CREATIVE ROADS TOWARDS URBAN NATURE-BASED SOLUTIONS

PROJECT DEVELOPERS ORGANIZING CREATIVITY

FOR NBS INTEGRATION INTO URBAN DEVELOPMENT

Master's Thesis written by C.L. Oldenbeuving

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1. Preface

Welcome to my thesis, *"Creative Roads Towards Urban Nature-based Solutions."* Over the past year, I have joyfully researched both creativity, a field I have explored since my bachelor's, and nature-based solutions, a new concept I came to know during my research. The primary reason for combining these two concepts is that creativity is a crucial yet often overlooked aspect of innovation and transitions. This insight, also evident in the nature-based solutions literature, led me to the challenge of connecting these two notions.

Before proceeding, I would like to thank my supervisors, Paul Chan and Herman Vande Putte, for their meaningful supervision and support throughout this challenge. They have been instrumental in helping me find my own creative roads within the research process. I am also grateful to all 15 interviewees who participated in this research for their openness and involvement. Special thanks to Emma Lucassen, who not only helped recruit these participants but also played a key role in sharpening my results from the project developer's perspective. Lastly, I want to express my appreciation to all my other teachers, family, friends, and fellow students who were sparring partners throughout this process, helping me to discover new perspectives and insights.

Reflecting on this journey, a thought struck me yesterday that perhaps this research could lay the groundwork for a book. This book would explore our historical, current, and future relationships with nature, inspired by the insights gained through my thesis. Moreover, it would go beyond viewing nature merely as flora and fauna with which we coexist. Instead, it would delve into how we can design environments that foster more natural human behaviors through the use of nature-based solutions. We often overdesign our spaces, unintentional making individuals less self-reliant.

“Consider the difference between placing a real tree in a children’s playground, with all its imperfect, potentially weak branches, versus installing a perfectly safe, manufactured climbing structure. The former teaches children to navigate risks and learn about safety through direct experience, while the latter might not challenge them to develop the same level of caution and self-reliance bringing them in danger for future situations less save.”

This anecdote highlights the deeper potential of integrating nature into our urban lives: rethinking how we integrate nature into our urban fabric not just for ecological benefits, but also as a way to restore intuitive interactions between humans and their environments learning them to be more self-reliant again.

2. Abstract

Urban developments in the Netherlands are becoming increasingly complex due to the extensive and often competing programs of requirements that must be met within limited urban spaces (Planbureau voor de Leefomgeving, 2021). Traditional solutions often fall short in balancing these priorities, however Nature-Based Solutions (NbS) hold promise as part of a cheat code, through solving different solutions within one providing co-benefits (Raymond et al., 2017). NbS studies have largely focused on building a coherent research field through an interdisciplinary and holistic perspective. This has resulted in more technical static frameworks, leaving challenges of dealing with complexities, uncertainties, adaptive management and private-sector involvement. However, studies have given less attention to uncovering more creative dynamic frameworks to navigate these complexities and uncertainties and respond adaptive to integrate NbS. Project developers, who need to compete against their competitors, may provide insights into these more creative frameworks. They inherently need to respond adaptively to the changing market and innovate to keep their position and achieve their business case. Therefore, it is proposed that organizing and fostering creativity is crucial for developing better and more Nature-based Solutions (NbS). Consequently, this research explores the following research question:

"How can project developers organize creativity to integrate NbS into their urban development projects?"

This question focuses on the characteristics, behavior and strategies of the project developer as an individual contributing to integrating better and more NbS. The project developer is in collaboration with their project collective and supported by their development company. This research aims to generate new theories about how the project developer organizes creativity in the form of strategies. Therefore, an explorative approach is necessary uncovering social perspectives, which can be effectively achieved through a qualitative study.

This research involves both theoretical and empirical research, including literature and a holistic multiple-case study. Four cases on different scales have been analyzed. These cases were compared with a cross-case analysis to indicate the important NbS barriers and Success factors that are connected to organizing creativity. Moreover data synthesis has been performed to capture the strategies for organizing creativity.

The main findings present the 4C model for and with NbS. This model encompasses four strategies for organizing creativity including Composing, Convincing, Conducting and Contemplating and can be performed on two levels. The first level consists of proactive strategies, building routines, while the second level uncovers reactive strategies, building habits. Be performing strategies on both levels the project developer can make sure to respond adaptively to current situations while also planning for the future enabling NbS success factors and positive creative situations. In this way the project developer can organize creativity to integrate NbS into their urban development, composing the right environment for learning and change, convincing actors to learn and change, conducting change by monitoring and iterating and contemplating to spot new needs for change.

3. Contents

3.1. Table of Contents

3.2. Table of Figures

3.3. Table of Tables

4. Introduction

Urban developments in the Netherlands are becoming increasingly complex due to the extensive and often competing programs of requirements that must be met within limited urban spaces (Planbureau voor de Leefomgeving, 2021). These requirements include the need for housing, infrastructure, and public spaces, while addressing environmental challenges such as flooding, urban heat islands, biodiversity loss and air pollution. Traditional solutions often fall short in balancing these priorities. But what if there's a cheat code, a way to solve these competing priorities simultaneously?

Nature-Based Solutions (NbS) hold promise as part of this cheat code, complimenting or entirely replacing the traditional "grey solutions"(Raymond et al., 2017). NbS can be considered living solutions underpinned by natural processes and structures that are designed to address various environmental challenges while simultaneously providing multiple benefits to economy, society and ecological systems creating urban resilience (Franzeskaki, 2019). These actions include the implementation of green roofs, water-absorbing parks, biodiversity-enhancing façades etc. (URBAN GreenUP, 2018). Despite the growing support for Nature-based Solutions (NbS) in EU sustainability agendas, national strategies, and municipal policies—which increasingly recognize nature as a vital new stakeholder in decision-making—their integration into urban development projects remains inconsistent and far from standardized (Dorst, 2022).

NbS studies have largely focused on building a coherent research field through an interdisciplinary and holistic perspective. This has resulted in more technical static frameworks, leaving challenges of dealing with complexities, uncertainties, adaptive management and private-sector involvement (Dorst, 2022). However, studies have given less attention to exploring how private sector actors, such as project developers, might need more creative frameworks to navigate these uncertainties and complexities to develop NbS. Project developers nowadays operate in a high-pressure environment because of these new challenges, while still trying to achieve their business case (Adams & Tiesdell, 2013). Therefore, relying on technical static frameworks for NbS alone might not be sufficient. Project developers may need to use frameworks that organize the integration of NbS into the overall project development. This could result in more adaptive and inclusive behavior around the creation of NbS. A need to organize and plan creativity as a specific point of attention is needed to be able to develop better and more NbS. Therefore, this research will explore the following research question:

"How can project developers organize creativity to integrate NbS into their urban development projects?"

This question focuses on the characteristics, behavior and strategies of the project developer as an individual contributing to integrating better and more NbS. The project developer is in collaboration with their project collective and supported by their development company. The research will contain the following steps:

1) Literature research about the project developers potential of organizing creativity is performed

2) Case studies were performed to learn from practice, how project developers integrate NbS barriers and create NbS Success factors, analyzing their organization of creativity.
3) The findings from the literature and practice are synthesized to understand what strategies for organizing creativity are most important to integrate NbS.

The report of the research consists of the following parts;

- Literature substantiation for the problem statement and societal relevance
- Used research frameworks, methods, findings, discussions & limitations
- Conclusions

5. Problem statement

This chapter explains the problem statement in more detail, starting with the research context and scope. Next, NbS are introduced, including their history, adoption, and examples. Then, the current status of the research field is discussed highlighting the underexplored challenges. Afterwords a framework for researching these challenges is proposed and finally the research gap is discussed.

5.1. NbS Research Context & Scope

This research is performed within the context of urban development within the Netherlands and has its scope on the project developer creative contributions to integrate NbS into the development process as an individual, collaborating with their project collectives and supported by the project development company they work for. This research specifically focuses on project developers considered successful. This section gives the most important characteristics of this context and scope. The further sections within the problem statement can be seen as the story that leaded towards this scope.

Urban development within the Netherlands is a collaborative effort between different stakeholders, including both public and private actors. These actors all have their own (often competing) interests and have to built a shared program of requirements that can be filled with a limited space. Within a development projects, project teams are dynamic. Daamen (2024, May 27) refer to them as project collectives, where different actors come and go during the project. There are known actors, like the project developer (PD) and municipality, who are dominantly involved during specific stages within the process and there are emergent actors; like ecologists and sustainability advisors, who come and go when needed within the urban development process. (see figure 1).

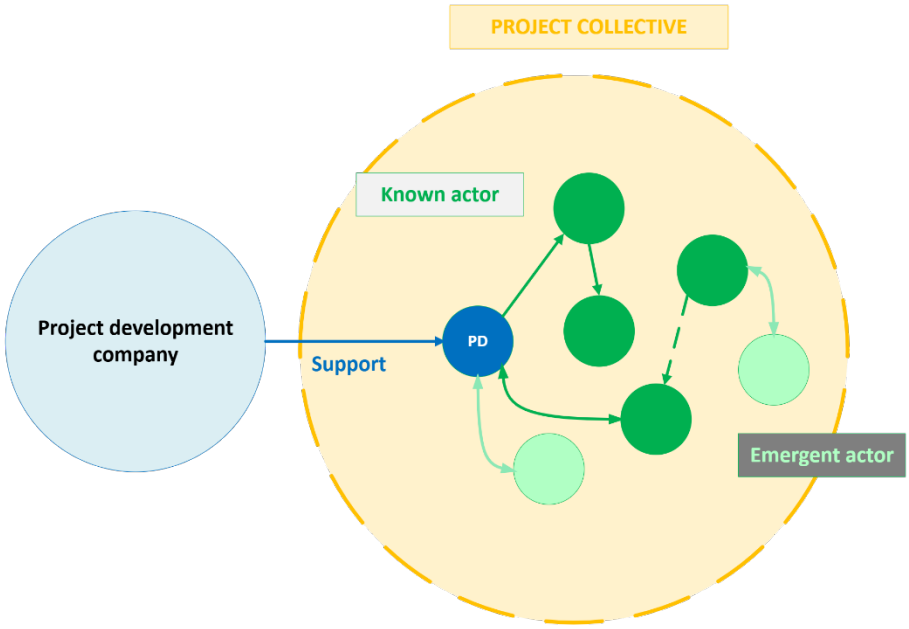

Figure 1: Research scope (Own work)

The project development collective is part of the five P's framework, which is essential for understanding urban development. This framework includes Person, Place, Process, Product, and Perspectives (Daamen, 2024, May 27).The first three P's interact with each other and form resources that influence the Product. The fifth P (perspective) represents the interaction between the actors and their institutional environment; the individual's perception of the environment.

The urban development project collective is responsible for allocating various resources, including financial resources, production resources, competencies, knowledge, and legitimacy (Daamen, 2024, May 27). Some of these resources are tangible and accompanied by formal power, while others are intangible and exert influence informally. However, due to the diversity and changing composition of actors within project collectives, these environments are characterized by a wide range of perceptions, leading to highly complex social settings (Daamen, 2024, May 27).

The project developer is someone who deals with this environment and has their own responsibilities as part of their role in this environment. The developer is a market actor and can have different roles in urban development (Adams & Tiesdell, 2013). The master developer operates strategically, planning and driving forward the overall development of a substantial area and will be the scope of this research. Others are infrastructure providers, parcel developers and building contractors. The master developer plays an important role in the production of built environments because of their expertise in spotting development opportunities, knowing the target market and resolving constraints to make things happen when required (Adams & Tiesdell, 2013). They are masters of location, product and timing. Moreover, they bring capital, labor and rights on location to create the right product on the right location at the right time.

A successful developer has relevant knowledge considering markets, construction and finance and has management abilities (Adams & Tiesdell, 2013). They are optimistic, imaginative, have practical vision, judgment, decision-making ability, courage and a thick skin (Adams & Tiesdell, 2013). These are all important characteristics for creativity. However, Dorst (2022) explains that private sector actors in the urban development sector are skeptical about costs, performance, and profitable business models of NbS and are therefore less willing to engage or invest. In the Netherlands specifically there is a lack of insight in NbS performance and technical quality that results in a lack of trust in urban NbS and skepticism.

Dorst's (2022) findings contrast with Adams & Tiesdell's (2013) description of successful project developers as optimistic and imaginative. While Dorst highlights skepticism and hesitancy towards NbS due to costs and lack of trust, this research will explore whether developers with Adams & Tiesdell's traits face the same challenges, hypothesizing they may navigate these challenges differently adopting a more creative approach for integrating NbS into the development process.

This research therefore focuses across the full implementation process of NbS as described by Raymond et al. (2017) includes six key steps:

1) Identifying the problem or opportunity.
2) Selecting and assessing NbS and related actions.

3) Designing NbS implementation processes.
4) Implementing NbS.
5) Frequently engaging stakeholders and communicating co-benefits.
6) Transferring and upscaling NbS.

Throughout this process, monitoring and evaluating co-benefits are critical. The final step, transferring and upscaling NbS, is especially vital as it fosters innovative solutions and advances sustainable transitions.

(Note that this research focuses on integrating NbS into the project development process, emphasizing fair treatment of nature alongside other priorities, while implementation addresses the steps to realize NbS on-site.)

5.2. NbS Definitions, History and Examples

5.2.1. NbS Definitions

NbS is a concept that is introduced to specifically promote nature as a means for providing solutions to climate mitigation and adaptation challenges (IUCN, 2012). It strengthens the resilience of ecosystems and response capacity (Fu, 2023). It also helps restoring ecosystems in cities and can be seen as new infrastructure solutions that increase urban resilience (Franzeskaki, 2019). Moreover, it provides co-benefits which also means an improvement of biodiversity, place attractiveness, health and quality of life and the creation of green jobs that can replace jobs within polluting industries (Raymond et al., 2017). It is a holistic means to create future resilience including environmental, social and economic resilience in multiple scales from individual to global. However, there is no formalized definition for NbS yet. It is therefore important to specifically define NbS in this research.

Important institutions like the IUCN, European Commission and ANEA have different interpretations. NbS is originally defined by the international Union for Conservation of Nature (IUCN) program as “actions taken to protect, manage and restore natural or modified ecosystems that can effectively and adaptively address societal challenges while benefiting human well-being and biodiversity” (IUCN, 2012). The European Commission later comes with a broader definition for NbS as actions that “aim to help societies address a variety of environmental, social and economic challenges in sustainable ways. These are actions which are inspired by, supported by or copied from nature” (European commission, 2026) (Nesshöver et al., 2017). The fifth session of the United Nations Environment Assembly proposed an alternative definition that combines elements of the IUCN and EC definitions: “NbS are actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems that address social, economic and environmental challenges in an effective and adaptive manner, while providing human well-being, ecosystem services and resilience and biodiversity benefits” (UNEP, 2022)(Portugal del Pino & Marquez, 2023).

NbS researchers also define NbS differently. In figure 2 three different kinds of definitions are shown to give an example. The differences in definition are recognized in two dimensions. The first dimension is about the definition of the challenges NbS addresses. Where Raymond et

al. (2017) focuses more on addressing societal challenges, Fu focuses more on addressing local challenges by addressing the city's resilience while also benefiting the environment and humanity. Frantzeskaki simultaneously focuses on both levels of challenges. The second dimension is about the definition of what the NbS consists of. Where Frantzeskaki sees it as natural processes and structures, Raymond et al. takes a more board perspective that solutions can also be inspired by nature. Fu even takes a broader perspective excluding a specific requirement of what the solution should consist of and only focuses on the outcome.

The different NbS defenitions
"solutions to societal challenges that are inspired and supported by nature" (Raymond et al., 2017)
"Natural solutions are the collective name for all solutions that increase the city's resilience while benefiting the invironment and humanity" (Fu, 2023)
"Living solutions underpinned by natural processes and structures that are designed to address various environmental challenges while simultaneously providing multiple benefits to economy, society and ecological systems" (Frantzeskaki, 2019)

Figure 2: The different definitions researchers give to NbS (Adopted from Raymond et al., 2017; Fu, 2023; Frantzeskaki, 2019)

For the purposes of this research to stay accessible, comprehensive, while remaining complete, Frantzeskaki's perspective will be adopted and adapted to the context of creating urban resilience:

"Nature-based solutions are living solutions underpinned by natural processes and structures that are designed to address various environmental challenges while simultaneously providing multiple benefits to economy, society and ecological systems creating urban resilience."

5.2.2. history, adoption & examples

NbS has its origins in past concepts like green infrastructure, natural capital and ecosystem services, ecological design and the ecosystem approach and can be seen as an umbrella term of these concepts (Nesshöver et al., 2017:, Cohen-Shacham et al, 2019:, Fu, 2023). However, it is a given that the implementation of NbS has been there since the beginning of humanity, because at that point in time there was only nature to rely on. Since the industrial revolution humans rely more and more on grey solutions which contribute to the cause of the climate problems of today (Doppelt, 2017). NbS has lost its dominance in the world and needs to regain it. Luckily, important institutions and policy platforms are adopting NbS and are replacing the ecosystem-based approach in addressing climate challenges and health and well-being in cities (Raymond et al., 2017).

The IUCN took the first initiative to globally define the concept NbS with the IUCN program in 2012 (IUCN, 2012). The EC is providing support for transdisciplinary research into the design and implementation of NbS with the goal to overcome the bias towards development alternatives with a focus on short-term economic gains and effectiveness (Nesshöver et al., 2017). They integrated NbS in a new framework program for research and innovation, "Horizon 2020" (European commission, 2016). Moreover, nature became an actual stakeholder within European policy, nature being part of European Green Deal, EU's biodiversity strategy for 2030 and

worldwide through the Kunming-Montreal agreement (European Commission, n.d.). These initiatives can stimulate new conversations about how we want to maintain and restore our relationship with nature while also thinking about how humanity itself can become healthier and more sustainable. It can foster a shift of thinking from “nature for people” towards “nature with people” (Mercado et al., 2024).

Moreover, the global interest in NbS is recognizable within research. Both developed and developing countries are performing NbS research (Fu, 2023). Franzeskaki (2019) did many case studies in different countries to gather lessons learned. Four of these case studies were in Rotterdam including the Delfshaven cooperative, Dakakkers Roofgarden, Boompjes promenade and Raingardens.

Although NbS has its origins outside of the urban landscapes in natural and coastal areas, NbS has also gain more attention in urban context, where a high concentration of people lives together with nature, which considers NbS relevant for this research. There are NGO's like WWF and EU-funded projects like URBAN GreenUP who are promoting NbS in urban areas. The WWF is providing case studies with detail about the co-benefits and lessons learned (see figure 3)(WWF, 2021). The URBAN GreenUP developed a NbS catalogue including a total of 46 NbS divided into 14 groups and includes information about their co-benefits, their prices, and technical drawings (see figure 4)(URBAN GreenUP, 2018).

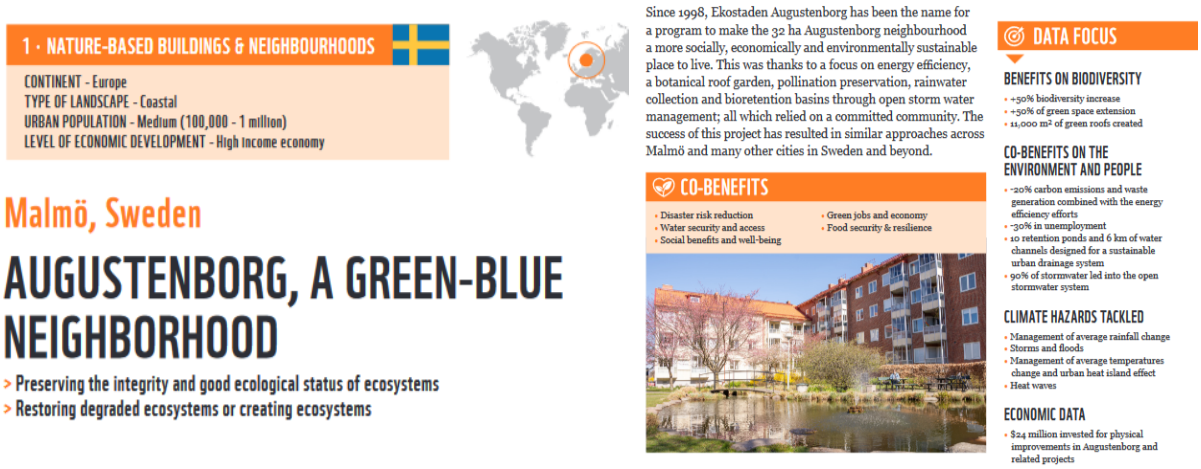

Figure 3: NbS – AUGUSTENBORG, A GREEN-BLUE NEIGHBORHOOD (WWF, 2021)

Green Route (1 NBS)	Arboreal interventions (5 NBS)	Carbon capture (1 NBS)	SUDs (3 NBS)	Flood actions (4 NBS)	Water treatment (2 NBS)	Green pavements (4 NBS)
Smart soils (3 NBS)	Pollinator (5 NBS)	Vertical GI (5 NBS)	Horizontal GI (5 NBS)	Pollutants filter (2 NBS)	Resting areas (2 NBS)	Urban farming (4 NBS)

Figure 4: NbS of Urban GreenUp (URBAN GreenUP, 2018)

5.3. NbS current status of the research field

The NbS research field is in full motion. Fu (2023) calls it still fragmented and in lack of a cohesive system. This will be further explored by identifying the focus of current frameworks found and the challenges that still needs to be tackled, framing the current status of the research field. For framing this current status, six papers have been selected based on the year of publication, its content and/or number of citations (see figure 5).

Author and year publication	Title publication	Number of Citations	Research focus	Research output
Nesshöver et al. (2017)	The science, policy and practice of nature-based solutions: An interdisciplinary perspective	703	reflection on the implications of science, policy and practice of NbS with a focus on european context	proposes questions to be addressed gives general framework for adressing these questions in NbS projects by funders, researcher, policy makers and practitioners
Portugal Del Pino & Marquez (2023)	Complementary ideas for the implementation of nature-based solutions	1 (selected on year)	Explores gap between theoretical frameworks of NbS and current NbS interventions	Four main gaps where identified Five main iedeas to help close the gap
Cohen-Shacham et al. (2019)	Core principles for successfully implementing and upscaling nature-based solutions	376	Clarifying the evolution, definition, principles of NbS and NbS its relation to related approaches	Three of eight NbS principles stand out form other approaches Five missing concepts in the NbS principles
Fu (2023)	A comprehensive Review of Nature-based solutions: current status and future research	0 (selected on year)	Gain deeper understanding of the focus of theoretical research and practical development of NbS	NbS related research focuses on five aspects Main empasis is on ideas and platform development Systematic framework the systematicity of the NbS system
Raymond et al. (2017)	A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas	592	Creating a framework for assessing and implementing the co-benefits of NbS	Holistic framework for socio-cultural and socio-economic systems, biodiversity, ecosystems and climate Seven-stage process for situating co-benefit assessmet within policy and project implementation
Frantzeskaki (2019)	Seven lessons for planning nature-based solutions in cities	339	cross-case comparative analyses with focus on ecosystem and social benefits	Seven overarching lessons related to all stages of proof-of-concept and implementation of NbS in cities

Figure 5: Chosen NbS literature (Own work)

Analyzing these six papers, it is clear that most of the literature takes an interdisciplinary approach, addressing theory, science, policy, and practices simultaneously. The focus is often on the mismatch between these areas, with new frameworks and strategies proposed to clarify concepts, principles, and policies. While Raymond et al. (2017) and Frantzeskaki (2019) provide practical assessment frameworks and lessons learned from a practitioner's perspective, they still approach it from an interdisciplinary lens. Moreover, much of the literature addresses frameworks for the ecological and technical aspects of NbS, with less focus on addressing the challenges arising from the complex social environments surrounding NbS.

These observations motivated the decision to focus this research on the perspective of a single actor and their interaction with these complex social environments, which are discussed in the chapter 5.1 (research context & scope).

5.3.1 NbS potential and challenges

Environmental, social and economic practices are inherent to sustainability and NbS its potential to address co-benefits is globally recognized with many countries studying it (Newman-Storen, 2014:, Fu, 2023). NbS has a simple construct everyone can understand; it shifts its focus from solely on nature towards people and nature, which provides co-benefits for biodiversity and human well-being (CohenShacham et al., 2019:, Raymond et al., 2017). Instead of being passive beneficiaries of nature, people have to become proactive managers of ecosystems to provide co-benefits. This resulted in the uptake of NbS by policy, practice and private sector (Nesshöver et al., 2017).

NbS is a holistic approach to deal with problems, which requires full understanding of every element of the process and their interconnectedness to grasp the shift of NbS to provide co-benefits (Newman Storen, 2014). This approach can facilitate inter- and transdisciplinary collaborations and research (Nesshöver et al., 2017:, Fu, 2023). Furthermore, it can enable transformational governance processes that creates inclusive and adaptive change, guaranteeing co-benefits for long-term (Nesshöver et al., 2017:, Portugal Del Pino & Marquez, 2023). Therefore, NbS needs open environments that require engagement with multiple actors (Raymond et al., 2017). Moreover, this has to be done in a pluralistic way to achieve inclusive and adaptive change (Portugal Del Pino & Marquez, 2023). Hence, NbS has the potential to become a real game-changer in addressing societal challenges due to its holistic approach and support for upscaling.

However, NbS still relies on outdated methods, a lack of actionable guidelines and insufficient knowledge among practitioners and absence of standardized evaluation metrics (fu, 2023). NbS principles need to be clear and coordinated and still need to capture the concepts of adaptive management and governance, effectiveness, uncertainty, multi-stakeholder participation and temporal scale (Cohen-Shacham et al., 2019). This results in a lack of indicators, misunderstanding of trade-offs, incorrect frame of priorities and lack of alignment with justified transformational governance processes (Portugal Del Pino & Marquez, 2023). Nesshöver et al. says stakeholders should be included to contribute to all dimensions of sustainability and “we should not expect NbS to be cheap and easy” (2017).

