, even all their conflicts.
Lastly, the project experienced multiple conflicts. One of the conflicts was between the data miners and the urban design office (MUSK). This urban development agency is driven by 'soft' indicators such as people, happiness and process, while the data miners were driven by the 'hard' facts. To quote interviewee II: *"They did not understand each other and went into serious conflicts."* Even though the spatial designers had difficulties with the hard, factual, abstract and technical approach, they were supporting the 'new development' model.
To summarize, the process of collaboration can be described by *an often conflicting but interdisciplinary approach, led by non-spatial designers.*

OUTCOMES

This section consists of two parts. The first part is a general description of the final outcomes of their City of the Future study. The second part is a description about the level of integrality within the outcome, and the last part is about whether the core of the outcomes can be better described as a futuristic detailed masterplan, a pragmatic adaptive framework, or if none of the descriptions is recognizable.

TYPOLOGY OF THE OUTCOMES

Description general outcomes - In appendix F, an overview can be found of a summary of the final outcomes of Team Triangel. In general, team Triangel delivered three main outcomes: a game with the intention to identify and align stakeholders' interests, a design consisting of a water square, and an iterative and adaptive policy and design process, which is shown in figure 51.

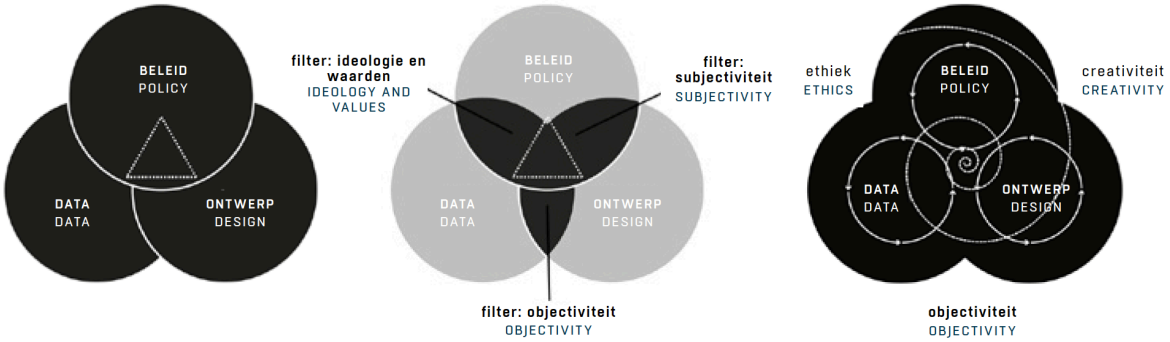


Figure 51: An iterative and adaptive policy and design process (Boer, 2019).

Although these three outcomes can be identified, the team is seeing their approach, the process of data, policy and design, as their main outcome (Interviewee I, II and III, 2019). Even they made a final design (the water square design), the team reject rigid masterplans '*because such a plan can be outdated before they have been agreed upon'* (interviewee I). This result, contrasting with the perspective of the team, can be explained by an intervention from the BNA. During the beginning and the end of the study, the BNA emphasized on the form of the deliverable as a spatial product and/or a spatial plan. According to interviewee II: "*The BNA was not very happy with us, because they wanted a plan. We are not making a plan, because we don't find that interesting,"* and *"in our daily work we are always trying to work towards a final solution, mainly because that's being asked by the client, or because you think that's good for a particular neighborhood, building or area. This time, we had the chance not to do that. To think ahead. I actually find it strange that almost all teams did fell back to their traditional way of working.* The team captain, a spatial designer, was placed in the middle of a conflict between the BNA and his team. Eventually, this team was forced to make a final spatial (master)plan, instead of delivering a new form of deliverable: the 'new development' process or strategy. From this point on, the team fell apart and were not supporting the final outcomes (interviewee II & III).

Description of specific outcomes with regard to a possible contribution to spatial planning policy-making - Three specific outcomes with a certain relation to policy-making has been identified: the use of data, the Fellenopoly game and the design process which combines policy, data and design.
First of all, team Triangel shows the potential of the use of data within the spatial domain, but also the urge. They tried to connect for example data about air quality, the number of inhabitants, mobility streams and underground-characteristics, to identify relationships and to make algorisms. This input has been translated to a spatial adaptive model, as in their turn input for policy-making (discussion material) and design. This use can inspire policymakers, to identify different scenarios with the help of data. In addition, it can also clarify the original tasks. For example, identify conflicts, like wishes with regard to the amount of inhabitants and mobility which can conflict with the quality of the air. Thereby, the eventual demand for housing will be more realistic in relation to existing policies.
Secondly, the Fellenopoly game as an instrument for facilitating citizen participation and other stakeholder involvement within the spatial domain. "The NOVI literally acknowledges the importance of the local scale and citizen participation. There is not yet a suitable instrument to do so, and our outcome is a start." – (Interviewee I, 2019). "With this game, you are working super democratic, because everyone can participate. Eventually, this saves every project 20 to 30K of euros." (Interviewee IV, 2019) Therefore, the game as an instrument is inspiring for policymakers: an example the facilitation of citizen participation. In addition, the game itself as used within the design process can be seen as clarifying, because it will identify and show the conflicts between stakeholders' interests.
Lastly, their strategy which combines policy, data and design can also be contribution to policymakers of spatial planning. The strategy itself is explained above and in appendix F. It clarifies relationships between input material such as spatial characteristics, facts and interests. It can also be inspiring as an innovating approach for area developers.

Allocation of the outcomes - The outcomes of team Triangel can be described as a pragmatic adaptive framework, which is mostly visible in their innovative process. The urge of the use of big-data combined with the facilitation of citizen participation and stakeholder alignment, have been used as the foundation for their design. This substantiation and degree of legitimacy of their design is a clear example of a pragmatic design approach. Also, they focused on making a framework which adapts over time and used scenario's (based on algorithms and data) as a way to gain insights for the future. They discovered possibilities, instead of searching for a single inspirational final image. Thereby, the explicitly reject deliverables as masterplans as mentioned above.
Interviewee II is describing their framework as the metaphor of a printer: *"We are a printer, the system that makes a print. We thought about, how does the machine work, if it works well, you get a good print. With the right way of connecting people, the right way of handling data. The rest of the teams just focused on the print itself."*
The outcomes are all both inspiring as clarifying in nature. The innovative character of the Fellenopoly game or the use of data are substantiating the inspiring character. At the same time, the team shows certain relationships, conflicts and realistic possibilities, which makes it 'clarifying' as well.

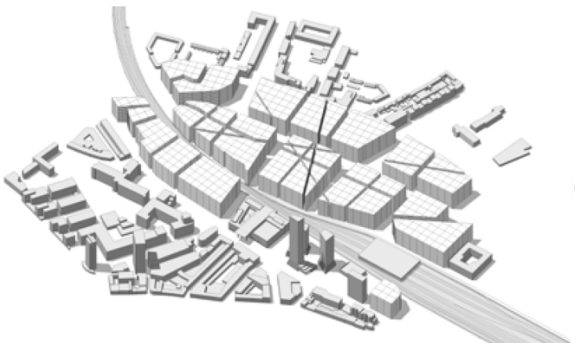
To summarize, the outcomes of team Triangel can be described as a pragmatic framework, which can be served as inspiring as well as clarifying with regard to policy of spatial planning.

SIGNIFICANCE WITH REGARD TO INTEGRALITY

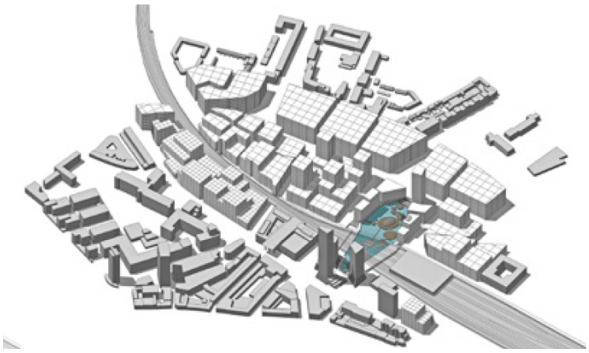
In this section, the outcomes will be assessed to the degree of integrality, with regard to time, scale, stakeholder involvement and function.

Integrality with regard to time - team Triangel did experiment with their framework over time. Their grid can be split up in scenarios' in 2040 (figure 52), within certain boundaries. The factor of uncertainty over time is taken into account as well: building on a site in the fluid grid is subjected to rules that are constantly adjusted by the iterative process of data, policy and design. This allows the city to adapt relatively easily to unforeseen developments within a set of boundaries. Thus, the iterative process of data, policy and design is also contributing to changes over time, although more specifications have not been given.

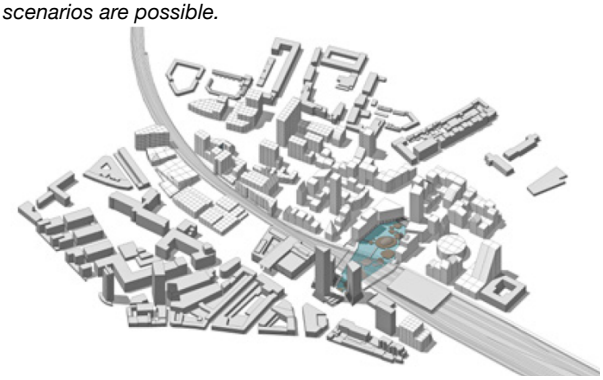
Thus, a single time jump (from 2027 till 2020) has been shown on a high abstract level, in which the single variable of density has been used, but the model itself is made up in a continuous spectrum.



Theoretical starting point: "full grid" as the maximum possible spatial outcome. Depending on trends in the field of property boundaries, demography and policy, various development scenarios are possible.

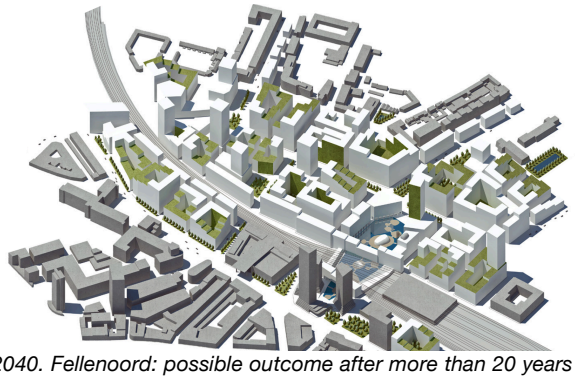


2027: The grid is developed with the 'Agora en suite' as the starting point.



2040: the grid is further developed to a lower density with approximately 5,000 dwellings and facilities.

2040: the grid is further developed to a higher density with approximately 10,000 homes and facilities.



2040. Fellenoord: possible outcome after more than 20 years of planning and building to a density with approximately 15,000 dwellings and associated facilities.

Figure 52: Series of possible spatial developments of the Fellenoord district over the years (Boer, 2019).

Integrality with regard to scale - Although the process of data, policy and design can be used within different scale levels, the final outcomes within the official publication of City of the Future is limited to the local scale, specifically the assigned 1km2. There are no indications that team Triangel have studied other scales.

Integrality with regard to interests of different stakeholders - "Regarding to policy-making, we have to leave the ivory tower, we have to include others!" – (Interviewee I, 2019). The deliverable "Fellenopoly" is an innovative game which facilitates citizen participation and stakeholder involvement. This game aims to align different interests, to set spatial preconditions. Because of the fair of the municipality to include real stakeholders (interviewee II, 2019), team Triangel used role-playing. Though, the game is intended to use real stakeholders. To conclude, the outcomes of team Triangel are strongly considering the integration of different interests of stakeholders. The instrument 'Fellenopoly' has been developed and will facilitate this. Also, a way has been found to connect stakeholder's interests to data and design.

Integrality with regard to function - Both deliverables, the design as well as the process, integrates different functions. Within their process and their game, team Triangel is mentioning explicitly climate, energy, ecology and urbanization as aspects.
Within the design, the water square has multiple functional purposes. First, to connect south and north. Secondly, to use as a public space for, for example, leisure. Third, to function as a water buffer for heat and cold storage and water surplus. Fourth, as an icon for the city of Eindhoven to make the city more famous, which can lead to more tourism or students. Fifth, to use this urban intervention as a driver for surrounding area development, and so on.

Sub-conclusion integrality - To conclude, the process and the game as well as their final design are all integrating multiple functions. Where the process and the game has been imbedded, a part of a bigger whole, the design is on itself a single intervention serving multiple purposes.

LEVEL OF INTEGRALITY REGARDING TO:	NOT IDENTIFIABLE	WEAK IDENTIFIABLE	IDENTIFIABLE	STRONG IDENTIFIABLE
SCALE		-		
INTERESTS				++
TIME		-		
FUNCTIONS			+	

Figure 53: Level of integrality per category for team Triangel (own image).

OVERVIEW CASE 1

To summarize the single analysis of the Triangel-case; the iterative, analytical, problem-oriented, interdisciplinary design-process which mostly increased the level of complexity resulted in a clarifying and inspiring framework, with a high level of integration, as can be seen in figure 54.

TEAM TRIANGEL

PROCESS	
Phasing	Iterative
Character of approach	Analytical
Handling complexity	Increasing
Focus	Problem-oriented
Form of collaboration	Interdisciplinary

OUTCOME	
Typology	Framework
Focus	Clarifying and Inspiring

INTEGRALITY	
Time	-
Scale	-
Interests	++
Function	+
	+

Figure 54: Overview of the single analysis of team Triangel (own image).

3.2.2 CASE DESCRIBTION 2 - TEAM URBAN ARCIPELAGO

INTRODUCTION

A summary of the outcomes of team Urban Arcipelago can be found in Appendix F.

DESIGN PROCESS

To describe the design process of team Urban Arcipelago, the way of collaboration and the characteristics of the design process will be elaborated on.

Characteristics of the design process

In the beginning of their project, they defined context-specific priorities: mobility and landscape. These priorities were leading for their design process, because the first made choices within these disciplines, which enabled the process around water. When choices were made with regard to water, it was the turn of the built environment. Little to no feedback loops have taken place, which means that no adjustments or improvements have been made after having chosen their solutions.
Also, designers used experiences and intuition to make their design choices, which indicates an experimental character. However, their main priority, mobility, have been elaborated and analyzed with numbers and facts as well. Thereby, the focus was mostly on problem-solving instead of problem-clarifying. One exception can be made: the non-spatial designers, the engineers, focused on the problem of the sewage, and tried to map the urgency of this matter. The spatial designers were more focused on mapping directions of solutions for the future. The total analysis of the process, substantiated by interviews and the publication, can be found in Appendix C.

TEAM URBAN ARCIPELAGO		A	B	C	D	
PHASING	Incremental	**Incremental**	Mostly incremental	Mostly iterative	Iterative	Iterative
CHARACTER OF APPROACH	Analytical	Strongly analytical	More analytical than experimental	**More experimental than analytical**	Strongly experimental	Experimental
HANDLING COMPLEXITY	Reduce	Reducing complexity	**More reducing than increasing**	More increasing than reducing	Increasing complexity	Increase
FOCUS	Problem oriented	Mostly problem oriented	More focused to the problem than to a solution	**More focused to solutions than to the problem**	Mostly solution oriented	Solution oriented

Figure 55: Design process of team Urban Archipelago (own image).

Form of collaboration

The form of collaboration will be described by means of the team composition and the process of collaboration.

Team composition - The team knew each other on beforehand: they performed studies like *Snelweg x Stad* and *Licht Verdicht*. Reasons to participate to City of the Future were 'simply, because we enjoyed it' (Interviewee IV).

Process of collaboration – "We are a team in which there is almost never conflict, we prevented conflicts" – Interviewee IV. In the beginning, they all started with bringing ideas from their own field (interviewee IV), which was a relatively short phase. Then, the mobility-expert took a more responsible role and designed the infrastructure and mobility related aspects. When he defined the conditions for the design with regard to mobility, the disciplines from green and water were able to, on their turn,

make their conditions. Subsequently, conditions had been set for the building environment. In the end, the spatial designers tried to combine all the elements in a design in the last couple of weeks.
Team members were used on the basis of their specialty. Although, instead of designing their own discipline, they were also allowed to participate in other disciplines.
"It was a process in which each discipline is taken into consideration by the others. But there are phases where one disciplines had more power in discussion, and then it can be rebalanced right after. At some point we were discussing bigger plans, as long as afterwards we managed to come back to a plan more realistic, more controllable and more integral." - Interviewee IV.
In practice this turned out differently, for example the participation with regard to mobility. There was one point that other disciplines suggest bigger and diverging ideas for the mobility discipline. Eventually, the mobility-expert rejected their input based on his experiences: I'm the expert of mobility, let me decide. '*These ideas will cost 4 billion euros, that we are not going to do. While, if you limit the complexity a bit in the front of the project, you will get an agreement more rapidly.'* – Interviewee V. He also stated: "I was the one responsible for the mobility concept. It was up to the others to further fill that space that was then created by mobility." As point of improvement, the team captain stated *'to try to take more time to work really together in the same space. There were meetings of course, but most of the work was done separately.'*

Another interesting point is the level of involvement of three non-spatial designers. One non-spatial designer has been involved within the theme of water. Another non-spatial designer stated, 'my role was mainly in the background', and the third non-spatial designer was also not able to contribute. According to interviewee IV, 'There are people that especially have a more theoretical background, that can bring a lot of theory, but we don't manage to integrate that into the design because it was too abstract or maybe not synchronized with the timing.' Hence, in general, the role of non-spatial designers has contributed little.

To summarize, spatial designers were used on the basis of their own discipline and had own responsibilities. As a result, the power of a fresh view with regard to a multidisciplinary collaboration was negated. Looking over one's own knowledge, methodologists and experiences was aspired, and attempts has been made, but have not been implemented in practice. The collaboration can be characterized as multidisciplinary. Therefore, the process of collaboration can be described by *a multidisciplinary approach, led by spatial designers.*

OUTCOMES

This section consists of two parts. The first part is a general description of the final outcomes of their City of the Future study. The second part is a description about the level of integrality within the outcome, and the last part is about whether the core of the outcomes can be better described as a futuristic detailed masterplan, a pragmatic adaptive framework, or if none of the descriptions is recognizable.

