From **Blue**print to **Green**print

transforming architecture
for a sustainable future

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CONTENT

1. INTRODUCTION
1.1 Problem Statement
Since the industrial revolution, man's influence on the climate has rapidly increased. The main reason for this is the emission of greenhouse gasses such as carbon dioxide (CO_2) and methane (Ministerie van Infrastructuur en Waterstaat, 2023). In particular, carbon dioxide emissions originating from the built environment play a significant role in shaping climate change. Specifically, the built environment contributes to 38% of total CO_2 emissions in the Netherlands (Whole Life Carbon, 2021). Within this percentage, 27% is attributed to operational emissions, which are tied to the energy consumption during the building's use, while the remaining 11% results from emissions linked to materials and construction procedures. The construction industry faces a significant sustainability challenge, including the responsible use of materials and the imperative to reduce CO_2 emissions across various phases: construction, the building's operational life, and even potential demolition. As a result of climate change, heat is retained and the earth's temperature rises with major consequences for humans, nature and the environment. Over the past 130 years the average temperature in the Netherlands has increased by 1.7 degrees.

In addition, human activities significantly impact climate change (Stern, 2000). An important way to limit climate change is to reduce the ecological footprint of inhabitants as much as possible. With an average ecological footprint of 5.7 hectares per Dutch citizen, biocapacity is exceeded, and the ecological deficit can lead to natural capital depletion and the loss of biodiversity (Nederland Fact Sheet – Global Footprint Network, 2023). The prevailing societal structure is predominantly organized for convenience and ease of replacement over ecologically beneficial practices (Speck & Hasselkuß, 2015). This consumerist mindset tends to encourage and sustain environmentally harmful behaviors, ultimately contributing to a larger ecological footprint. Hence, there is an urgent need for change.

In response, sustainable architecture endeavors to address contemporary concerns related to human impact, emphasizing reduced resource consumption and waste, along with the use of eco-friendly materials to lower energy usage and carbon emissions (Bennetts et al., 2002). Beyond environmental aspects, it also considers the social and cultural relevance of buildings, and aims for balanced economic development while respecting natural resources. However, the pervasive 'green' movement has distorted the genuine meaning of sustainability, transforming it into a marketing strategy termed 'greenwashing'. This often fails to align practices with the fundamental principles of sustainability – people, planet and profit (Ghisleni, 2022).

1.2 Research Question
To address these challenges and meet the urgent need for change towards a sustainable future, a fresh perspective is required on how the construction industry can transform towards greater sustainability (Whole Life Carbon, 2021). The transformation towards a sustainable future is crucial due to the evolving environmental landscape, increasing carbon dioxide emissions, and the necessity for an innovative approach that addresses the pervasive issue of greenwashing. Architects must take the responsibility of designing buildings that not only serve functional purposes, but also offer lasting solutions for a sustainable future. A comprehensive view of sustainability within specific contexts is fundamental in the design of sustainable architecture (Bennetts et al., 2002). Neglecting this approach may lead to counterproductive outcomes when solely relying on existing published advice. Hence, the research defines a building as an ecosystem comprising materials and living entities. In order to grasp the intricate nature of diverse sustainability principles in architectural contexts, the following question is raised:

'Does the creation of a building as an ecosystem, encompassing materials and living entities, significantly impact behavioral patterns of its inhabitants with respect to sustainability?'.

The sub questions derived from this are:
- *'What obstacles emerge during the architectural design process when accounting for the multifaceted aspects of sustainability?'*
- *'In what manner does the architectural representation of a building as an ecosystem proficiently communicate this concept to its inhabitants?'.*

This research focuses on the complex dynamics of sustainable architecture and seeks to analyze whether the creation of buildings as ecosystems influence inhabitants sustainability behavior. By exploring the questions, the research aims to provide insight into the multifaceted principles of sustainability in architecture to address the challenges posed by climate change in the built environment. Ultimately, the goal is to shed light on how innovative design strategies in sustainable architecture can be effectively implemented to achieve a more sustainable future. This addresses the urgent need for change and responsible practices within the construction industry and societal behavior.

1.3   Design

The outcomes derived from the research will establish the foundation for my design proposal within the 'Advanced Housing Design' studio, specifically focusing on victims of domestic violence. This emphasis stems from the alarming statistic that 1.2 million Dutch individuals from sixteen-year-old experience domestic violence annually (Ministerie van Justitie en Veiligheid, 2021). Designing for this target group entails addressing challenges related to safety and security, privacy, affordable housing, and emotional well-being.

The proposed design involves the creation of sustainable housing with a maze structure, intending to yield visually appealing residences with a distinctive character seamlessly integrated into the environment (figure 1&2). The maze structure serves a dual purpose, acting as a natural barrier that enhances security and making it challenging for external entities to locate and access the dwellings. The intricate layout of the maze, characterized by numerous twists, turns, and dead ends, offers a heightened level of privacy. Additionally, the maze structure allows for the incorporation of multiple rooms without expanding the land footprint, thereby optimizing land utilization. Within the framework of sustainable design, the maze structure contributes to natural shading and wind protection, potentially reducing reliance on artificial cooling or heating systems. Furthermore, to enhance emotional well-being and facilitate the reintegration of the target group into society, support services will be strategically integrated into the design of the maze.