NbS implementation in practice (within urban areas)

The practice of implementing NbS within urban areas mostly deals with organizing co-creation, including interdisciplinary stakeholders working together in the design and implementation process (Frantzeskaki, 2019). This process applies a holistic approach by understanding the context of NbS co-benefits, taking advantage of these benefits while designing NbS, implementing NbS across multiple scales using learning-by-doing-approach and managing, maintaining, monitoring and assessing NbS using multi-actor co-production processes (Raymond et al., 2017). Hence it requires solutions that are integrated, creative and innovative (Newman-Storen, 2014). However, how to organize these co-production processes in a pluralistic way to be inclusive remains unanswered. Furthermore, NbS needs qualitative and quantitively impact-oriented indicators to learn from practice to establish confidence in NbS trough evidence (Portugal Del Pino & Marquez, 2023). In practice these indicators need to be identified and assessed (considering their uniqueness, considering environmental context and temporal scale) across each stage of the NbS cycle to monitor its effectiveness (Raymond et al, 2017). Hence, more case studies are needed to acquire lessons for the creation of criteria for more standardized indicators and guidelines to outweigh its uniqueness. Until then integrating NbS is still very complex, uncertain and innovative.

Based on these findings and the evolving nature of the NbS research field, integrating NbS into the development process in an inclusive way requires an approach centered on learning, change, and adaptation, which are integral to creativity. Such an approach has potential to address the complexities and uncertainties of NbS and can add extra support for sustainable transitions. The next section will explore this potential in more detail.

5.4. A Thinking-Saying-Doing Framework for NbS Barriers and Success Factors

This chapter explains the different kinds of uncertainties that developing with nature brings along, which also addresses the complexities inherent and the need for learning, change and adaptation. Afterwards a framework is proposed, that will be used in this research to analyze the these uncertainties and complexities and ways to deal with them to learn, change and adapt enabling sustainable transitions.

5.4.1 The uncertainties and complexities of developing with nature

Using nature in development brings along uncertainties. Ecoshape (2023) captures these uncertainties by categorizing them along different types, sources and levels (see figure 6). They distinguish tree types of uncertainties; Unpredictability 'cannot know', incomplete knowledge 'do not know yet' and Ambiguity 'know differently' based on Brugnach et al. (2008). These types of uncertainties can come from different kinds of sources such as the natural system, technical system and social system. Finally the uncertainties can have a certain level of uncertainty from near certain future to probabilistic future to range of futures to unknown future.

Furthermore they mention that these uncertainties can occur from both the problem space and solution space and highlights that the types of problems building with nature addresses are typically highly complex and deeply uncertain (ecopshape, 2023). They stated that these problems involve all three types and sources of uncertainties, which cannot be fully resolved through further research. Therefore, an adaptive approach in practice is needed, focusing on managing uncertainties within the problem and solution space. In this research, these problems will be identified and classified as NbS barriers. The ways for dealing with these uncertainties (learning outcomes) will be classified as NbS Success factors.

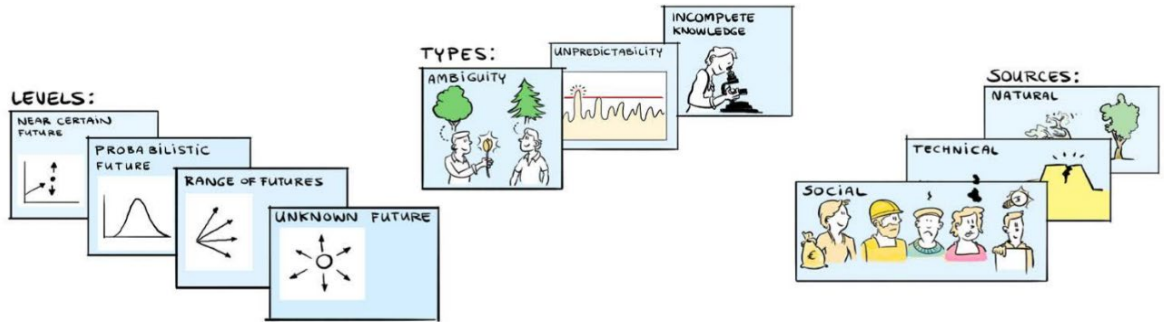

Figure 6: The complexity of developing with nature: Uncertainties and different sources (Ecoshape, 2023)

As mentioned before, current literature primarily addresses natural and technical perspectives, focusing on uncertainties from these areas. This research shifts to the social perspective, exploring social uncertainties in developing with nature and how the use of creativity address them in both the problem and solution spaces. Therefore a thinking-saying-doing framework is proposed to identify and analyze NbS barriers and success factors.

5.4.2. Thinking-Saying-Doing framework

Stam et al. (2023) also highlights the importance of both focusing on the problem and solution space and connects this to the difference between thinking, saying (problem-space) and doing (solution-space).They explain to really make sure that change happens and enables sustainable transitions, one should focus on all three aspects and the translations between them. Learning

is an important driver here, understanding its distinction in conceptual learning outcomes (learning-by-thinking), relational learning outcomes (learning-by-saying) and practical learning outcomes (learning-by-doing) (Van Poeck et al. 2020; Stam et al. 2023).

In this research this framework will be applied to identify and classify the NbS barriers and Success factors. The specific overview of this classification system is explained in table 1. This overview also forms the hypothesis for what NbS barriers and success factors to expect in further empirical research. How is dealt with these kinds of NbS barriers and success factors from a creative perspective will the main focus of the research to fill the research gap.

Table 1: Thinking-Saying-Doing Classification System (Adopted from Van Poeck et al. 2020; Stam et al. 2023)

NbS thinking barriers & success factors	Identifying conceptual problems and learning outcomes	*wen it comes to broadening the scope of how problems are framed and defined and to "skills" that may contribute to integrating NbS such as divergent thinking (often viewed as creativity), critical thinking, reflection and reframing*
NbS saying barriers & success factors	Indentifying relational problems and learning outcomes	*outcomes when it comes to creating new relationships and network development, social arrangements and building trust to integrate NbS*
NbS doing barriers & success factors	Identifying practical problems and learning outcomes	*when it comes to taking novel, collaborative action: behavior, habits, routines and technology*

5.5. Research Gap

To summarize the problem statement and address the research gap, the current state of NbS research field highlights several gaps that this study aims to address. While existing literature is mainly focusing on natural and technical perspectives, analyzing ecological systems and technical solutions, and related uncertainties, there has been limited attention to the social complex environment for integrating NbS.

Moreover, much of the literature addresses interdisciplinary approaches, combining theory, science, policy, and practice, but lacks a focused perspective on a single actor's contribution to navigating these challenges. Specifically, the role of the private sector, project developers, which are key actors in urban development, remains underexplored not understanding how they perceive and address more social uncertainties and complexities that limits the integration of NbS, in this research addressed as NbS barriers (limitations) and success factors (addressing these limitations).

Therefore, there is a need for researching from a creative perspective, centered around learning, change and adaptation to integrate NbS, contributing to the overall sustainable transition. Moreover, we need to gain more understanding in how one can actively organize this creativity, changing not only practitioners ways of doing, but also their ways of thinking and saying to capture all conceptual, relational and practical learning outcomes.

This research gap provides an opportunity to investigate how creativity, framed through the thinking-saying-doing framework, can be organized by project developers in transforming NbS barriers into success factors, contributing to the broader sustainable transition.

6. Societal relevance

6.1. Importance of the perspective of the project developer

Urban developments in the Netherlands face growing complexity, balancing housing, infrastructure, and public spaces while addressing environmental challenges like flooding, heat islands, and biodiversity loss. NbS, such as green roofs and water-absorbing parks, offer innovative alternatives to traditional "grey solutions," promoting urban resilience and delivering social, economic, and ecological benefits. However, despite increasing recognition in EU agendas and municipal policies, the integration of NbS into urban development projects remains inconsistent and unstandardized.

This is due to the fact that NbS is still in its sustainable transition phase, highlighting the need for learning, change and adaptation within urban development to integrate NbS into the development process, emphasizing fair treatment of nature alongside other priorities. Moreover there remains a gap in understanding how private parties, such as developers, can respond to the need for more nature-inclusive building practices. These market parties should be active participants in the transition toward nature-inclusive construction, as public parties rely on them. Moreover successful project developers have the creative capacities and potential to drive these kinds of changes. To keep their market positions the always need to find new ways to distinguish themselves from others in order to achieve their business case, making them reliant on creativity and innovation. Learning from those project developers trough research can shed light on what is important to focus on now to push the sustainable transition of NbS forward.

6.2. Importance of organizing creativity

Creativity encompasses making new, critical and lateral thinking, storytelling, creating equity and encouraging social change using “Outside of the box thinking” as a paradigm shift towards innovation (Newman-Storen, 2014). This makes creativity necessary to lead the integration of NbS, especially because NbS still seeks innovation, inclusiveness and social change. Therefore, we might learn about NbS by studying creativity especially considering dealing with “wicked problems” in a pluralistic way.

“Wicked problems” are considered complex problems which are debatable, raise questions, dilemma or value shift that challenge governance structures, skills sets and organizational capacity (Newman-Storen, 2014). Fostering creativity is a way to deal with these kinds of problems, because it requires thinking differently and embracing the uncertainty of the future (Newman-Storen, 2014:, Gould, 2023:, Woodman, 1993).

NbS tries to deal with wicked problems, addressing societal challenges. However, there is a call for practical support and guidance to tackle them in the form of careful inclusive facilitation (Nesshöver et al., 2017:, Gould, 2023). Moreover, the concepts of adaptive management/governance, uncertainty and multi-stakeholder participation still need to be captured in the NbS principles (Cohen-Shacham et al., 2019). NbS literature exposes a significant gap in dealing with wicked problems in an inclusive way and advocates for creative guidance.

To offer creative guidance, we should look at cognitive skills like being able to perceive alternative problems to deal with wicked problems, considering diverging and converging skills and incorporate this in strategic planning processes of organizations (Woodman, 1993). Moreover, we should embrace teamwork (Newman-Storen, 2014).

When looking at creativity literature it becomes clear that fostering creativity is broader than just including all values into discussion. It is only one small aspect of a complex system considering power dynamics which become especially dominant during decision-making (Newman-Storen (2014). Organizing creativity can enable justice including recognitional (recognition of different needs, values and preferences), procedural (participation in decision-making) and distributional (distributed for all) justice to enable continuous inclusive change (Portugal Del Pino & Marquez, 2023).

The interactionist model (inherent to social sciences) towards organizational creativity encompasses antecedent conditions of the individual, individual creativity behavior, group creativity behavior and organizational creativity behavior (Woodman, 1993). All these different levels of creativity are influenced by each other in the form of social and contextual influences. This creativity might be inspiring for enabling the three types of justice within the social complex system of integrating NbS.

In conclusion, NbS calls for practical support and guidance to tackle wicked problems in a justified way in the form of organizing creativity and look for social innovators to optimize this enabling the development of NbS. Furthermore, this social innovator organizes pluralistic processes for including the three types of justice NbS needs. In this research the project developer is seen as this potential social innovator who can optimize their organization of creativity to contribute to the integration of NbS.

7. Research frameworks

7.1. Research questions

As mentioned before, to fill the research gap, the following main research question will be investigated: ***"How can project developers organize creativity to integrate NbS into their urban development projects?"***

To answer this research question, in total four sub-questions are constructed:

SQ1: *"How can project developers organize creativity for their urban development projects?"*

SQ2: *"What are the main barriers and success factors project developers face for integrating NbS into their urban development projects?"*

SQ3: *"How do these NbS barriers and success factors inform the organization of creativity?"*

SQ4: *"What strategies can they apply to organize creativity to the integration of NbS into their urban development projects? "*

7.2. Conceptual framework

The conceptual framework explains the scope, context and main concepts of this research as seen in figure 7.

Figure 7: Conceptual framework (Own work)

7.3. Theoretical framework

The theoretical framework serves as the foundation for the research, providing a structure for answering the main research question. It outlines key concepts, theories, and relationships that further defines the scope and focus (see figure 8). This theoretical framework is derived from the problem statement and the answers to SQ1, guiding the other three sub-questions. It is therefore advised read chapter 9.1 if concepts are not clear yet. Additionally, it clarifies and operationalizes the main concepts of the conceptual framework, showing how researching these concepts will lead to answering the main research question.

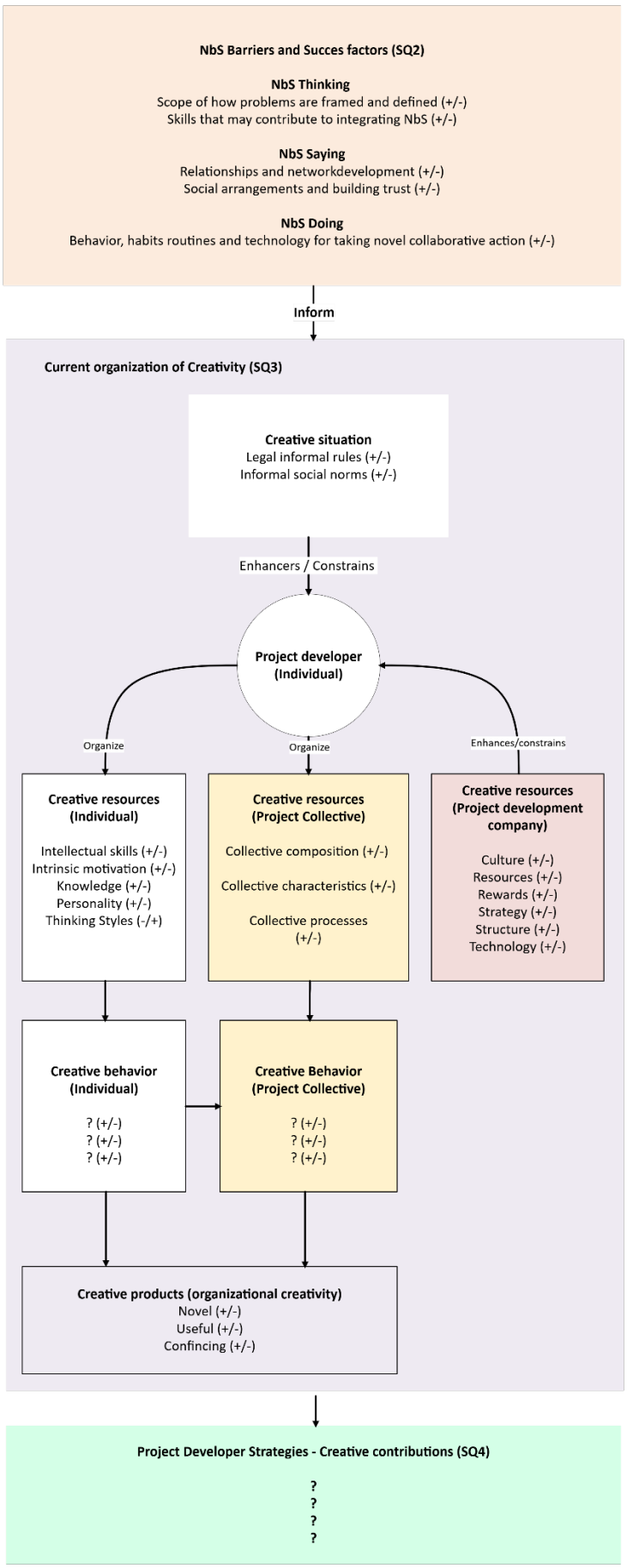

Figure 8: Theoretical framework (Own work)

7.4. Propositions

This section explains all propositions behind the theoretical framework, explaining the principles, relationships, hypotheses and assumptions.

Proposition 1

"Creativity in project development can be organized by an individual through creative contributions influencing creative resources and behavior of others within the project collective."

This proposition assumes that creativity is not spontaneous, however can be intentionally cultivated by an individual within the project collective. The hypothesis is that project developers can organize creativity by analyzing the creative situation within their projects. This analysis will provide insights into their current organization of creativity, revealing the contributions needed to reorganize and improve it to enhance the creative product.

Proposition 2

"The Creative situation consists of NbS Barriers indicating the constrains for the organization of creativity and NbS success factors indicating the enhancers for the organization of creativity."

This proposition assumes that the NbS barriers and Success factors are central to creativity, assuming a seamless connection between the Thinking-saying-doing framework and creativity. The hypothesis is that by identifying and analyzing NbS barriers and success factors, project developers can gain a clearer understanding of the creative situation, enabling them to tailor their organization of creativity to overcome challenges and leverage opportunities.

Proposition 3

"The organization of creativity by the project developer is directly influenced by the specific challenges and opportunities factors presented by NbS integration."

This proposition assumes that how creativity should be organized depends on the unique demands of NbS projects. The hypothesis is that NbS integration will need an adaptive and ongoing process of organizing creativity as a response to the challenges and opportunities that come along the urban development process.

8. Methods

8.1. Type of research

Since this research explores a new perspective on integrating NbS in two areas by considering the role of the individual project developer and creativity, an explorative approach is necessary. Additionally, the study needs to uncover social perspectives, which can be effectively achieved through a qualitative study. As Blaikie & Priest (2017) mention, a qualitative study generally focuses on producing discursive descriptions and exploring social actors' meanings and interpretations.

Moreover, there are no operationalized constructs yet for this area of study. Therefore, this study aims to generate new theories and hypothesis about how the project developer organizes creativity in the form of creative contributions. This is an abductive logic of inquiry. Blaikie & Priest (2017) explain that abductive logic attempts to understand how social actors view, understand, and respond to their world of interest. Instead of a top-down approach, this provides a bottom-up perspective. This type of inquiry is also often used in design-oriented studies that strive for possible solutions to potential realities (Blaikie & Priest, 2017).

8.2. Methods and Techniques to be Used

This research involves both theoretical and empirical research. Especially the theoretical research for answering SQ1 uses this design-oriented approach creating a theoretical framework to guide the research towards possible solutions to potential realities. The empirical research is captured by case studies, answer SQ 2 & 3. A holistic multiple-case design is used (Yin, 2014) (see Figure 9) to capture NbS barriers and success factors as perceived by stakeholders in practice from different cases and different contexts. Additionally, it explores how creativity is organized across different cases and contexts. The theoretical and empirical research together will form the hypothesis answering RQ4 and finally the main research question.

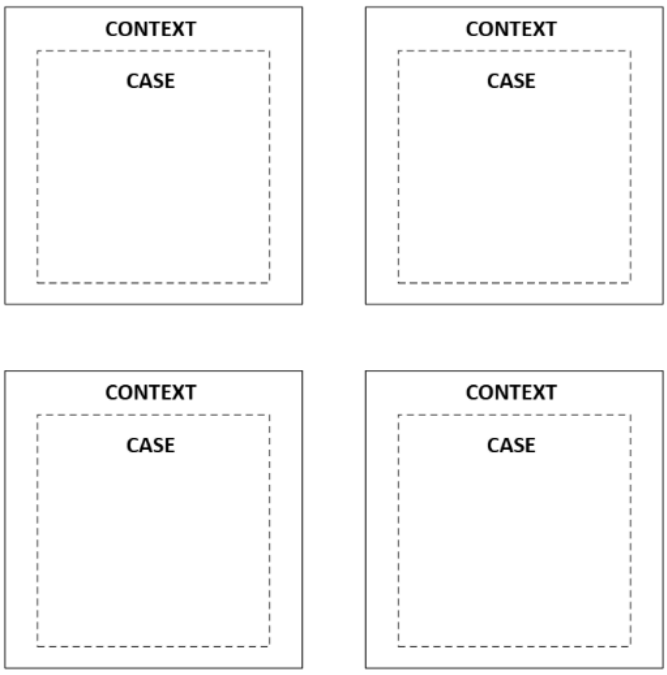

Figure 9: Holistic multiple-case design (Yin, 2014)

8.3. Data Collection & Analysis

This research involves multiple stages of data collection and analysis (see figure 10). First Data was collected from creativity literature to answer SQ1. In total10 creativity papers were found and analyzed and 6 papers were used to construct the theoretical framework. Afterwards four case studies were performed parallel collecting data from in total 15 interviews and 42 publicly available and internal documents. These interviews were exploratory open interviews. In appendix A, a protocol for the interviews is found. These interviews were conducted with:

1. *Concept/Area/project developers working on the urban development project cases*
2. *Their sustainability advisors helping them (from within their development company)*
3. *(Landscape) Architects with whom they collaborate within their development projects*

The interviewees were selected to provide insights into the three main concepts of the research question. While their roles overlap, project developers primarily offer perspectives on the development process, sustainability advisors contribute insights related to NbS, and (landscape) architects bring ideas about (traditional) creativity and design. The collected data was analyzed using both closed-coding using the theoretical framework and open-coding, explore multiple interpretations to see if patterns are occurring. By combining these methods of coding, the data can be structured in a concise way fitting within the scope, while exploring new insights utilizing research findings.

To be able to answer SQ2 and SQ3 a cross-case analysis was necessary to compare them, taking into account their differences in contexts. These cases were compared using the five P's framework core to urban development. In this way the cases could be systematically compared to identify patterns, similarities, differences and insights that that informed conclusions and theories answering RQ 2 & 3.

Afterwards data-synthesis was performed taking the findings from the case studies and consulting again the creativity literature to connect the case study findings to creative contributions answering SQ4. By placing the findings from SQ 4 back into the context of the existing conversation about NbS in literature and discussing the theoretical and practical implications, limitations, and future research prospects, the RQ could be answered and concluded.

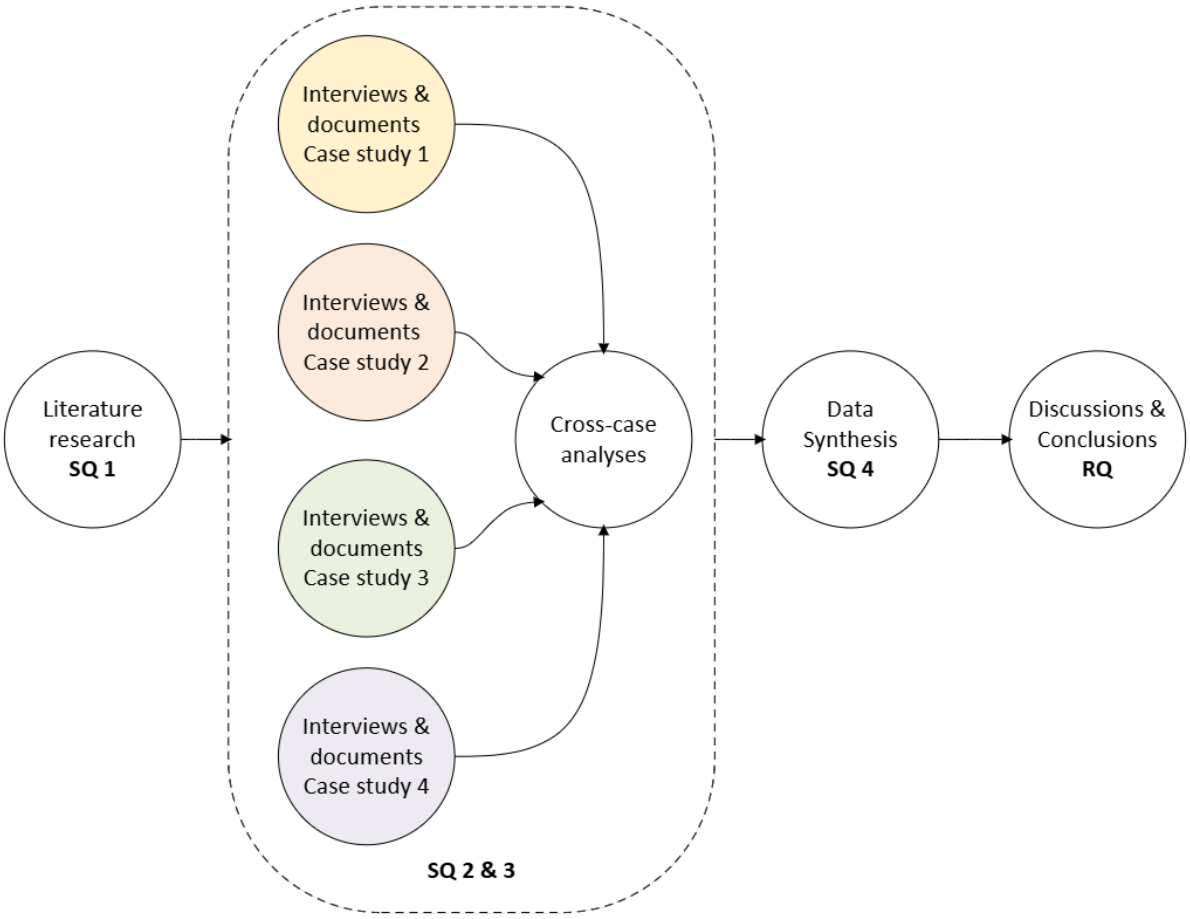

Figure 10: Data collection & analysis (Own work)

8.4. Data plan & Ethical considerations

This chapter provides the data plan used in this research, which was constructed based on the FAIR guiding principles as described by Shenton (2004). The data plan consists of an assessment of the methods used for data collection and analysis against the FAIR guiding principles, ensuring the data plan is trustworthy. The overview of this assessment is shown in Figure 11. Moreover the data plan is based on ethical considerations to make sure that the data is collected in in a justified and ethical way, making sure participants are not harmed by the research process and outputs.