TYPOLOGY OF THE OUTCOMES

Description general outcomes - In appendix F, an overview can be found of a summary of the final outcomes of team Urban Arcipelago. In general, team Arcipelago has focused on solving the mobility issues.

The team therefore devised various connections under the tracks and an extra strip along the railway, where space is made for, for example, a cycle path. In the future a light rail line can be installed which connects Fellenoord, Berenkuil and the airport, and which may one day be part of a ring through the entire city (Interviewee VI).
Thereby, they clarified the sewage problem, which could be a major issue for area-development, and brought solutions like decentral sewage systems.

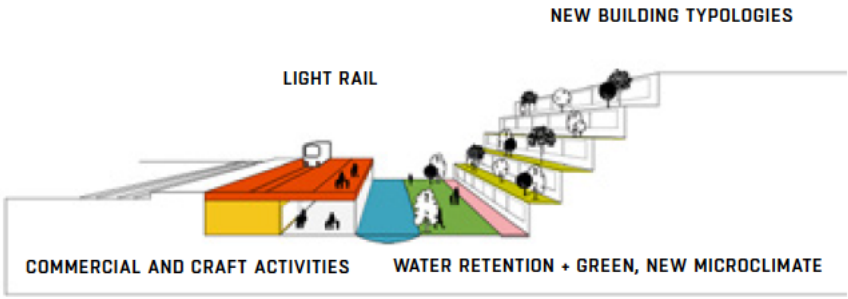


Figure 56: New area-development consisting of water, green, buildings and infrastructure (Boer, 2019)

Description of specific outcomes with regard to a possible contribution to spatial planning policy-making - Three specific outcomes can possibly contribute to spatial planning policy-making. First of all, the analysis concerning the sewage in Eindhoven, is a clear example of 'problem clarification'. According to interviewee VII, "If you have not thought about how to handle the sewage as an obstacle in advance, you will encounter a problem in a later stage. Then is becomes a show-stopper for area developers." An analysis has been made about the capacity of the current system, where the main obstacle was 'peak rain'. In this case, the issue has been clarified not by just quitting at 'the sewage is an obstacle for spatial development', but, the capacity factor of the sewage due to peak rain is an obstacle for spatial development. Therefore, a more suitable solution can be proposed. In this case, the (policy-oriented) solution of local disconnection of the sewage at events of peak rain. Additionally, an extra mobility strip is used, not only to upgrade the space along the railway but also to take factors like time and uncertainties into account.
Thereby, the team shows that 'mobility' can be a leader in supporting other transitions and problems. For example, their plan connects mobility and economy by facilitating shops below the extra mobility strip and thereby creating an extra shopping street.
In general, the team gives high abstract problems a tangible content, and tries to inspire others by showing spatial possibilities.

Allocation of the outcomes - Even if the team is constantly emphasizing the importance of setting boundaries instead of solutions (They are options, you don't have to choose them, - Interviewee VII), in my interpretation that is not worked out that well. Splitting up a bus station in three locations, try to solve the sewerage by means of local policies, or make a '14m strip' are all single-sided solutions with a certain level of detail, which go beyond 'just giving direction'. Therefore, the outcomes of team Urban Arcipelago will be considered as a detailed 'masterplan', more than 'strategy'. Also, the outcomes will not be considered as an average or high value of integration, due to the lack of stakeholder involvement and function-combinations.

To summarize, the outcomes of team Urban Arcipelago can be described as a detailed masterplan, which can be served as inspiring in the context-specific area of Eindhoven.

SIGNIFICANCE WITH REGARD TO INTEGRALITY
In this section, the outcomes will be assessed to the degree of integrality, with regard to time, scale, stakeholder involvement and function.

Integrality with regard to time - First of all, the team begins with mentioning the importance of time in their plan: *"The transition plan defines long-term strategies and allows gradual implementation, ensuring that the plan can grow. ..Time is an important element in designing the city of the future"* (Boer, 2019). One spatial example with regard to time is the 14-m-wide mobility strip which is reserved over time. At different moments in time this strip will accommodate either a sidewalk/bicycle path or bus lane or a 'people mover'/light rail line. According to interviewee IV, *"a place where you could start having bikes, and in the future busses or autonomic vehicles, or a light rail to the airport."* In this way, there will be dealt with the uncertainties of mobility in the future. The moments in time have not been defined.
Another example which is implicitly mentioned is the use of 'green and blue' by creating conditions to eventually create conditions for a second center of Eindhoven. Even this can be seen as designing with regard to the future, further explanation is lacking, and time jumps have not been made.

Also, they mention the importance of starting right now: making a plan based on what we have now, the problems and potentials of the site, how can we can immediately start with something. (Interviewee IV, 2019). Interviewee V is stating that this plan can be rolled out in 10 years, and is not futuristic in nature. So, this design is typically a contemporary design which tries to adapt to the future in prospect. Hence, an attempt has been made to integrate the plan over time. However, this attempt is primary focused on mobility interventions, where only a few discrete time jumps have been made.

Integrality with regard to scale - The team starts with the ambition to make Fellenoord an international hub, and a hub of importance to the city and various tech and educational campuses. One of the interventions they made was linking the light rail line to the existing bus lines in a smart way to create a robust public transport loop that connects various scales (local, regional, international), which makes Fellenoord a spider in the Brainport City web to facilitate meetings and to transfer knowledge. This intervention was made on an urban scale. However, interviewee IV states *"That was definitely behind and beyond the scope, outside of the Fellenoord."* Although this statement has been made, the 'ring' is still presented in the final publication. Another example is Fellenoord as green connector. Analyses have shown that Fellenoord could be the opportunity to connect different green areas to connect the regional scale. Hence, multiple scale levels have been linked due to explicit use of mobility interventions and the use of green.

Integrality with regard to interests of different stakeholders - The team has not involved different stakeholders. Interviewee V explains this as that the place was not suitable enough. You have to go to other places, where you bring up issues much earlier. That could be a post-war neighborhood in Rotterdam-South or in Transvaal. Then, local residents are more involved. In contrast to interviewee VI, which mentioned that there were some team members who said that "We can work that out, but we also need to talk to people to know what they are really up to." So, the awareness was there, but they did not go through with it.

Integrality with regard to function - With regard to integrality over function, the team has chosen to pick two dominant themes and link them to other themes (Boer, 2019; Interviewee IV and V). These themes are mobility and climate adaptation, mainly because mobility claims the most space. "*If you first figure out the mobility issue, you create space for other spatial interventions."* (Interviewee V, 2019). Also, they reason that "*If you deal with everything at the same time, you might develop everything in an average way. If you deal with one topic and the others are attached to it, that topic can bring the project much further" (interviewee IV).*
Due to the great dominance of mobility, greenery and water, it is difficult to discover other functions. They themselves also acknowledge that synergy could be stronger and that, for example, a theme such as health did not play a role (Interviewee V). The team is typically using the principle of linking (koppelen). Even they tried to combine elements, the level of integration is almost not visible: issues and themes are still being designed side by side, which can be seen in figure 57.

Figure 57: Combined with shops, greenery and water, the mobility strip creates the conditions for a second center area north of the station (Boer, 2019).

Sub-conclusion integrality - As can be seen in appendix G, the level of integrality over interest and function is lacking, but an attempt has been made to integrate the design with regard to scale and time.

LEVEL OF INTEGRALITY REGARDING TO:	NOT IDENTIFIABLE	WEAK IDENTIFIABLE	IDENTIFIABLE	STRONG IDENTIFIABLE
SCALE			+	
INTERESTS	--			
TIME			+	
FUNCTIONS		-		

Figure 58: Level of integrality per category for team Urban Arcipelago (own image).

OVERVIEW CASE 2

To summarize the single analysis of the Urban Arcipelago-case; a incremental, experimental, solution oriented, multidisciplinary design-process which mostly reduces the level of complexity, resulting in a inspiring masterplan, which a low level of integration, as can be seen in figure 59.

TEAM URBAN ARCIPELAGO

PROCESS		OUTCOME		INTEGRALITY	
Phasing	Incremental	**Typology**	Masterplan	**Time**	+
Character of approach	Experimental			**Scale**	+
Handling complexity	Reducing	**Focus**	Inspiring	**Interests**	--
Focus	Solution-oriented			**Function**	-
Form of collaboration	Multidisciplinary				**-**

Figure 59: Overview of the single analysis of team Urban Arcipelago (own image).

3.2.3 CASE DESCRIBTION 3 - TEAM SOCIOTECHNICAL CITY

INTRODUCTION

A summary of the outcomes of team Sociotechnical City can be found in Appendix F.

DESIGN PROCESS

To describe the design process of team Sociotechnical City, the way of collaboration and the characteristics of the design process will be elaborated on.

Characteristics of the design process

The design process can be described as a clear and structured incremental process, which have gone through the phases of ideation, testing, defining and working out. Major feedback loops haven't been identified. Because a single urban design agency was leading the project, their experimental approach was visible through the project. 'There is no justification for how a solution or direction was chosen, it was simply chosen on the basis of intuition, experience and 'eureka moments', and those decisions were tried to substantiate by facts and numbers.' Therefore, the process can be defined as 'more experimental than analytical'. Thereby, the process was strongly focused on the final design(s) in the end: strong solution-oriented. They (interviewee IX) literally said, "the problem was not that visible" and "you had to go to a point at the end". This also resulted in a strong focus on reducing complexity: only information that contributes to the solution was involved.
The full analysis of the design process of team Sociotechnical City can be found in appendix C.
To summarize, the design process of team Sociotechnical City can be described by an incremental, experimental, solution-oriented process where complexity has mainly been reduced.

TEAM SOCIOTECHNICAL CITY		**A**	**B**	**C**	**D**	
PHASING	Incremental	Incremental	**Mostly incremental**	Mostly iterative	Iterative	Iterative
CHARACTER OF APPROACH	Analytical	Strongly analytical	More analytical than experimental	**More experimental than analytical**	Strongly experimental	Experimental
HANDLING COMPLEXITY	Reduce	**Reducing complexity**	More reducing than increasing	More increasing than reducing	Increasing complexity	Increase
FOCUS	Problem oriented	Problem oriented	More focused to the problem than to a solution	More focused to solutions than to the problem	**Solution oriented**	Solution oriented

Figure 60: Design process of team Sociotechnical city (own image).

Form of collaboration

The form of collaboration will be described by means of the team composition and the process of collaboration.

Team composition – The team Sociotechnical city consisted of 12 architects and urban designers from UNStudio, and 5 other companies which are specialized in landscape, energy, circularity, climate adaptation and technical innovations. They were selected on the basis of their specialism, where most of them knew each other on beforehand.

Process of collaboration - The way in which the team is composed, is also visible within the process. The spatial designers prevailed, where other participants were mainly used as an 'expert' function to provide input, but not to design. This is also visible in the following quotes: "this expert is about climate adaptation, he doesn't have much to say about energy (interviewee IX)', or 'then I specifically consulted that expert (interviewee VIII)'. According to a non-spatial designer, the leading agency said; 'it will be look like this, can you add something to that from your expertise?'. Thus, the spatial designers acted as integrators. In this collaboration, each expert contributed their own discipline-specific part of the project, non-spatial designers were not being responsible to design elements because spatial designers were the leading and responsible party, and little to no interactions between experts took place, this form of collaboration is considered as multidisciplinary.

OUTCOMES

This section consists of two parts. The first part is a general description of the final outcomes of their City of the Future study. The second part is a description about the level of integrality within the outcome, and the last part is about whether the core of the outcomes can be better described as a futuristic detailed masterplan, a pragmatic adaptive framework, or if none of the descriptions is recognizable.

TYPOLOGY OF THE OUTCOMES

Description general outcomes - The outcomes of team Sociotechnical City can be described by means of three kind of so-called 'gate-ways'. A gateway is a physical architectural intervention that offers a practical solution for each technical problem, and it also forms an attractive symbol for the theme at hand. The three gateways are the Energy Cathedral (figure 61), the Biopolis (figure 62) and a gateway for water. Details of these outcomes can be found in appendix F.

Figure 61: Gateway I, the Energy Cathedral (Boer, 2019).

Figure 62: Gateway II, the Biopolis (Boer, 2019).

Description of specific outcomes with regard to a possible contribution to spatial planning policy-making. - Sociotechnical City has multiple added values, what can be used within policy-making.
First of all, they showed the value of hybrid building types. These buildings of the city of the future contribute to water buffering and biodiversity as independent ecosystems. Functions such as living, working, recreation and production are increasingly intertwined at the scale of the building. The hybrids are also the city's new icons, for example 'transition cathedrals' or water squares (Boer, 2019).
Secondly, these independent ecosystems also contribute to the possibility of making areas with a high density self-sufficient and independent by introducing decentralized energy and/or water supply.
In addition, they themselves acknowledge that redefining the problem has become "not so visible." (interviewee IX, 2019). Generally seen, this team contributed namely to national policy-making by translating high abstract tasks into a tangible masterplan. They have inspired others and have been innovating with regard to the hybrid buildings.

Allocation of the outcomes - According to interviewee VIII, they developed ‘a generic masterplan, in which the picture is telling the whole story.’ Also, ‘they have designed the image very explicitly to make it tangible’ (interviewee IX). Thereby, they described their plan as futuristic, but in a way that is able to happen (Interviewee VIII). Also, within the publication they explicitly tell ‘It is a blueprint that can be implemented in other places as well.’ Therefore, their outcomes can be summarized as masterplans, which can be served as inspiring and innovating.

SIGNIFICANCE WITH REGARD TO INTEGRALITY

As mentioned in section 2.3.3, integrated design will be described with regard to time, scale, stakeholder involvement and function.

Integrality with regard to time - First of all, the team put their point in time beyond 2050, and designed at that point a generic masterplan. An explanation of the development towards this point is missing, except for the gradual growth into a city center by the new urban top layer and greenery. Instead of characterizing the integration over time as rewinding or fast forwarding, this is mainly one point in time. Thereby, the extent to which uncertainties are mentioned or have taken into account is little. Only one sentence explains the awareness of uncertainties: ‘although the hyperloop station is still in the future, it can become a reality in the city of the future, as soon as the time and technology are ready (Boer, 2019).’ This uncertainty has been taken into account as ‘in our design we assume that it will come’. No other possibility is worked out. Hence, little to no integration with regard to time has been done; it is primarily one point in time without thinking in scenarios.

Integrality with regard to scale - The analyses of the team show that the 1km2 van the Hague is suitable for connecting the city with international locations. Not only through the use of mobility (a hyperloop station to make the area a Metropolitan super hub), but also as an innovation hub. The team also designed many contact points at different levels – from shared living rooms to new breeding grounds – which improves the quality of encounters (Boer, 2019).
Apart from establishing relationships with other scales, attempts have also been made to make the 1km2 more independent to certain large-scale systems outside the city. Also, 16 maps have been used in the final publication to communicate their findings, while all of them just shows the 1km2. Some other images have been used to zoom in on the 1km2 map, but zooming out is not been applied.

Integrality with regard to interests of different stakeholders - As guiding theme, the team used ‘the sociotechnical city’, which means the interface between social and technology. According to Interviewee IX, the social aspect is not a particularly strong feature in the final design. ‘We could have shed more light on the social side, but due to money and time we were unable to do so.’ The social aspect was mainly translated into the creation of meeting places, and no stakeholders have been consulted or involved (Interviewee IX). In addition, the team did not have a participant with a social background (interviewee IX).

Integrality with regard to function - Team Socio-Technical City decided to solve as many as possible of the challenges that are relevant to today’s major transition issues – energy, circularity, mobility, climate adaptation/water management and food production – on the local scale (Boer, 2019). The way in which the team tries to do so, is to add a hierarchy to the project with regard to the various transitions. "*We separate integrality. By designating one player as dominant, it becomes the leader in the process. Without such a leading position, no one feels ownership of the process and nobody starts pulling it.*" – states the team captain of Sociotechnical City (BNA, 2018). According to interviewee IX, ‘*this decoupling of integration can be explained by the fact that the final design consists of one biopolis, one energy cathedral, another way to deal with climate adaptation, again another way to help ecology. All this expertise has been pulled apart, while if you have integrated, you would have one story.”*
A counter argument can be given as well: the team shows that an energy cathedral built over a geothermal well can also function as a bridge, house companies and invite encounter in a tropical greenhouse. Thereby connects the team different elements to each other, like the accelerating urbanization and the quality of life, how mobility junctions can function as a space for technical solutions, or how the biopolis is working together with the energy cathedral. Still, it can be seen as a form of ‘linking’ instead of integrating, because each time a single theme is leading for the interventions: the contributions are not 'equivalent' to all functions. For example, 'living and encounter’ are linked to

the energy transition. To conclude, even the final design is facilitating multiple transitions, is has been done in single sub designs and are therefore single solutions 'linked' to bycatches.

Sub-conclusion integrality - As can be seen in the overall assessment of the level of integrality (figure 63), this project cannot be used as a strong example of an integrated design. It is, however, a clear example of a futuristic detailed plan instead of a framework. It is inspiring and innovative, because of the clear directions of solutions with regard to transitions like the circular economy and sustainable energy.

LEVEL OF INTEGRALITY REGARDING TO:	NOT IDENTIFIABLE	WEAK IDENTIFIABLE	IDENTIFIABLE	STRONG IDENTIFIABLE
SCALE		-		
INTERESTS	--			
TIME	--			
FUNCTIONS			+	

Figure 63: Level of integrality per category for team Sociotechnical City (own image).

OVERVIEW CASE 3

To summarize the single analysis of the Sociotechnical City-case; an incremental, experimental, solution oriented, multidisciplinary design-process, which mostly reduced the level of complexity, resulting in an inspiring masterplan, which a low level of integration, as can be seen in figure 64.

TEAM TRIANGEL					
PROCESS		**OUTCOME**		**INTEGRALITY**	
Phasing	Incremental	**Typology**	Framework	**Time**	--
Character of approach	Experimental			**Scale**	-
Handling complexity	Reducing	**Focus**	Inspiring	**Interests**	--
Focus	Solution-oriented			**Function**	+
Form of collaboration	Multidisciplinary				**-**

Figure 64: overview of the single analysis of team Sociotechnical City (own image).

3.2.4 CASE DESCRIBTION 4 - TEAM ALL INCLUSIVE CITY

INTRODUCTION

A summary of the outcomes of team All Inclusive City can be found in Appendix F.

DESIGN PROCESS

To describe the design process of team All Inclusive city, the way of collaboration and the characteristics of the design process will be elaborated on.

Characteristics of the design process

The design approach consisted of an organic collaborative design-process. First of all, multiple feedback loops have been implemented. For example, topics as the urban density, or the forbidden train station have been discussed multiple times, which lead to multiple adjustments and improvements. Thereby, there was no clear on beforehand design-plan, which resulted it an organic process. Sub teams designed sub-parts of the design, and in the collective meetings it all came together, where new research questions were set up by all participants. Therefore, this organic process with feedback loops is an example of an iterative design process.

According to the interviewers, the design process was more experimental than analytical in nature, because they were 'quite ideological, by means of experiments and intuition.' At the same time, they also used facts and data to clarify the problem. Also, the team was in the beginning not afraid for complexity: they didn't limit their selves by costs (interviewee XI), and big complex ideas like a hyperloop station located in the North Sea and relocating train stations came up. However, that was just in the very beginning, because in later phases, they have been guided by realistic and feasible designs, under the influence of the municipality (interviewee X).

Lastly, they were more focused on the problem itself that to a solution. For example, they argued that the future housing-demand in the Hague of the government was impossible to cover in low-rise areas, because that would take too much space. At the same time, they showed that this housing-demand within central urban areas, will result in extreme rents. This will have the consequence that only the upper-class is able to live there, which does not match the housing-demand. Hereby, they clarified the problem. Also, they used fictional role play to really understand the demand within the area. Hence, the team was more problem-oriented than solution oriented.

The full analysis of the design process of team All Inclusive City can be found in appendix F.

To summarize, the design process of team All Inclusive City can be described by an iterative, experimental, problem-oriented process where complexity has mainly been reduced (figure 65).

TEAM ALL INLCUSIVE CITY		**A**	**B**	**C**	**D**	
PHASING	Incremental	Incremental	Mostly incremental	Mostly iterative	**Iterative**	Iterative
CHARACTER OF APPROACH	Analytical	Strongly analytical	More analytical than experimental	**More experimental than analytical**	Strongly experimental	Experimental
HANDLING COMPLEXITY	Reduce	Reducing complexity	**More reducing than increasing**	More increasing than reducing	Increasing complexity	Increase
FOCUS	Problem oriented	Mostly problem oriented	**More focused to the problem than to a solution**	More focused to solutions than to the problem	Mostly solution oriented	Solution oriented

Figure 65: Design process of team All inclusive city (own image).

Form of collaboration

The form of collaboration will be described by means of the team composition and the process of collaboration.

Team composition - The team composition within this team is a remarkable story. They begin with the idea to make a traditional masterplan. As interviewee X said: we selected persons who were good in designing public space, who were good in designing mobility, energy, etc. As a wildcard they involved

an artist, to have a new perspective as well. However, along the way, they experienced the importance of the social side, and the drive to design an excellent process instead of that traditional masterplan. Also, along the way, they started to value multidisciplinarity. To quote interviewee XI: '*At one point, our artist said, I have been thinking and, we can easily make a city of the future, but what will happen there? We can design buildings, but with all the transitions maybe there just older people who can't pay their bills anymore. And then we saw the light: this project isn't a urban challenge, it is a huge social transition."* From that point on, the team wanted to design the transition itself, the process, and a livable area. Not 'just' an urban design'.
Therefore, this team is begun with the mindset of having a tradition set up, and along the way they changed their course into designing a process instead of a masterplan, in which the role of the non-spatial designers became more important.

The way of collaboration – To begin with a statement of interviewee X*: 'Within a traditional process, the architect or urban planner takes the lead and the rest is functioning as advisors. Then it becomes a plan of our own architectural office, with a couple of advisors who only provided input. This was just not the case in this project'.* And, interviewee XI says: *"If everyone designs from their own discipline, then it does not lead to the City of the Future but to a number of independent studies of parts of that city."* These quotes show that the awareness of working interdisciplinary instead of multidisciplinary was there. So, they worked differently this time: they worked within subgroups which were rotating, and came together with the whole team, which ratio of meetings were quite equal. According to interviewee XII, that it was important 'that you hear each other's arguments, take each other's knowledge and respond to it from your field or your knowledge and experience.' Thereby, making each discussion a collaborative thing. In this way, it differs form case 2 and 3, and it can be defined as interdisciplinary.
In addition, interviewee XII tells that it is a fairly harmonious process in which there were no conflicts, that there were no communication barriers that allowed them to understand each other well, and that there were no dominating parties.
To summarize, team All Inclusive City had a harmonious form of interdisciplinary collaboration, where no dominating parties were involved.

OUTCOMES

This section consists of two parts. The first part is a general description of the final outcomes of their City of the Future study. The second part is a description about the level of integrality within the outcome, and the last part is about whether the core of the outcomes can be better described as a futuristic detailed masterplan, a pragmatic adaptive framework, or if none of the descriptions is recognizable.

Typology of the outcomes

Description general outcomes - In appendix F, an overview can be found of a summary of the final outcomes of Team All Inclusive City. In general, team All Inclusive City came up with vertical neighborhoods: high rise buildings with many different functions. Green and water were priorities, and at the same time extreme urban densities have been met. Also, these vertical neighborhoods consisted of public levels, where the identity of neighborhoods can be met. In addition, the vertical city is located above train-tracks. Among other inclusions like circular economy and renewable energies, this all can be found in figure 66.

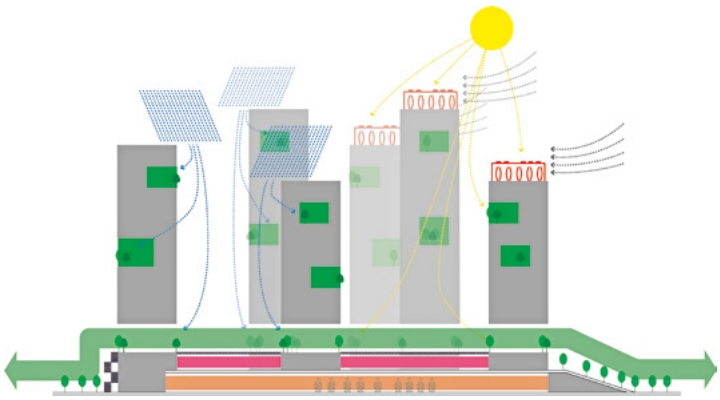


Figure 66: A stack of functions; the vertical neighborhood (Boer, 2019).

Besides the vertical neighborhood, they turned the ‘schenkviaduct’ into a ‘Ponte Vecchio’ for self-construction with a maximum construction weight per plot. In this way, local initiatives are encouraged, in which social ownership is growing. In this Ponte Vecchio, the ground floor comprises studios and businesses (manufacturing industry) and people live on the upper floors.

Figure 67: The Schenkviaduct as a Ponte Vecchio, as a social capacitor in the heart of the CID (Boer, 2019).

Description of specific outcomes with regard to a possible contribution to spatial planning policy-making - Team All Inclusive City has multiple added values, what can be used within policy-making. First of all, City 1.0 and City 2.0: the approach of starting with the existing before you can come up with something new, (Interviewee XI, 2019) and at the same time starting with ambitions and aligning that with the present. Secondly, junctions such as stations and other public hubs are ideal places for function mixing and integration (Interviewee X, 2019). Third, the spatial translation of participation and that it is the residents' first turn (Schedeviaduct), as the point of the shared city as a challenge. In the future the realization of urban infra-structure and high-quality public facilities will still require a public investment program. The public side of city making and steering towards social inclusion remain high on the agenda. Public-private coalitions are necessary for implementation, but the government cannot be dismissed from its helmsmanship (Boer, 2019). Lastly, they clarified the problem: when the municipality actually wants to realize 18,000 homes in this area, the area will become the most densely populated area in Eastern Europe. At the same time, if you want to realize this 18,000 outside the city, you need too much km2, which you don't have. So, within the city, but the question is whether the municipality thinks this density is desirable at all (BNA, 2019; interviewee X, 2019).
All these means are both functioning as inspiring, as well as clarifying. Therefore, Team All Inclusive city has the role to inspire and clarify, at the same time.

Allocation of the outcomes - This outcome lacks details and solutions but is a clear example of a pragmatic framework. It is re-defining the problem: the demand of housing in this area is too high, but a lower (but still high) density can go hand in hand with a high quality of life. Directions for the future has been given: high-rise as a basis for many functions, in which public levels are included as well (vertical cities). Thereby, as discussed within the form of collaboration, they changed course from the goal of having a masterplan to the goal of making a transition (process-based). Therefore, their outcomes can be summarized as pragmatic frameworks, which can be served as inspiring as well as clarifying with regard to policy of spatial planning.

Significance with regard to integrality
As mentioned in section 2.3.3, an integral design will be described with regard to time, scale, stakeholder involvement and function.

Integrality with regard to time - Within the outcomes of team All Inclusive City, both the rewind-approach as the fast-forward approach has been used. The whole story of the outcome is process-oriented through the whole timeline. This story consists of elements like '..can start with..' 'From there,..', 'Next,..'' "subsequently, .." and process-oriented statements such as *'early construction of this hub is crucial to bring about a cultural change in mobility thinking among residents from the outset' and 'The program also has to be able to adapt to changes in time and (continue to) have room for a variety of users.'* These statements indicated the awareness of uncertainties and to make the design able to adapt to the future. Thereby, the present and the future are being connected: '*by creating a new entrance, the existing dwellings and public cultural functions will be better connected to the changing environment'.*
Hence, this outcome is an example for an integrated design with regard to time.

Integrality with regard to scale - Furthermore, the team is also integrating with regard to scale. They try to connect local households to buildings as systems, and at the same time they are looking at the meaning of the Central innovation district at a global scale (Boer, 2019). These connections have been made explicitly but also implicitly. For example, the open floors as 'living rooms' to connect households, the hyperloop and stations for connections with other countries and continents, but also by stimulating connections between knowledge institutes and the new manufacturing industry in the district. Thereby, this area will be able to connect even better to the existing internationally oriented economy of the city (Boer, 2019). Hence, spatial interventions have been made to connect these scales,

Integrality with regard to interests of different stakeholders - The plan is based on a social approach, where the public space was leading. By means of a fictive roleplay, three 'Hagenezen' have been identified and formed a starting point for their design. These roles eventually were used through the entire process, from start to finish, and multiple choices were made based on these roles.
Also, a sociologist was a member of the team, whose added value was more than recognized by the other team members. "It was very useful to have people on the team who are good storytellers and writers " – Interviewee XII

Integrality with regard to function - Also, the team has achieved a high degree of integrality across functions. For example, they used the height of buildings to live, work and relax, where greenery, energy, water, mobility and other functions all come together. In figure 68, sections has been given where the use of water, wind, transport, residential construction, and energy has been integrated in a single framework. Also, they showed how the urban acceleration can go together with a high quality of life. For example, due to the multiple raised ground levels. Apart from the growing housing market, no dominant function can be designated, what makes it an integrated whole.

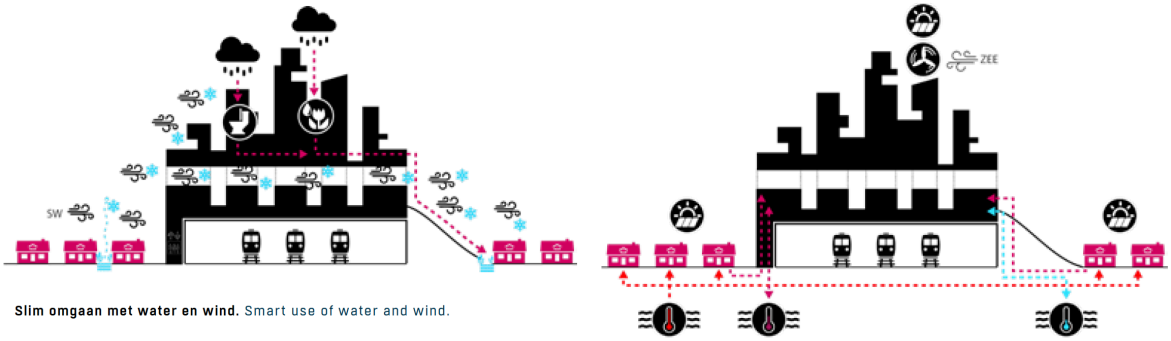


Figure 68: The integrations of multiple functions is a single framework (Boer, 2019).

Sub-conclusion integrality - To conclude, the demand reached a remarkable high level of integrality. This is possibly due to their form of collaboration. The total assessment can be found in appendix G, but is summarized in figure 69.

LEVEL OF INTEGRALITY REGARDING TO:	NOT IDENTIFIABLE	WEAK IDENTIFIABLE	IDENTIFIABLE	STRONG IDENTIFIABLE
SCALE				++
INTERESTS			+	
TIME				++
FUNCTIONS			+	

Figure 69: Level of integrality per category for team All Inclusive City (own image).

OVERVIEW CASE 4

To summarize the single analysis of the All Inclusive City-case; an iterative, experimental, problem-oriented, interdisciplinary design-process which mostly reduced the level of complexity resulted in a clarifying and inspiring framework, with a high level of integration, as can be seen in figure 70.

TEAM ALL INCLUSIVE CITY					
PROCESS		**OUTCOME**		**INTEGRALITY**	
Phasing	Iterative	**Typology**	Framework	**Time**	++
Character of approach	Experimental			**Scale**	++
Handling complexity	Reducing	**Focus**	Clarifying and Inspiring	**Interests**	+
Focus	Problem-oriented			**Function**	+
Form of collaboration	Interdisciplinary				**+/++**

Figure 70: Overview of the single analysis of team All Inclusive City (own image).

3.3 CROSS ANALYSIS

After having established the characteristics of each individual case study, a cross analysis is describe the common findings. First, the individual analyses of the case studies are merged, and overall findings are given. This is first described per part (outcome, process, integrality). Then, an analysis between the parts is given. Then, an elaboration of the findings will be given.

3.3.1 OVERVIEWS PER RESEARCH COMPONENT

This section merges the individual analyses with regard to the outcomes, processes and the level of integrality. Per part, a cross analysis describes observations and findings. In order to specify the effectiveness of design research for policy-making, the distinction between outcomes and roles are studied first, before looking at how they are established within the design process. That is why the outcomes of the case study are first considered within this cross analysis.

DESIGN OUTCOMES

The results of the outcomes and their role, as explained in the previous chapter, of the single analyzes are combined in figure 71.

ROLE	OUTCOME: MASTERPLAN	OUTCOME: FRAMEWORK
INSPIRING	SOCIO TECHNICAL CITY, URBAN ARCIPELAGO	-
CLARIFYING	-	-
INSPIRING & CLARIFYING	-	ALL INCLUSIVE CITY, TRIANGEL
NON	-	-

Figure 71: Overview outcomes and their role of the case studies (own image).

This figure shows that, according to the hypothesis, differences can indeed be identified between outcomes and their roles. Although all four cases can be interpreted as inspiring and clarifying, there are characteristics that the masterplans are mainly serving as inspiring material, where frameworks are having both characteristics to inspire and to clarify. Hence, the difference with the hypothesis is that, there is not one that inspires and the other that clarifies, because the clarifying design research also have the characteristics to inspire.

To continue testing the hypothesis, the following terms are now used: possible type 1 and possible type 2, according to figure 72.

INSPIRING MASTERPLAN	*INSPIRING AND CLARIFYING FRAMEWORKS*
Possible type 1	**Possible type 2**

Figure 72: Type 1 and type 2 of design research (own image).

DESIGN PROCESSES

When analyzing how these two outcomes are established, according to the overview of the properties of the design process, two components stand out. First of all, in figure 73 a distinction can be made between the properties of the spatial design approach and the engineering approach with the colors blue and green. Due to the diversity of properties within the hypothetical typologies of design research, the assignment of different design processes per type cannot be achieved by means of the different design approaches. This is contrary to the hypothesis as well.

	POSSIBLE TYPE 1		POSSIBLE TYPE 2	
	SOCIO TECHNICAL CITY	**URBAN ARCIPELAGO**	**TRIANGEL**	**ALL INCLUSIVE CITY**
PHASING	More incremental	Incremental	More iterative	More iterative
CHARACTER OF APPROACH	More experimental than analytical	More experimental than analytical	Strongly analytical	More experimental than analytical
HANDLING COMPLEXITY	Reducing complexity	More reduced than increased	Increasing complexity	More reduced than increased
FOCUS	Solution-oriented	More solution-oriented than problem-oriented	Problem oriented	More problem-oriented to the problem than to a solution
		Engineering approach		***Spatial design approach***

Figure 73: Properties of the design process, in relation to the two types of design research, according to the distinction of Voorendt (own image).

A second observation is that another strong common factor can be identified. The teams from possible design research types, have similar properties with regard to the design process (figure 74). Type 1 has an incremental, more experimental, solution-oriented and complexity-reducing approach. This is contrary to type 2, which is more iterative and problem-oriented in nature (figure 74).

It can therefore be concluded that **a different design process is used within the two typologies**, except that this cannot be attributed to the type of design approaches from Voorendt.

	POSSIBLE TYPE 1		POSSIBLE TYPE 2	
	SOCIO TECHNICAL CITY	**URBAN ARCIPELAGO**	**TRIANGEL**	**ALL INCLUSIVE CITY**
PHASING	More incremental	Incremental	More iterative	More iterative
CHARACTER OF APPROACH	More experimental than analytical	More experimental than analytical	Strongly analytical	More experimental than analytical
HANDLING COMPLEXITY	Reducing complexity	More reduced than increased	Increasing complexity	More reduced than increased
FOCUS	Solution-oriented	More solution-oriented than problem-oriented	Problem oriented	More problem-oriented to the problem than to a solution

Figure 74: Different design approaches per design-typology (own image).