FAIR GUIDING PRINCIPLES (SHENTON, 2004)		RESEARCH IMPLEMENTATION
Credibility	The adoption of research methods - well established	A buttom-up approach is used within an abductive logic of inquiry using different frameworks based on literature research
	The development of an early familiarity with the culture of participating organisations	Upfront contact with a company representetive for selecting cases interviewing 3 people within the organisation context
	Trangulation	Collecting different types of data: literature, case interviews & case documents
	Tactics to help ensure honesty in informants	Participants can refuse or withdraw at any moment during the research and where informed by this trough a concent form and within the introduction of the interview
	Iterative questioning	Use of probes to elicit detailed data and iterative quesioning trough rephrased questions, using upchunking and down chunking methods when nessusary
	Frequent debriefing sessions	Discussions were held with my supervisors to widen my vision
	Peer scrutiny of the research project	Discussions were held with my peers to gather feedback
	The researcher's reflective commentary	I kept a log book with reflections on the research process
	Member checks	The analyzed transcriptions of the interviews and workshop were shared with the participants to check accuracy
Transferability	Results of the study must be understood within the context of the particular characteristics of the organisation and geographical area	The context is described in detail and is also incorporated in RQ 2 & 3
Dependability	The research design and implementation, the operational detail of data gathering & reflective appraisal of the project	The final research report will provide a prisise description of the methodoly and methods used until operational detail and reflects on the execution
Confirmability	preventing investigator bias	Trangulation
	Create audit trail	Constructing diagrams using a data-oriented approach

Figure 11: Assessment data plan (Adopted from Shenton (2004))

First, it was essential that participants signed an informed consent form before participating in the interviews (see Appendix B). Participants were informed that they could withdraw at any time without providing a reason, even after signing the form. The consent form was developed using the templates and guidelines provided by TU Delft ensuring all important elements were there.

The collected data was strictly limited to addressing the research questions. Participants' identities were anonymized during data analysis through the use of pseudonymous codes. Any confidential information disclosed during the interviews was removed from the dataset. Additionally, to protect participants' pseudonymity, the companies involved were only given access to the final results, not the raw data, ensuring that participants could not be identified by colleagues or other members of their project collectives.

To ensure secure data storage, measures were taken to minimize the risk of identifying participants. Informed consent forms were stored separately from the Pseudonymized datasets. A single document linking identities to codes was stored separately from the informed consent forms in a secure, European-authorized database, protected by a password.

To ensure secure data storage, measures were taken to minimize the risk of identifying participants. Informed consent forms and personal information were stored, in a secure European-authorized database protected by a password, separately from the pseudonymized datasets and were locked with a password for additional security. A single document linking identities to codes was stored separately from the informed consent forms also in a secure, European-authorized database, protected by a password.

Lastly, ATLAS software was used to analyze and code the data. No AI features within the software were utilized; it was employed solely for structuring the analysis. The audio recordings and datasets will be retained for six months after graduation or five years following the last publication.

9. Findings

This chapter captures the findings of all SQ's including:

1. *Creativity literature findings: explaining the theoretical framework*
2. *Case study findings: describing the NbS barriers & Succes factors informing the organization of creativity*
3. *Cross-case findings: describing the similarities and differences found in the cases*
4. *Data Synthesize findings: forming strategies for creative contributions*

9.1. Literature research – Organizing Creativity in project development

In this chapter SQ1: *"How can project developers organize creativity for their urban development projects?"* will be answered. This will be done by performing a literature study about creativity applied to the metrics and responsibilities of the project developer in urban development.

9.1.1. Defining creativity

General definitions

The definition of creativity within the research field was first defined by Stein (1953) as "a creative work is a novel work that is accepted as tenable or useful or satisfying by a group in time". Stein further describes novelty as: "the creative product did not exist previously in precisely the same form." They are "reintegration of already existing material or knowledge, but when it is completed, it contains elements that are new". Many researchers frame creativity a bit differently, however all are certain that creativity is a process that leads to novel and useful products and that it contains a rearrangement of already existing knowledge. Rhodes (1961) describes that it also includes articulating that synthesis so that other people understand the meaning which is a requirement for the group in time to accept the work as tenable, useful or satisfying. Steinberg (2006) adds to this by addressing the importance to understand the perspective of the judges: the once that needs to accept the work, to make sure the creative product is adopted and implemented within the organization context. Therefore, a creative work should be novel, useful and its communication should be convincing to the judges.

Creativity resources, processes and products

Creativity however not only limited to the description of its product. Rhodes (1961) describes three more elements and named the four P's: Person, Process, Product and Press (relationship between human beings and their environment) as important to understand creativity. Woodman (1993) agrees and states that if you are to research creativity one should incorporate all four P's to gain a full understanding of what is happening.

Input-process-output model

These four P's can be translated in the well-known input-process-output model, where person and press can be seen as creative resources (inputs) for the creative process and product (output). Sternberg (2006) names four different categories of creative resources that belong to the creative person: Intellectual skills, Knowledge, Thinking styles and Personality. There are many things that researcher describe what a creative person should or have:

- Skill to see problems in new ways and to escape the bounds of conventional thinking (Sternberg, 2006)
- Tolerance for ambiguity and risk-taking (Amabile, 2012)
- Ability to accept conflict and tensions (Rhodes, 1961)
- Capacity to maintain direction as one develops and tests hypotheses (Stein, 1953)

For this research the creative resources of the individual as defined by Sternberg (2006) will be used which are more shown in detail in figure 12. Sternberg sees these creative resources as something that is autonomous, and one can choose and adapt to. The person is interacting with this environment and is called their ecology (Rhodes, 1961). It consists of two instruments: the climate of a particular environment and the person's reaction to its environment. This highlights the importance of perception, the fifth P as described Daamen (2024). In this research the press will be simplified capturing the NbS barriers and Success factors as perceived by the interviewees which will be discussed later.

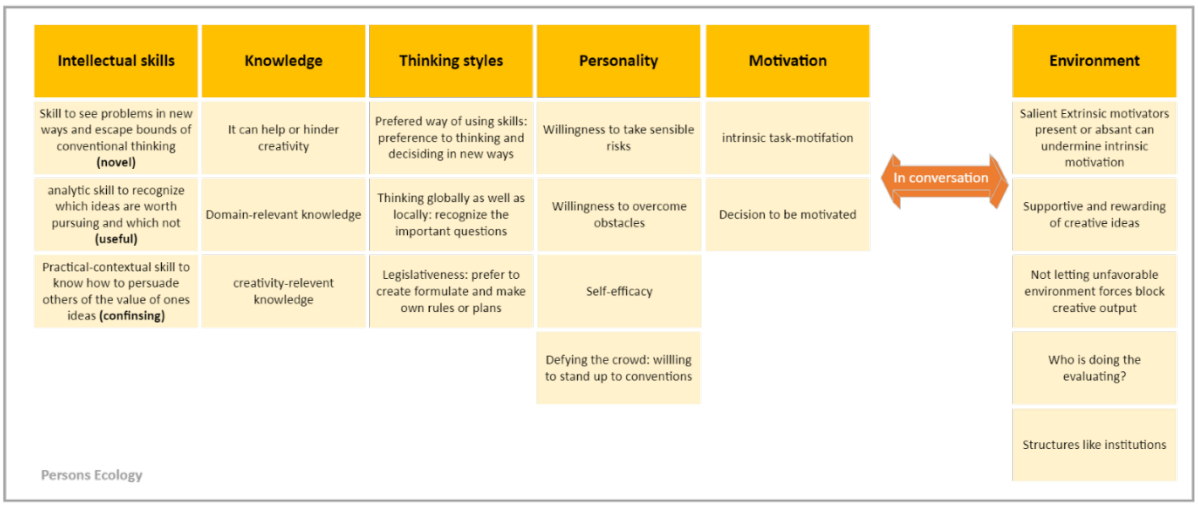

Figure 12: Creativity resources forming the persons ecology (Adopted from Sternberg (2006):, Rhodes (1961);, Amabile (2012)).

Rhodes (1061) sees motivation, perception, learning, thinking and communication as essential elements of creative processes, highlighting the importance to ask questions about these concepts to understand its value within the creative processes. Important to highlight is that creative processes are in fact not random. It needs its scope to create useful ideas within the given context. The judges are also part of this context.

The creative product has its relationship with the definition of innovation in creative literature. Innovation is defined by Amabile (2012, p.7) as the “successful implementation of creative ideas within an organization”. In this research, creativity is seen as an innovation means or in different words the sub-processes that leads to innovation. Furthermore, the creative product can come in many forms, where the definition of creativity is centered around the criteria of the creative product. Rhodes describes this as “there is no standard system for organizing artifacts according to idea value or degree of originality. Consequently, any artifact is called a creation and mystery surrounds them all". These words suggest there is always a magic touch to the product. If the creative product is seen as creative

Conclusion

Based on the findings from this literature review and the objectives of this research, creativity will be defined as: *"The process of creating new, novel, and convincing work, performed by creative persons in conversation with their environment."* This definition highlights the dynamic interplay between individual creativity and the influences of external pressures, emphasizing the innovative and persuasive nature of creative endeavors.

9.1.2. The three levels of creativity: from Individual to organizational

Until now, creativity has been discussed from an individual viewpoint and its interaction with their environment. However many literature also discusses more 'joint creativity' involving collaboration as important aspect for creativity in connection to its social complex settings, as is the case with urban development. This literature research will zoom in on 2nd and 3rd level of creativity introducing group and organizational creativity, to understand the different kinds of components important for creativity within collaborations. The concepts of individual, group and organizational creativity will be discussed together looking at the work of Woodman (1993).

Individual, group and organizational creativity (Woodman, 1993)

Talking about the f tree levels and their connections one can look at the model of organizational creativity. Woodman (1993) has been citated the most for a theory of organizational creativity, which will be one of the main frameworks used for this research. The theory brings the perspective of interactional psychology forward and shows an interactionist perspective that explains human behavior in complex social settings, showing individual, group and organizational characteristics and behaviors as important elements for organizational creativity (product). This model is hard to explain in one graphic. Figure 13 shows the most important links between person, process, press and product in combination with all its components of individual, group and organizational characteristics and behavior important for the creative product, or as also described here; output, outcome and organizational creativity. Important to notice is that press is mentioned here as creative situation and that it has been put within the transformation Colom to gather with creative behavior (process). This is different from described before, were press was described as input together with person and personal behavior is seen as part of the process. This model shows better the dynamic nature of creativity an highlights that the inputs can change along the process due to transformations; represented in this model by the lines between inputs, transformations and outputs, not having a specific direction. This clearly shows the complexity of relationships between the different elements at play when it comes to creativity, going beyond the individual and could partly explain why creativity has been viewed as very complex to research, including all its components, going beyond researching the individual, as mentioned by Woodman (1993).

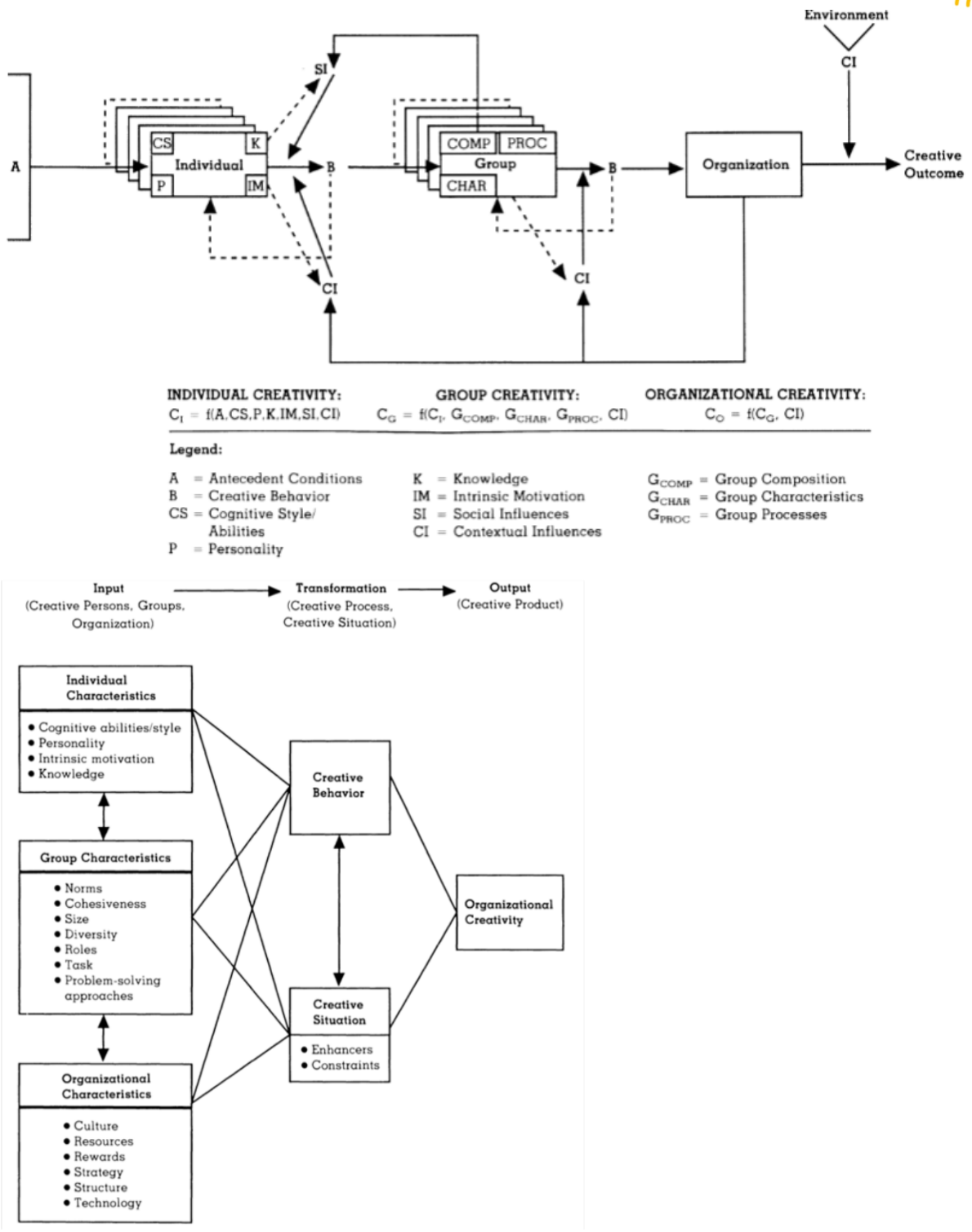

Figure 13: Conceptual links among creative persons, processes, situations and products (Woodman, 1993)

To simplify it a bit to the purposes of this research, lets distinguish the six elements that interact with each other focusing on the individual, group and organization characteristics that are in conversation with each other and in conversation with the creative situation and performs creative behavior. All these elements together lead towards an output, the creative product and as Woodman (1993) calls organizational creativity.

Creative Characteristics forming creative resources

Taking the creative characteristic of Woodman (1993) and interpreting them as creative resources as described by Sternberg (2006), Creative resources are not only on individual level, however also on group and organizational level all forming the input for the creative process together with the creative situation. Individual resources are cognitive abilities/styles, personality, intrinsic motivation and knowledge as described by Woodman (1993). Sternberg (2006) also describes personality intrinsic and knowledge, however splits cognitive abilities/styles in two naming them intellectual skills and thinking styles, giving more concrete definition to what is mend by this. Group resources are composition, characteristics and processes and organization resources are culture, resources, rewards, strategy, structure and technology. All these components are important to capture within the theoretical framework to see how these components are recognized and discussed by practitioners in urban project development.

In urban project development however, there are no groups or at least not a standard group which stays the same during the entire process. Instead, there are project collectives, with actors joining and leaving during the process. This means that the creative resources on group level will constantly change, constantly influencing the creative situation, individual and organizational creativity. Moreover these actors within the collectives are connected of multiple project teams that all are part of different organizations which also is part of the creative situation enhancers and constrains. In this research these are also captured among NbS barriers and Success factors. With this in mind, group level creativity will be used as theoretical framework for describing the project collective with its corresponding resources.

Creative behavior & Situation

So, creative behavior is a complex person-situation interaction (woodman, 1993). The creative behavior of the project developer can influence the creative behavior of urban development projects collective. For this research, it is important to identify these creative behaviors and the influence of the developer's creative behavior on the project collectives.

The creative situation is defined as: “the total sum of social and environmental (contextual) influences on creative behavior” (Woodman, 1993). It consists of legal formal rules and informal social norms (North, 2003). To simplify this, the social and environmental (contextual) influences will be informed by the NbS barriers and success factors, which consists of existing institutions for NbS. If it is a barrier or success factor depends on whether it enables or constrains the initial creative behavior for or with NbS.

Measuring creative behavior will be done by recognizing new ways of thinking, saying and doing, highlighting learning and change contributing to the sustainable NbS transitions (see again section 5.3).

In this research the assumption is that project developer can manage their own creative behavior and influence the creative behavior of the project collective as response to the creative situation transforming NbS barriers in to NbS success factors.

9.1.3. Defining “Organizing creativity”

In this research “organizing creativity “refers to the influence that the project developer can have on this model of organizational creativity by performing strategies. Sternberg (2006) describes these deliberate alterations as creative contributions where one can contribute to the overall creativity by pushing forward current lines of thinking, going against current lines of thinking and altering currents lines of thinking by looking for synergies with other lines of thinking. Considering the framework of thinking, saying and doing as components for sustainable transitions (Stam et al., 2023), the project developer should also be able to contribute by influence the current lines of saying and doing within their project collectives to transform the different NbS barriers into success factors.

Following the logic of the literature as described, while focusing on the influence of the individual on the project collective, the following definition of organizing creativity is constructed:

“performing creative contributions by:

1) *pushing forward current lines of thinking, saying, and/or doing*
2) *going against current lines of thinking, saying and/or doing*
3) *altering current lines of thinking, saying and/or doing*

within the project collective, transforming NbS barriers into NbS success factors”

In figure 14 an overview is shown of how the project developer can do this in theory considering the research context as desbribed in section 5.1.

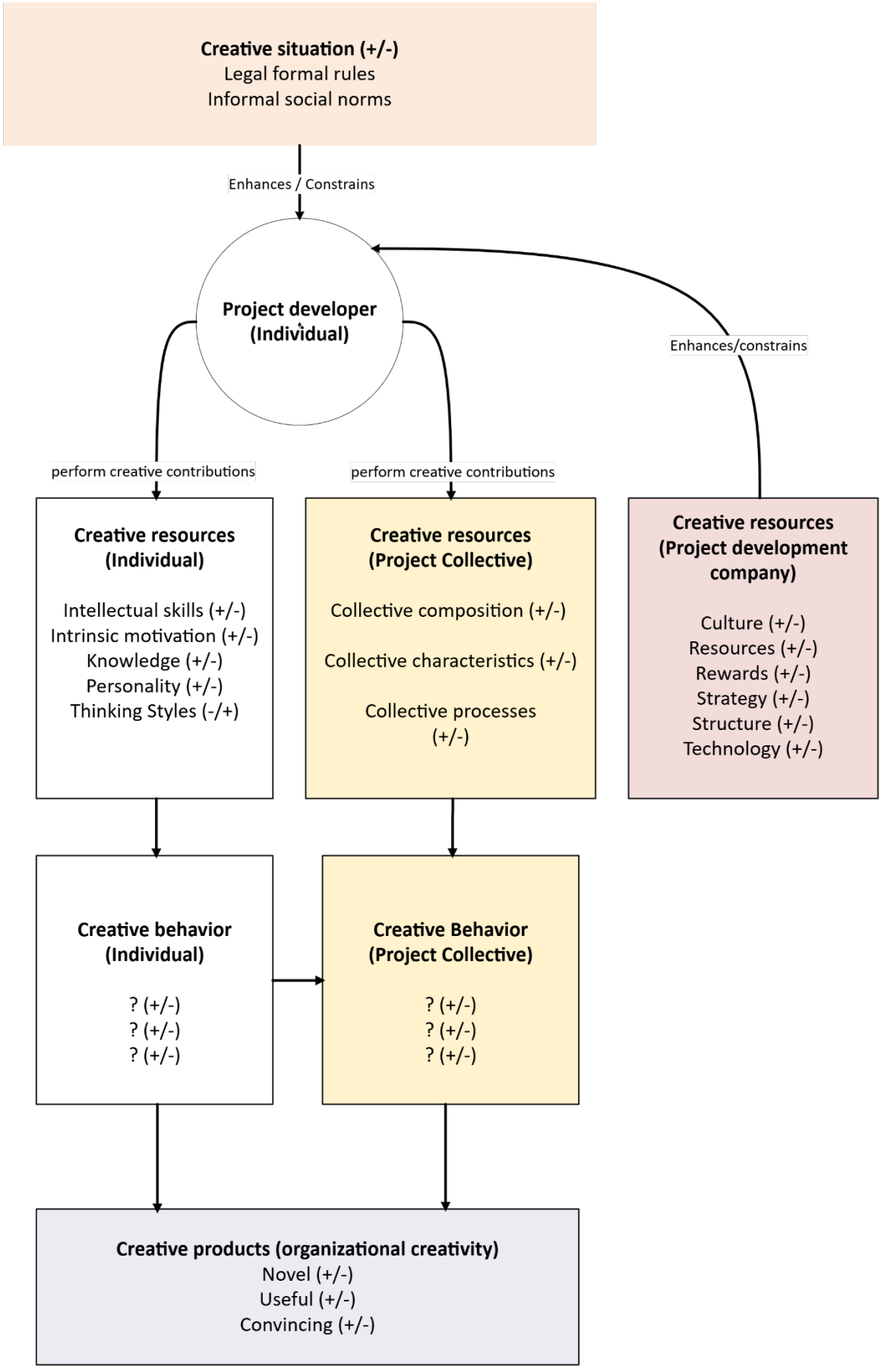

Figure 14: Theoretical framework for the project developers organizing creativity (Own work)

the project developer as an individual can perform these contributions by performing strategies to change their own creative resources and the project collective's creative resources. Moreover, the project developer can change their creative behavior to influence the creative behavior of the project collective. The development company can constrain or enhance the project developers' strategies to do so, which is indicated by the project development company creative resources. To effectively organize creativity the project developer first needs to observe all components of the model in practice to identify their current organization of creativity scoring all components of the model as an enhancer (+) or constrain (-) for the organizational creativity. After identifying these enhancers and constraints, the project developer can respond to this, performing strategies, creative contributions that sustain the enhancers and deals with the constraints, or even turn them into enhancers for organizational creativity. So, the project developer in this way can optimize their organizational creativity to achieve the optimal creative products. This forms the base for the theoretical framework as precented in section 7.3.

9.1.4. Conclusion

To summarize this literature research SQ1: *"How can project developers organize creativity for their urban project developments?"* will be answered.

The project developers can organize creativity by optimizing the organizational creativity needed to find a novel, useful and convincing solution to an open-ended problem which has no standardized solution. They can do this by analyzing the framework of organizational creativity and judging what parts of the framework are constraining and enhancing the organizational creativity. Based on this judgement they can respond with strategies, enabling creative contributions to influence these enhancers and constraints to the optimal organizational creativity needed for the problem at hand.

9.2. Findings Case studies

This section discusses the findings of the four case studies through concise summaries by using closed-coding. First, an introduction to each case is provided. Afterwards, the key themes and approaches for the integration of NbS are outlined, followed by main storylines found in the data, connecting the identified NbS barriers and success factors to the organization of creativity. Finally, some close insights are presented. A total of 15 storylines were identified: 9 focused on NbS success factors, 4 on barriers transformed into success factors, and 2 solely on barriers.

For this research, four cases were analyzed, each (subconsciously) focusing on integrating NbS within their urban development projects. Figure 15 provides an overview of the cases, including the development company-municipal context and distribution of interviewees across the cases, their pseudonyms, and roles within the projects. 3 interviewees where more contextual to AM development company allowing the creation of familiarity with the culture of the project development company.

The cases were selected based on their proven or potential success and innovative efforts to integrate NbS and the characteristics of the project development companies involved. The characteristics sought were based on the description by Adams & Tiesdell (2013) of successful developers (see section 5.1).

The first case is Berckelbosch in Eindhoven, developed by Ballast Nedam Development. This project serves as the base case in this research due to its proven success and innovation in NbS implementation. In 2021, Berckelbosch won the Dutch award “Natuurinclusief bouwen & Ontwerpen,” granted by Vogelbescherming Nederland (Vogelbescherming Nederland, n.d.). This award recognizes projects that integrate the needs of both people and animals in urban design, construction, renovation, and environmental development. Berckelbosch was specifically praised for its large-scale nature-inclusive work and integration with the community, making it a benchmark for the other cases.

The other three cases, Wickevoort in Haarlemmermeer, Hero in Breda, and ZOË in Amsterdam, are being developed by AM, which has been identified as a successful development company. The cases were selected for their innovative efforts in integrating NbS. This selection process was conducted in collaboration with a company representative, ensuring the inclusion of projects with varied innovative efforts. However, whether these efforts were successful still needed to be proven. This highlights an additional reason why they were compared to Berckelbosch in the cross-case analysis: to determine whether they met the benchmark for successful NbS implementation.

Figure 15: Chosen cases – their context & interviewees (Own work)

9.2.1. Berckelbosch, Eindhoven – Ballast Nedam Development

Figure 16: Berckelbosch project: Bird view (Ballast Nedam Development, 2023)

Case introduction

Berckelbosch is a long-term urban area development of +/- 950 dwellings (mid and high range houses for selling) near the center of Eindhoven (Berckelbosch., n.d.). The project started in 2003 when the “Old Berckelbosch was built”. During the crisis the project has been paused and restarted afterwards building the “New Berckelbosch” (Lily, developer; Hugo, developer). Now new Berckelbosch is being built which has been developed by Hugo, Lily joined later and is now working on the last sub-plans 7 & 9 where the new zoning plan still needs to be excepted, building more homes than expected focus on more affordable dwellings (Lily, developer; Hugo, developer; Gemeente Eindhoven., n.d.).

Over the years the development project has made an evolving commitment to nature-inclusive solutions and biodiversity making it a great example of how a development can transform from a traditional residential development towards an exemplary nature-inclusive neighborhood. This has been validated by experts in the field granting the project a nature-inclusive Design and Construction award in 2021 as mentioned before (Vogelbescherming Nederland, n.d.). Working from the existing ecosystem structures and an existing urban plan, they mainly collaborated with Vogelbescherming Nederland to develop NbS, maximizing space for public green structures and stimulate NbS, with community engagement. (Lily, developer; Hugo, developer; Nick, Ornithologist).