Forms of collaboration:
When analyzing the manner of collaboration, a clear observation can also be made. Here, it can be concluded that within these case studies, **the collaboration of design research type 1 is multidisciplinary in nature, with the collaboration of design research type 2 being interdisciplinary in nature.**

	POSSIBLE TYPE 1		POSSIBLE TYPE 2	
	SOCIO TECHNICAL CITY	URBAN ARCIPELAGO	TRIANGEL	ALL INCLUSIVE CITY
MULTIDISCIPLINAIR	x	x		
INTERDISCIPLINAIR			x	x

Figure 75: Two forms of collaboration, in relation to the two types of design research (own image).

The difference in design processes can relate to the difference between forms of collaboration. In particular the intermediate form of All Inclusive city. The composition of the All-Inclusive city team is more similar to the type 1-teams in terms of the ratio of spatial and non-spatial designers and the selection of participants. However, at the start of the study, All Inclusive city made a change of course to steer towards a more interdisciplinary and more integrated approach, which may have created the mix of both design processes.

LEVEL OF INTEGRALITY

In the final analysis of the level of integrality in relation to the two types of design research, the typologies are differing further. Here, the design-typologies are plotted to the level of integrality of one of the four features. This can be seen in Figure 76.

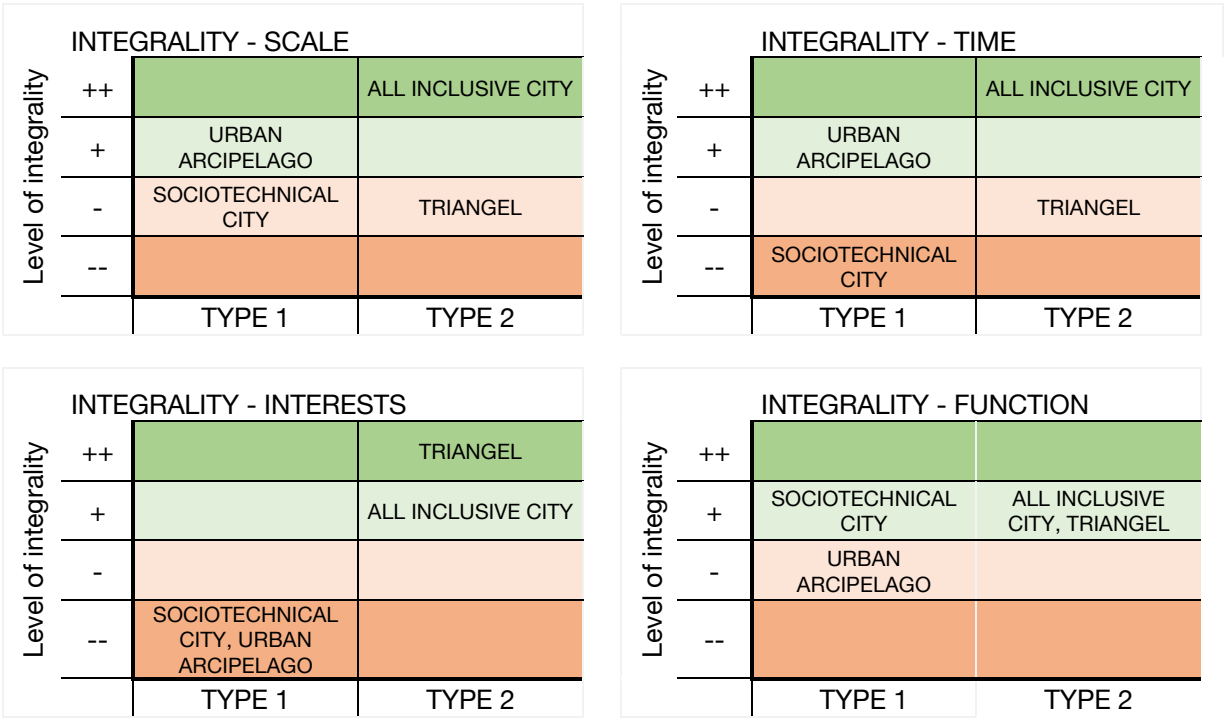


Figure 76: The four features of integrality, in relation to the two types of design research (own image).

When the four features are combined, a general statement can be made within this case study. However, it has been pointed out from theory that this is not reliable. The weight of, for example, integration with regard to functions outweighs other elements. Further research needs to be done to find a suitable relationship, but in this research, two scenarios are worked out in Figure 77. The first table shows the degree of integrality in which the four elements with the same weight are combined. The second table recognizes a larger contribution (50%) from the feature of function. Both extremes result in a clear observation: **type two results in a higher degree of integrality than type 1.**

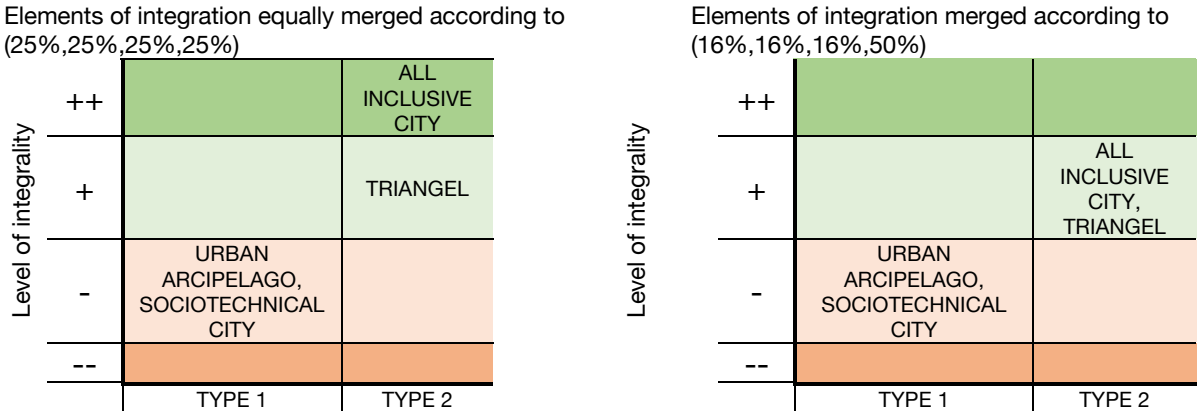


Figure 77: The level of integrality in relation to the two types of design research (own image).

3.3.2 TYPOLOGIES OF DESIGN RESEARCH

After each individual analysis has been combined per subject, this section looks at the mutual coherence, in relation to the hypothesis. First of all, Figure 78 shows an overview of the results of the case studies. Urban Arcipelago team & Sociotechnical city team have the same results on all subjects. This is also the case with Team Triangel and All Inclusive City, but the design processes differ. When the results are compared with the hypothesis, **it can be observed that two typologies of design research can indeed be distinguished.**

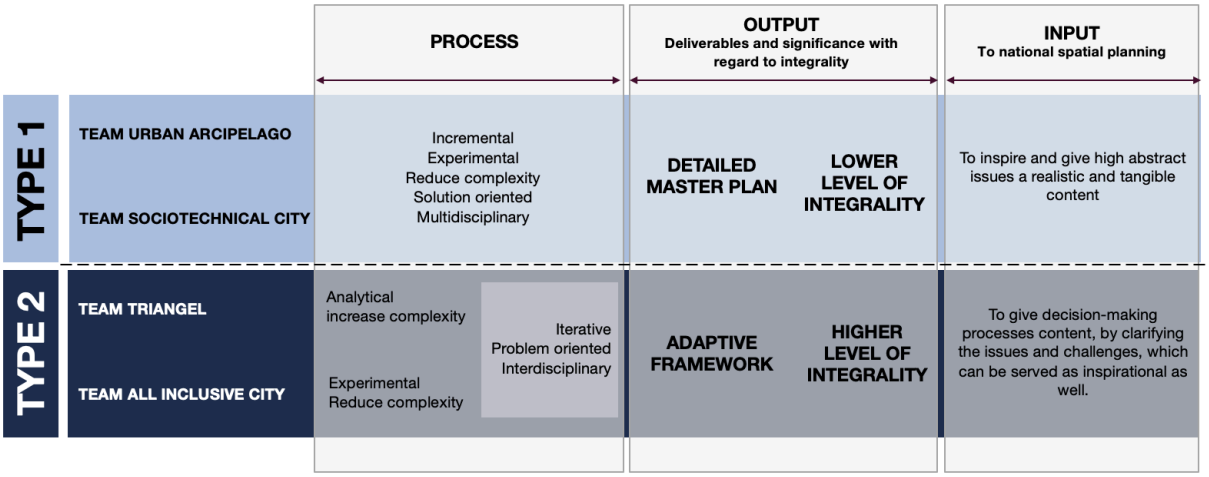


Figure 78: Overview of the properties of the case studies (own image).

When the results are compared with the hypothesis, it can be observed that two typologies of design research can indeed be distinguished.

However, there are also two differences:

A) It was expected that the design processes would differ based on characteristics from the engineering design approach and the spatial design approach. However, this is not the case, as explained in the section of design processes. However, the core of the hypothesis has been validated: both forms indeed have different design processes.
B) The second difference concerns the significance for policy. It was expected that one form would focus primarily on inspiration, while the second would focus on clarification. However, it emerges from the case studies that the second form not only clarifying, but also contains characteristics to an inspiring role.

CONTRIBUTION TO INTGRALITY

After the two different forms of design research have been established, one more step further can be made: to analyze which parts of the design process actually contribute to achieving a higher degree of integrality. This analysis can be found in appendix G, an example of which is given in Figure 79. Three observations will be explained in this section. However, a reading guide to this analysis will be explained first.

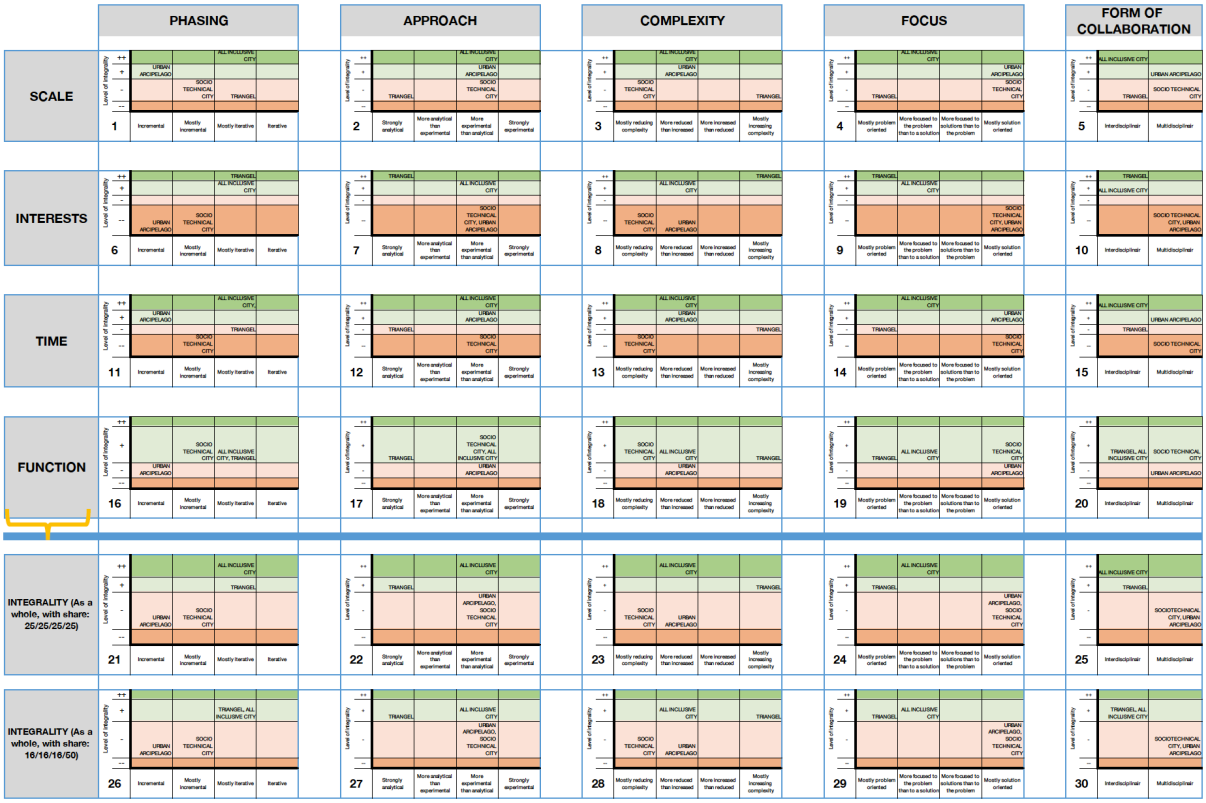


Figure 79: Example of appendix H (own image).

First of all, in this analysis the 5 characteristics of the design process are plotted against the 4 features of integrality. This results in 5 * 4 = 20 tables (table #1 to 20). For each table the scale of process characteristics is plotted against the degree of integrality, whereby teams are placed within the tables, as can be seen in figure 80.

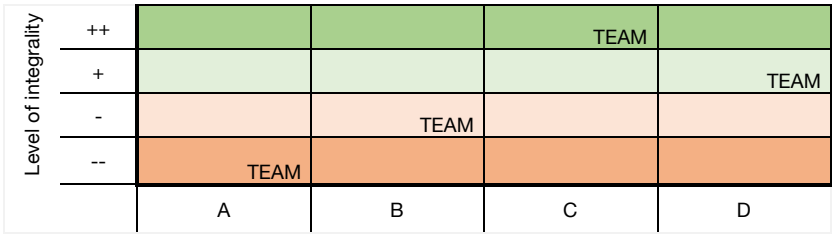


Figure 80: Explanation of the process/integrality analysis (own image).

Within the theory about integrality in Chapter 2.3.3, it has been explained that the total degree of integrality is a combination of the four features scale, time, interests and function. However, the ratio between the weighting between these four features is unknown. That is why this analysis is based on two extremely realistic scenarios, whereby within features 1 the features are weighted equally, so each has a 25% share on the overall integrality. And where within scenario 2, the features are not weighed equally. Section 2.3.3 explained that the weighting of integrality across function is probably more important than the other features, so the ratio of 16% for the other features and 50% of the features was used. Scenario 1 results in tables 21-25, and scenario 2 results in tables 26-30.
In the end there is negligible difference in outcomes within the two scenarios.

In the following section, three observations will be discussed, based on tables 21, 24 and 25. These tables correspond to tables 26, 29 and 30 in terms of outcomes.

OBSERVATION 1:

The first observation is about the relationship between the phases within the design process and the degree of integration. Figure 81 shows that the teams with a more iterative process have achieved a higher degree of integrality. This implies that an iterative process contributes to a higher degree of integrality.

Level of integrality				
++			ALL INCLUSIVE CITY	
+			TRIANGEL	
-	URBAN ARCIPELAGO	SOCIO TECHNICAL CITY		
--				
21	Incremental	Mostly incremental	Mostly iterative	Iterative

Figure 81: Level of integrality in relation to the characteristic of phasing (own image).

OBSERVATION 2:

The second observation is about the relationship of the focus within the design process versus the level of integrality. Here you can see that the problem-oriented teams have achieved a higher degree of integrality. This implies that a problem-oriented approach results in a higher degree of integrality.

Level of integrality				
++		ALL INCLUSIVE CITY		
+	TRIANGEL			
-				URBAN ARCIPELAGO, SOCIO TECHNICAL CITY
--				
24	Mostly problem oriented	More focused to the problem than to a solution	More focused to solutions than to the problem	Mostly solution oriented

Figure 82: Level of integrality in relation to the focus of the design process (own image).

OBSERVATION 3:

The third observation is about the way of collaboration versus the degree of integrality. Figure 83 shows that the teams with an interdisciplinary collaboration have achieved a higher degree of integrality. This implies that an interdisciplinary collaboration form results in a higher degree of integrality.
This difference can relate to the observation that the teams with a multidisciplinary way of working had a clear breakdown structure of tasks, with a dominant role to the spatial designers; both resulting in an independent learning curve during the project. This in contrast to the teams with an interdisciplinary way of working, which were having a dependent and therefore integral learning curve during the project.

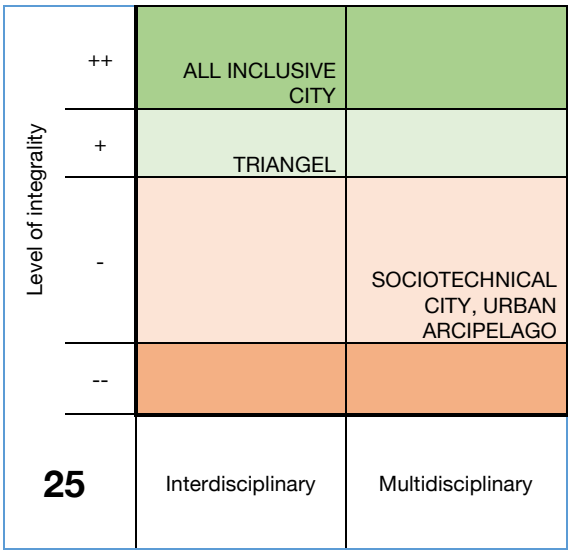


Figure 83: Level of integrality in relation to the form of collaboration (own image).

To conclude, the cross analysis of this empirical study shows that an iterative, problem-oriented and interdisciplinary approach leads to a higher degree of integrality within their outcomes.

DEFINING THE TWO TYPES OF DESIGN RESEARCH

As noted, two typologies of design research can indeed be distinguished. This section will deal with the naming of both typologies, including the considerations.

- First of all, it all started with the theory of the division of the engineering design approach and the spatial design approach. However, this assignment cannot be made because the characteristics within the design process differ too much. Therefore, this does not suit.

- The second method, also from the hypothesis, is to name the typologies as inspiring design-based research (iDBR) and clarifying design-based research (cDBR). However, it has been shown that certainly the cDBR form also has the same inspiring characteristics. So to put the emphasis on the roles, the overlap between the roles is ignored. Therefore, this does not suit as well.

- The third possible method is to name the two forms based on their composition. The second method is strongly characterized by interdisciplinary collaboration. A possible appointment can therefore be design-based research collaboration (DBRC), whereby the first classic form can simply be called design-based research (DBR). However, this form ignores the most important characteristics, such as problem-oriented, clarifying, frameworks and an iterative nature. This form is therefore too generalistic, and does not suit as well.

The trade-off that can be made, without generalizing, is the fact that the first type of design research takes ‘design’ as a given, and does so in an research-based way. This type focusses on to inspire. The second type of design research takes the research element as given, and does so in a designerly way. This type focusses on to clarify. This results in the nuance difference between the design-type and research-type. Both terms are not new, but the definition, meaning and thus the difference has been clarified through this research.

It has to be said that, it was precisely within the theory-oriented research, that it was found that a fragmentation of definitions about "design research" had a confusing and, above all, not clarifying effect. Therefore, prior to the assignment, it has not been preferable to introduce a new term. This argumentation suits the appointment of the design-type and the research type as well.

3.3.3 RELATIONSHIP OF THE DIFFERENT TYPES AND DUTCH SPATIAL PLANNING POLICY

Apart from the fact that the research-type leads to a higher degree of integrality within spatial planning, it is certainly not possible to draw the conclusion that the research-type is always more effective than the design-type for spatial planning policy-making. This depends on the intention of commissioning a design research. First of all, two perspectives of this request are given, after which it is examined what type of design research can fit for what type of request.

The NOVI and the associated Regional Agendas are both elaborated on within Chapter 2.1. The difference between Regional Agendas and the NOVI is, among other things, the level of scale: national versus regional. This results in a different objective. The NOVI focuses on drawing up a directional strategic spatial vision at a national level, in which it is setting a framework for, for example, the implementation of Regional agendas. The Regional Agendas have the focus to formulate a context-specific executive plan, bounded by the framework of the NOVI. In other words, the NOVI sets frameworks for making choices within a context-specific situation, for example within the Regional agendas.

In order to map those frameworks (which are therefore not yet defined), those frames must first be identified. In addition, to make the bandwidth of choices visible, it is necessary to move back and forth between scale levels to investigate what is desirable. The smaller the scale level (local), the more concrete the challenges becomes. The higher the scale level (national / European), the more abstract the challenge is. Although there must simultaneously be moved through scales in order to analyze, abstract frameworks must first be created before concrete choices can be made. It is therefore important to first do clarifying research, to which inspiring research can contribute. With regional agendas this is the other way around: the main objective is to be able to have the strategy landed within the region in concrete terms, whereby clarifying research can supplement to. The focus of these scales differs: the NOVI needs in-depth research, where inspiring research can contribute, and where the regional agendas need inspiring research, to which in-depth research can contribute.

With this in mind, a relationship can be established to the type of research. Due to its characteristics, the research-type can be more effective for the NOVI, whereby the design-type can supplement to. In addition, the design-type can be more effective for regional agendas, where the research-type can supplement to. Ideally, both forms are applied, with the focus (in terms of time and intensity) being on one form or another, since both forms make a different contribution to policy-making.

The difference in use of the design-type or the research-type therefore lies in the nature of the request. When an assignment is further defined, such as where frameworks have already been set and the context is known, a design-type approach is appropriate. If these are still undefined, a research-type approach is appropriate (figure 84).
However, it is extremely difficult to recognize an undefined task and its importance. Therefore, the clarifying research-type suits the cyclical spatial planning system and the (new) facilitating role of the government, and advocates for the continuous use of exploratory and clarifying design research.

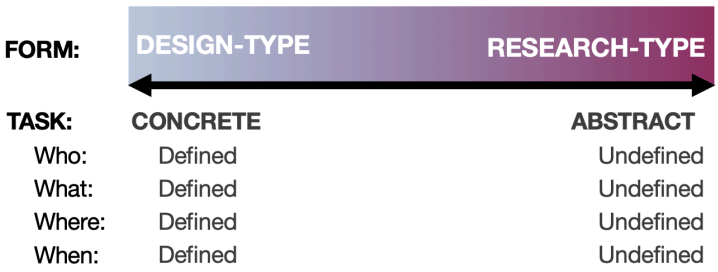


Figure 84: The use of design research is context-specific (own image).

This 'definability' of the task is reminiscent of the classification for wicked and tame problems. However, a defined task within spatial planning can still be classified as wicked, because, for example, there is still a unique problem, there are no unequivocal answers, and they are still 'one-shot' operations. The conclusion therefore remains that a wicked problem can best be tackled by the combination between the research-type and the design-type.

3.4 SUMMARY PRACTICE-ORIENTED RESEARCH

Within the case studies, the hypothesis of this research was tested, in which it was expected that design research consists of two different forms. The case studies show that there are indeed two clearly distinguishable forms of design research, each with a different design process, different outcomes, a different role for policy-making, and also each with a different degree of significance for national spatial planning policy. The two different types are called the inspiring design-type and the clarifying research-type.

The first type, the inspiring design type, can be characterized by an incremental, experimental, solution-oriented, multidisciplinary process that is focused on reducing complexity. This form delivers a detailed masterplan in order to inspire and give high abstract issues and realistic and tangible content.
The second type, the clarifying research-type, can be characterized by an iterative, problem-oriented and interdisciplinary design process, which delivers an adaptive framework to give desicion-making processes content by claryfying the issues and challenges and the same time inspires as well.
These results are summarized in figure 85.

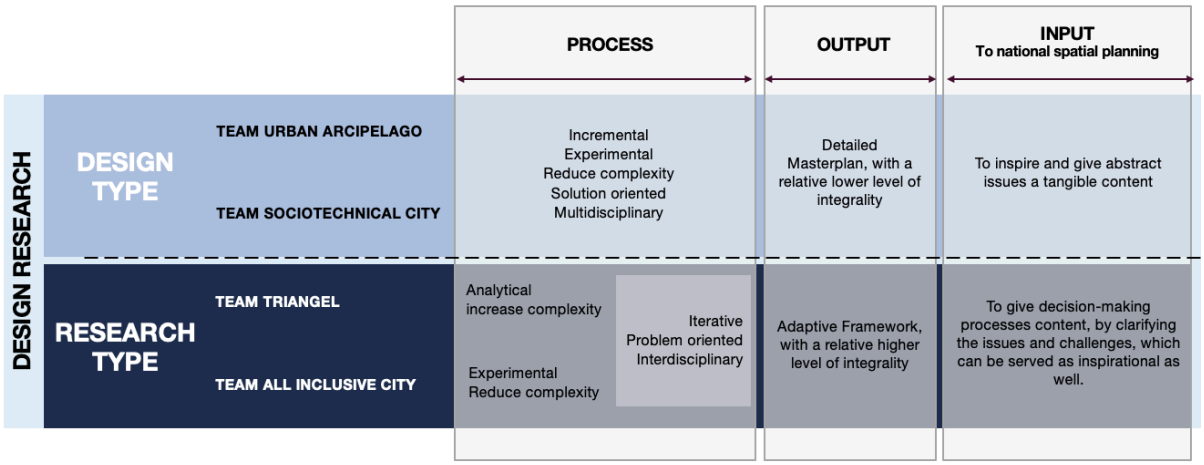


Figure 85: Summary of the results of the case studies (own image).

The next step is to identify which design method is contributing to a higher degree of integrality, in order to conclude which method is more significant for national spatial planning policy. Within these case studies, it emerged that the research-type, results in a higher degree of integrality than the design type. In particular, an iterative, problem-oriented interdisciplinary approach leads to a higher degree of integrality.

4. Conclusion

4. CONCLUSION

In this research, an effective application of design research for national spatial planning policy has been analyzed. This chapter consists of the conclusions for answering the research question as introduced in chapter 1: *How can design research be used more effectively for national spatial planning policy?*

1. The Dutch national spatial planning system is increasingly dealing with complex 'wicked' integral challenges.

The challenges of the Dutch national spatial planning system become increasingly complex. They reach more and more through sectors, scales and various interests (figure 38). Within this thesis, these challenges are referred to as multilayered spatial challenges or integral challenges. These challenges call for more collaboration between different governments, departments, and society, which has consequences for the overall Dutch spatial planning system: the sectoral, top-down and systematic approach in which every square meter is planned, does not suit the complexity of these challenges anymore. To tackle these challenges more effectively, a change is requested towards a holistic adaptive approach using a strong collaboration. In the Netherlands this is also known as a multi-level governance. Here, the role of the national government will change from a leading role to a coordinating role. The demand for this new approach has been addressed by the transition to a new spatial planning system, by means of the new Environmental and Planning Act. This Act consists of multiple instruments, including the development of a national spatial long-term strategy: the NOVI. The NOVI is also dealing with integral challenges. Hence, one of the current key challenges within the Dutch national spatial planning system is dealing with integral challenges.

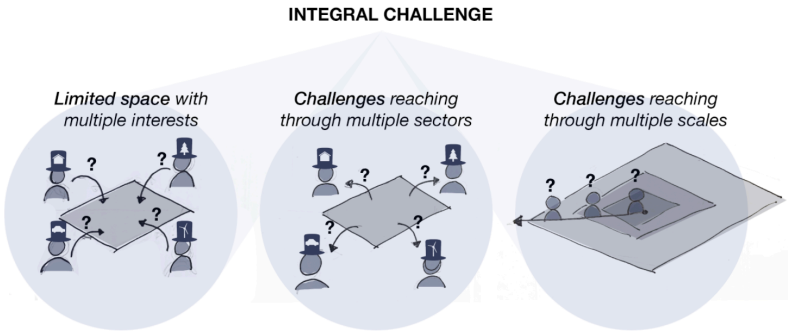


Figure 86: Explanation of multi-layered spatial challenges (own image).

2. Design research can address 'wicked' multi-layered spatial challenges

Theorists define these integral challenges as wicked. They argue that the traditional 'scientific way of problem-solving', using the deductive or inductive forms of reasoning, does not suit. Therefore, an alternative is needed. The alternative approach applies the 'designerly way of problem-solving', which can be applied in many ways. This is reflected, for example, by the variety of design processes.

One of the applications that is often mentioned in literature for solving wicked (social) challenges within policy-making is design research. The positive contribution of design research for spatial planning policy can be summarized as *connecting*, *inspiring*, *integrating*, *clarifying* and *innovating*.

As mentioned, integrality is one of the key challenges for the Dutch spatial planning system, while integration is, at the same time, a fundamental role of design research. Therefore, it can be concluded that the significance of design research for national spatial planning policy lies in facilitating the achievement of integrality, by means of connecting and clarifying in an inspiring and innovative way.

As discussed, the challenges of the national spatial planning policy are inherently wicked, which can be approached by the designerly way of thinking, especially using design research. Over the last decades, design research has already been applied within Dutch policy-making. However, because of the increasing complexity within spatial challenges and the transition towards a more adaptive, cyclical, multi-governance system, design research will become increasingly important.

3. Design research consists of two forms, with each another design process, outcome, and function

The question remains how design research can be used (more) effectively within national spatial planning policies, despite the variation in requirements put forward by policymakers.

This graduation study, consisting of four case studies, showed that design research has two types: the design-type and the research-type, each with a different design process, different outcomes, and also each with a different contribution for national spatial planning policy.

The design-type is characterized by an incremental, experimental, solution-oriented process, in which the complexity has been reduced. The collaboration is multidisciplinary in nature and is led by spatial designers. The

outcomes are characterized as masterplans. Here, the combination between a solution-oriented process and a detailed masterplan are indicators for the focus on an inspiring contribution. The research-type is characterized by a different process, which is more iterative and problem-oriented in nature. The collaboration is characterized by an interdisciplinary approach, whereby the non-spatial designers also have a sense of responsibility. The outcomes are illustrated as frameworks. These guiding frameworks are provided in combination with a problem-oriented approach argue for a clarifying focus. These results are summarized in figure 87.

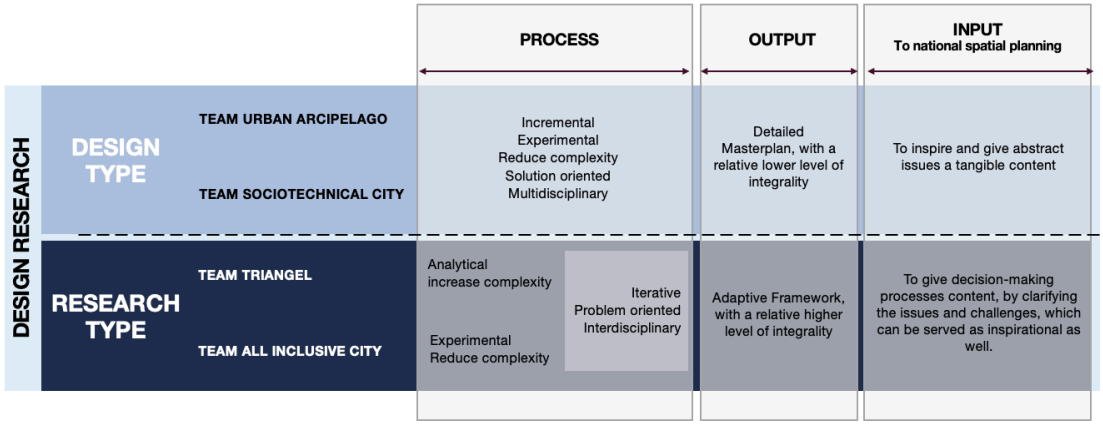


Figure 87: Summary of the results of the case studies (own image).

This research shows that an iterative, problem-focused and interdisciplinary way of working leads to a higher level of integrality. These characteristics all suit the research-type of design research. Therefore, the case studies with the research-type approach reach higher levels of integrality than the case studies with a design-type approach (figure 88). Here, integrality is defined by means of four features: integrality with regard to scale, time, function and interests.

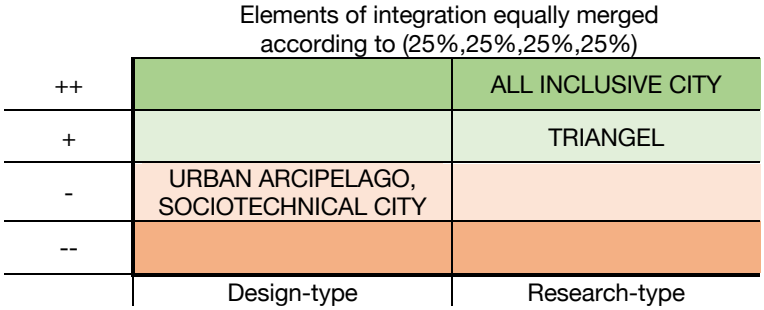


Figure 88: The case studies with a research-type approach reach higher levels of integrality than the case studies with a design type approach (own image).

Apart from the observation that the research-type leads to a higher degree of integrality, it is not possible to draw the conclusion that the research-type is in every case more effective than the design-type for spatial planning policy-making. This depends on the intention of commissioning a design research.
Ideally, both forms are applied, with the focus (in terms of time and intensity) on one form or the other, because each form has a different contribution to policy-making. When an assignment is rather concrete, more focus should be on the design-type, whereas a more abstract assignment, demands more focus on the research-type. For Dutch spatial planning policy, this could mean the following. Because the NOVI creates frameworks at a high level, the clarifying research-type is initially more effective, to which the inspiring design-type can contribute. Because the Regional Agendas makes context-specific concrete choices, the inspiring design-type is more effective at first, to which clarifying research-type can contribute.
However, it is difficult to initiate the research-type of design research as a policymaker concerning an undefined and abstract task. However, this clarifying research-type suits the intended cyclical and adaptive character of the Dutch spatial planning system and the (new) facilitating role of the national government, and advocates for the continuous use of exploratory and clarifying design research.

To conclude, because of the increasing complexity within spatial challenges and the transition towards a more adaptive and collaborative approach, design research will become increasingly important within national spatial planning policy-making. Design research can be used more effectively within national spatial planning policy-making, if the appropriate form of design research is used that fits to the nature of the request.

5. Discussion

5. DISCUSSION

This chapter consists of two sections. First, recommendations are given for further scientific research. Second, recommendations and implications are given about the use of design research.

5.1 RECOMMENDATIONS FOR SCIENCE

MEASURING INTEGRALITY

During this study, it was observed that integrality is often used as a catch-all term and used in all kind of situations. However, as explained in this study, there is a difference between linking (koppelen) and integrating, whereby the degree of integrality differs. Integration is often used as positive, instead of negative. However, in some situations the way of linking may be more applicable than the way of integrating.
The second point is related to the fact that people often state that they have been working "for years" in an integral way. This may be true, but often a specific part of integration is meant. Such as that designers have been using a function mix within their buildings for years. However, if this statement is compared with the Katwijk parking garage, in which construction, nature and functions are actually integrated, as opposed to a single stack of functions within buildings, there is a big difference between the degrees of integration. As demonstrated in this study, not only function integration is part of integration, but also scale, time and interests.
That is why more research is needed to actually make the definition of integrality uniform and complete. In addition to the definition, more research is also needed to get a better picture of the relationships between the features. As mentioned, function integration has a larger share in the definition of "integral design" than, for example, scale integration. A quantitative ratio is not appropriate for this qualitative concept, but in order to ultimately make integrality measurable, it is necessary to provide insight into the weight of the features within the total concept of integrality.
Another possibility would be to search for measurability in the monetary savings of an integral project compared to the multiple individual projects.

TOWARDS A GENERAL STATEMENT OF THE DIVISION OF DESIGN RESEARCH

Because of the limitations of this graduation project, the validation of the hypothesis is only tested on four case studies, which are afterwards be queried. To make a general statement about the division of design research into the two types, more (in quantity) research is needed.
For this addition research, it is recommended to change some characteristics of the research set up. First of all, direct observations besides afterwards second-hand interviews can improve the reliability of results, and with that reliability of the outcome, especially with regard to the design process. Secondly, the case studies are assessed on the basis of explicit examples from interviews and the final publication of City of the Future. Therefore, it could be that some integrality features are taken into account in the designs, but that they are not been explicitly shown or mentioned. Therefore, this is not included in the assessment. This can be improved by validating the completeness by interviewing more team members, or to be more involved in their design-process.