Key themes and approaches for the integration of NbS

Berckelbosch integrated NbS before and after the ambition for nature-inclusiveness was introduced. On macro level NbS were already introduced before; existing tree structures where preserved, forming the foundation for green corridors that connect the neighborhood with nearby natural areas like the Urkhoven "We didn’t start with a blank canvas," said Lily (Developer), highlighting how the existing landscape influenced the urban design back in 2003. This was actually a somewhat unintentional benefit for nature-inclusiveness clarifies Hugo (Developer);

"Berckelbosch was designed about twenty years ago by a firm from Eindhoven and the municipality. At that time, promoting biodiversity and nature-inclusive building was less prominent…but they still came up with some clever solutions." These solutions also encompassed the realization of diverse green property boundaries on micro level.

Then after the crisis the CEO of the project development company was one of the initiative takers for introducing this nature-inclusive theme and asked Hugo and Nick to collaborate and proof that the project development company was doing great with this theme, which had become more and more relevant to master over the years (Hugo, developer; Nick, Ornithologist). They developed NbS on macro scale including Wadi's and urban green spaces with native species including various grasses and herbs. Moreover, they developed NbS on micro scale realizing overgrown pergola's, sedum roofs on the garages and spaces for plants in front of the houses.

Now Lily is working on subplans 7 & 9 where they will also include the creation of a water biotope, creating a natural living environment for native animal species (Lily, developer; Hugo, developer). Thesis still very new and not yet realized.

Main Storylines from NbS barrier and or Success Factor to the organization of creativity

Overruling priorities of space use due to common practice asks for searching synergies (NbS barrier – NbS Succes factor)

Although stakeholders within the project collective are not against NbS, other priorities often overrule due to their common practice.

"Yes, everyone always says; I am in favor of green, and I think everyone is… however, the people are also in favor of adhering to all guidelines (in any case the municipality), which is usually at the expense of public green areas." (Lily, developer)

This something that let towards the strategy of searching for synergies making sure that you can have a win-win situation. Although this is not always as easy, not everything seems possible. Lily explains that as a project developer you need to see the couple of opportunities and be able to combine things. The project developer can do this because they have an overview of many different aspects of the project and need to guard this process. Lily calls this: "Spin in het Web".

To find these synergies she brainstorms with the architects until they have the best creative ideas, both judging the ideas to steer for usefulness, as well as hitchhiking to stimulate novelty and combinations. On the other hand, she tries to challenge the current ways of thinking of stakeholders with the overruling priorities are perceived as outdated, loosening up scope boundaries. See figure 17 for the connection to the theoretical framework.

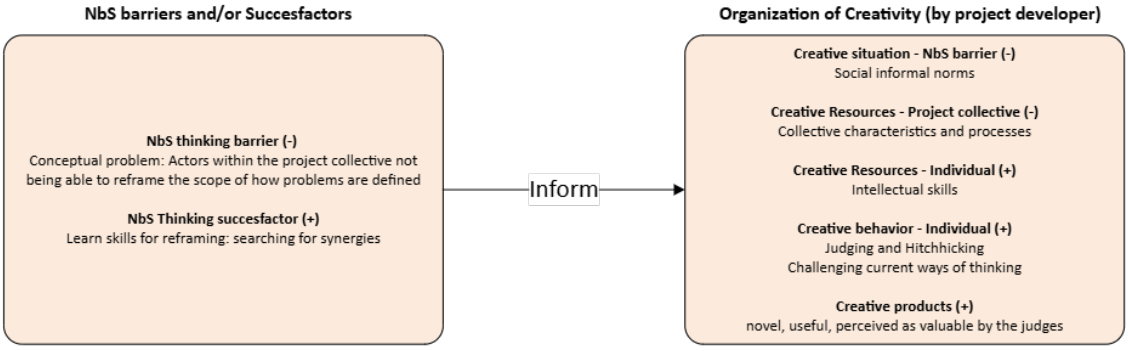

Figure 17: Overruling priorities calls for searching synergies - NbS Success Factors informing organization of creativity (Own work)

Maintenance barriers from the municipality due to regulations and municipal policies (NbS barrier – NbS Success factor)

One of the main barriers that Lily, Hugo and Nick spoke about was the municipal policies working against NbS in ways. Their handbook is not equipped for NbS maintenance and the structures within the municipality are not flexible enough to go beyond the standards most of the time. Hugo (developer) tells how the only thing you can do about it is trying to convince them in creative ways showing that it fits into their policies by involving specialists to show that the approach is better.

"They are always people, and of course you can convince people. That is actually the only thing you can do. And look, the civil servant can't do anything about that, but policy always lags behind reality, which moves faster than you can make policy. And if we have a higher ambition, then sometimes it doesn't meet a number of things... then you have to be a bit creative to make it meet the policy after all... that is just difficult, even though it is a theme known to everyone. That requires perseverance ...then you will have to bring in other specialists to show that your approach is better."

- (developer) agrees; *"people say, you won't get past my hatch, and then there really has to be such a convincing force from the municipality or from ourselves to actually get more, and we drop some things, so that consideration, that is sometimes quite tough."*

However, Lily explains that sometimes involving specialists is not enough:

"We looked at certain types of trees with the ecologist and the landscape architect and it was concluded that it is important for different animals that there should be different types of trees and then you include that in your plan and the municipality says: 'just do the same standard trees everywhere, because that is better for our management policy.' And to then still get it your way takes a lot of time. Then you really need someone from the municipality to lobby for you."

Nick actually used the strategy of lobbying after disagreements that are due to current lines of thinking

"*De municipality responded; Yes, you should take it out, because there could be houses there. But then you enter into those conversations, and eventually you win them over. That doesn't really happen on the basis of arguments or anything like that. That's really an investment in relationships. So, you go out for a bite to eat or a drink with a municipal official, and then you talk*

about it together. You have to get to know each other first, and then a kind of goodwill factor develops, and then it is granted."

The NbS Succes factor to overcome municipal policy barriers involves perseverance, creatively strategies, involving specialist and sometimes through lobbying, however it not always works. See figure 18 for the connection to the theoretical framework.

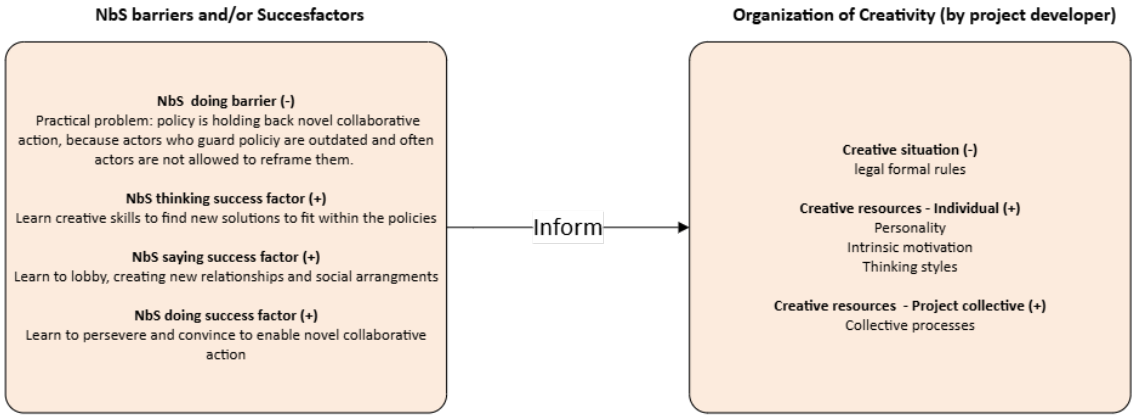

Figure 18: Maintenance barriers from the municipality due to regulations and municipal policies - NbS Success Factors informing organization of creativity (Own work)

Project developers' ambition for doing something extra: Using the Plug-inn method (NbS Success Factors)

"it is not so much that this is specifically designed from the complete biobased concept or nature inclusiveness. But at Ballast we have the CEO as an internal big driver in green, so to speak. And because real estate and area development are going so slowly, we have said here: We are going to plug in the maximum here. So not as a concept, but in practice, how can we make it as green as possible here, with the aim of making it as sustainable as possible in all its aspects."(Hugo, Developer)

Both Hugo (developer) and Nick (Ornithologist) mentioned that the enthusiasm and intrinsic motivation of the CEO was one of the main drivers for their ambition to do something extra for nature. The CEO personally asked them to make it happen which created space for taking a step further.

"The cool thing was that the CEO said, 'Hugo, I need references. I'm going to say something, and you have to make it happen.' And then you literally and figuratively get the space to do that." (Hugo, Developer)

And he said: "Here I actually want to do things differently. This is the first district where I actually want to show how well we are doing as Ballast Nedam." And that's where a lot of those elements actually came together." (Nick, Ornithologist).

Nick also mentioned that the collaboration with Lily (developer) was very positive. Lily herself also mentioned a great ambition for green: *"If you are involved with public space, you have to fight for as much greenery as possible."*

This ambition led to the plug-inn method. Hugo (developer) explains what it means: *"What I mean, is that we just put the maximum into it and sometimes that doesn't have to be complicated at all. It's all known resources, no higher mathematics, just doing it. And in a way I also find that creative, because you can make a lot of policy plans for a very nature-inclusive neighborhood. Sometimes you have low-hanging fruit and then you just have to do things."*

See figure 19 for the connection to the theoretical framework.

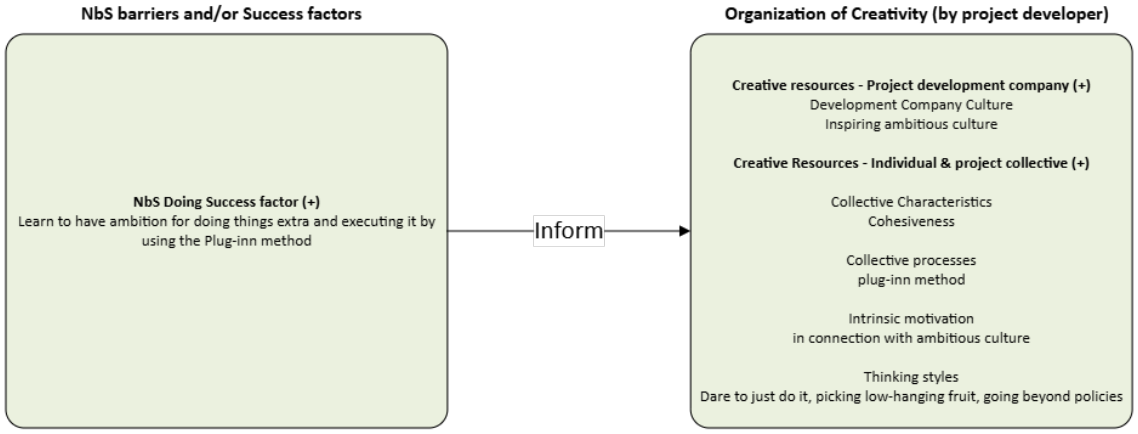

Figure 19: Project developers ambition for doing something extra: Using the Plug-inn method - NbS SuccessFactors informing organization of creativity (Own work)

Barrier to Resident-Nature Relationships: playing with Public and Private Spaces for effective NbS Implementation and Resident Education (NbS barrier – NbS success factor)

Overall residents do not have the best relationships with nature when it comes to making their property nature-inclusive and implementing NbS and the urban plan had reserved a lot of space for private gardens. This, however, did not hold the project collective for coming up with creative solutions.

First of all, they used the plug-inn method by playing with public and private spaces. They took out most of the front gardens and made a big public green space. Moreover, they created private parking spaces in the backyards to again create a big public green space. The private parking spaces were then covered with an overgrown pergola.

*"Because we try our best to keep the buyers' gardens green. But I also know that there will always be a terrace, so that is often paved. That is bad for water drainage, heat stress and biodiversity. But, if we take a few meters of the garden and add that to the public green, the cars don't have to be there. By parking in the backyard, the garden becomes a bit smaller, and we add more space to the public area. We can make that public area nice and green, which actually gives us less heat stress."(*Hugo, Developer)

For the remaining private space, they also took the initiative to educate and inform residents in engaging ways, making brochures and lots of videos.

"We also organized a bird safari with Nick, for example. And with the ecologist from the local garden center we explained how to design your garden, and you have to sell that (literally sell) and that really gets people excited. That way you literally and figuratively create space for others, such as architects and consultants, to excel as well."(Hugo, developer) Lily (developer) adds;

“Everyone really just cheers that on. That's really great to see. And then you also see that the residents themselves are actually getting enthusiastic about making their own garden completely nature inclusive. And of course, you always have people who are tiling everything. But you really see that it's getting greener. So, then you really have ambassadors from the neighborhood”.

See figure 22 for the connection to the theoretical framework.

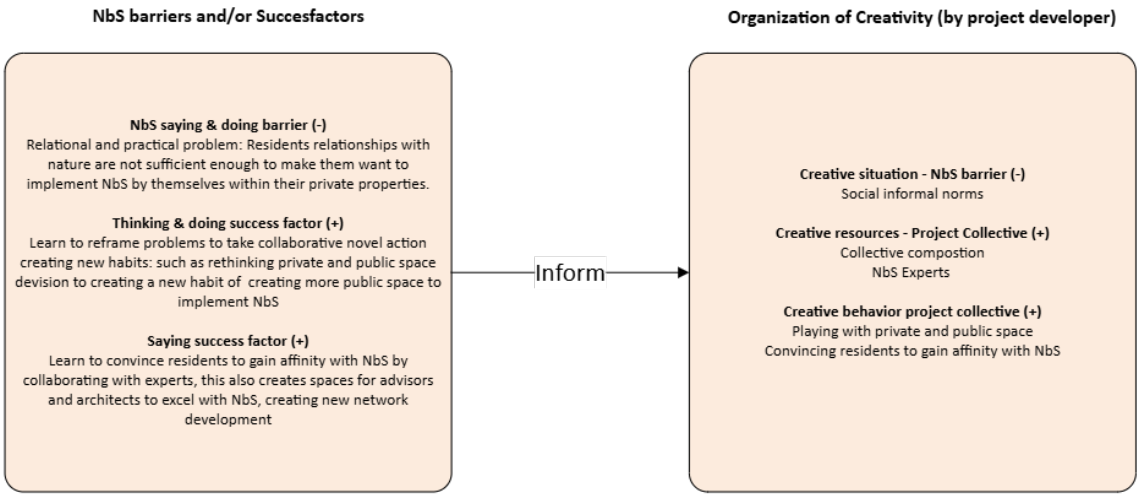

Figure 20: *Barrier to Resident-Nature Relationships: playing with Public and Private Spaces for effective NbS Implementation and Resident Education* - NbS success factor informing organization of creativity (Own work)

Closing insights

Although their focus was not on NbS integration from the beginning and their urban structure was already quite fixed, they still searched for room to integrate NbS in creative ways and has created some large-scale solutions. They were lucky that the existing ecological structures were already there when following their own ambitions to integrate the NbS, however it still took a lot of perseverance and persuasiveness to gain this NbS quality.

9.2.2. Wickevoort, Haarlemmermeer – AM

Figure 21: Wickevoort – Woonveld Bos (Wickevoort, n.d.)

Case introduction

Landgoed Wickevoort is a big area development project of 850 dwellings in Haarlemmermeer. It is a mixed neighborhood with 40% social rent. It goes from apartments of 40 m^2 - 80 m^2 until villas of 220 m^2 (Lucas, Area developer). AM won the tender due to their distinguishing ideas on energy. For NbS there were no set rules, however Area Developer Lucas took the initiative to introduce the theme of nature as important within this area as response to this area of 54 hectare, where 12 hectare of woods is preserved. They are also working with a new wood-built concept. 2/3 is already delivered and 1/3 still has to be built. They have a city farmer who is spread within their neighborhood. Moreover, they implemented green property boundaries, semi-paved parking spaces surrounded with mixed hedges, green facades and pergolas, green places to stay and play and do sport (Jonas, Landscape architect). They came up with a lot of strategies for making private properties as green as possible with legal measures and accompaniment to help them with a green interior (Anne, Project developer).

Key themes and approaches for the integration of NbS

Wickevoorts original green characteristics made it very clear that it was a perfect place to preserve existing green structures and built from that by introducing more NbS. This has been done in many ways with special attention to the relation with the residents in the neighborhood, by guiding the integration of NbS in the residential life.

Main Storylines from NbS barrier/success factor to the organization of creativity

Municipality ways of thinking and maintenance barriers for playgrounds - (NbS Barrier)

Jonas (Landscape architect) talks about the issues they had with their creation of playgrounds within nature. He tells about the municipality being very strict on safety issues and changing maintenance.

"Playgrounds are always a challenge with this municipality.... We want to create playgrounds under trees. The municipality doesn't always want that, sometimes we have to use artificial grass, There must be some fall ground for safety, for example under a cable car, but we do try to keep it as green as possible."

He vents his frustrations that they could have made Wickevoort much greener, however sometimes the maintenance of municipality works against it and it takes long coversations to get small wins.

"Here has to be a certain subsoil for maintenance. For example, if they have difficulty mowing around the legs of a swing, then they have to do extra maintenance again, and that is all extra costs. There should also be no sandboxes because that requires extra management... That is a great loss for the neighbourhood, and it is all about maintenance... My colleague has had discussions about this with the municipality... they have been really difficult discussions... we have really tried to achieve as much as possible... Sometimes it is a win that we are allowed to use wood chips for playgrounds in the forest instead of having to put artificial grass under the forest. These are very small wins."

See figure 22 for the connection to the theoretical framework.

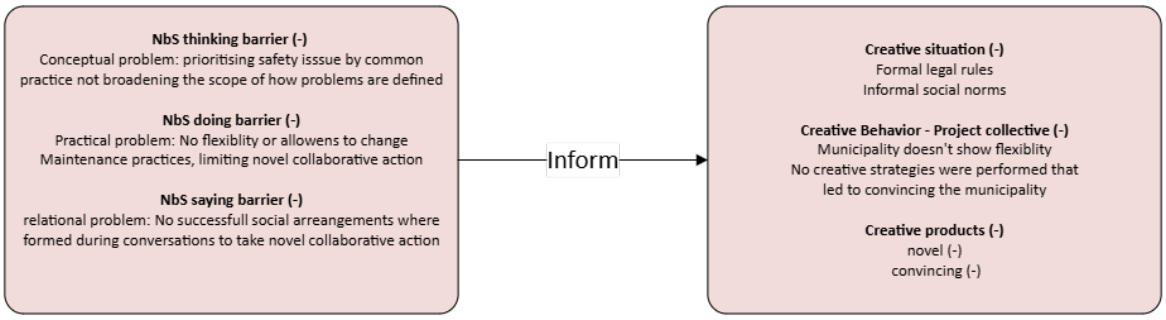

Figure 22: Municipality ways of thinking and maintenance barriers for playgrounds - NbS Barrier informing organization of creativity (Own work)

From ambition for innovation towards clear guidelines and Vision towards choosing the corresponding advisors towards responding to uncertainties with flexibility (NbS Success factor)

Anne describes its sequence of things that the project developer should do/have, all are connected to integrate nature within a project development.

"Although it is not new, nature, the capacity in which we now want to integrate nature into our environment, that is indeed new... it starts with embracing that innovation and not being put off by the unknown and therefore trying to hold on to the traditional approach, then you might end up with a traditional building with a single ivy on the facade. But if you embrace that innovative

approach from day one, new ideas really emerge. Of course, that requires project developers to sometimes let go a little and bring flexibility to the process.... As far as I am concerned, the architect must in any case have a feeling for the ambitions that you set and therefore embrace nature-based solutions or nature-based design.....It is my role to make it clear at the beginning that the starting points for this project are that it must be nature-inclusive and climate-adaptive, and that it must meet certain standards. The entire project must, as it were, "breathe green." Then I choose an architect who feels connected to that. I think that is an important step in securing the entire process." (Anne, developer)

Also Lucas mentiond the ambition they had to do more than standard and also choose their adivosers based on that.

"And it also came from the core values, because those core values also included sustainability, but then again specifically aimed at improving nature. So it wasn't legislation, but it was more initiative from, well, from us or from the development team to do something about that. Also reinforced by advisors who were involved and who thought it was really cool and who themselves also had that as, well, an objective or ambition, so they just helped with that. But we really chose those advisors for that." (Lucas, developer)

Jonas (Landshape architect as advisor gave back that he saw the intrinsic motivation from the project developers.

"I know them from their role as client and developer here. But they really do their best, also in other projects, to create the greenest possible situations. Maybe it's a sales technique, but I think they really care about the green and the quality. I also notice it in phase three. The project developer Anne from AM. We started out in the field to see what the good trees are. They really want to learn about that."

See figure 23 for the connection to the theoretical framework.

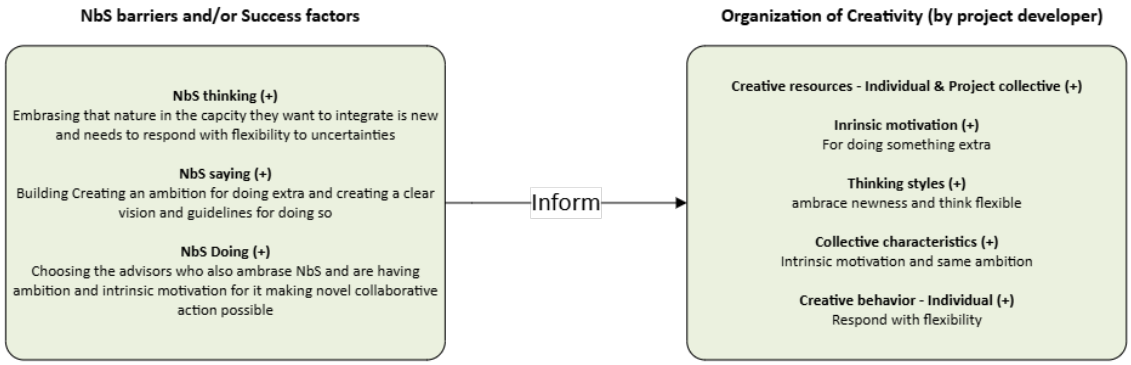

Figure 23: From ambition....to flexibility - NbS Success factor informing organization of creativity (Own work)

Resident acceptance – taking new measurements for community Engagement (NbS Barrier – NbS success factor)

The project developer has set many guidelines and also took legal measures to help the residents with implementing NbS by themselves. However, this was not always successful. Lucas (developer) explains the issue of some of the legal measurements:

"For example, we have also imposed a qualitative obligation that people may only pave their garden to a certain percentage... But then you see that there are people who pave 100% of their garden. Yes, then I sometimes think: how is that possible? ... You record it in contracts, and then it happens anyway. The argument is then: 'Yes, if I have grass, I have to mow it, and if my garden is completely paved, I don't have to do anything to it. Sweeping it once a year is sufficient." (Lucas, area developer)

Lucas explains that they also organized an enforcement from the local maintenance association to monitor if people follow the legal agreements, however, also have droughts about its effectiveness due to social pressures.

"For example, trees are sometimes cut down by the resident, and then the management association has to enforce. But what you then see is that if you are my neighbor and you remove your hedge, I am of course not going to betray you, because then we are no longer friends. So that enforcement is also very difficult." (Lucas)

On the other hand, they also took the initiative to inspire residents and show them who in the neighborhood has the knowledge to help by making a booklet with local examples, this seems to be more effective said Jonas, however you will still have residents who do not participate.

"We now see, although we don't know exactly whether it is because of that booklet, that in phase one there are already gardens that are completely green, even with trees that are not from us. So it seems that some people are really greening their gardens, but whether they would have done that anyway, we don't know of course." (Jonas, Landscape architect)

Anne adds that sometimes they take the control in their own hands making sure that the NbS implemented is qualitative for biodiversity.

"In the front gardens we have zones with planters that are close to the footpath. I thought it would be a shame to leave this up to the residents themselves, because people often think that a hydrangea, for example, is very biodiverse, while it contributes little. That is why I wanted to choose plants that are really good for biodiversity and that fit in with the existing landscape that is already there."

She does leave space for residents to choose from a selection of plants and processes the additional costs in the business case, including it in the sales price of the dwellings.

It is recognizable in all these stories that they are experimenting with different kinds of new measurements to make the NbS effective even on the private plots of the residents and it is recognizable that they monitor its effectiveness reflecting on their own work. See figure 24 for the connection to the theoretical framework.

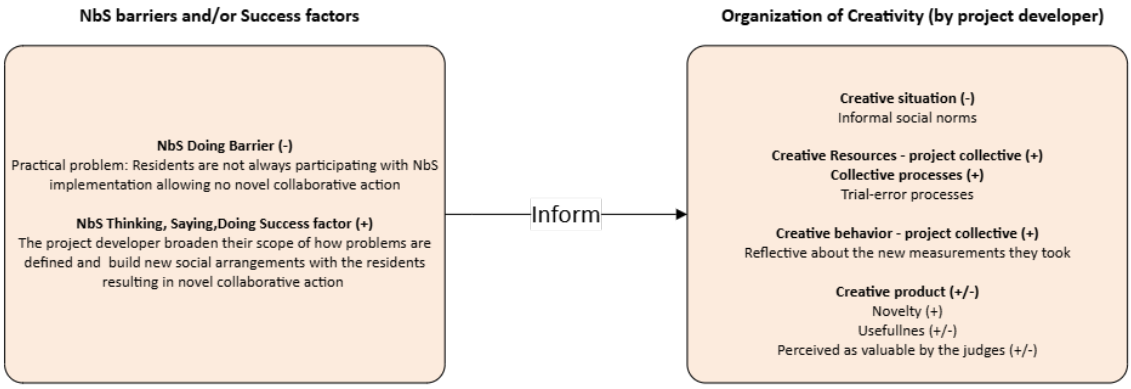

Figure 24: Resident acceptance – taking new measurements for community Engagement - NbS Success factor informing organization of creativity (Own work)

Challenges on construction site needs monitoring and creative problem solving (NbS barrier- NbS Success factor)

Lucas (developer) says that it takes a lot of explanation to argument why you do things differently when speaking to contractors, because otherwise other things will happen on the construction site that are designed on paper.

"For example, we spent a lot of time on preserving trees, making development plans around existing trees, really huge puzzles... we also have to make a business case fit, so that costs us a lot of time and energy. And well, in the end we succeeded, then you also have to pay attention, because a contractor looks at it completely differently... he comes into his area, sees that tree, well shit, there's a tree, it's actually in the way. Before you know it, he's sawing into the tree, so you also have to communicate very clearly with guys, there's a tree with a fence around it, because those roots have to be protected, so take that into account. Well, you also record that in agreements, in contracts, that they at least take that into account." However Lucas explains that this is not enough, *"you also have to monitor it by having sometimes someone on the construction site with the knowledge, in this case the landscape architect did this."*

Jonas (landscape architect) reflects on how he did this one time: "*when we arrived at the start of construction, there was no fence around half of the trees, even though we had indicated that there was. Now we also have a building that is going to be expanded and is quite close to an existing wooded bank. There is discussion about the piles that have to be placed there, because they will be in the crown zone of the trees... We are looking at whether we can tie a number of branches so that the piles can pass by, or, if there is no other option, how far we can possibly prune... As a landscape designer, I am perhaps also a bit spoiled in my creativity, because some things are very normal to me, such as: "Oh, then you just tie some branches to the side and work around them." But for the executing party, BAM, I think that requires quite a bit of creativity, because they are not used to this. Certainly, if you are really dealing with situations where trees had to be cut down because they were too close to a house. And BAM still can't figure it out, while there are certainly examples of building around a tree, which of course also requires a creative solution and probably also more costs and care."*

See figure 25 for the connection to the theoretical framework.

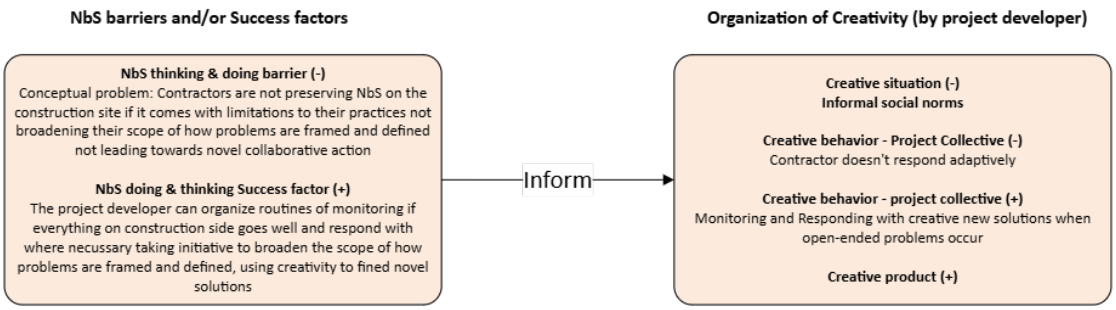

Figure 25: Challenges on construction site needs monitoring and creative problem solving (Own work)

Closing insights

Due to the already natural environment, the preservation and acceleration of NbS was the most challenging, which had a lot to do with the stakeholders involved, more to the end of the project development. This case shows how beginning with a strong vision also responded in a strong security of NbS in the execution and usage phase, where the project developer responded adaptively to the challenges that came along and took lessons-learned for future projects.

9.2.3. Hero, Breda – AM

Figure 26: Hero- Birdview (Hero van Breda, n.d.)

Case introduction

Hero Breda is an urban development of about 450 dwellings in the east of Breda next to the railroad. Back when the started the development, AM had the ambition to make this the healthiest Neighborhood of the Netherlands (James, project developer). However, this has been downsized towards the healthiest neighborhood of Breda. The location has been a former industrial location where the factory of Company Hero was situated. There they produced their jams and fruit drinks, which has a special place in this project. The new neighborhood will be full of different kinds of fruit trees connecting the historical characteristics to the implementation of NbS, making NbS integrative. Moreover, they engaged the community to take care of these trees. The project is focused on creating spaces for doing sports and creating social cohesion all with the ambition of creating health and wellbeing for humans. It is a very mixed neighborhood with social rent, middle rent, high rent, however, also care homes (Tom, Project developer).

Key themes and approaches for the integration of NbS

Their key themes are gathered form their DNA-sessions which resulted in the construction of an essence of creating a vibrant neighborhood, with green as connecting factor, focused on creating a conscious living style within a stimulating environment (Hero Breda, 2022).

Main Storylines from NbS barrier/success factor to the organization of creativity

Connection History with the future – Story telling trough NbS (NbS success factor)

One of the main success factors for NbS here has been story telling. They put a lot of emphasis on the history of the place and telling that story. To integrate this story, they used NbS; fruit trees as a means to connect this story with the future residents. These trees will not only function as

an enhancement for biodiversity, however, will also allow the own food production of the neighborhood. Moreover, the maintenance of this NbS will be done by the residents themselves, due to maintenance barriers from the municipality. This is however not seen as an issue because they came up with a new solution that also fosters social cohesion and public wellbeing.

"What often happens is that the municipality takes it over when we have constructed it, because it becomes public space. We had to have a lot of discussions with the municipality. These are the people who have to do the maintenance, and they say, yes, you know, these are species that require so much maintenance, we cannot pay for that from municipal charges... So, we have now said, we think it is important in the inner area, where all the people are/stay, that there are fruit trees, because Hero is linked to that. That means that we have actually described a maintenance situation in which everyone who comes to live there becomes a member of the maintenance association". (James, Area developer)

Especially the connections that we put in our DNA at the beginning. For example, from a health perspective we want to stimulate a healthy living environment. So, then you think about how you do that, and that translates into, for example, introducing fruit trees and fruit crops in the outdoor area. That also fits in with the health theme, but also with HERO, and you make a nod to the past of the HERO site, where fruit juices used to be made. Then you look for people who want to organize a picking route, for example a local resident who is very interested in that, and who will later organize picking routes for residents. In that way you have that connection with both the social aspect and nature that you already provide at the beginning. (Tom, Project developer)

James (area developer) tells how these kinds of initiatives also lead to new kinds of unexpected collaborations

"Hero of course originates from the Hero factory, being the jam factory, and cassis etc. So, we really looked to find things in the street names that have a wink to that. And the funny thing is, because we are really going live now, that Hero, the main company from Switzerland is now calling from: Wow, we actually find it so charming what you are doing there, we would like to participate. Yes, how do you want to participate? Well, I don't know, maybe you can think of things for me that we can contribute to financially, so that it gets better".

See figure 27 for the connection to the theoretical framework.

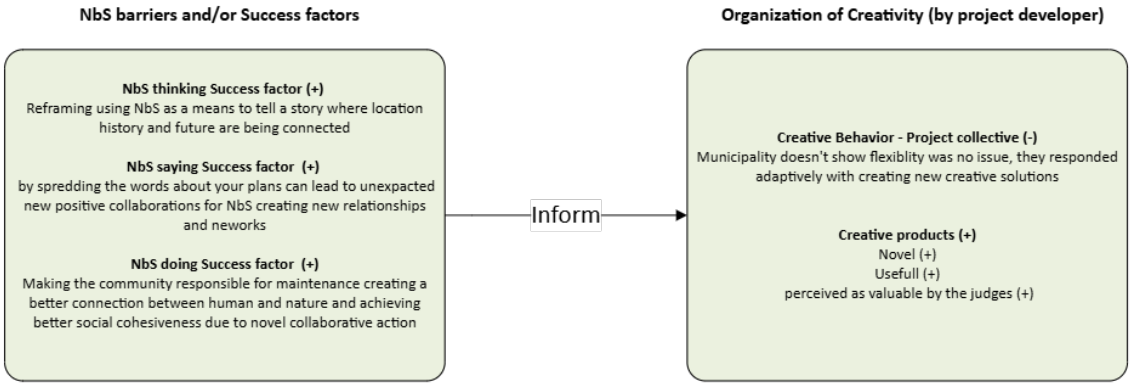

Figure 27: Connection History with the future – Story telling trough NbS - NbS Success factor informing organization of creativity (Own work)

Take initiative and preserve; Enthusiasm - challenge - integral thinking - critical thinking – following your instincts – adaptiveness (NbS Success factors)

The project developers of Hero put a lot of attention to taking upfront initiative for NbS and preserved it trough the whole process to make it happen.

"*What you often see is that it is not sufficiently included in the design at the front. So then at the end it becomes, oh, we still have to do something about that, so then it becomes a sauce that is thrown over it. So, if you really want to do it well, then you have to name it quite early in your design process. Asking questions like, what is there then? Make a kind of analysis, that scientific thing, and then you just have to keep that on the agenda constantly, guys don't let it get lost. It is easy, in the madness of the day, to lose things, but you have to keep it there, so that is actually the most important thing, that you include it well from the start and monitor it.*" (James, Area developer)

James mentioned that nothing is as human as enthusiasm, so as a project developer you only have to initiate by turning the right knobs by challenging them, how can we do this in the smartest way possible. *"How can you help each other by, so to speak, cleverly placing everything on top of each other and not creating all transitional constructions?" (*James, Area developer)

Tom (project developer) highlights that this process needs integral thinking and critical thinking before going to the judges.

" You *need to know a lot technically, construction-wise, and you need to be able to supervise the project team, you need to know how to design. Financially you need to be good, know the revenues and costs and whether the project is healthy financially. Commercially you also need to have an opinion about marketability. Legally you need to know what is possible and what is not, such as with deliveries, notaries and agreements.... You need to spend a lot of time with the landscape architect, so that any problems you may have, have already been solved. Then you can go to the municipality or the city council with a more well-considered story and there is no need to make endless adjustments. Thinking together, assessing together and being critical, that is in my opinion the best way to make a project run smoothly."*

Also, he talks about the importance of adaptiveness to preserve.

"Then we try to come up with something else that still supports the same theme. It is not that we simply scrap things, because then we do not keep our promises to the municipality and/or the project team. We have agreed on a DNA with ten core points, and if you keep scrapping things, nothing remains of that DNA. People can then address us with: "You promised this two years ago." So, we ultimately have to see how to make it come true." (Tom, Project developer)

See figure 28 for the connection to the theoretical framework.

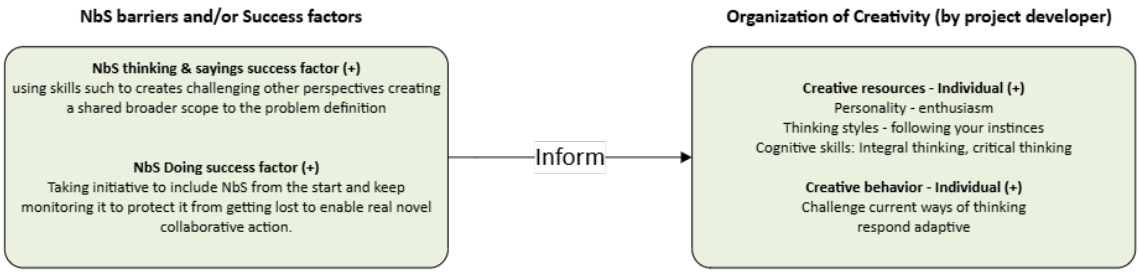

Figure 28: *Take initiative and preserve* - NbS Success factor informing organization of creativity (Own work)

Working with limited space – Searching for solutions through time (NbS barrier – NbS success factor)

Alex (Concept developer) explains how working with limited space sometimes means that you have to solve problems trough time and shows an example of how NbS in the future can have more chance.

"We once made a very green street plan that eventually had to be considerably simplified because more parking spaces were imposed by the municipality. It was a disappointment. Nevertheless, we tried, for example, to green some of those parking spaces or to put the parking spaces together, so that we could perhaps free up space for greenery later. Because area developments are often long-term, we try to solve problems over time. So that is often a good strategy, to solve it now, but to remain flexible about changes in the future. If the policy changes later, we can possibly reverse it again. For example, parking spaces are often moved next to the streets. But once they are installed, they are difficult to remove. We can also create a car-free street and solve the parking elsewhere, in 1 spot. If the parking standards decrease in the long term, we can remove the parking spaces, which only improves the situation, but you have made that street". (Alex, Concept developer)

This can also work the other way around. Niko (Landscape architect) explains how you can reserve parking space for the future to create space now for other things like NbS.

"In some cases, we reserve parking spaces that are only created when really needed".

What Niko (Landscape architect) also mentions is that in urban areas the ways of thinking are changing, and that people are becoming more flexible:

"People are also prepared to think differently now and say: "well then I won't buy a car". We have really done projects in the inner cities without cars. Just figure it out; take the train."

This also helped with Hero where they succeeded in solving the parking problem in a green way, hidden from the streets, which resulted in a nice living environment that attracts these people who think differently. See figure 29 for the connection to the theoretical framework.

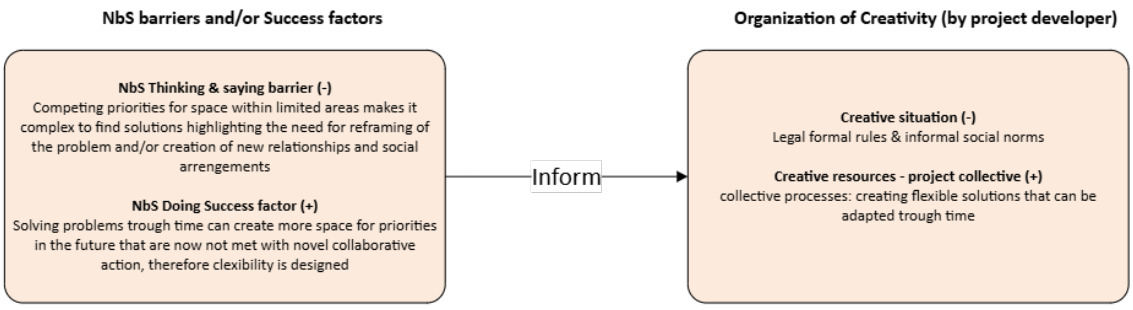

Figure 29: *Working with limited space – Searching for solutions through time* - NbS Succes factor informing organization of creativity (Own work)

Closing insights

If Hero van Breda is really going to be a great example for NbS integration is still to be proven, because they just started with the construction phase. Although they have had some bumps on the road, they always took it as a way to respond adaptively by coming up with new solutions that unintentionally led to positive surprises. James (area developer) also quoted: “Kwaliteit verloochent zich nooit - Quality never fails”. This mindset probably helped them to work with intrinsically motivation on the integration of NbS.

9.2.4. ZOË, Amsterdam – AM

Figure 30: ZOË – Architecture (Zoë Amsterdam, n.d.-b)

Case introduction

ZOE, is a plot development of plot 4A, part of a larger urban area development in Sluisbuurt, Amsterdam (Steve, project developer; Jasper, Architect).

"We started two years ago with a tender request from the municipality of Amsterdam … and a key aspect of this request for this plot is both high energy efficiency and nature inclusivity. The project focuses on the coexistence of people, animals, and plants as an important starting point." (Steve, project developer).

Now the project developer has been working with the architect and landscape architect to create 82 dwellings; apartments. Moreover, they will realize a commercial plinth and underground parking garage with limited spaces (Steve, project developer; Zoë Amsterdam, n.d.). Their main NbS contribution is the creation of 8 rooftop gardens with all their own theme related to NbS, creating biotopes. These are connected from the level of the canal all the way up to the highest roof (see figure 31).

Figure 31: ZOE, Rooftop Gardens (Zoe Amsterdam, 2024 August 12)

Key themes and approaches for the integration of NbS

The Key theme is to create a building were nature and people live in Harmony next to each other. Their main approach for this is implementing NbS in a way that will need less governance in the future which is different from standard ways of designing. Liam (landscape developer) explains how this works:

"The difference is that a garden is designed and maintained so that it remains as conceived. At ZOE, we initiate natural development, but then we also allow invasive pioneer species and exotic species. These are tolerated and included, and with an ecological management approach, it is actually guided. This means that the green roofs, the nature you create on and around your building, will change; it is and remains dynamic. This has the advantage that it becomes more stable and requires less maintenance over time, allowing more nature to establish itself."

Main Storylines from NbS barrier/success factor to the organization of creativity

ZOE as strategic pilot project (NbS Success Factor)

Special to ZOE is that the creative situation for the project developer was already set in favor of NbS by the municipality. First of all, the municipality did this by setting a high ambition for nature-inclusiveness. As Liam (Landscape architect) explained:

"It might be important to mention that the creativity realized in ZOE actually stems from the municipality. The municipality issued the tender, and what makes ZOE in the Sluisbuurt unique is that it had to become an icon project for the Sluisbuurt. An icon for nature-inclusive building."

Secondly the municipality understood that this is not a standard development and therefore did not assign their low segment targets for Sluisbuurt to this assignment, giving financial space for ZOE. (Zoe., n.d.-a). In this way the municipality has already created space for quality, by allowing more budget.

The project developer also responded with the same mentality. *"This project is not the most financially profitable, but it is valuable for knowledge development and reputation. Having*

completed such a building, and for our construction turnover, we are willing to invest in it. The indirect result is therefore an important aspect." (Steve, project developer)

In conclusion, The NbS Succes factor stems from the municipality's high ambitions for nature-inclusivity and giving financial flexibility, enabling a focus on quality for NbS. The project collective embraced this, valuing ZOE's contribution to knowledge and reputation over profit, setting a benchmark for NbS integration. See figure 32 for the connection to the theoretical framework.

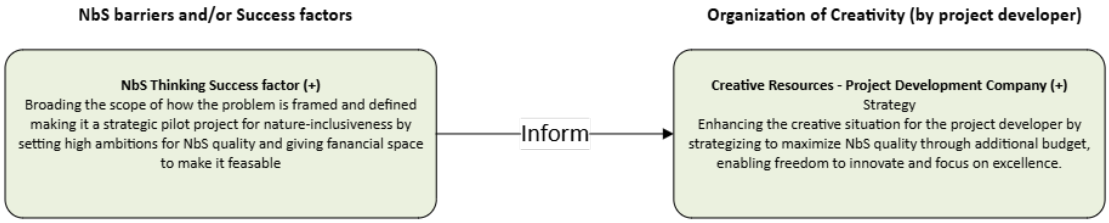

Figure 32: ZOE as strategic pilot project - NbS success factor informing organization of creativity (Own work)

A small green tile within a grey environment (NbS Barrier)

Due to the small scale of ZOE it cannot create biotopes on its own creating more dependency on their surroundings and the municipality to create room for ecological connections in their zoning plan. Both Liam and Steve explain this issue.

"I must say that what is less creative on the part of the municipality is that the attention for nature inclusivity is actually somewhat limited to ZOE, which is a shame, because nearly every building should be constructed this way to make the built city function as a living space for flora, fauna, and people." (Liam, Landscape Architect)

"On the other hand, there is also the realization that you are dependent on what happens in the surrounding area. It remains critical because a building on its own is not a habitat for plants and animals if the surrounding, for example, the access roads are disrupted. Those roads also need to be available, so there is a dependency on third parties." (Steve, project developer)

This NbS barrier might transcends the power of the project developer because they are not having the right resources to solve this and has to be solved by the municipality before creating tenders. The only thing the project developer could do is take this as a learned-lesson and communicate this to the municipality to make sure that this doesn't happen in the future. See figure 33 for the connection to the theoretical framework)

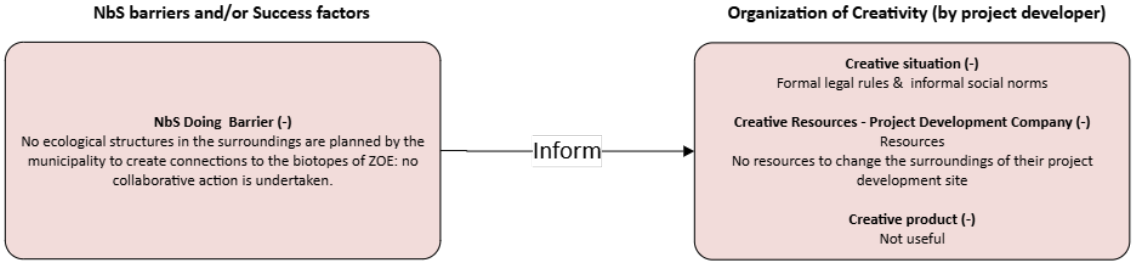

Figure 33: ZOE a small green tile in a grey environment - NbS barrier informing organization of creativity (Own work)

Designing a new governance process (NbS success factor)

As mentioned before their main strategy is to create a starting point for nature's development by itself. This, however, needs a totally new design for the governance of the NbS because you cannot predict if the design you imagined is going to work. Therefore, a more adaptive governance strategy needs to be designed. Liam (Landscape architect) explains;

"We give our best effort with our knowledge, but there are always moments when we learn, such as when there's too much moisture, too little light, etc. There are so many unpredictable factors, necessitating management adjustments not just to replace plants according to a planting plan, but to change the approach. We attempt again with a different type of plant that we believe will thrive better, aiming to achieve a stable and balanced planting system. Thus, you need to adapt governance practices."

The governance strategy involves a dedicated gardening service "de Hovenieren" for maintenance, supported by a Homeowners Association (VvE) with a 'green commissioner' who is connected to the project developer and landscape architect. This setup includes a five-year management plan with an outlook for ten years, emphasizing knowledge sharing and proactive adaptation to natural growth conditions. Wageningen University also conducts periodic monitoring to see how the NbS are developing (Steve, developer; Liam, Landscape architect). See figure 34 for the connection to the theoretical framework.

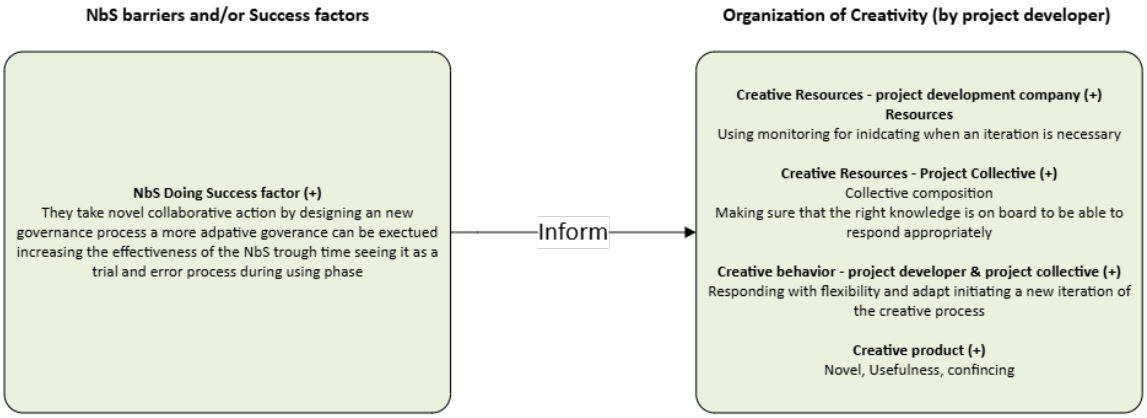

Figure 34: Designing a new governance process - NbS Success factor informing organization of creativity (Own work)

Excepting NbS as full-fledged ingredient for the design challenges – perceiving nature as a stakeholder with its own needs (NbS success factors)

From the interviews it became clear that all of the project collective really engaged with the assignment seeing nature as a stakeholder just like human in this assignment. Liam (landscape architect) mentioned it as creating and implementing a *"programma van Eisen van de dieren"*.

Steve (project developer) mentioned *"I am no specialist, however, know that there needs to be enthusiasm for this theme, this is not a standard building, so you need to be open for renewal and critically engage this theme, to be able to separate sense from nonsense."* Liam (landscape

architect) also mentioned; *"Steve actively learned more about nature-inclusive design. He has been taught to look at other perspectives and learned think like an animal would think."*

Jasper (Architect) showed their commitment for renewal *"For us it was especially important to see what is nature-inclusive and to what extent will that guide our design? An important choice we made is that we really want to create quality nature on and around the building."*

Openness for renewal, intrinsic motivation, knowledge and thinking about the influence of it on the creative design, building new relationships with nature itself as a stakeholder, were all considered to really integrate NbS. See figure 35 for the connection to the theoretical framework.

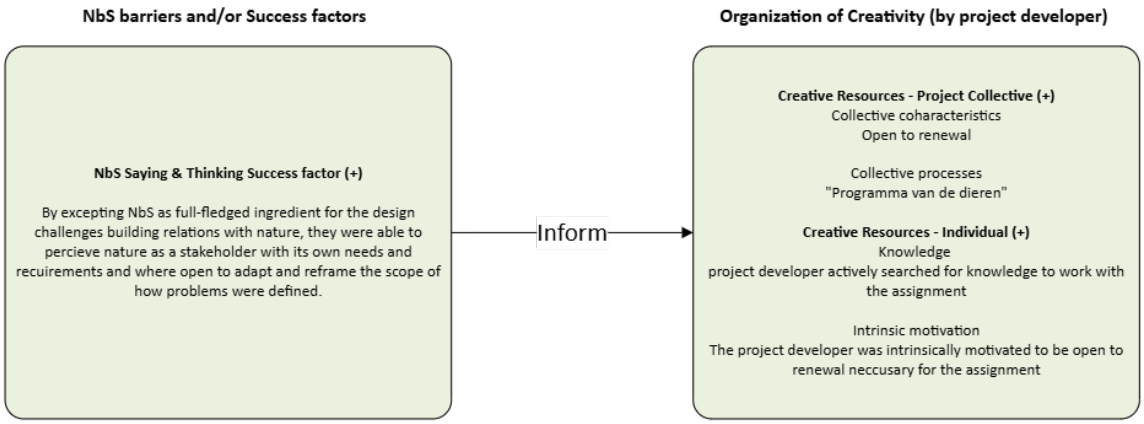

Figure 35: Excepting NbS as full-fledged ingredient - NbS Success factor informing organization of creativity (Own work)

Closing insights

What the outcome of the case will be is not yet clear, because they are still waiting for their permit to build. Although they have shown their great commitment and proactive management to make the NbS implementation a success for long-term, really integrating NbS into the development project. Even though the scale of the development project is limited, they worked with the measures they got to make this project an innovative example for NbS integration going further than the standard.