ABDUCTION

Due to the limitations of this research, it only involved deduction, induction and abduction. However, research has been done about the different forms of abduction, for example by Cross. He suggests two forms of abduction, in which one defines frameworks. It is possible that his theory can be combined with the theory of the two forms of design research. More research is needed to identify this relationship.

5.2 RECOMMENDATIONS FOR POLICY

This thesis reveals the added value of applying design research for national spatial planning policy, by means of its connecting, inspiring, integrating, clarifying and innovating character. It elaborates on both the urgency of avoiding the scientific-based approach for wicked societal problems and the potential of design research. As a result, the study recommends to increase the use of design research for national spatial planning policy-making – however, a specific approach should be followed.

To inform spatial planning policy, a particular approach for applying design research is required. As demonstrated by the interviews, the main incentive of design research initiators (like the BNA, the *Deltametropool* association & the Ministry of the Interior and Kingdom Relations) is to be inspired and surprised, and to innovate. Naturally, the application of design research is therefore focused on the application of the *inspiring design-type* of design research*,* which has been successful in the past.

Nonetheless, the existence and potential of the *clarifying research-type* of design research is hardly acknowledged. This appears to be a blind spot of both initiators (such as policy makers at the NOVI) and spatial designers at the example the City of the Future-study. Design research goes beyond the creation of compelling images. **I strongly recommend to consciously add the research-type to the overall application of design research for policy-making, because of its potential to clarify.** This potential is demonstrated by the following contemporary examples from practice:

1. *SPATIAL EXPLORATION*
   The NOVI remains challenged regarding the lack of knowledge of future development objectives, like ‘health’. Living in a healthy environment is undoubtedly a widely supported future vision, but how the issue of health ‘lands’ in spatial terms remains unclear. Certain elements of health such as 'greenery' and 'bicycle cities' are named, but the necessary space claim (how many m2 of green space is needed for an X number of inhabitants to live 'healthily'?) or the link between creating healthy spaces and the actual use of people is missing. This is also the case with ‘circular economy’. The Netherlands wants to develop a circular economy, but how does that translate in spatial terms? Storage is needed for a circular economy, because supply and demand do not connect seamlessly: how much space do they require, what will storage places look like, and how does this connect to mobility and renewable energy? For these thematic objectives, the research-type can argue substantively why certain spatial policy measures have to be applied where to facilitate desirable development, instead of merely showing possibilities. Hence, in contrast to the inspiring design-type, the clarifying research-type is able to tackle these challenges using clear argumentation in combination with spatial design.

2. *STAKEHOLDER INVOLVEMENT*
   Citizen participation, interdepartmental collaboration, and collaboration between different governments seems to be facilitated by the clarifying research-type. This is demonstrated by the fact that the case studies classified as the research-type all involved stakeholders, as compared to the design-type cases (which had little to no stakeholder involvement). Although all interviewees are aware of the potential of design research for stakeholder involvement, in practice it does not happen. This can likely be explained by traditional design practice, where the initiator and designer make their own decisions and stakeholder involvement is considered as complex, disruptive, time-consuming, and more expensive. As a result, the designer is not familiar with her/his potential role as a ‘social integrator’. Fictitious role plays are often used to identify the interests of stakeholders instead. With such an approach, the designer can make misinterpretations because this method relies on personal interpretation (consciously or unconsciously) that may result in bias. In today's society, collaboration has become a goal in itself through the growth in demand for actual participation and inclusiveness in particular. Hence, there is an urgency for designers move beyond the ‘constructible city’ towards the ‘livable city for and by citizens’, which can be facilitated properly with the research-type.

3. INTERDISCIPLINARY COLLABORATION
   Where the design-type uses multidisciplinary collaboration, the research-type applies interdisciplinary collaboration. As explained in this thesis, interdisciplinarity goes beyond multidisciplinarity and has many advantages. For City of the Future, major differences in collaboration can be observed. In a number of teams, spatial designers led the work, where non-spatial designers were occasionally consulted as experts, resulting in monologue. Other teams had an equal involvement between spatial and non-spatial designers. This equal ownership of the project often resulted in a genuine exchange, a dialogue between fields of knowledge, that can be classified as interdisciplinary collaboration and resulted in increasingly integrated outcomes. Given the fact that obtaining integrality is one of the biggest challenges in the Dutch spatial planning system, interdisciplinary collaboration should be pursued above multidisciplinary collaboration. The research-type, due to its interdisciplinary character, holds the greater promise.

Therefore, I recommend adding this *clarifying research-type* to the current practice of national spatial planning policy making, next to the current success of the *inspiring design-type*. Ideally, a combination of both types is applied in all cases, allowing to shift the focus on the one or the other type, depending on the nature of the request.

To further improve design research, two recommendations can be made. First, initiators should be aware of a possible paradox between contractual freedom and limitations. A number of characteristics that contribute to integrality can be organized in advance: for example, there can be an incentive added to consciously manage interdisciplinarity, or to require a certain team composition, or combine the two forms of design research within the contract. This would limit contractual freedom. Both types of design research, however, require a certain freedom in order to inspire and innovate. This is a paradox. One wants to steer at the front, in order to properly meet requests and achieve integrality, by setting boundaries and limitations. However, this will reduce the degrees of liberty and decreases the opportunities for innovation and inspiration. Initiators should be aware of these two sides of the same coin. Although it can be argued that this goes against the nature of most policymakers, I recommend creating as few as possible requirements and deliverables within the contract when the primary objective is about to be *inspired*. To boot, it is not possible to define clearly outlined deliverables if the objective is to *clarify* a certain spatial problem. This may go against traditional guidelines of governmental policy as spending tax money must be substantiated. However, as has often been argued, freedom is fundamentally important to arrive at desirable outcomes.

Second, I believe spatial designers who engage in design research should refrain from appearing as too arrogant. The facilitating role of the spatial designer, a great responsibility, is key to improving design research. For City of the Future, I observed spatial designers that believed that their own solution is THE BEST solution, that their interpretation in role play matches the real interests of stakeholders, or that they can omit substantiation when the image is sufficiently expressive. In my opinion, such designers underestimate the legitimate and democratic nature of spatial planning policy-making. In this thesis, I have explained that there is no BEST solution, that interests can only be obtained by asking stakeholders themselves, and that substantiation is an intrinsic part of policy-making. That is why I recommend that spatial designers, at all times, extend their analysis phase from "mapping the current situation " to "understanding the real problem," by means of the clarifying research-type. I believe that spatial designers can be of great significance for policy-making, but only when they use creativity and imagination as a force within policy-making, rather than the other way around.

To conclude: design research should be used increasingly for national spatial planning policy-making. Despite the clear inspirational contribution of the design-type, the potential of the clarifying research-type has been underestimated. Therefore, the research-type should be added consciously to the design-type that currently dominates. The focus on one of the two types should depend on the nature of the request (clarify or inspire). Trust in the value of design research should allow for less rigid contracts.

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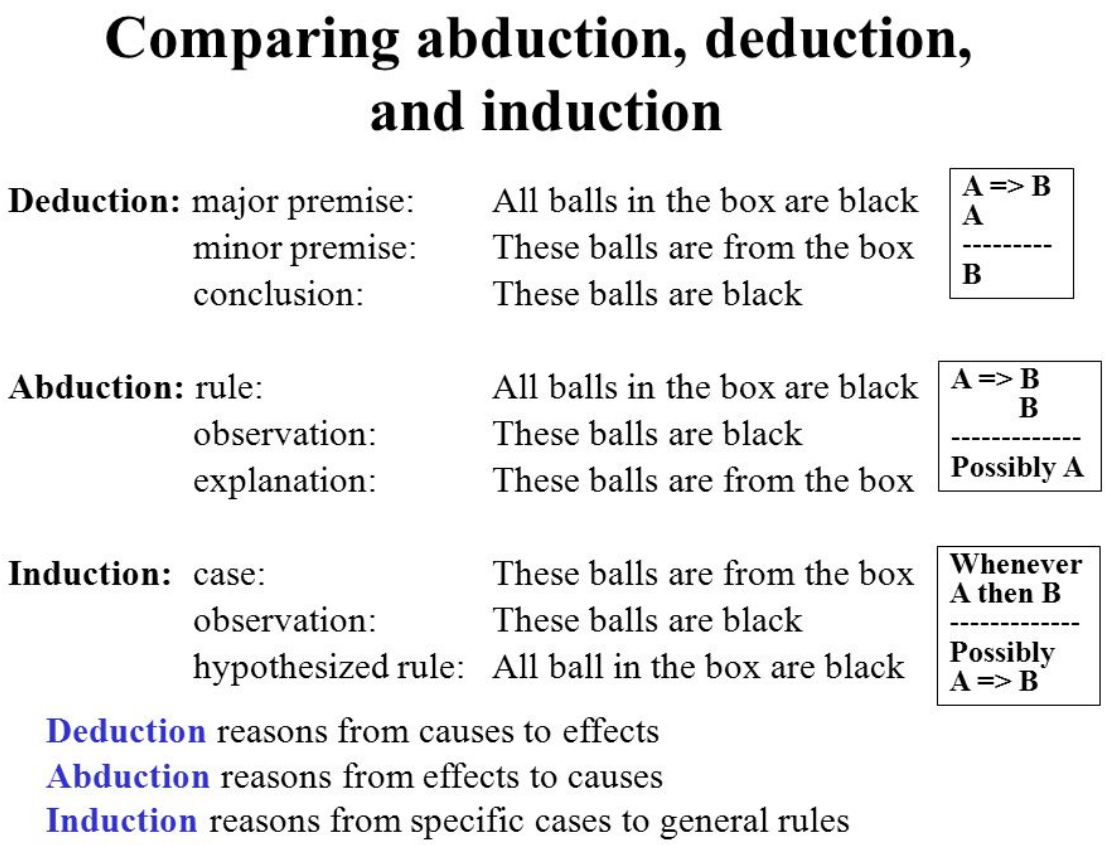
7. Appendix

7. APPENDIX

APPENDIX A – FORM INTEGRALITY ASSESSMENT

	Describing the level of integrality	Assessing the level of integrality												
SCALE	· Explicit or implicit bridges due to interventions.	The range of bridges:		inapplicable	Buildings	Street	Neighbourhood	Urban	Regional	National	Subcontinental	Continental	Intercontinental	Mondial
	· The range of bridges	- Within the ambition		o	o	o	o	o	o	o	o	o	o	o
	· The degree of implementation	- Within real interventions		o	o	o	o	o	o	o	o	o	o	o
	o A) having an ambition to connect scales,	The degree of implementation	Is mentioned explicitly or clearly visible:	Not identifiable	Weak identifiable	Identifiable	Strong identifiable							
	o B) to be able to see and explain current or possible relationships between scales,	- Having an ambition to connect scales		o	o	o	o							
	o C) to have impact with spatial interventions by creating or strengthening relationships between scales.	- To see and explain current or possible relationships between scales,		o	o	o	o							
		- To have impact With spatial interventions by creating or strengthening relationships between scales.		o	o	o	o							
		Subconclusion:	Level of integrality regarding to scale	Not identifiable o	Weak identifiable o	Identifiable o	Strong identifiable o							
INTERESTS				Just the design team and clients	Involvement by a fictional role play	Involvement of one or a few stakeholders	Involvement of multiple stakeholders							
	A) the way of involving stakeholders	- the way of involving stakeholders		o	o	o	o							
				Q1	Q2	Q3	Q4							
	B) the moment of involvement and	- the moment of involvement		o	o	o	o							
				Interpreted as wish and inspiration	..	..	Interpreted as hard requirement							
	C) the way in which different interests are weighed, combined and eventually been used.	- the way in which different interests are weighed, combined and eventually been used.		o	o	o	o							
		Subconclusion:	Level of integrality regarding to scale	Not identifiable o	Weak identifiable o	Identifiable o	Strong identifiable o							
TIME				No descrete time jumps	Some descrete time jumps	Description or continious development over a part of the total timeframe	Description or continous development over the entire time frame							
	· Rewind or fast forward	- what time frame is considered		o	o	o	o							
	· A) what time frame is considered,			No mention of uncertainties	Some mentions of uncertainties without spatial interventions	Some mentions ofuncertainties with spatial interventions	Many mentions of uncertainties with spatial interventions							
	· B) The adaptability: how the design or plan is dealing with uncertainties	- the adaptability: how the design or plan is dealing With uncertainties		o	o	o	o							
		Subconclusion:	Level of integrality regarding to scale	Not identifiable o	Weak identifiable o	Identifiable o	Strong identifiable o							
FUNCTION	· To link or to integrate	The presence of:	Present on its own	The accelerating urbanization	The energy transition	Shortage and waste of materials	Accessibility and mobility	Quality of life	Sustainability	Airquality	Noise hindrance	Economic vitality	Social inclusiveness	
	· the accelerating urbanization, the energy transition, shortage and waste of materials, accessibility and mobility, quality of life, sustainability, air quality, noise hindrance, economic vitality, and social inclusiveness.	The accelerating urbanization	o	X	o	o	o	o	o	o	o	o	o	
		The energy transition	o	o	X	o	o	o	o	o	o	o	o	
		Shortage and waste of materials	o	o	o	X	o	o	o	o	o	o	o	
		Accessibility and mobility	o	o	o	o	X	o	o	o	o	o	o	
		Quality of life	o	o	o	o	o	X	o	o	o	o	o	
		Sustainability	o	o	o	o	o	o	X	o	o	o	o	
		Airquality	o	o	o	o	o	o	o	X	o	o	o	
		Noise hindrance	o	o	o	o	o	o	o	o	X	o	o	
		Economic vitality	o	o	o	o	o	o	o	o	o	X	o	
		Social inclusiveness	o	o	o	o	o	o	o	o	o	o	X	
		Subconclusion:	Level of integrality regarding to scale	Not identifiable o	Weak identifiable o	Identifiable o	Strong identifiable o							



Source: Comparing deduction, induction and deduction. (n.d.). Retrieved from http://images.slideplayer.com/15/4559301/slides/slide_5.jpg

APPENDIX C – DESIGN PROCESS ANALYSIS

TEAM SOCIO TECHNICAL CITY	INTERVIEWEE 1	INTERVIEWEE 2			PUBLICATION	OWN INTERPRETATION	A		B	C	D	
PHASING	Aan het begin heel iteratief gedaan, maar laatste stuk heel incrementeel.	meer incrementeel dan iteratief. Eigenlijk kwam dat doordat UNstudio bepaalde beslissingen nam, en wij daar weer op door gingen. Dus het groeide wel maar wel dat we op dezelfde manier daarmee aan de haal gingen. Het was niet een soort samen komen, het was echt dat zij zeiden: het onderwerp wordt nu sociotechnical city want dat hebben wij er nu uit gehaald. En dan gingen wij daar weer op voortbouwen.				Duidelijke stappen, maar het ontwerp werd wel telkens aangevuld met nieuwe informatie vanuit de experts. - The design process can be described as a clear and structured incremental process, which have gone through the phases of ideation, testing, defining and working out. Major feedback loops haven't been identified.	Incremental	Incremental	**Mostly incremental**	Mostly iterative	Iterative	Iterative
CHARACTER OF APPROACH	van te voren analyses gedaan met hoeveel water is er nodig, hoeveel energie is er nodig, al dat soort dingen zijn allemaal onderzocht. Hoeveel m2 er nodig is, maar dit wel op een experimentele manier doorgezet	vanuit mijn bedrijf doen het met de feiten, uiterst analytisch, maar dit proces was ookmeer experimenteel van aard.				Er is niet onderbouwt door middel van abductie hoe een antwoord is gekozen, er is gewoon gekozen op basis van intuitie, ervaring en eurekamomenten, en die zijn geprobeerd te onderbouwen door feiten en nummers.	Analytical	Strongly analytical	More analytical than experimental	**More experimental than analytical**	Strongly experimental	Experimental
HANDLING COMPLEXITY	Meer reduceren dan vergroten - 'We koppelen de integraliteit los . Door één speler als dominant aan te wijzen wordt hij leidend in het proces. - Niet losknippen , je gaat zoeken naar aspecten wat klein en behapbaar is.	Ja steeds narrow narrow narrow. -					Reduce	**Reducing complexity**	More reducing than increasing	More increasing than reducing	Increasing complexity	Increase
FOCUS	Als je een definitie en begrip hebt van het probleem en de opgave hebt, dan ben je er nog niet. - Wij hebben het opgevat als hoe kunnen we dat condenseren zodat we het in de vierkante kilometer kunnen oplossen. - Wij hebben gekeken naar die zo grote opgave zo klein mogelijk oplossen, iets wat mensen ook begrijpen. - you had to go to a point at the end	Probleem definerend door: denk ik die barrières die infrastructuur is een lappendeken. Daarmee hebben we echt wat gedaan. En klimaatbestendigheid denk ik. En voldoen aan de energievraag denk ik. - the problem was not that visible			It is a blueprint that can be implementedin ohter places as well.	Sterk in oplossingen gedacht, ruimtelijk laten landen en daarmee concreet gemaakt.	Problem oriented	Problem oriented	More focused to the problem than to a solution	More focused to solutions than to the problem	**Solution oriented**	Solution oriented