9.3. Findings cross-case analysis

This section will answer SQ2: *"What are the main barriers and success factors project developers face for integrating NbS into their urban development projects?"* and SQ3: *"How do the NbS barriers and success factors inform the organization of creativity?"*

First the interpretation of the two notions by the interviewees will be discussed to put into perspective how this differs from the theoretical framework, therefore more open-coding was used. Afterwards the similarities and differences of all cases will be described. Then SQ 2 and SQ 3 will be answered by addressing how the main storylines found in the cases are present in the other cases, discussing similarities, differences and gained insights to answering the questions.

9.3.1. Findings of understanding and using the notion NbS

NbS is not a commonly used term in project development practice. While the case studies were selected for their NbS implementation, interviews revealed that participants used terms like nature-inclusiveness, green structures, biodiversity, and water adaptation instead. Of the 11 interviewees asked to describe NbS, only 5 accurately referred to its core concept of using nature-based solutions for urban resilience or ecosystem-related interventions. Two associated it with biobased building, which is outside this research's scope. 5 did no attempt to describe it (see Table 2).

Table 2: NbS definitions given by interviewees (Own work)

NbS Definition	Quotation	Code Count	Simularities to Literature
The use of nature as solution to solve problems considering urban resiliance (they answered yes)	"Nou, volgens mij gaat nature-based solutions heel erg over dat je natuur inzet om dingen in je plan voor elkaar te krijgen, dus dat je natuurlijke principes gebruikt om bijvoorbeeld te koelen, om met de hittestress om te gaan en dat je natuurlijke filtersystemen gebruikt. Dus eigenlijk weg van alles wat machinaal en te digitaal is. Ja, dat is misschien iets te kort door de bocht. Maar ja, gebruik gewoon natuurlijke processen om dingen op te lossen waar je mee te maken hebt." (Alex, Concept Developer, Wickevoort, Hero, ZOE)	**3**	The use of nature as solution to solve problems considering urban resiliance
Interventions correlated with Ecosystems, Green structures and Water (they answered yes)	"Dus ja, natuur is natuurlijk echt een heel groot begrip. Misschien wel alles omvattend, maar Nature-based Solutions is voor mij dan ja iets specifiekere maatregelen of ingrepen die je kunt nemen die te maken hebben met ecosystemen, groen of met water, ook wel in gebiedsontwikkelingen bijvoorbeeld." (Chloe, Programm manager, sustainability)	**2**	Interventions correlated with Ecosystems, Green structures and Water
Bio-based development	"Nou ja, voor mijn gevoel kan het heel breed zijn, maar ik moet vooral denken aan bio-based bouwen en dat soort dingen. Ik denk dat dat een groot onderdeel daarvan is." (Jonas, Landscape architect, Wickevoort)	**2**	-
Can picture something or has learned something about it but no Definition	-	**5**	-
Not asked	-	**4**	-

After introducing the NbS concept, all participants understood it and acknowledged implementing it in their urban development projects. However, as previously explained, they kept referring to it in different terms. Some explained that the NbS concept is too scientific and not easily understandable for all stakeholders involved, reasoning for using other terms. They emphasized the need to communicate it in very concrete terms to ensure clarity and alignment.

"Well, people just really want to know in a down-to-earth way, what are you actually talking about? For example, everyone has an image of what a wadi is. So, people very quickly gravitate towards the components rather than the system behind it. That's really very technical. But when you explain what it entails, then someone gets it, like, 'Yes, that's it.' And then it becomes very normal again" (Alex, Concept developer).

The concept most commonly used was nature-inclusiveness, which closely relates to NbS but primarily focuses on meeting the program of requirements for animals. While it involves solutions utilizing nature and plays an important role in enhancing biodiversity and sustaining ecosystem structures, it lacks a direct focus on people. This connection to people typically emerges during the design process, as the project collective develops solutions to achieve their nature-inclusiveness ambitions, thereby indirectly supporting NbS.

"We enrich it with species that are quality species, useful as food for both animals and humans... If you were to do it just for animals, it wouldn't be attractive enough to also create support among people." (Liam, Landscape architect).

The interviews revealed that, despite not using the term NbS, there is a strong positive affinity toward its principles. The value of nature for humans is widely recognized, and many participants expressed a willingness to cooperate in its implementation.

"I notice that many colleagues enjoy working on this theme; people can imagine a kind of romantic picture of an area with many Nature-based Solutions. And that makes it tangible and fun to work on." (Chloe, Program manager Sustainability).

9.3.2. Findings of understanding creativity

Creativity is a broad concept, so interviewees were asked about its meaning and role in their work. Their definitions aligned with the literature, focusing on process, product, person, or press (see table 3).

Table 3: Definitions of Creativity by the interviewees (Own work)

Creativity Definition	Quotation	Code Count	Creative P
Making something new, special, better, more beautiful using out of the box thinking	"making reality just a little bit more beautiful. Think carefully: how can you make it better, more fun, more pleasant and can you make one plus one become three? So that is a bit of creativity for me. It is not really a definition, but yes, how can you just be different from standard, how can you think out-of-the-box?" (Hugo, Developer)	**4**	Process & Product
Process of creating new ideas that needs a lot of freedom	"Creativity is a process that needs a lot of freedom and that should be able to go in all directions. At the very beginning of a creative process there should be total freedom, no boundaries experienced. During a project this can of course be increasingly funneled." (Anne, Project Developer)	**3**	Press

Holistic thinking and combining ideas	"But what I find creative is that sometimes you also break away from that one discipline and that you see the whole and that you actually say that the total of all the things that you add up must be more than the individual things that you add up." (James, Area Developer)	**3**	Person & Process
Associating, hitchhiking and Iterating	"For me, creativity has a lot to do with continuing on each other, so you can stand on each other's shoulders. Creativity arises when someone does something and someone else builds on it and gives it a new interpretation and content." (Alex, Concept Developer)	**2**	Process
Experimenting	"Yes, then I think about trying, about coming up with new things, about testing things without limits to come up with new things. Trying, seeing how something develops, looking at different angles, and trying different things to see what works best." (Jasper, Architect)	**2**	Process
Physical and cultural expression of feelings and ideas	"I think creativity, I think it is the... for us the... how do I say this? The physical, cultural expression of our feeling, of our ideas." (Nick, Ornithologist)	**1**	Person
Knowledge, Talent and Creativity Skills Domain-specific	"Partly creativity, partly scientific knowledge, partly talent, and those aspects are all related to creativity. You can be creative, but that doesn't mean you can design a city." (Niko, Landscape Architect)	**1**	Person
Stepping outside comfort zones	"Daring to think beyond your own nose, and that daring also has something of creativity in it." (Hugo, Developer)	**1**	Person

During the interviews, two misconceptions about creativity were identified. The first is the belief that creativity requires complete freedom to produce novelty, often overlooking its usefulness. Developers, therefore, need to focus on setting boundaries for creativity.

"Sometimes it's very useful (and sometimes not (whispering)). I think in the design process, there is naturally creativity... but as a project developer, you also act as the guardian of the business case... in that, you must not let yourself be completely led by your creative process. You also need to be able to impose restrictions and within those confines, allow creativity to thrive." (Lily, developer).

While the developer should set boundaries to steer the usefulness at some points, it does not mean that you are limiting creativity, you are organizing it in a way it comes to useful results. Creativity is about divergent thinking, critical thinking, reflection and reframing. Organizing creativity is both about creating novelty and creating usefulness and giving space or setting boundaries in different points in time.

The second misconception, or lack of association with creativity, relates to the idea that a creative product must be perceived as valuable by its judges. None of the interviewees explicitly connected this to creativity, yet they operate in environments where their creative products are evaluated by judges, prompting them to adapt accordingly.

"It's really great when you win a tender, and sometimes we also make a decision, this one yes, that one no, and you also try to estimate; how will the judging party feel about this?" (James, area developer).

9.3.3. Case similarities & differences

In table 4 the most important similarities and differences between the cases are shown according to the 5P's of urban development to understand how these can be compared in the cross-case analysis: Person, Place, Process, Product, and Perspectives.

Table 4: Similarities and differences between the cases (Own work)

Case	**NbS themes** Perspective	**Scale and density** Place	**Project status** Process	**Surroundings** Place	**Main collaborations for NbS** Person & Process	**Community Engagement** Person & process	**Implementation of/for NbS** Product
Berckelbosch	Maximizing Nature-inclusiveness transforming form standard development to nature-inclusive development	Large Area development (Low/mid density)	Design phase/ Construction phase/Delivered	Ecological structure	Vogelbescherming Nederland & ecologist for new Berckelbosch (ecologist, landscape architect, architect for plot 7 & 9)	NbS Education	Preservation tree structures, creating green corridors, connecting to natural areas, wadi's, urban green spaces, native species, water biotope (upcoming), overgrown pergolas, sedum roofs, green property boundaries, spaces for plants in front of houses
Wickevoort	Build on existing structures of the forest estate	Large Area development (Low density)	Design phase/ Construction phase/Delivered	Big Ecological structure	Landscape architect, ecologist, Architect	NbS Education NbS Governance	Preserved 12 hectares of tree structures, semi-paved parking spaces with hedges, green spaces for play, sports, and recreation. Green property boundaries, facades, pergolas, and guided resident efforts for green interiors, supported by legal measures.
Hero	Creating the healthiest neighborhood of Breda, preserving the locations history	Middel-size area development (Mid density)	Construction phase	Some ecological structure	Landscape architect, ecologist, Architect	NbS Education NbS Governance	Fruit trees for biodiversity and historical connection, resident-managed maintenance, public green spaces. Greening of hidden parking spaces and integration of green environments in design strategies.
ZOE	Facilitating all ingredients for nature to accelerate by themselves	Small Plot development (High density)	First sale/ waiting for permit	No ecological structure	Landscape architect, ecologist, Architect, Hovenieren	NbS Education NbS Governance	Eight rooftop gardens forming biotopes, adaptive ecological management, and integration with the canal-level environment Nature as a stakeholder with a "programma van Eisen van de dieren" approach and governance processes ensuring sustainable NbS implementation.

9.3.4. NbS Barriers & Success factors

To answer RQ2, Table 5 presents all main NbS barriers and success factors across the cases, verifying whether the same storylines appear and exploring reasons for their presence or absence based on case differences and similarities. The table uses the following color guidelines:

- Yellow: Both barriers and success factors are identified.
- Red: Only a barrier is identified.
- Green: Only a success factor is identified.
- Grey: No data on barriers or success factors.

Table 5: Cross-case analysis of main NbS barriers and success factors (Own work)

NbS Barrier	**NbS Successfactor**	**Berckelbosch**	**Wickevoort**	**Hero**	**ZOE**
Project actors sometimes struggle to redefine problem scopes prioritizing common practice (thinking)	Use skill of reframing: Searching for synergies (thinking)	**Main storyline**	**Main storyline**	**Main story line** Different NbS succesfactor: Use critical thinking challenging other perspectives (thinking) or solving problems trough time making flexibility (doing)	NbS barrier mentioned, However NbS succesfactor was Prioritizing NbS on the list within tender, however project is not realized yet

Policy restrictions holding back novel collaborative action (doing)	Use creative skills to find new solutions that fit within policies (thinking) Lobbying, creating new relationships and social arrangements (saying) Use perseverance and convince to enable novel collaborative action (doing)	**Main storyline**	NbS barriers mentioned however did not come with NbS succesfactors for it	Mentioned	Not relevant, because no public space had to be maintained by municipality
	fullfill ambitions for exceeding standards by using the plug-in method (Doing)	**Main story line**	Not relevant – NbS was already a focus point when making urban plan	Not relevant – NbS was already a focus point when making urban plan	Not relevant – NbS was already a focus point when making urban plan
Residents lack a strong relation with nature to motivate self-implementation of NbS on private properties limiting novel collaborative action. (saying & doing)	Learn to reframe problems to take collaborative novel action creating new habits (Thinking & doing) Learn to convince residents to gain affinity with NbS by collaborating with experts, creating new network development (saying)	**Main story line**	**Main story line** But different NbS succesfactor: The project developer broaden their scope of how problems where defined and build new social arrangements with the residents resulting in novel collaborative action (thinking, saying & doing)	Not mentioned, however project is not realized yet	Not relevant, because no private gardens are created
No allowence for changing maintenance practices from municipality, limiting novel collaborative action (doing) No successfull social arreangements where formed during conversations to take novel collaborative action (saying)		Was mentioned and NbS successfactor was inidcated to convince and challenge ways of thinking	**Main storyline**	Was mentioned and NbS successfactor was inidcated to convince and challenge ways of thinking	Muncipality was supportive of NbS, however the case size also did not ask for collaborative action with the municipality implementing NbS on-site
	Embrace innovative nature of NbS and respond with flexibility to uncertainties (thinking)	Mentioned	**Main storyline**	Not really mentioned	Mentioned
	Building a collaborative ambition for doing something extra and creating a clear vision and guidelines to do so and monitor (saying)	Mentioned, however after the urban plan was already set	**Main storyline**	**Main storyline**	Mentioned
	Choose advisors who embrase NbS and are having ambition and intrinsic motivation for it making novel collaborative action possible (doing)	Mentioned	**Main storyline**	Mentioned	Mentioned
Contractors are not preserving NbS on the construction site if it comes with limitations to their practices	The project developer can organize routines of monitoring if everything on construction side goes well and respond where necessary taking initiative to broaden the scope of how problems are framed and	Not mentioned	**Main storyline**	Not data yet (beginning of construction phase and no existing NbS)	Not data yet (not yet in construction phase and no existing NbS)

(thinking & doing)	defined, using creativity to fined novel solutions (thinking, saying doing)				
	Reframing using NbS as a means to tell a story where location history and future are being connected (Thinking)	Mentioned with preserving exisitng trees	Mentioned with preserving exisitng trees	**Main storyline**	Mentioned by makingprogramma van eisen for animals as important as for human
	by spredding the words about your plans can lead to unexpacted new positive collaborations for NbS creating new relationships and neworks (saying)	Mentioned, however not unexpected	Mentioned, however not unexpected	**Main storyline**	Mentioned, however not unexpected
	Making the community responsible for maintenance creating a better connection between human and nature and achieving better social cohesiveness due to novel collaborative action (doing)	Not necussery, municipality does maintenance	Mentioned	**Main storyline**	Mentioned
	Broading the scope of how the problem is framed and defined making it a strategic pilot project for nature-inclusiveness by setting high ambitions for NbS quality and giving fanancial space to make it feasable (Thinking)	Mentioned, not as concept but by using plugg-inn method	Mentioned, esspecially with strategies for engaging residents	Not mentioned	**Main storyline**
No surrounding ecological structures to create NbS connections (doing)		There were surrounding ecological structures	There were surrounding ecological structures	Not mentioned as issue	**Main storyline**
	Novel collaboative action by designing new governance process increasing the effectiveness of the NbS trough time, seeing it as a trial-error process during user phase (doing)	Not mentioned	Not mentioned	Not mentioned	**Main storyline**
	By excepting NbS as full-fledged ingredient for the design challenges building relations with nature, they were able to percieve nature as a stakeholder with its own needs and recuirements and where open to adapt and reframe the scope of how problems were defined. (Saying & thinking)	mentioned	mentioned	mentioned	**Main storyline**

Further Comparisons and Key Insights

The first conclusion from this overview is that all cases can learn from each other. Berckelbosch, as the base case, has proven their success, but can learn from ZOE in governance processes and from Wickevoort in community engagement. It can also learn from Hero and ZOE about broadening and reframing problem statements. Other cases can also learn from each other, making them all innovative and successful in their own ways.

Moreover the overview highlights important insights form similarities and differences between the cases. For example, larger-scale, low-density developments such as Berckelbosch and Wickevoort seem to have more opportunities to create ecological integration compared to smaller, high-density projects like ZOE. ZOE doesn't have the ability to connect to surrounding structures or create their own implying a significant NbS barrier that wasn't resolved, however also not applicable to other situations.

Projects which started their focus on NbS in a later stage of the process, such as Berckelbosch, faced barriers in adjusting established plans, whereas projects like ZOE which has been grounded by NbS have more flexibility for innovation, this is however not always in the power of the project developer to decide. Berckelbosch therefore had to use different methods giving insight in to a special NbS success factor of using the plug-inn method later into the development process.

Governance processes also vary, with ZOE's innovative approach standing out as a model for other cases planning an adaptive approach upfront. Meanwhile, Wickevoort goes beyond in community engagement, demonstrating the importance of context-specific strategies and learning-by-doing highlighting the importance of creating adaptive habits.

Lastly, the overview shows that the NbS barrier of policy restrictions is not always addressed by a success factor, highlighting developers' limitations in overcoming all barriers and leading to compromises in NbS quality.

Figure 36 summarizes the main barriers and success factors from the cross-case analysis. During the analysis, it was observed that the thinking, saying, and doing perspectives are often intertwined, demonstrating why barriers constrain change and success factors drive change. This interconnectedness also explains why these perspectives are not separated in the summary, as they collectively provide the full context understanding a barrier and/or success factor. This will be further explored in the data synthesis.

	NbS barriers	NbS Success factors
1	**Policy restrictions**	Find new creative solution that fit policy restrictions Lobby Try to convince and persever, challenging current ways of thinking (These are not always sufficient or not executed well enough)
2	**Actors Prioritizing other things over NbS due to common practice**	reframe: searching for synergies Use critical thinking challenging other perspectives Solve problems trough time (when current ways of thinking, saying and doing have changed) Put NbS on the top of priority list (within tender phase)
3	**Integrating NbS after the design phase started**	use plug-inn method
4	**Actors not preserving NbS on construction side due to common practice**	Monitor on construction-site Respond adaptively using creativity to find novel solutions
5	**Community engagement issues** Weak relationship with nature no participation implementing NbS themselves	Inform, educate and inspire Collaborate with them and experts for collective maintenance of NbS
6		**compose creative resources for NbS** Embrace innovative nature of NbS Use flexibility to respond to uncertainties Ambitions for going beyond the standard solutions Choose advisors who also have these resources Create clear vision and guidelines Monitor vision and guidelines creating creative freedom and setting creativity boundaries gain understanding of NbS as an equal stakeholder along others with their own needs and requirements
7		**Create new relationships and network development** Use storytelling to integrate NbS with other ambitions Inform world about NbS integration plans
8		**Do NbS pilot projects** Do pilot projects with NbS for extra financial and creative space Create and test new governance processes
9	**No Surrounding ecological structures**	

Figure 36: Main barriers & Success factors – after cross-case analysis (Own work)

Conclusion

To answer SQ2: *"What are the main barriers and success factors project developers face for integrating NbS into their urban development projects?"* Nine main barriers and/or success factors were identified. Five are NbS barriers linked to success factors addressing policy restrictions, actors prioritizing other tasks over NbS due to common practices, integrating NbS after the design phase, lack of preservation during construction and community engagement issues. Three success factors stand alone: composing creative resources for NbS, building new relationships and networks, and conducting NbS pilot projects. One stand-alone NbS barrier is the absence of surrounding ecological structures. However, policy restrictions were not always solvable.

9.3.5. Organization of creativity

To answers SQ3: *"How do these NbS barriers and success factors inform their organization of creativity?"* figure 37 provides a visual representation of the translation of NbS barriers and success factors into constraints and enhancers within the organization of creativity, the project developers response to organize and their impact chain. The model highlights how certain factors either support or hinder the development of novel, useful, and convincing solutions.

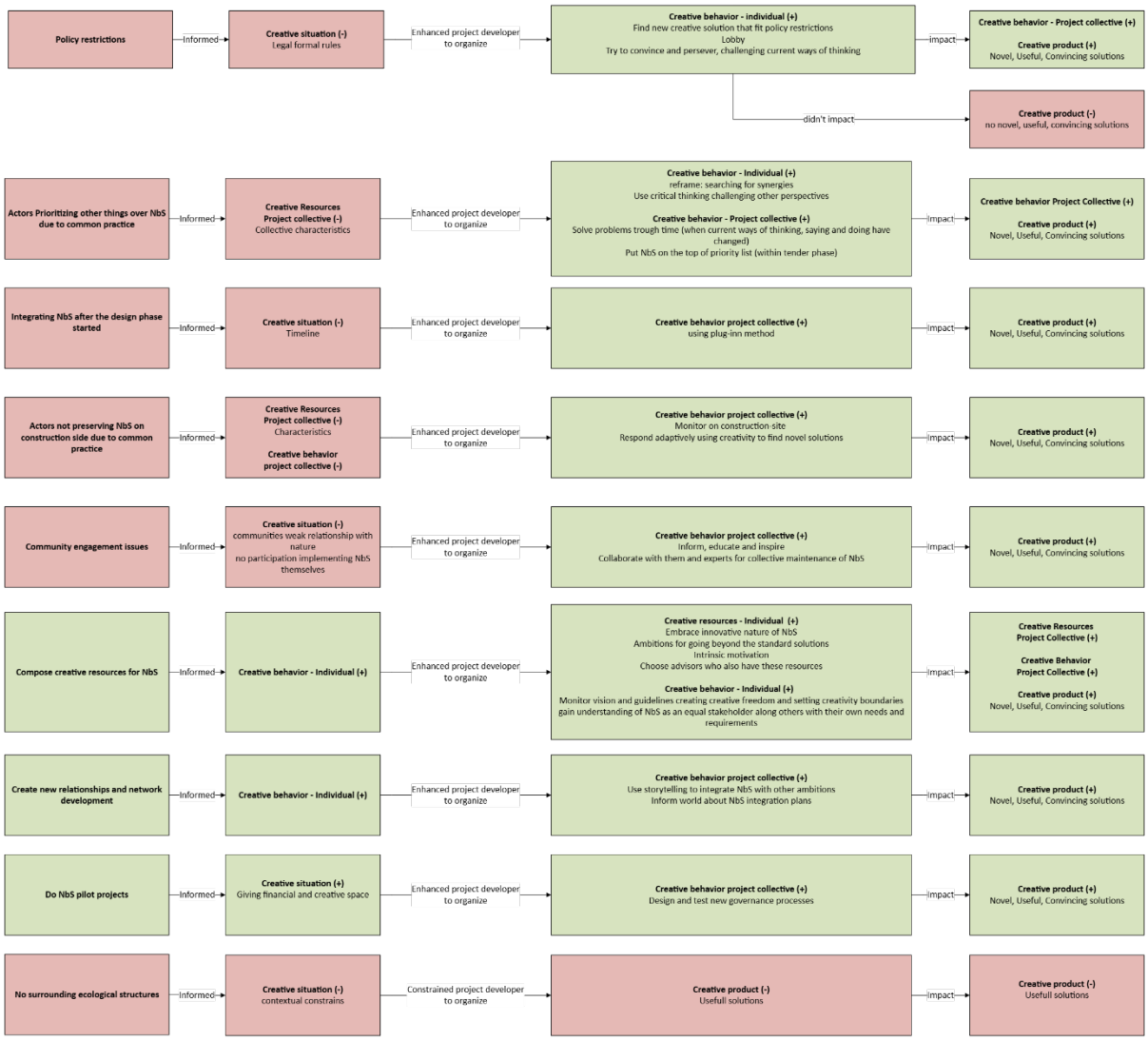

Figure 37: Main NbS barriers and Success factors informing the Organization of Creativity (Own work).

The figure highlights that the project developer can organize creativity for eight out of nine indicated NbS barriers and/or success factors. One out of eight however is not always as effective. The project developer can organize their own creative resources & creative behavior and the creative resources & behavior of the project collective to positively impact the creation of positive creative and behaviors by project collective and creative products. This is done as a response to creative situations creating boundaries and openness for creativity. In both cases it enhances the project developer to respond organizing creativity.

9.4. Strategies

This section will present the findings of the data synthesis answering SQ 4: *"What strategies can they apply to organize creativity for integrating NbS into their urban development projects?".*

The cross-analysis has been the result of closed-end coding however is not sufficient to answer SQ4. Therefore data-synthesis has been done using open-ended coding to find new patterns within the different stories told and connecting them back to the closed-end coding and literature findings. The open-ended coding tried to identify different kinds of actions that were performed by the project developer that could potentially connect to the organization of creativity and NbS barriers and Success factors. In total more then 20 different actions where identified. In the end four main concepts where discovered within this coding. These concepts are composing, convincing, conducting and contemplating and together form a holistic framework for strategies project developer can apply to organize creativity for integrating NbS. I called this the 4C model. The first three of concepts respond to NbS barriers and success factors. The fourth concept: contemplation, was found as additional concept guiding the other three making it a dynamic model. In appendix C an overview is shown of how these concepts are constructed from the raw data from the interviews. The next sections will dive deeper into these four concepts and their relations to the literature and case study findings.