TEAM URBAN ARCIPELAGO	INTERVIEWEE 1	INTERVIEWEE 2	INTERVIEWEE 3	Interviewee 4	PUBLICATION	OWN INTERPRETATION		A	B	C	D	
PHASING	Incremental - Yes, we were not searching long for the concept, but there was a long working out phase - In a way I like this graphic (figure XX). Because we did increase the complexity around green and mobility. - At the moment that we reach a point this because a guiding topic, then we started to increase the complexity of the building environment. It all came together in the end. I would say probably water was in between those. - if one step is finished, another can start., Yes agree - In the end, other ideas come around. We were not in the condition to make another project (because it was in a later stage), and so we didn't.	voor mij was het al duidelijk vanaf het begin deze kant gaat het op. - ja, in september gepresenteerd bij de gemeente en dat was prima. En dan is het maken van de eindbeelden en komt het heel erg aan op de detaillering. - In het begin verkennen, exploreren, en gewoon maar plaatjes maken.- In het begin verkennen, exploreren, en gewoon maar plaatjes maken. Tot juni denk ik dan. Toen hebben we vrij snel een goede inhoudelijke slag kunnen maken. In september hebben ewe een presentatie bij de gemeente gehouden. Toen hadden we szoiets van, we zijn klaar. Laten we naar het eind gaan. Daarna is er nog vrij veel tijd besteed aan dingen die wat lastiger bleken te zijn. Van meer stedenbouwkindge invulling. Gemeentebezoek was ergens in september. - Er waren bepaalde momenten.. Dat je wist we moeten over twee weken presenteren. Of we moeten naar de gemeente, of we moeten een stukje voor de eindpresentatie doen. Dan was het een soort versnelling daarin. Het was niet zo dat we elke week in de agenda hadden staan we moeten bij elkaar komen.	Meer incrementeel dan iteratief. - Dat het meer steeds een voortbouwen geweest is op stukken en verder bouwen, dan dat het iteratieve - wat je ook af en toe ziet. Dat je een voorontwerp maakt, dat er commentaar op komt. Dat je denkt: Het is echt niet goed. Ik ga het nog eens opnieuw maken. Dat is iets wat hier niet zozeer gebeurd. Het is heel opbouwend.	Heel iteratief. Op het laatste moment helemaal terug naar het begin.	-	Zeer incrementeel process. Er werd niet teruggegrepen op eerder gemaakte beslisisngen, op het onderwerp 'ring' na. Voordat de volgende stap wordt gemaakt, moest een andere fase worden afgerond. Zo maakten Mobility en Green de contouren waar anderen op konden verder werken.	ential and increm	**Incremental**	Mostly incremental	Mostly iterative	Iterative	Iterative
R OF APPROACH	B. Intuition, we used it, based on knowledge. Not pure intuition, background that you carry on from previous experiences and research. But there is a high level of intuition. more experimental then. We used data but we already.. we made some intuition choices.	A. experimenteel en intuitief.	B Ik zou het meer experimenteel noemen. - ik werk wel meer intuïtief en associatief en minder systematisch.	D: Dat eerste, experimenteel. - niet uiterst. We hebben wel wat dataonderzoek gedaan.			Analytical	Strongly analytical	More analytical than experimental	**More experimental than analytical**	Strongly experimental	Experimental
NG COMPLEXITY	We see that the city grow by dynamics that are not only based on the drivers by economy, market, movement of people. Things that a designer cannot control. - For me that was not a problem, that at some point we were discussing bigger plans, as long as afterwards we managed to come back to a plan more realistic, more controllable and more integral.	Er zijn ook schetsen gemaakt van roteringen zus en zo. Veel te ingewikkeld. Mijn insteek was al heel snel : oke, hier kan ik nog wel mee leven. Maar dit suggereert een soort lightdeel loop over de ring van Eindhoven. Mega ingewikkeld. Dit stukje is al ingewikkeld genoeg. - voor mij was het al duidelijk vanaf het begin deze kant gaat het op. - Wat betreft verkeer en vervoer en groen hebben we de complexiteit er vrij snel uitgehaald. Maar wat betreft gebouwde omgeving en water heeft het lang geduurd voordat de complexiteit eruit was en misschien zit dat er nog in.		B: Je moet het gewoon verkleinen om het behapbaar maken dat je er wat mee kan doen. - Je verkleint hem niet, want dan mis je dingen.			Reduce	Reducing complexity	**More reducing than increasing**	More increasing than reducing	Increasing complexity	rease and dealing v
FOCUS	Collages of images which gives an impression of the atmosphere and the perception of the space that we want to generate. It is not design because non of those buildings have been measures design. It is an impression.	voor mij was het al duidelijk vanaf het begin deze kant gaat het op.				Splitting up in three busstations - linear strips of green and blue, plus an extra strip for mobility.	Problem oriented	Mostly problem oriented	More focused to the problem than to a solution	**More focused to solutions than to the problem**	Mostly solution oriented	Solution oriented

TEAM ALL INLCUSIVE CITY	INTERVIEWEE 1	INTERVIEWEE 2	INTERVIEWEE 3		PUBLICATION	OWN INTERPRETATION	A		B	C	D	
PHASING	Ik zie dat ietsje anders, Divergeren en convergeren doe je natuurlijk altijd. Die momenten liggen misschien iets chaotischer. - We hadden soort momenten dat we gingen presenteren. De officiële momenten. Dan ga je enorm convergeren, terwijl het een week daarvoor nog is wat gaan we hier nou van maken. - Dan ga je even heel erg, oke, dit is minder relevant en dit meer. - een cyclische loop: Het convergeren zit op de punten waar je aan een nieuw loopje begint. Daar ga je samenvatten wat er in het vorige loopje gebeurde.	De vraag van de dichtheid hebben we wel vaak over nagedacht. Het verboden station die is natuurlijk wel weer terug gekomen.	Meer iteratief dan incrementeel, duidelijk.		-	Multiple feedback loops (Forbidden city, urban dense), chaotic and organic process. No clear steps identifiable	Incremental	Incremental	Mostly incremental	Mostly iterative	**Iterative**	Iterative
CHARACTER OF APPROACH	Meer experimenteel dan analytisch - nou we zijn niet echt met de iconische kant bezig geweest. Maar we zijn wel behoorlijk ideologisch bezig geweest.	Meer experimenteel dan analytisch	meer experimenteel, daar hebben we mee zitten spelen. We hebben niet gerekend. Het process wat meer experimenteel en intuitief ingestoken.		-	In between experimental and analytical. They also used facts and numbers to substantiate issues, like the housing demand or the schede-bridge.	Analytical	Strongly analytical	More analytical than experimental	**More experimental than analytical**	Strongly experimental	Experimental
HANDLING COMPLEXITY	we hadden aan het begin eerst als onderzoek als doel van dat station moet je verplaatsen	Maar we zijn wel behoorlijk ideologisch bezig geweest.	Aan het begin: *Als je leeg begint, wat zou je dan kunnen maken? Hoe wild kan je het dan maken? (Martijn)* - We hebben ons niet laten beperken door kosten. - We hebben aan het begin gekeken naar hyperloop op zee, en naar het verplaatsen van huidige stations.		-	the team was in the beginning not afraid for complexity: they didn't limit their selves by costs, and big complex ideas like a hyperloop station located in the North Sea and relocating trainstations came up. However, that was just in the very beginning, because in later phases, they have been guided by realistic and feasible designs, under the influence of the municipality (interviewee XX).	Reduce	Reducing complexity	**More reducing than increasing**	More increasing than reducing	Increasing complexity	Increase
FOCUS	Je moet het toch voorstelbaar maken. Je kan niet alleen maar tekst maken want dat gaat er natuurlijk niet in. Je moet het voorstelbaar maken, maar het zijn meer collages dan ontwerpen. Dus stel, als je met deze regels werkt, zou dit een voorstellingen kunnen zijn van hoe dat eruit zou kunnen komen zien.	Wilfried: naar mijn beleving hebben we helemaal geen plan gemaakt.	er is gekeken naar de lokale problematiek - Met name voor mijn gevoel hebben we de eerste (probleem vatten) gedaan - (later:) Zeker een inspirerend beeld, niet zo zeer probleem verduidelijkend.		-	they were more focused on the problem itself that to a solution. For example, they argued that the future housing-demand in the Hague of the government was impossible to cover in low-rise areas, because that would take to much space. At the same time, they showed that this housing-demand within central urban areas, will result in extreme rents. This will have the consequence that only the upper-class is able to live there, which does not match the housing-demand. Hereby, they clarified the problem. Also, they used fictional role play to really understand the demand within the area.	Problem oriented	Mostly problem oriented	**More focused to the problem than to a solution**	More focused to solutions than to the problem	Mostly solution oriented	Solution oriented

TEAM TRIANGEL	INTERVIEWEE 1	INTERVIEWEE 2	INTERVIEWEE 3		PUBLICATION	OWN INTERPRETATION		A	B	C	D	
PHASING	D. *There were clear phases: data gathering and interpretation, the game, and the design stage, but they constantly influenced each other.* - · For example, when the density is too high, then you will tweak your data, and then going back to the policy making-table.	D. *Extremely iterative. That is very clear, we worked a lot with feedback loops. You have to walk through the bulbs a few times.* - · .. We followed the cycle approximately five times within our research.	D. Extremely iterative.			C. Clear phasing, what indicates a incremental approach, but the 5 feedbackloops (the cycle of the data/policy/design model) indicates a clear iterative approach. Therefore, . More iterative than incremental.	Incremental	Incremental	Mostly incremental	**Mostly iterative**	Iterative	Iterative
R OF APPROACH	The translation of policy into design is absolutely intuitive: based on the creativity of designers. Fortunately, because that makes cities look differently. Still remains that the overall process is highly analytical. So: room for intuition within the analytical system.	No no no, not at all intuitive. Don't get me wronf: intuition is a beautiful thing, but we have opposed to intuition. Within spatial planning, too much is done based on intuition.	In the beginning, we intented to work fact-based, to use that as a basis, and then to put some creativity to it. Unfortunately, we never got to that creativity phase.		Especially in a time of major changes in 'slower' but all determining undercurrents such as climate, economy, demography and mobility, we can simply no longer afford to design the built environment 'by intuition' or 'by force majeure'.	Initially, they wanted to add a creativity layer, but in the end they wouldn't go through with it. The spatial designs have done an attempt to put intuition and creativity into the outcomes, but with high unsatisfaction of the other teammembers. Therefore, this outcome with its focus on the strategy, they used an strongly analytical process.	Analytical	**Strongly analytical**	More analytical than experimental	More experimental than analytical	Strongly experimental	Experimental
NG COMPLEXITY	D. We have not reduced complexity, we have just diverge and tried to get that under control in the end.	• You are going to collect data, so we went very broad. - We deep dived into the data, and collected data as much as was available. Then, we put that data in the policy process to arrive at a PoR. A kind of so-called 'wybertje'.- • We have been working at the front for a long time. - the more people at the table, the harder it gets.	D. "Yes, I see that the same"			They focused on increasing the complexity (by data, and a lot of different stakeholder involvement) and at the same time tried to manage this complexity by their game of their data-based spatial model.	Reduce	Mostly reducing complexity	More reduced than increased	More increased than reduced	**Mostly increasing complexity**	ease and dealing v
FOCUS	The essence is that nobody knows what the future looks like. You are really fixated when you submit a detailed master plan as 'the best solution',	..the real estate and the development world is an un-transparent world with fragmented information and powerfull dominante parties that pull the strings. Nowadays, this world is focused on intuition and power, decided on the basis of favoritism and money.				Problem oriented: They were searching for the real problem: the untransparent market, the un-democratic system. And tried to found systems to deal with that. This is a clear example of finding the questions behind the question: it is not 'develop this area with the problems of complaining neighbours and with a few information'. - Hence, the refinement of the original question by searching for data and identify the different interests.	Problem oriented	**Mostly problem oriented**	More focused to the problem than to a solution	More focused to solutions than to the problem	Mostly solution oriented	Solution oriented

APPENDIX D – INTERVIEW GUIDE

Most important questions are green

OUTCOMES (10MIN)

TEST: FUTURISTIC OR PRAGMATIC, AND CLEARIFYING VS INSPIRING

1. How would you describe the final result?
2. Would you consider your deliverable as very modern?
3. Would you consider your deliverable as futuristic? Why? To what extent?
4. To what extent is the design really able to happen? Why?
5. What does your deliverable clarify?
6. What are the inspiring elements of your outcomes?
7. Would you consider your deliverable more as clarifying or as inspiring?
8. Can it be also both, why?
9. Would you consider your deliverable as more helpful for the decision-making processes or as more helpful for giving high abstract issues a realistic and tangible content?
10. Would you consider your deliverable as an integral design? Why?
11. Beside the deliverable, can you recognize yourself more in an idealist or pragmatist?

EXPERIENCES & BACKGROUND (5MIN)

1. Can you tell me something about your BACKGROUND related to your education and work experience?
    a. Onderwijs in manier van denken: toekennen aan science, humanities of design.
2. Do you have experiences with working for or with the government? And with policy-making at RO?
3. Do you have experience with design-based research collaboration, like SvdT?

HOW WERE THEY ACHIEVED DURING THE DESIGN PROCESS (20 MIN)

Elementen van proces in kaart brengen (FORM 1 & 2)
Multi of interdisciplinair definiëren

- **ELEMENTS OF PROCESS:**

1. FORM 1 – DESIGN PROCESS, FIL IN TOGETHER
2. FORM 2 – DISCUSS ADVANTAGES
3. What was explicitly the task definition at the beginning of the SvdT? And what was the problem statement?
4. . Did you find the problem A) well and clearly defined? B) was all information available to get started? (if not, how long have they been involved and which elements have you added, and how did you get this information?
5. To what extent have you used research questions, literature, and scientific reports?
6. Was there a ‘eukera’moment? What, how and when?

- **COLLABORATION**

7. Which activities needed to be distributed?
8. How did a week look like concerning joint meetings, meetings in subgroups, and individual work?
    - Joint meetings meant to 1) inform and inspire or 2) to allign / integrate knowledge into 1 course.
9. How were the roles and tasks assigned to people?
10. Do you think each team member mostly contributes to their own discipline-specific part? Why (not?) Example.
11. Can you explicitly describe a moment of a synthesis of knowledge during the process?
12. Which collaborations took place outside the team? Or which stakeholders are involved?

13. Was there a difference between spatial designers and non-spatial designers regarding to involvement, responsibility or activity?
14. How is the information from the non-spatial designers processed? Did they process this information themselves, or did the spatial designers processed it?
15. Would you say that they were also ‘designing’, or were they used as input values that others used and made it spatial?
16. Would you say the multidisciplinary nature and collaboration amongst the actors complicated the process?
17. What were the main conflicts within your team? (Without naming names)

HOW ARE THEY CONTRIBUTING TO THE NOVI (20 MIN)

1. What is the point of a project like SvdT?
2. How can your final result contribute to the NOVI? (Ask through, 3 added values?)
3. How should the NOVI implement your result?
4. Can you put the following added values of design-based research collaboration in order from most recognizable to less or no recognizable? Why?
    a. . What is the most important one?
    b. . What is the most recognizable one in your process?
    c. . What added value should be added?
    d. . What is the less important one?
    e. . What is the most unrecognizable one in your process?
5. *What is the contribution of SvdT for the NOVI?*
6. *What is the contribution of design-based research collaboration for policy-making of spatial planning?*
7. Which obstacles are still standing in the way of implementing your result in the NOVI?
8. Can you put the following added values of design-based research collaboration in order from most recognizable to less or no recognizable?
    a. . What is the most important one?
    b. . What is the most recognizable one in your process?
    c. . What obstacles should be added?
    d. . What is the less important one?
    e. . What is the most unrecognizable one in your process?

CLOSURE:

9. What would you do differently, looking back on the whole project?
10. What is the most valuable lesson you have learned during SvdT?

APPENDIX E – INTERVIEW TRANSCRIPTS

*Can be requested by sending an email to the author.