9.4.1. The 4C model

The 4C model presents four strategies emphasizing the different ways in which a project developer can perform creative contributions, organizing creativity to integrate NbS into their urban developments. These strategies are focused at making new organizational structures to build capacity to apply a long-term relational approach to nature to integrate NbS as Meroda et al. (2013) suggested, creating a symbiose between nature and people. The project developer performs the 4C's for NbS implementation as a response to the creative situation for and with NbS including; composing, convincing, conducting and contemplating during their entire involvement within the project. These 4C's are applied on two levels: proactive, planning for creativity and reactive, by responding with creativity in occurring situations (see figure 38):

- 1st level of the 4C model: along the timeline of the full development process (see figure 39)
    - Seeing Conducting as the starting point of the process where NbS ideas still needs to be created and a lot of uncertainty is still there
    - towards Convincing where NbS ideas need to be accepted as a creative product by the judges to push the project forward
    - towards Conducting where approved NbS ideas really need to be implemented
    - Contemplation is necessary along the whole timeline of the development process to allow integration of NbS into the whole development process, this also explains the 2nd level of the 4C model.
- 2nd level of the 4C model: as continuous process of contemplation switching between composing, convincing and conducting within the composing, convincing and conducting phase

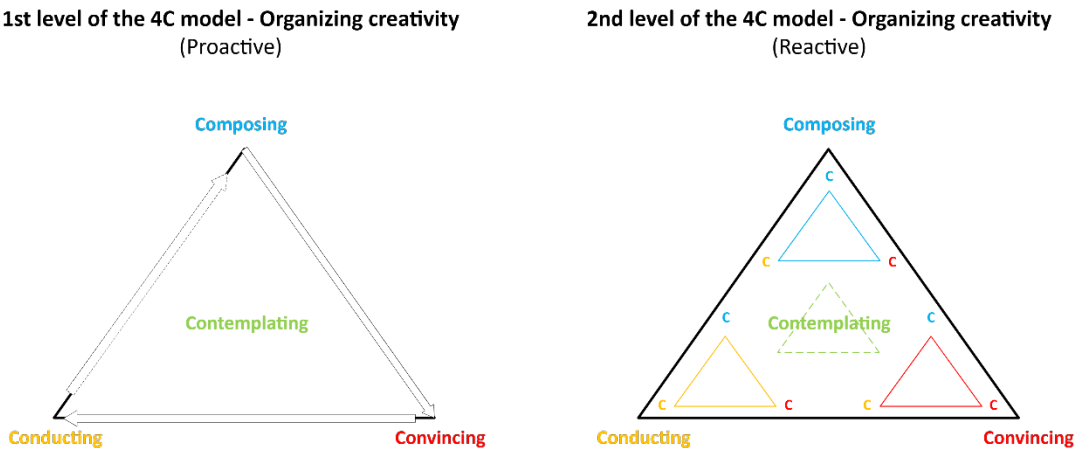

Figure 38: The 4C's for NbS integration along the timeline of the full development process and as continuous day-to-day process (Own work)

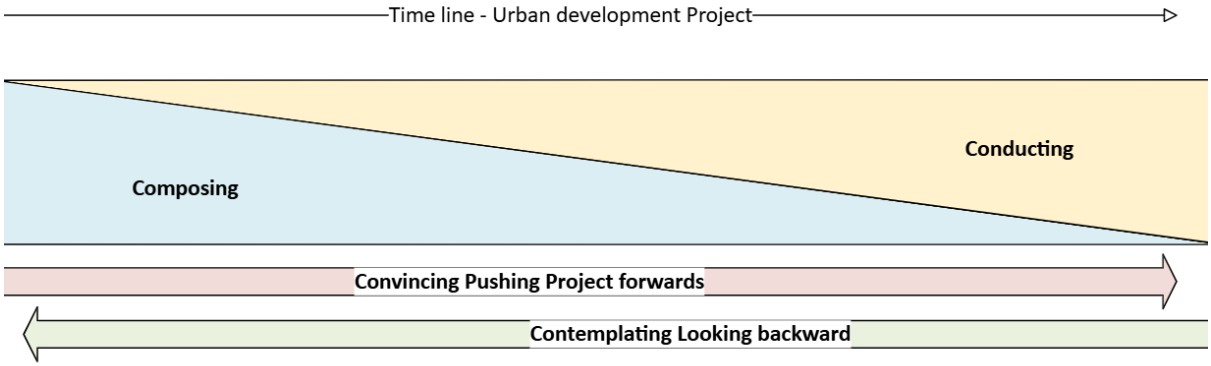

Figure 39: Timeline - from start to finish of developers involvement (Own work)

All these C's stand for fundamental elements that need organization of creativity to generate ongoing creative products. The fundamentals are:

1. ***Compose*** *creative solutions for and with NbS*
2. *Use creative strategies to* ***Convince*** *the judges of these creative solutions*
3. ***Conduct*** *these creative solutions in an adaptive way, searching for new creative solutions with or for NbS when (NbS) barriers occur.*
4. *Organize creative ways of making time for* ***Contemplation*** *during the whole process, to reflect and learn from the creative solutions exposing new ways of Composing Convincing and Conducting.*

When performing these four C's, project developers are building towards a self-sustaining product where the users of the urban areas are in a symbiotic relationship with the NbS within their neighborhood.

The next sub-sections will go deeper into the four components of the 4C's including one case example for each on the 1st level and one case example for a 2nd level strategy.

9.4.2. Compose

Definition: Forming creative behavior from various creative resources

Fundamental : **Compose** a supportive environment for creativity for NbS, creating space and setting boundaries for change of current lines of thinking, saying and doing by the project collective

The project developer can compose the following things:

- Ambitions for and with NbS (In conversation with the creative situation)
- Project collective on their creative resources fitted with the ambitions
- Multi-functional solutions by composing their own creative resources and behavior to influence the project collective.

Ambitions for NbS

The project developer can compose ambitions for and with NbS including:

Protection of Ecosystem structures
Maximizing Ecosystem structures
Quality of Ecosystem structures
Integration of NbS with other Ambitions

Project Collective

The project developer should select a project collective that is in alignment with these ambitions:

Selecting on Intrinsic motivation for integration of NbS with other Ambitions
Selecting on NbS expertise
Selecting on Creative skills to integrate NbS with other ambitions

Multi-functional solutions

The project developer should compose multi-functional solutions with the project collective towards addressing the ambitions for and with NbS, especially to achieve integration of NbS with other ambitions:

Recognizing and leveraging opportunities
Correlating and Combining
Challenging current ways of thinking
Judge upon the criteria of the creative product

Case example: "Friction between the architects' ambitions and the NbS ambitions for Wickevoort Lanen"

"If you talk about design; we have two designers here who are working on it. They are sometimes still searching for how they can integrate nature as part of the architecture. So I actually see two convictions more and more in the design world or the green world. I myself prefer to see nature really take over a building... On the other hand, I have an architect here who really likes the purity of architecture and appreciates the contrast between the built and nature... This creates a search

*between him and me and also with the quality team: how far does he want to go in greening his design? ...when I start a conversation with the architect, feedback also comes from the quality team. For example, they judge whether there are too many heat islands in the design without ecological connections, so more green connections and interventions are needed. This is how adjustments are made, and this makes the conversation with the architect easier.... I would also like to say: precisely because I am at the beginning of the process and selecting the architect, it is my role to make it clear at the beginning that the starting points for this project are that it must be nature-inclusive and climate-adaptive, and that it must meet certain standards. The entire project must, as it were, "breathe green." Then I choose an architect who feels connected to that. I think that is an important step to safeguard the entire process."(*Anne, project developer)

This case example shows how project developer Anne has used Judging upon criteria of the creative product to challenge the architects current ways of thinking taking the architect along towards creating more ecosystem structures. She also mentioned how it is her responsibility to already make sure upfront to select the architect who does feel connected to the set ambitions.

9.4.3. Convince

Definition: To cause someone to believe in or do something with the creative products for and with NbS by framing the correct narrative

Fundamental: *Use creative strategies to **Convince** the judges of the creative solutions, creating a collective understanding of the scope of the problem statement integrating NbS, influencing current ways of thinking, saying and doing*

The project developer can Convince to:

- Get approval from judges with authority enabling NbS implementation (municipality – investors etc.)
- Enable creative behavior and resources allowing collaborations with (new) stakeholders (project collective, community, sponsors etc.)
- Stimulate others implementing NbS (Residents, other project developers etc.)

Get approval, enable resources, Stimulate others

The project developer should convince to get approval, enable resources, stimulate other by:

Framing the correct narrative, what this is, depends on the situation and the judge, therefore it is important to think about what the judge would appreciate or give them incentive. In this way the project developer can construct their own creative problem and then trying to solve it.

Case example: "The parking-norms of the municipality vs space for NbS – Berckelbosch)

"I think you have to find a kind of synergy, where you can find each other... you have a book and it's called the right of the fastest....Now we were working on the public design of Berckelbosch and there was someone from the municipality and he was quite focused on the traffic rules. We were in the aquarium and there was this book at the bottom and we gave it to them. And at the next meeting he came: "yes, I have thought about it, we can also.....'. And then he started looking for space within his own frameworks. So you want people to have the same goal." (Lily, developer)

In this case example Lily performed a creative strategy; using the book *"right of the fastest"* as a way to convince someone to thinking beyond their own boundaries using her own creative behavior as a way to foster someone else's creative behavior.

9.4.4. Conduct

Definition: To organize and direct a particular activity for or with NbS to make something happen, in order to find out or prove facts.

Fundamental: Make sure that *creative processes are performed as a response to NbS barriers coming along by monitoring, checking if new ways of thinking, saying and doing are working out as planned*

The project developer can Conduct by:

- Monitoring to understand when an NbS barrier occurs
- Respond adaptively creating an iteration on the conducted NbS to persevere the NbS or create an NbS as response to other barriers that occurs

Case example: "The frog incident at Wickevoorts construction site"

"In a partial plan, we made the ground ready for construction, and at one point the ground was a bit sandy. There was a risk that there might be frogs in that area, but nobody saw them. However, those frogs are protected and they hibernate there and they only come out of hibernation in May, which ultimately caused a 7-month delay in that partial plan.

However, we never saw those frogs and never heard them, because you hear those animals, but you can't prove it. So we had to wait until May.

Well, I did learn from it, because you can also deal with it in a very creative way and that is through ecological management. Then you let pigs or goats or sheep walk around in that area or partial plan: and they are allowed to eat those frogs. So that is allowed." (Lucas, area developer)

Lucas told in this story that he could have overcome an NbS barrier by creating a new NbS, using creativity. This however didn't happen that time and therefore he learned from it instead for the future.

9.4.5. Contemplate

Definition: To spend time considering a possible future action for or with NbS considering

Fundamental: Proactively Organize creativity to create time, space and ways to considering a possible future action for or with NbS – Consider the needs for different ways of thinking, saying and doing nessusary

The project developer can Contemplate by:

- Organizing events such as peer reviews, workshops, presentations to inspire each other
- Joining external events to learn from outside perspectives
- Chancing environment to get inspiration, for instance search for nature to spark creativity

Case example: "from implementing Hero biodiversity scan toward education of approaching Dutch Biodiversity collabs"

AM is working on their biodiversity scan to create supporting technology for NbS and to iterate this scan they test it within development projects and when they tested it with Hero something unexpected happened.

"After the scan we did at Hero, I was asked to give a kind of workshop. Then I was locked up with someone for an afternoon and thought: how can we do that? In the end, we came up with a biodiversity game, inspired by the scan. We used a Jenga tower as a model for biodiversity in the Netherlands, with different colored blocks for the species in the food pyramid, such as soil life, birds, insects, and so on. Then we had cards with everything we do wrong for biodiversity in the Netherlands, such as pesticide use. When that came up, the players had to push four insect blocks out of the tower, so push out four purple blocks. And then we continued with petrified gardens, highways, and so on, and finally, when the tower fell: "biodiversity Collapse". Then we went on to say that that is really coming. Then we explained how you can use the scan to counteract that in your projects. I've never had such positive reactions to anything I've done, even from the most traditional colleagues (because we gave them internally), the most traditional colleagues really said: "I'm going to do it completely differently." So when you see that you can explain the problem in a very creative way and then explain the solution in a very enthusiastic way, people are so sold." (Olivia, Sustainability advisor)

Olivia showed how she used creativity to contemplate with her colleagues about the importance of NbS and with excellent results.

9.4.6. 2nd level of organizing creativity

The second level of organizing creativity is considered a continues process of contemplation which is more about being able to take a step back or forward, reactively jumping from conducting to convincing to composing when events happen that can be promising or challenging. This has to become a habit of the project developer. In this way the consideration of a need for a different way of thinking, saying or doing can directly lead towards creating the right environment for it (composing) convincing the right people for it (convincing) and planning methods to monitor them (conducting).

Case example: "Hero Factories a new stakeholder in Hero development project".

From Convincing to Composing

The name Hero originates from the Factories Hero, producing jam and fruit drinks etc. which were previously located on the construction site. During the composing phase of Hero, the project collective Translated this story towards environmental and social characteristics of the neighborhood using NbS. They created different areas with different kinds of fruit trees and gave corresponding street names (1st level of composing). Sadly, they failed to convince the municipality to maintain these fruit trees which led them back to the 2nd level of composing, introducing a community engagement initiative to integrate the NbS while also stimulating social cohesion.

From Conducting to Convincing to Composing

"Hero of course originates from the Hero factory, which is the jam factory, and cassis etc. So we really looked for things in the street names that have a nod to that. And the funny thing is, because we are now really going live (1st level of Conducting), that Hero, the main company from Switzerland, is now calling from: Wow, we actually find what you are doing there so charming, we would like to participate. Yes, how would you like to participate? Well, I don't know, maybe you can think of things for me that we can contribute to financially, so that it will be better. (2nd level of Convincing) So they now see on the internet that we want to create the healthiest district in Breda and they want to be associated with that. And we can do that by doing concrete things that respond to all the things that are going on. So that could be for flora and fauna, but it could also be movement. There could also be something else. So the team that is currently in place is now going to think of possibilities for that (2nd level of Composing)." (James, Area Developer)

9.4.7. Conclusion

Concluding SQ 4: ***"What strategies can they apply to organize creativity for integrating NbS into their urban developments?",***

the project developer can apply the 4C model for NbS using the Composing, Convincing, Conducting and Contemplating. This model can be applied on two levels. The first level considers the timeline of the full construction process starting from composing transitioning into convincing and then towards conducting. Composing focuses on the composition of the creative resources and individual creative behavior in correlation with the set ambitions for and with NbS in combination with other ambitions. Convincing focuses on making sure that composed NbS are allowed to be implemented, creating more creative resources or stimulating others to implement the NbS. Conducting focuses on making sure the approved NbS are actually implemented and becoming effective by responding adaptively when challenges or opportunities come along. Contemplation can be proactively organized during the whole process to make sure these three C's are performed effectively and gather lessons-learned for future projects. The second level the model can be applied and involves a continuous process of contemplation to guarantee a reactive response to the creative situation allowing the effectiveness of composing, convincing and conducting.

Moreover, the 4C model is a strategy for enabling NbS thinking, saying an doing, activating the process of learning and change. Composing focuses on creating the right environment, convincing on making sure the right stakeholders are on board, conducting monitors if new ways of thinking, saying and doing are working out, Contemplating is about spotting needs of different ways of thinking, saying and doing.

10. Discussions

This chapter discusses the findings of this research, situating them within the ongoing NbS research conversation and highlighting their theoretical and practical significance. Additionally, it addresses the research limitations, reflecting on the credibility, transferability, dependability, and confirmability of the study, while informing future research directions.

10.1. Theoretical Significance

NbS research conversation has been focused on identifying challenges addressing future research directions for researching how to solve these challenges navigating uncertainties and complexities to create standardized frameworks. This research was at the same time trying to continue this conversation by identifying a framework navigating uncertainty and complexity while opposing this strategy of doing this by research for creating standardized frameworks augmenting that we should take a learning-by-doing approach. Ecoshape (2023) also highlighted that the uncertainty an complexities inherent in building with nature can not always be solved trough more research and needs a learning-by-doing approach.

However, the novelty of these research findings when looking at existing NbS literature are somewhat limited. The created framework matches very well with the frameworks constructed by Mercado et al. (2023) nature-based thinking framework highlighting the importance of understanding tree key dimensions: nature itself and its ecological processes, formal and informal institutions that owns, governs and/or manages a natural space and finally communities that lives in, for and with nature (composing). Moreover it matches with Raymond et al. (2017) NbS assessment framework with its focus on constant reflection and reframing (Contemplation). Lastly the model of Nesshöver et al. (2017) addressing the importance to deal with uncertainty and complexity, develop common understanding of multifunctional solutions and evaluating and monitoring for mutual learning (convincing & conducting).

The novelty of this research findings is that it highlights the importance of creativity as sub-process of innovation leading towards learning and change enabling sustainable transitions. Van Poeck et al. (2020) highlights the difference between the creative perspective on learning, seeing it as never ending and a more static perspective on learning with a fixed-end goal in mind. This creative perspective on the NbS integration created a more dynamic model for learning creating new habits: convincing, whereas existing literature more focused on ecological and technical aspects has created more static models for learning engaging with creating new routines: for example community engagement, introducing the need for new habits due to changes in social dynamics. Both perspectives of learning are necessary to proactively work towards the completion of certain stages within the urban development process, while remaining some flexibility to go back to a part of a previous stage when necessary to address uncertainties and complexities in the moment. These research findings are therefore answering a how question while existing research has been more focused on the what question. This means this framework is not replacing frameworks within existing literature, however complement them, guiding its interpretation how to use them in practice.

Furthermore the findings from the research are from one single actor from the private sector who are perceived as being successful developers. This research results however did not

found the same barriers as Dorst (2022) explaining low private sector engagement; them being skeptical about costs, performance, and profitable business models of NbS and are therefore less willing to engage or invest. In the Netherlands specifically there was a lack of insight in NbS performance and technical quality that results in a lack of trust in urban NbS and skepticism. In contrast, the empirical data revealed developers focusing on long-term benefits, with the believe that it can lead to profitable business models. James (developer) said; ": "Kwaliteit verloochent zich nooit - Quality never fails". These cases therefore can be seen an example to how the private sector can successfully engage with NbS.

10.2. Practical Significance

To understand the practical significance of the 4C model, it is essential to consider the nature of the practical settings in which it is applied. Successful use of the 4C model depends on the creative resources of the project developer, including their cognitive style, abilities, personality, intrinsic motivation, and knowledge of NbS (Woodman, 1993). While these can develop through the process of integrating NbS, doing so requires time and effort.

Additionally, the creative resources of the project development company play a critical role. Elements such as culture, resources, rewards, strategy, structures, and technologies can either enable or constrain the project developer's ability to create impact. Awareness of their creative influence is vital, and project developers can benefit from consulting Cohen's (2012) seven levels of the continuum of creative behaviors, ranging from individual learning (level 1) to transforming the field (level 7). The analyzed companies in this research achieved levels 1 through 6, contributing significantly to advancing the field of NbS.

The specific characteristics of the case also shape how the 4C model is applied. As NbS implementation is highly issue-specific, the 5P's for urban development by Daamen (2024) should be considered. For example:

- The process phase determines the approach; a plug-in method might not be needed if NbS is integrated early but may be necessary during later phases.
- The place of the project influences contextual factors such as the municipality's creative capacity, ecological structures, and the power dynamics of convincing stakeholders. Existing ecological structures shape dependency and the project's scope, influencing the problems addressed and the final product.

To ensure time for contemplation, project developers can organize peer reviews, InterVision sessions, or workshops. External feedback from knowledgeable yet unbiased individuals can help refine ideas, focusing on topics like NbS concepts or lessons learned from practice. Since creativity and NbS are inherently challenging to grasp, taking time to learn and reflect on these concepts is crucial.

A final check to ensure success involves applying the NbS thinking framework (Meroda et al., 2013), which guarantees qualitative connections between nature, governance, and community, ensuring harmony between humans and the environment.

By addressing these aspects, project developers can:

- Compose the right environment for learning and change.
- Convince stakeholders to embrace learning and change.
- Conduct change by monitoring progress and iterating as needed.
- Contemplate to identify new needs for change.

10.3. Research limitations and future research directions

The first limitation lies in the focus on only three levels of creativity. This research primarily explored creativity at the individual, group, and organizational levels but did not address interorganizational and network-level creativity. Hemonnet-Goutjet et al. (2022) conceptualizes five levels of interdependencies as crucial for understanding creativity at the network level, where public and private actors jointly develop novel, useful ideas. Hemonnet-Goutjet emphasizes the heterogeneity of actors and resources, the nature of interaction processes, and the importance of setting common goals. This gap limits the believability, accuracy, and credibility of the research findings. Future research could expand on these network-level dynamics, better exploring practices like creating common understanding, network development, and governance mechanisms, connecting the bottom-up perspective from individuals to interdisciplinary levels as described in the literature on NbS.

Though the research reflects a single perspective, it has been contextualized to a large extent, making it transferable to other contexts. The findings highlight the importance of flexibility and adaptability in making novel ideas work and integrating nature effectively. The research also underscores that stakeholders in different contexts need to adopt more adaptive and flexible approaches to implement NbS successfully. One major barrier identified was the tendency of actors to prioritize traditional practices over NbS. For example, municipalities need not only to adjust their project assignments but also their maintenance practices. Future research could investigate the perspective of municipalities, where creativity may naturally be less prominent.

Several limitations were identified in the methodology and data gathering. First, all cases studied were considered successful to some extent, which was intentional, but it excludes insights into project development companies with more skeptical perspectives on NbS. Additionally, the research focused on projects developed by two relatively large and innovative companies with abundant resources, including in-house contractors. This capacity for flexibility and risk-taking is a significant factor that fosters creativity in these companies but may not be available to smaller companies. Furthermore, these companies had a strong ambition to innovate, which might not be the case for every development company. Consequently, the findings may be less transferable to smaller development companies with fewer resources and less focus on innovation.

Another limitation was the scarcity of useful documentation for the case study analysis. The research focused primarily on social perspectives, which were often absent in documents that had a more commercial focus. Additionally, interviews, while insightful, have their own limitations. Although interviews can explore many aspects, they cannot directly capture people's ways of thinking, saying, and doing within their work environments. This is especially challenging outside the immediate context of their work. People’s perspectives on creativity are often ambiguous, making it difficult to discuss critically in interviews. These limitations affect the

dependability and credibility of the research. Future research could address this by using alternative methodologies, such as direct observations, to gather more detailed and credible insights, complementing the findings from interviews.

11. Conclusions

This study aimed to answer the main question: ***"How can project developers organize creativity to integrate Nature-based Solutions into their urban developments?"***

This has been explored through four sub-questions. All conclusions will be set out here before addressing the main question.

SQ1: *"How can project developers organize creativity for their urban project development?"*

The project developers can organize creativity by optimizing the organizational creativity needed to find a novel, useful and convincing solution to an open-ended problem which has no standardized solution. They can do this by analyzing the framework of organizational creativity and judging what parts of the framework are constraining and enhancing the organizational creativity. Based on this judgement they can respond with strategies, enabling creative contributions to influence these enhancers and constraints to the optimal organizational creativity needed for the problem at hand.

SQ2: *"What are the main barriers and success factors project developers face for integrating NbS into their urban development projects?"*

Nine main barriers and/or success factors were identified. Five are NbS barriers linked to success factors addressing policy restrictions, actors prioritizing other tasks over NbS due to common practices, integrating NbS after the design phase, lack of preservation during construction and community engagement issues. Three success factors stand alone: composing creative resources for NbS, building new relationships and networks, and conducting NbS pilot projects. One stand-alone NbS barrier is the absence of surrounding ecological structures. However, policy restrictions were not always solvable.

SQ3: *"How do these NbS barriers and success factors inform their organization of creativity?"*

It was found that NbS barriers and success factors either support or hinder the development of novel, useful, and convincing solutions. As a response the project developer can organize creativity for eight out of nine indicated NbS barriers and/or success factors. One out of eight, however is not always as effective considering municipal policies. The project developer can organize their own creative resources and creative behavior and the creative resources & behavior of the project collective to positively impact: 1) the creation of positive creative behaviors by project collective and 2) creative products. This is done as a response to creative situations creating boundaries and openness for creativity. In both cases it enhances the project developer to respond organizing creativity.

SQ4: *"What strategies can they apply to organize creativity for integrating NbS into their urban developments? "*

the project developer can apply the 4C model for NbS by Composing, Convincing, Conducting and Contemplating. This model can be applied on two levels. The first level considers the timeline of the full construction process starting from composing transitioning into convincing and then towards conducting. Composing focuses on the composition of the creative resources

and individual creative behavior in correlation with the set ambitions for and with NbS in combination with other ambitions. Convincing focuses on making sure that composed NbS are allowed to be implemented, creating more creative resources or stimulating others to implement the NbS. Conducting focuses on making sure the approved NbS are actually implemented and becoming effective by responding adaptively when challenges or opportunities come along. Contemplation can be proactively organized during the whole process to make sure these three C's are performed effectively and gather lessons-learned for future projects. The second level of the model can be applied and involves a continuous process of contemplation to guarantee a reactive response to the creative situation allowing the effectiveness of composing, convincing and conducting.

Moreover, the 4C model is a strategy for enabling NbS thinking, saying an doing, activating the process of learning and change. Composing focuses on creating the right environment, convincing on making sure the right stakeholders are on board, conducting monitors if new ways of thinking, saying and doing are working out, Contemplating is about spotting needs of different ways of thinking, saying and doing.

This study aimed to answer the main question: ***"How can project developers organize creativity to integrate Nature-based Solutions into their urban developments?"***

The project developer can organize creativity be responding to their creative situation. This creative situation consist of NbS barriers and success factors which informs what components are constraining and/or enhancing their current organization of creativity for the integration of NbS, impacting the quality of the creative product. To overcome NbS barriers and ensuring NbS success factors the project developer can use the 4C model for NbS to perform strategies, organizing creativity. This model consists of four strategies including Composing, Convincing, Conducting and Contemplating and can be performed on two levels. The first level consists of proactive strategies while the second level uncovers reactive strategies. Be performing strategies on both levels the project developer can make sure to respond adaptively to current situations while also planning for the future enabling NbS success factors and positive creative situations. In this way the project developer can organize creativity to integrate NbS into their urban development by:

1. Composing the right environment for learning and change
2. Convincing actors to learn and change
3. Conducting change by monitoring and iterating
4. Contemplating to spot new needs for change

However it must be mentioned that the project developers organization of creativity has its limits to fully integrate NbS. NbS barriers such as myunicipal policies and residents not participating is outside of the power of the developer to fully mitigate. The project developer can only stimulate these things. Moreover when the surroundings of the project site are not having ecosystem structures, the project developer also does not have the resources to do something. They only can inform the municipality about these constrains. Lastly, the competing priorities for space can become increasingly complex when space is limited, that combining things is not sufficient, then compromises must be made.

Future research can therefore focus on the municipality and how the can become more adaptive towards NbS implementation, potentially indicating their own strategies for organizing creativity.

12. References

Adams, D., & Tiesdell, S. (2013). *Shaping places: Urban planning, design and development*. Routledge.

Amabile, T. M. (2006). *Componential Theory of Creativity*. Working paper.