APPENDIX F – CITY OF THE FUTURE, PUBLICATION

APPENDIX G – ANALYSED INTEGRALITY

TEAM TRIANGEL - INTEGRALITY ANALYSIS

SCALE

Describing the level of integrality	**Assessing the level of integrality**												
· Explicit or implicit bridges due to interventions.	The range of bridges:		inapplicable	Buildings	Street	Neighbourhood	Urban	Regional	National	Subcontinental	Continental	Intercontinental	Mondial
· The range of bridges	- Within the ambition		X	o	o	o	o	o	o	o	o	o	o
· The degree of implementation	- Within real interventions		o	o	o	o	o	o	o	o	o	o	o
o A) having an ambition to connect scales,	The degree of implementation	Is mentioned explicitly or clearly visible:	Not identifiable	Weak identifiable	Identifiable	Strong identifiable							
o B) to be able to see and explain current or possible relationships between scales,	- Having an ambition to connect scales		X	o	o	o							
o C) to have impact with spatial interventions by creating or strengthening relationships between scales.	- To see and explain current or possible relationships between scales,		X	X	o	o							
	- To have impact With spatial interventions by creating or strengthening relationships between scales.		o	X	o	o							
		Level of integrality regarding to scale	--	-	+	++							
	Subconclusion:		o	X	o	o							

INTERESTS

			Just the design team and clients	Involvement by a fictional role play	Involvement of one or a few stakeholders	Involvement of multiple stakeholders							
A) the way of involving stakeholders	- the way of involving stakeholders		o	o	o	X							
			Q1	Q2	Q3	Q4							
B) the moment of involvement and	- the moment of involvement		X	X	X	o							
			Interpreted as wish and inspiration	..	..	Interpreted as hard requirement							
C) the way in which different interests are weighed, combined and eventually been used.	- the way in which different interests are weighed, combined and eventually been used.		o	o	X	o							
		Level of integrality regarding to scale	--	-	+	++							
	Subconclusion:		o	o	o	X							

TIME

			No descrete time jumps	Some descrete time jumps	Description or continious development over a part of the total timeframe	Description or continous development over the entire time frame							
· Rewind or fast forward	- what time frame is considered		o	o	X	o							
· A) what time frame is considered,			No mention of uncertainties	Some mentions of uncertainties without spatial interventions	Some mentions ofuncertainties with spatial interventions	Many mentions of uncertainties with spatial interventions							
· B) The adaptability: how the design or plan is dealing with uncertainties	- the adaptability: how the design or plan is dealing With uncertainties		o	X	o	o							
		Level of integrality regarding to scale	--	-	+	++							
	Subconclusion:		o	X	o	o							

FUNCTION

· To link or to integrate	The presence of:	Present on its own	The accelerating urbanization	The energy transition	Shortage and waste of materials	Accessibility and mobility	Quality of life	Sustainability	Airquality	Noise hindrance	Economic vitality	Social inclusiveness	
· the accelerating urbanization, the energy transition, shortage and waste of materials, accessibility and mobility, quality of life, sustainability, air quality, noise hindrance, economic vitality, and social inclusiveness.	The accelerating urbanization	X		o	o	X	X	X	o	o	o	X	
	The energy transition	o	o		o	o	o	o	o	o	o	o	
	Shortage and waste of materials	o	o	o		o	o	o	o	o	o	o	
	Accessibility and mobility	o	X	o	o		X	X	X	o	X	X	
	Quality of life	o	o	o	o	o		X	o	o	o	o	
	Sustainability	o	X	o	o	X	X		X	o	X	X	
	Airquality	o	o	o	o	o	X	X		o	o	o	
	Noise hindrance	o	o	o	o	o	o	o	o		o	o	
	Economic vitality	o	o	o	o	o	X	X	o	o		o	
	Social inclusiveness	o	X	o	o	X	X	X	o	o	X		
	Level of integrality regarding to scale	--	-	+	++								
	Subconclusion:	o	o	X	o								

TEAM URBAN ARCIPELAGO - INTEGRALITY ANALYSIS

	Describing the level of integrality	Assessing the level of integrality												
SCALE	· Explicit or implicit bridges due to interventions.	The range of bridges:		inapplicable	Buildings	Street	Neighbourhood	Urban	Regional	National	Subcontinental	Continental	Intercontinental	Mondial
	· The range of bridges	- Within the ambition		o	o	o	o	o	o	o	o	o	o	o
	· The degree of implementation	- Within real interventions		o	o	o	o	o	o	o	o	o	o	o
	o A) having an ambition to connect scales,	The degree of implementation	Is mentioned explicitly or clearly visible:	Not identifiable	Weak identifiable	Identifiable	Strong identifiable							
	o B) to be able to see and explain current or possible relationships between scales,	- Having an ambition to connect scales		o	o	X	o							
	o C) to have impact with spatial interventions by creating or strengthening relationships between scales.	- To see and explain current or possible relationships between scales,		o	o	X	o							
		- To have impact With spatial interventions by creating or strengthening relationships between scales.		o	X	o	o							
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				o	o	X	o							
INTERESTS				Just the design team and clients	Involvement by a fictional role play	Involvement of one or a few stakeholders	Involvement of multiple stakeholders							
	A) the way of involving stakeholders	- the way of involving stakeholders		o	X	o	o							
				Q1	Q2	Q3	Q4							
	B) the moment of involvement and	- the moment of involvement		o	X	o	o							
				Interpreted as wish and inspiration	..	..	Interpreted as hard requirement							
	C) the way in which different interests are weighed, combined and eventually been used.	- the way in which different interests are weighed, combined and eventually been used.		X	o	o	o							
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				X	o	o	o							
TIME				No descrete time jumps	Some descrete time jumps	Description or continious development over a part of the total timeframe	Description or continous development over the entire time frame							
	· Rewind or fast forward	- what time frame is considered		o	X	o	o							
	· A) what time frame is considered,			No mention of uncertainties	Some mentions of uncertainties without spatial interventions	Some mentions ofuncertainties with spatial interventions	Many mentions of uncertainties with spatial interventions							
	· B) The adaptability: how the design or plan is dealing with uncertainties	- the adaptability: how the design or plan is dealing With uncertainties		o	o	X	o							
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				o	o	X	o							
FUNCTION	· To link or to integrate	The presence of:	Present on its own	The accelerating urbanization	The energy transition	Shortage and waste of materials	Accessibility and mobility	Quality of life	Sustainability	Airquality	Noise hindrance	Economic vitality	Social inclusiveness	
	· the accelerating urbanization, the energy transition, shortage and waste of materials, accessibility and mobility, quality of life, sustainability, air quality, noise hindrance, economic vitality, and social inclusiveness.	The accelerating urbanization	o		o	o	X	o	o	o	o	o	o	
		The energy transition	o	o		o	o	o	o	o	o	o	o	
		Shortage and waste of materials	o	o	o		o	o	o	o	o	o	o	
		Accessibility and mobility	o	X	o	o		X	o	o	o	X	X	
		Quality of life	o	o	o	o	X		X	o	o	o	o	
		Sustainability	o	o	o	o	o	X		o	o	o	o	
		Airquality	o	o	o	o	o	o	o		o	o	o	
		Noise hindrance	o	o	o	o	o	o	o	o		o	o	
		Economic vitality	o	o	o	o	X	o	o	o	o		o	
		Social inclusiveness	o	o	o	o	X	o	o	o	o	o		
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				o	X	o	o							

TEAM ALL INCLUSIVE CITY - INTEGRALITY ANALYSIS

	Describing the level of integrality	Assessing the level of integrality												
SCALE	· Explicit or implicit bridges due to interventions.	The range of bridges:		inapplicable	Buildings	Street	Neighbourhood	Urban	Regional	National	Subcontinental	Continental	Intercontinental	Mondial
	· The range of bridges	- Within the ambition		o	o	o	o	o	o	o	o	o	o	o
	· The degree of implementation	- Within real interventions		o	o	o	o	o	o	o	o	o	o	o
	o A) having an ambition to connect scales,	The degree of implementation	Is mentioned explicitly or clearly visible:	Not identifiable	Weak identifiable	Identifiable	Strong identifiable							
	o B) to be able to see and explain current or possible relationships between scales,	- Having an ambition to connect scales		o	o	X	o							
	o C) to have impact with spatial interventions by creating or strengthening relationships between scales.	- To see and explain current or possible relationships between scales,		o	o	X	o							
		- To have impact With spatial interventions by creating or strengthening relationships between scales.		o	o	X	o							
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				o	o	o	X							
INTERESTS				Just the design team and clients	Involvement by a fictional role play	Involvement of one or a few stakeholders	Involvement of multiple stakeholders							
	A) the way of involving stakeholders	- the way of involving stakeholders		o	X	o	o							
				Q1	Q2	Q3	Q4							
	B) the moment of involvement and	- the moment of involvement		X	X	X	o							
				Interpreted as wish and inspiration	..	..	Interpreted as hard requirement							
	C) the way in which different interests are weighed, combined and eventually been used.	- the way in which different interests are weighed, combined and eventually been used.		o	o	X	o							
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				o	o	X	o							
TIME				No descrete time jumps	Some descrete time jumps	Description or continious development over a part of the total timeframe	Description or continous development over the entire time frame							
	· Rewind or fast forward	- what time frame is considered		o	o	o	X							
	· A) what time frame is considered,			No mention of uncertainties	Some mentions of uncertainties without spatial interventions	Some mentions ofuncertainties with spatial interventions	Many mentions of uncertainties with spatial interventions							
	· B) The adaptability: how the design or plan is dealing with uncertainties	- the adaptability: how the design or plan is dealing with uncertainties		o	X	o	o							
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				o	o	o	X							
FUNCTION	· To link or to integrate	The presence of:	Present on its own	The accelerating urbanization	The energy transition	Shortage and waste of materials	Accessibility and mobility	Quality of life	Sustainability	Airquality	Noise hindrance	Economic vitality	Social inclusiveness	
	· the accelerating urbanization, the energy transition, shortage and waste of materials, accessibility and mobility, quality of life, sustainability, air quality, noise hindrance, economic vitality, and social inclusiveness.	The accelerating urbanization	o		X	X	X	X	X	o	o	X	X	
		The energy transition	o	X		X	X	X	X	o	o	X	X	
		Shortage and waste of materials	o	X	X		X	X	X	o	o	X	X	
		Accessibility and mobility	o	X	X	X		X	X	o	o	X	X	
		Quality of life	o	X	X	X	X		X	o	o	X	X	
		Sustainability	o	X	X	X	X	X		o	o	X	X	
		Airquality	o	o	o	o	o	o	o		o	o	o	
		Noise hindrance	o	o	o	o	o	o	o	o		o	o	
		Economic vitality	o	X	X	X	X	X	X	o	o		X	
		Social inclusiveness	o	X	X	X	X	X	X	o	o	X		
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				o	o	X	o							

TEAM SOCIO TECHNICAL CITY - INTEGRALITY ANALYSIS

	Describing the level of integrality	Assessing the level of integrality												
SCALE	· Explicit or implicit bridges due to interventions.	The range of bridges:		inapplicable	Buildings	Street	Neighbourhood	Urban	Regional	National	Subcontinental	Continental	Intercontinental	Mondial
	· The range of bridges	- Within the ambition		o	o	o	o	o	o	o	o	o	o	o
	· The degree of implementation	- Within real interventions		o	o	o	o	o	o	o	o	o	o	o
	o A) having an ambition to connect scales,	The degree of implementation	Is mentioned explicitly or clearly visible:	Not identifiable	Weak identifiable	Identifiable	Strong identifiable							
	o B) to be able to see and explain current or possible relationships between scales,	- Having an ambition to connect scales		o	o	X	o							
	o C) to have impact with spatial interventions by creating or strengthening relationships between scales.	- To see and explain current or possible relationships between scales,		o	X	o	o							
		- To have impact With spatial interventions by creating or strengthening relationships between scales.		o	o	X	o							
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				o	o	X	o							
INTERESTS				Just the design team and clients	Involvement by a fictional role play	Involvement of one or a few stakeholders	Involvement of multiple stakeholders							
	A) the way of involving stakeholders	- the way of involving stakeholders		X	o	o	o							
				Q1	Q2	Q3	Q4							
	B) the moment of involvement and	- the moment of involvement		o	o	o	o	**not applicable**						
				Interpreted as wish and inspiration	..	..	Interpreted as hard requirement							
	C) the way in which different interests are weighed, combined and eventually been used.	- the way in which different interests are weighed, combined and eventually been used.		o	o	o	o	**not applicable**						
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				X	o	o	o							
TIME				No descrete time jumps	Some descrete time jumps	Description or continious development over a part of the total timeframe	Description or continous development over the entire time frame							
	· Rewind or fast forward	- what time frame is considered		X	o	o	o							
	· A) what time frame is considered,			No mention of uncertainties	Some mentions of uncertainties without spatial interventions	Some mentions ofuncertainties with spatial interventions	Many mentions of uncertainties with spatial interventions							
	· B) The adaptability: how the design or plan is dealing with uncertainties	- the adaptability: how the design or plan is dealing With uncertainties		X	o	o	o							
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				X	o	o	o							
FUNCTION	· To link or to integrate	The presence of:	Present on its own	The accelerating urbanization	The energy transition	Shortage and waste of materials	Accessibility and mobility	Quality of life	Sustainability	Airquality	Noise hindrance	Economic vitality	Social inclusiveness	
	· the accelerating urbanization, the energy transition, shortage and waste of materials, accessibility and mobility, quality of life, sustainability, air quality, noise hindrance, economic vitality, and social inclusiveness.	The accelerating urbanization	o		o	o	o	X	o	o	o	o	X	
		The energy transition	X	o		o	o	o	X	o	o	o	o	
		Shortage and waste of materials	o	o	o		o	o	X	o	o	o	o	
		Accessibility and mobility	o	o	o	o		o	X	o	o	o	o	
		Quality of life	o	o	o	o	o		X	o	o	o	o	
		Sustainability	X	o	X	X	X	X		X	o	X	o	
		Airquality	o	o	o	o	o	o	X		o	o	o	
		Noise hindrance	o	o	o	o	o	o	o	o		o	o	
		Economic vitality	o	o	o	o	o	o	X	o	o		o	
		Social inclusiveness	o	o	o	o	o	o	o	o	o	o		
		Subconclusion:	Level of integrality regarding to scale	--	-	+	++							
				o	o	X	o							

APPENDIX H – CROSS ANALYSIS

	PHASING	APPROACH	COMPLEXITY	FOCUS	FORM OF COLLABORATION
SCALE	**1** Incremental / Mostly incremental / Mostly iterative / Iterative	**2** Strongly analytical / More analytical than experimental / More experimental than analytical / Strongly experimental	**3** Mostly reducing complexity / More reduced than increased / More increased than reduced / Mostly increasing complexity	**4** Mostly problem oriented / More focused to the problem than to a solution / More focused to solutions than to the problem / Mostly solution oriented	**5** Interdisciplinair / Multidisciplinair
++	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY
+	URBAN ARCIPELAGO	URBAN ARCIPELAGO	URBAN ARCIPELAGO	URBAN ARCIPELAGO	URBAN ARCIPELAGO
-	SOCIO TECHNICAL CITY / TRIANGEL	TRIANGEL / SOCIO TECHNICAL CITY	SOCIO TECHNICAL CITY / TRIANGEL	TRIANGEL / SOCIO TECHNICAL CITY	TRIANGEL / SOCIO TECHNICAL CITY
--					
INTERESTS	**6** Incremental / Mostly incremental / Mostly iterative / Iterative	**7** Strongly analytical / More analytical than experimental / More experimental than analytical / Strongly experimental	**8** Mostly reducing complexity / More reduced than increased / More increased than reduced / Mostly increasing complexity	**9** Mostly problem oriented / More focused to the problem than to a solution / More focused to solutions than to the problem / Mostly solution oriented	**10** Interdisciplinair / Multidisciplinair
++	TRIANGEL	TRIANGEL	TRIANGEL	TRIANGEL	TRIANGEL
+	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY
-					
--	URBAN ARCIPELAGO / SOCIO TECHNICAL CITY	SOCIO TECHNICAL CITY, URBAN ARCIPELAGO	SOCIO TECHNICAL CITY / URBAN ARCIPELAGO	SOCIO TECHNICAL CITY, URBAN ARCIPELAGO	SOCIO TECHNICAL CITY, URBAN ARCIPELAGO
TIME	**11** Incremental / Mostly incremental / Mostly iterative / Iterative	**12** Strongly analytical / More analytical than experimental / More experimental than analytical / Strongly experimental	**13** Mostly reducing complexity / More reduced than increased / More increased than reduced / Mostly increasing complexity	**14** Mostly problem oriented / More focused to the problem than to a solution / More focused to solutions than to the problem / Mostly solution oriented	**15** Interdisciplinair / Multidisciplinair
++	ALL INCLUSIVE CITY,	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY
+	URBAN ARCIPELAGO	URBAN ARCIPELAGO	URBAN ARCIPELAGO	URBAN ARCIPELAGO	URBAN ARCIPELAGO
-	TRIANGEL	TRIANGEL	TRIANGEL	TRIANGEL	TRIANGEL
--	SOCIO TECHNICAL CITY	SOCIO TECHNICAL CITY	SOCIO TECHNICAL CITY	SOCIO TECHNICAL CITY	SOCIO TECHNICAL CITY
FUNCTION	**16** Incremental / Mostly incremental / Mostly iterative / Iterative	**17** Strongly analytical / More analytical than experimental / More experimental than analytical / Strongly experimental	**18** Mostly reducing complexity / More reduced than increased / More increased than reduced / Mostly increasing complexity	**19** Mostly problem oriented / More focused to the problem than to a solution / More focused to solutions than to the problem / Mostly solution oriented	**20** Interdisciplinair / Multidisciplinair
++					
+	SOCIO TECHNICAL CITY, ALL INCLUSIVE CITY, TRIANGEL	SOCIO TECHNICAL CITY, ALL INCLUSIVE CITY	SOCIO TECHNICAL CITY, ALL INCLUSIVE CITY, TRIANGEL	TRIANGEL, ALL INCLUSIVE CITY, SOCIO TECHNICAL CITY	TRIANGEL, ALL INCLUSIVE CITY, SOCIO TECHNICAL CITY
-	URBAN ARCIPELAGO	TRIANGEL / URBAN ARCIPELAGO	URBAN ARCIPELAGO	URBAN ARCIPELAGO	URBAN ARCIPELAGO
--					
INTEGRALITY (As a whole, with share: 25/25/25/25)	**21** Incremental / Mostly incremental / Mostly iterative / Iterative	**22** Strongly analytical / More analytical than experimental / More experimental than analytical / Strongly experimental	**23** Mostly reducing complexity / More reduced than increased / More increased than reduced / Mostly increasing complexity	**24** Mostly problem oriented / More focused to the problem than to a solution / More focused to solutions than to the problem / Mostly solution oriented	**25** Interdisciplinair / Multidisciplinair
++	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY
+	TRIANGEL	TRIANGEL	TRIANGEL	TRIANGEL	TRIANGEL
-	URBAN ARCIPELAGO / SOCIO TECHNICAL CITY	URBAN ARCIPELAGO, SOCIO TECHNICAL CITY	SOCIO TECHNICAL CITY / URBAN ARCIPELAGO	URBAN ARCIPELAGO, SOCIO TECHNICAL CITY	SOCIOTECHNICAL CITY, URBAN ARCIPELAGO
--					
INTEGRALITY (As a whole, with share: 16/16/16/50)	**26** Incremental / Mostly incremental / Mostly iterative / Iterative	**27** Strongly analytical / More analytical than experimental / More experimental than analytical / Strongly experimental	**28** Mostly reducing complexity / More reduced than increased / More increased than reduced / Mostly increasing complexity	**29** Mostly problem oriented / More focused to the problem than to a solution / More focused to solutions than to the problem / Mostly solution oriented	**30** Interdisciplinair / Multidisciplinair
++	TRIANGEL, ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	ALL INCLUSIVE CITY	TRIANGEL, ALL INCLUSIVE CITY
+	TRIANGEL	TRIANGEL	TRIANGEL	TRIANGEL	
-	URBAN ARCIPELAGO / SOCIO TECHNICAL CITY	URBAN ARCIPELAGO, SOCIO TECHNICAL CITY	SOCIO TECHNICAL CITY / URBAN ARCIPELAGO	URBAN ARCIPELAGO, SOCIO TECHNICAL CITY	SOCIOTECHNICAL CITY, URBAN ARCIPELAGO
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APPENDIX I – LIST OF FIGURES