Ballast Nedam Development. (2023). Berckelbosch project (Birdview) [Photograph]. Retrieved 18th of November, 2024 from https://www.development.ballast-nedam.nl/developments/2023/berckelbosch

Berckelbosch. (n.d.). *Berckelbosch: Een groene wijk in ontwikkeling*. Retrieved December 2, 2024, from https://www.berckelbosch.nl/

Blaikie, N., & Priest, J. (2017). *Designing social research*. (3rd ed.). Polity Press.

Cohen, L. M. (2012). Adaptation and creativity in cultural context. *Revista de Psicología*, *30*(1), 3-18. https://doi.org/10.18800/psico.201201.001

Cohen-Shacham, E., Andrade, A., Dalton, J., Dudley, N., Jones, M., Kumar, C., Maginnis, S., Maynard, S., Nelson, C. R., Renaud, F. G., Welling, R., & Walters, G. (2019). Core principles for successfully implementing and upscaling Nature-based Solutions. *Environmental Science and Policy*, 98, 20-29. Scopus. https://doi.org/10.1016/j.envsci.2019.04.014

Daamen, T. (2024, May 27). *2024 05 27 Perspectives lecture URG course*. TU Delft. Brightspace.

Doppelt, B. (2017*). Leading change toward sustainability: A change-management guide for business, government and civil society* (Updated 2nd ed). Greenleaf.

Dorst, H., Van Der Jagt, A., Toxopeus, H., Tozer, L., Raven, R., & Runhaar, H. (2022). What's behind the barriers? Uncovering structural conditions working against urban nature-based solutions. *Landscape and Urban Planning, 220*, 104335. https://doi.org/10.1016/j.landurbplan.2021.104335

EcoShape. (2021). A future-proof strategy for coping with a changing and uncertain world [White paper]. Retrieved December 10, 2024, from https://www.ecoshape.org/app/uploads/sites/2/2021/05/Whitepaper-a-future-proof-strategy-for-coping-with-a-changing-and-uncertain-world.pdf

European Commission. (2016). *Work programme 2016-2017: Climate action, environment, resource efficiency and raw materials*. Retrieved on March 15th, 2024, from https://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h200wp1617climate_en.pdf

European Commission. (n.d.). *Nature and biodiversity*. European Commission. Retrieved October 14, 2024, from https://environment.ec.europa.eu/topics/nature-and-biodiversity_en

Frantzeskaki, N. (2019). Seven lessons for planning nature-based solutions in cities. *Environmental Science & Policy, 93*, 101-111. https://doi.org/10.1016/j.envsci.2018.12.033

Fu, H. (2023). A Comprehensive Review of Nature-Based Solutions: Current status and future research. *AIMS Environmental Science, 10*(5), 677-690. https://doi.org/10.3934/environsci.2023037

Gemeente Eindhoven. (n.d.). *Berckelbosch: Bouwprojecten in Eindhoven*. Retrieved December 2, 2024, from https://www.eindhoven.nl/bouwen/bouwprojecten/berckelbosch

Gould, R. K. (2023). How creativity can help research on the multiple values of nature become more innovative and inclusive. *People and Nature, 5*(2), 244-257. https://doi.org/10.1002/pan3.10204

Het NLP College. (n.d.). *Chunking vragen*. Retrieved December 3, 2024, from https://hetnlpcollege.nl/chunking-vragen/

Hero Breda (2002). *HERO BREDA; DNA Gezonde buurt*. (personal communication)

Hero van Breda. (n.d.). Retrieved December 2, 2024, from https://herovanbreda.nl/nl/

IUCN. (2012). *The IUCN programme 2013–2016*. In IUCN World Conservation Congress (pp. 1–30).

Mercado, G., Wild, T., Hernandez-Garcia, J., Baptista, M. D., Van Lierop, M., Bina, O., Inch, A., Ode Sang, Å., Buijs, A., Dobbs, C., Vásquez, A., Van Der Jagt, A., Salbitano, F., Falanga, R., Amaya-Espinel, J. D., De Matos Pereira, M., & Randrup, T. B. (2024). Supporting Nature-Based Solutions via Nature-Based Thinking across European and Latin American cities. *Ambio, 53*(1), 79-94. https://doi.org/10.1007/s13280-023-01920-6

Merrey, D. J., & Cook, S. (2012). Fostering Institutional Creativity at Multiple Levels: Towards Facilitated Institutional *Bricolage*. *5*(1).

Nesshöver, C., Assmuth, T., Irvine, K. N., Rusch, G. M., Waylen, K. A., Delbaere, B., Haase, D., Jones-Walters, L., Keune, H., Kovacs, E., Krauze, K., Külvik, M., Rey, F., Van Dijk, J., Vistad, O. I., Wilkinson, M. E., & Wittmer, H. (2017). The science, policy and practice of nature-based solutions: An interdisciplinary perspective. *Science of The Total Environment, 579*, 1215-1227. https://doi.org/10.1016/j.scitotenv.2016.11.106

Newman-Storen, R. (2014). Leadership in Sustainability: Creating an Interface between Creativity and Leadership Theory in Dealing with "Wicked Problems". *Sustainability, 6*(9), 5955-5967. https://doi.org/10.3390/su6095955

North, D. C. (2003). *The role of institutions in economic development*. United Nations.

Planbureau voor de Leefomgeving. (2021). *Grote opgaven in een beperkte ruimte*. PBL. Retrieved on November 27, 2024, from https://www.pbl.nl/publicaties/grote-opgaven-in-een-beperkte-ruimte

Portugal Del Pino, D., & Marquez, J. F. (2023). Complementary ideas for the implementation of nature-based solutions. *Environmental Science & Policy, 141*, 146-157. https://doi.org/10.1016/j.envsci.2023.01.008

Raymond, C. M., Frantzeskaki, N., Kabisch, N., Berry, P., Breil, M., Nita, M. R., Geneletti, D., & Calfapietra, C. (2017). A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. *Environmental Science & Policy, 77*, 15-24. htts://doi.org/10.1016/j.envsci.2017.07.008

Rhodes, M. (1961). An Analysis of Creativity. *The Phi Delta Kappan, 42*(7), 305-310.

Stam, K., Van Ewijk, E., & Chan, P. W. (2023). How does learning drive sustainability transitions? Perspectives, problems and prospects from a systematic literature review. *Environmental Innovation and Societal Transitions*, *48*, 100734. https://doi.org/10.1016/j.eist.2023.100734

Stein, M. I. (1953). Creativity and culture. *The Journal of Psychology, 36*(1), 311–322.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information, 22*(1), 63–75. IOS Press. https://doi.org/10.3233/EFI-2004-22201

Sternberg, R. J. (2006). The nature of creativity. *Creativity Research Journal, 18*(1), 87–98.

UNEP (2022). *UN Environment Assembly concludes with 14 resolutions to curb pollution, protect and restore nature worldwide*. Retrieved from https://www.unep.org/news-and-stories/ press-release/un-environment-assembly-concludes-14-resolutions-curb-pollution

United Nations. (2017). *The Sustainable Development Goals Report 2017*. Retrieved on March 30th , 2024, from https://unstats.un.org/sdgs/files/report/2017/thesustainabledevelopmentgoalsreport201 7.pdf

URBAN GreenUP (2018). *D1.1: NBS Catalogue (WP 1, T 1.1). URBAN GreenUP*. Innovation Action – Grant Agreement No. 730426.

Van Poeck, K., Östman, L., & Block, T. (2020). Opening up the black box of learning-by-doing in sustainability transitions. *Environmental Innovation and Societal Transitions*, *34*, 298-310. https://doi.org/10.1016/j.eist.2018.12.006

Vogelbescherming Nederland. (n.d.). *Award Natuurinclusief Bouwen & Ontwerpen*. Retrieved November 22, 2024, from https://bouwnatuurinclusief.nl/award

Wickevoort. (n.d.). *Woonvelden*. Retrieved January 9, 2025, from https://wickevoort.nl/nl/plan/woonvelden/

Woodman, R. W. (1993). Toward a Theory of Organizational Creativity. *Academy of Management Review, Vol. 18*(No. 2), 293-321. https://doi.org/10.5465/amr.1993.3997517

WWF (2021). *URBAN NATURE BASED SOLUTIONS*. WWF INTERNATIONAL 202.

Yin, R. K. (2014). *Case study research design and methods* (5th ed.). Sage. (2014).

Zoë Amsterdam. (n.d.-a). *Aanbod*. Retrieved January 9, 2025, from https://www.zoe-amsterdam.nl/nl/aanbod/?currentLevel=level1&projectId=1013&buildingId=1013

Zoë Amsterdam. (n.d.-b). ZOË – Architecture renders [Photograph]. Retrieved November 18, 2024, from https://www.zoe -amsterdam.nl/nl/

Zoë Amsterdam. (2024, August 12). Welke verschillende daktuinen vind je in Zoë? Retrieved from https://www.zoe-amsterdam.nl/nl/nieuws/2024/08/12/welke-verschillende-daktuinen-vind-je-in-zo%C3%AB/

Zoë Amsterdam. (n.d.). ZOË – Architecture renders [Photograph]. Retrieved November 18, 2024, from https://www.zoe -amsterdam.nl/nl/

13. Appendices

13.1. Appendix A: Interview Protocol

Introductie

(Bedank de interviewee)

Ik wil graag meer te weten komen over jouw ervaringen met natuur-inclusief bouwen en hoe creativiteit een rol speelt in het overwinnen van barrières en het realiseren van succes factoren binnen deze projecten. Dit gesprek is bedoeld om samen te verkennen welke factoren een rol spelen bij het ontwikkelen van urban nature-based solutions (NBS). Ik ben vooral benieuwd naar jouw persoonlijke ervaringen en inzichten. Alles wat je deelt, is waardevol voor mijn onderzoek.

Het interview duurt ongeveer 45 minuten. Als je je ergens niet comfortabel bij voelt, kun je altijd een vraag overslaan of het interview beëindigen. De deelname is geheel vrijwillig. Het gesprek zal worden opgenomen zodat ik later terug kan luisteren naar wat we hebben besproken en kan verwerken voor data analyse. De opname blijft privé en wordt niet met anderen buiten het onderzoeks team gedeeld. De data zal pseudoniem verwerkt worden. (leg eventueel verder uit).

Zijn er nog vragen of onduidelijkheden? Zou ik de opname mogen starten?

(start opname)

Ter bevestiging, Heb ik jou toestemming om dit gesprek op te nemen?

A. Achtergrondinformatie

1. **Kun je iets vertellen over jouw huidige rol?**

a. Hoe ben je in deze positie terechtgekomen, en wat zijn jouw belangrijkste verantwoordelijkheden?

b. Wat motiveert je in je werk?

2. **Kun je kort je team omschrijven? Hoe ervaar je de samenwerking binnen jouw team?**

a. Welke aspecten van samenwerking werken volgens jou goed?

b. Wat zou je anders willen zien in de samenwerking binnen projecten?

c. Wat is de rol van de organisatie hierbij?

B. Verkenning van Urban Nature-Based Solutions en Creativiteit

1. **Wat roept het begrip 'natuur' voor jou op, zowel persoonlijk als in je werk?**

a. Hoe heeft jouw ervaring met natuur invloed gehad op de manier waarop je aan projecten werkt?

b. Hoe bekent ben je met het begrip Nature-based Solutions? Hoe word dit begrip toegepast in jou werkomgeving? Welk begrip word er wel toegepast? Waarom? Wat zijn de verschillen tussen dit begrip en Nature-based solutions?

2. **Wat betekent creativiteit voor jou in jouw dagelijkse werk?**

a. Wat betekent creativiteit voor jou?

b. Zijn er specifieke momenten waarop je creatief moest zijn om een probleem op te lossen?

c. Hoe ervaar je creativiteit binnen het team waarmee je werkt? Binnen de organisatie?

3. **Hoe denk je dat creativiteit en natuur samenkomen in de projecten waar je aan werkt?**

a. Zie je verbanden tussen het oplossen van obstakels en de creativiteit die nodig is om natuur-gebaseerde oplossingen te realiseren?

C. Verkenning van een Specifiek Project

1. **Kun je me meenemen door een project dat je hebt gedaan waarbij nature-based solutions werden toegepast?**

a. Welke nature-based solutions zijn toegepast?

b. Wat waren de grootste uitdagingen?

c. Hoe zijn deze uitdagingen overwonnen?

2. **Kun je een moment beschrijven waarop je tegen een barrière aanliep een creative oplossing vereiste?**

a. Hoe heb je dit aangepakt, en wat was de uitkomst?

b. Hoe heb jij de samenwerking binnen het project team beïnvloed?

i. Welke strategieën heb je hiervoor toegepast?

ii. Welke ingredienten heb je nodig gehad om deze strategieen toe te passen? Hoe heb je deze verzameld?

c. Hoe heb jij de organisatie van het project beïnvloed?

i. Welke strategieën heb je hiervoor toegepast?

ii. Welke ingrediënten heb je nodig gehad om deze strategieën toe te passen? Hoe heb je deze verzameld?

D. Algemeen Reflecteren op Obstakels en Oplossingen

1. **Zijn er in jouw ervaring veelvoorkomende obstakels bij het werken aan nature-based solutions?**

a. Hoe ga je doorgaans om met deze obstakels? Worden standaardoplossingen gebruikt, of moet je vaak iets nieuws bedenken?

2. **Hoe kijk je terug op de strategieën die je hebt gebruikt om deze obstakels te overwinnen?**

a. Wat werkte goed, en wat zou je anders doen?

E. Afsluitende vragen

1. **Zijn er onderwerpen die we nog niet hebben aangeraakt maar die volgens jou van belang zijn voor dit gesprek?**

2. **Zijn er andere mensen die je zou aanraden om mee te praten voor dit onderzoek?**

13.2. Appendix B: Interview Informed Consent

Delft University of Technology
HUMAN RESEARCH ETHICS
FORMULIER VOOR GEINFORMEERDE TOESTEMMING

U wordt uitgenodigd om deel te nemen aan een onderzoek genaamd "Creative Pathways Towards Urban Nature-based Solutions." Dit onderzoek wordt uitgevoerd door masterstudent Charlotte Oldenbeuving, onder begeleiding van Paul Chan en Herman Vande Putte van de TU Delft.

Het doel van dit onderzoek is te begrijpen hoe creativiteit kan helpen bij het overwinnen van barrières voor natuurgebaseerde oplossingen in stedelijke planning. We richten ons specifiek op de rol van de projectontwikkelaar. Het interview duurt ongeveer 60-90 minuten. De gegevens worden gebruikt voor een masterscriptie die wordt gepubliceerd in de TU Delft Education Repository. We vragen u naar uw kennis en ervaring met natuurgebaseerde oplossingen en creativiteit binnen uw werk, en hoe deze met elkaar samenhangen. Ook vragen we naar de obstakels die u bent tegengekomen en hoe deze zijn opgelost. Dit interview wordt opgenomen. Nadat de opname is uitgeschreven, sturen we de transcriptie naar u voor controle. Zo kunt u eventuele wijzigingen doorgeven voordat de gegevens verder worden verwerkt.

Zoals bij elke (online) activiteit is het risico van een databreuk aanwezig. Wij doen ons best om uw antwoorden vertrouwelijk te houden. We minimaliseren de risico's door de data pseudoniem te verwerken en persoonlijke gegevens apart te beveiligen met encryptie. De gepseudonimiseerde informatie wordt in de scriptie gebruikt in de vorm van citaten. De scriptie zal openbaar gemaakt worden, maar transcripties en samenvattingen van de interviews worden niet gepubliceerd.

Uw deelname aan dit onderzoek is volledig vrijwillig, en u kunt zich elk moment terugtrekken zonder reden op te geven. U bent vrij om vragen niet te beantwoorden. Als u na het interview van gedachten verandert, kunt u tot een week voor de scriptie-indiening (3 januari 2025) vragen om gegevens te verwijderen of aan te passen. U ontvangt een transcript van het interview ter beoordeling voordat de gegevens verder worden verwerkt.

Expliciete toestemmingspunten

VINK DE JUISTE VAKJES AAN	Yes	No
A: ALGEMENE OVEREENKOMST – ONDERZOEKSDOELEN, DEELNEMERSTAKEN EN VRIJWILLIGE DEELNAME		
1. Ik heb de informatie over het onderzoek gedateerd [----/----/--------] gelezen en begrepen, of deze is aan mij voorgelezen. Ik heb de mogelijkheid gehad om vragen te stellen over het onderzoek en mijn vragen zijn naar tevredenheid beantwoord.	☐	☐
2. Ik doe vrijwillig mee aan dit onderzoek, en ik begrijp dat ik kan weigeren vragen te beantwoorden en mij op elk moment kan terugtrekken uit de studie, zonder een reden op te hoeven geven.	☐	☐
3. Ik begrijp dat deelname aan de studie een interview met audio-opname inhoudt dat zal worden getranscribeerd als tekst. Na voltooiing van de transcriptie zal de audio-opname worden vernietigd.	☐	☐

4. Ik begrijp dat de studie eindigt nadat de master student is afgestudeerd, wat is gepland in januari 2025.		
B: POTENTIËLE RISICO'S VAN DEELNAME (INCLUSIEF DATA BESCHERMING)		
5. Ik begrijp dat mijn deelname de volgende risico's met zich meebrengt waaronder gevoelige vragen welke zowel professioneel als persoonlijk kunnen worden opgevat. Ik begrijp dat deze risico's worden geminimaliseerd doordat de onderzoeker zich op het vakgebied richt en neutraal blijft. Verder kan de deelnemer altijd weigeren te antwoorden op elke vraag gedurende het interview. De deelnemer kan op elk moment tijdens en na het interview van gedachten veranderen en data aanpassen of weghalen tot een week voor de scriptie zal worden ingeleverd (waarschijnlijk tot 3 januari 2025).	☐	☐
6. Ik begrijp dat mijn deelname betekent dat er persoonlijke identificeerbare informatie, waaronder volledige naam, telefoonnummer, e-mailadres en onderzoeksdata, waaronder audio-opnamen, beroep en werkervaring, worden verzameld, met het risico dat ik hieruit geïdentificeerd kan worden, wat kan leiden tot veranderingen in de publieke/professionele reputatie.	☐	☐
7. Ik begrijp dat de volgende stappen worden ondernomen om het risico van een databreuk te minimaliseren, en dat mijn identiteit op de volgende manieren wordt beschermd in het geval van een databreuk. De gegevens worden pseudoniem verzameld en worden opgeslagen in een beveiligde projectopslagdrive bij de TU Delft die alleen toegankelijk is voor geautoriseerde personen om het risico op een databreuk te beperken. De geïnformeerde toestemmingsformulieren die de persoonlijke informatie bevatten, worden apart opgeslagen en vergrendeld met een encryptie om de identiteit van de deelnemers te beschermen in het geval van een dergelijke breuk.	☐	☐
8. Ik begrijp dat de persoonlijke informatie die over mij verzameld wordt en mij kan identificeren, zoals naam, telefoonnummer en e-mailadres niet gedeeld worden buiten het studieteam.	☐	☐
9. Ik begrijp dat de persoonlijke data die over mij verzameld wordt, vernietigd wordt een maand nadat het onderzoek is beëindigd, wat is geanticipeerd in februari 2025.	☐	☐
C: ONDERZOEK PUBLICATIE, VERSPREIDING EN TOEPASSING		
10. Ik begrijp dat na het onderzoek de gepseudonimiseerde informatie die ik verstrek gedeeltelijk zal worden opgenomen in de master scriptie in de vorm van citaten, waarbij de scriptie openbaar toegankelijk wordt gemaakt in de TU Delft Education repository. Interviewtranscripties en samenvattingen zullen niet worden gepubliceerd. Bovendien zal de scriptie-inhoud gegevens bevatten over werkervaring en beroepen van de deelnemers.	☐	☐
11. Ik geef toestemming om mijn antwoorden, ideeën of andere bijdrages pseudoniem te quoten in resulterende producten.	☐	☐
D: (LANGETERMIJN) DATA OPSLAG, TOEGANG EN HERGEBRUIK		

12. Ik geef toestemming om de gepseudonimiseerde informatie uit de gepseudonimiseerde transcripten die ik heb goedgekeurd, op basis van het interview dat ik heb gegeven, te archiveren in de TU Delft Education repository, zodat deze kan worden gebruikt voor toekomstig onderzoek en leren.	☐	☐

Handtekeningen

_____	_____	_____
Naam deelnemer	Handtekening	Datum

Ik, **de onderzoeker**, verklaar dat ik de informatie en het instemmingsformulier correct aan de potentiële deelnemer heb voorgelezen en, naar het beste van mijn vermogen, heb verzekerd dat de deelnemer begrijpt waar hij/zij vrijwillig mee instemt.

_____	_____	_____
Naam onderzoeker	Handtekening	Datum

Contactgegevens van de onderzoeker voor verdere informatie: Charlotte Oldenbeuving, +31 6 25269061, C.L.Oldenbeuving@student.tudelft.nl

13.3. Appendix C: Open-ended coding towards 4C model

NbS Barriers and successs factors	1st category	2nd category	3rd category	Raw data
1) Compose creative resources for NbS & 2) Do NbS pilot projects	**Composing**	***Problem statement integrating NbS***	*Protection, maximization and quality of Ecosystem structures*	"Wickevoort itself is also an area development with a lot of attention for nature, which was part of the ambition from the start. For example, Lucas immediately focused on preserving as many trees as possible." (Anne, project developer)
			Clear vision & guidelines	"It's not so much that this is specifically designed from the complete biobased concept or nature inclusiveness. But at Ballast we have the CEO as an internal big driver in green, so to speak. And because real estate and area development are going so slowly, we have said here: We are going to plug in the maximum here. So not as a concept, but in practice, how can we make it as green as possible here, with the aim of making it as sustainable as possible in all its aspects." (Hugo, developer)
			Ambition for going beyond standard solutions *Fair integration of NbS with other Ambitions*	"Here I actually want to do things differently. This is the first district where I actually want to show how well we are doing as Ballast Nedam." And that's where a lot of those elements actually came together." (Nick, Ornithologist).
		Project Collective	*Selecting on Intrinsic motivation for integration of NbS with other Ambitions*	"Precisely because I am at the beginning of the process and selecting the architect, it is my role to make it clear at the beginning that the starting points for this project are that it must be nature-inclusive and climate-adaptive, and that it must meet certain standards. The entire project must, as it were, "breathe green." Then I choose an architect who feels connected to that. I think that is an important step to safeguard the entire process." (Anne, project developer)
			Selecting on NbS expertise *Selecting on Creative skills to integrate NbS with other ambitions*	
		Guidence for Multi-functional solutions	*Recognizing and leveraging opportunities*	"A really good developer who feels that this is the right choice, because then it is not only good for this, but also good for that, so that produces a much better result in total. And in that respect you have to have a bit of a creative mind, to signal opportunities that are everywhere and then have them applied." (James, area developer)
			Correlating and Combining	"How can you help each other by, so to speak, cleverly placing everything on top of each other and not creating all transitional constructions?" (James, Area developer)
			Challenging current ways of thinking	
			Judge upon the criteria of the creative product with the judges in mind	"It's really great when you win a tender, and sometimes we also make a decision, this one yes, that one no, and you also try to estimate; how will the judging party feel about this?" (James, area developer).
1) Policy restrictions; 2) Actors prioritizing other things over NbS due to common practice; 3) Community engagement & 4) Create new relationship networks	**Convincing**	**Get approval for NbS implementation**	Expose ambiguity	*"the municipality says: 'just do the same standard trees everywhere, because that is better for our management policy.' And to then still get it your way takes a lot of time. Then you really need someone from the municipality to lobby for you." (Lily, developer)* *"And if we have a higher ambition, then sometimes it doesn't meet a number of things... then you have to be a bit creative to make it meet the policy after all... that is just difficult, even though it is a theme known to everyone. That requires perseverance..."* (Hugo, developer)
			Lobby	
			Use persuesiveness and perseverense	
		Enable resources for NbS implementation	*Reframe and search for synergies*	"Then we try to come up with something else that still supports the same theme. It is not that we simply scrap things, because then we do not keep our promises to the municipality and/or the project team. We have agreed on a DNA with ten core points, and if you keep scrapping things, nothing remains of that DNA. People can then address us with: "You promised this two years ago." So, we ultimately have to see how to make it come true."(Tom, developer)
		Stimulate NbS implementation	*Inform and educate* *Inspire*	
1) Integrating NbS after design phase started & 2) NbS not being preserved on construction site	**Conducting**	**Monitor**	Natural, construction and NbS maintenaince processes	"but there are always moments when you learn from, yes, but apparently there is still too much moisture, too little light, too many people walking by. There are so many things that you cannot foresee and that requires management, so that you do not just say: oh, we have to plant new plants because they should be here according to the planting plan, but no, we are just going to change it." (Liam landscape architect)
		Respond adaptively	*Using creative problem solving*	Case example: "The frog incident at Wickevoorts construction site"
		Use plug-inn method	Learning-by-doing	"it is not so much that this is specifically designed from the complete biobased concept or nature inclusiveness. But at Ballast we have the CEO as an internal big driver in green, so to speak. And because real estate and area development are going so slowly, we have said here: We are going to plug in the maximum here. So not as a concept, but in practice, how can we make it as green as possible here, with the aim of making it as sustainable as possible in all its aspects."(Hugo, Developer)
	Contemplating	**Organizing time by organizing activities**	*Peer reviews, intervisions, etc.*	Reccommendation
		Change Environments	*work environments, case environments*	You do that by indeed looking for a moment, but also for example a different kind of place. Often we don't do that here in the office. We often go to architects and designers, that is anyway a nice environment to work. Because there is all sorts of things hanging on the walls, things happen and you also look for a kind of environment for inspiration.'" (Alex, Concept Developer)
		Educate	*Yourself*	"Steve actively learned more about nature-inclusive design. He has been taught to look at other perspectives and learned think like an animal would think." (Liam, landscape arhcitect)
			Others	Case example: "from implementing Hero biodiversity scan toward education of approaching Dutch Biodiversity collabs"