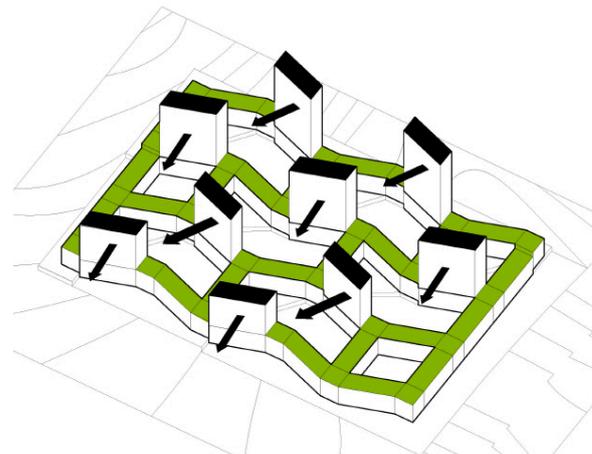*Figure 1: First sketch of the design proposal*

Figure 2: Diagram 'Nine Dragon' Housing Complex

2.   THEORETICAL FRAMEWORK

The research will be done through an ecologic way of thinking in the way American feminist and science philosopher Donna Haraway emphasizes. An ecologic way of thinking encourages a deep understanding of the relations of organisms to one another and to their physical environment (Oxford Languages, 2022). Haraway states that nothing is connected to everything, but everything is connected to something (figure 3). Therefore, it is crucial to acknowledge the entanglement of various entities, and acknowledge the complex relationships and interdependencies between humans, non-human beings, and the environment (Van Dooren, 2014). Through this approach, I aim to clarify the multitude of mutual relationships among the different elements in a sustainable built environment.
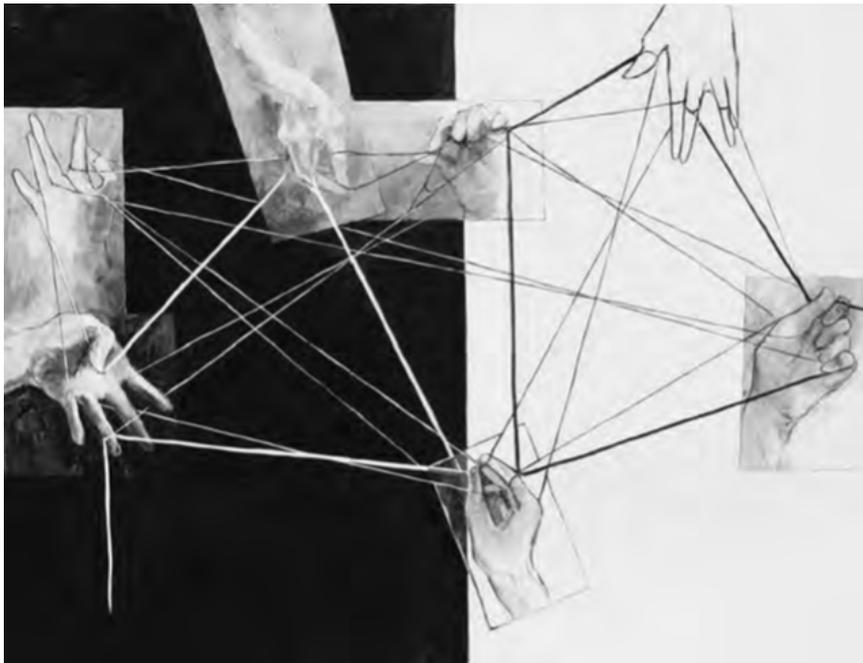

Figure 3: Cat's Cradle / String Theory.

To get a deeper understanding of the effects of the built environment on the planet, I will use speculative storytelling as a tool to reimagine worlds that can be radically different from the one we know. Storytelling or Haraway's Speculative Fabulation is a 'mode of attention, a theory of history and a practice of worlding' (Donna Haraway, 2016). We need Science Facts, but also Speculative Fabulations – fabulations to help us build theory and make a different future. The idea of 'Imagining Dialogues with the Voiceless', developed by philosopher and sociologist Bruno Latour, suggests that non-human entities should be granted equal rights to humans (De Wit, 2023). Viewing non-humans as active participants, as co-citizens with their own entitlements and perspectives, can provide us with a more profound insight into the influence of human activities on the environment. These frameworks investigate the entanglement between inhabitants of sustainable architecture, the building as an ecosystem and the environment.

3.   METHODOLOGY

The urgent need for innovative design strategies that holistically integrate environmental, social, cultural, and economic elements in sustainable architecture, requires various interconnected methods. The methodology will be conducted through Case Study Analysis and Speculative Storytelling.

3.1   Case study analysis

Three to five sustainable architectural projects in the Netherlands will be selected to identify obstacles and challenges, knowledge deficiencies, and successful approaches in sustainable architecture.

3.1.1   Literature Review

In this part of the analysis, the research will delve into existing literature and analyze the selected case studies. These findings will form the foundation for further investigation.

3.1.2   Quantitative Analysis – measurements

To get insight on the effect of the projects on the environment, numerical data will illustrate the impact of buildings' carbon footprint on the environment. Additionally, numerical data will depict how the carbon footprint of the case studies affects the environment. The measurements will be conducted utilizing the CO_2 calculation tool provided by Klimaatplein in the Netherlands: https://klimaatplein.nl/handige-tools/gratis-co2-calculator/. Furthermore, data regarding the sustainability of the case studies will be gathered, including details on resource utilization and the quantity of energy consumed.

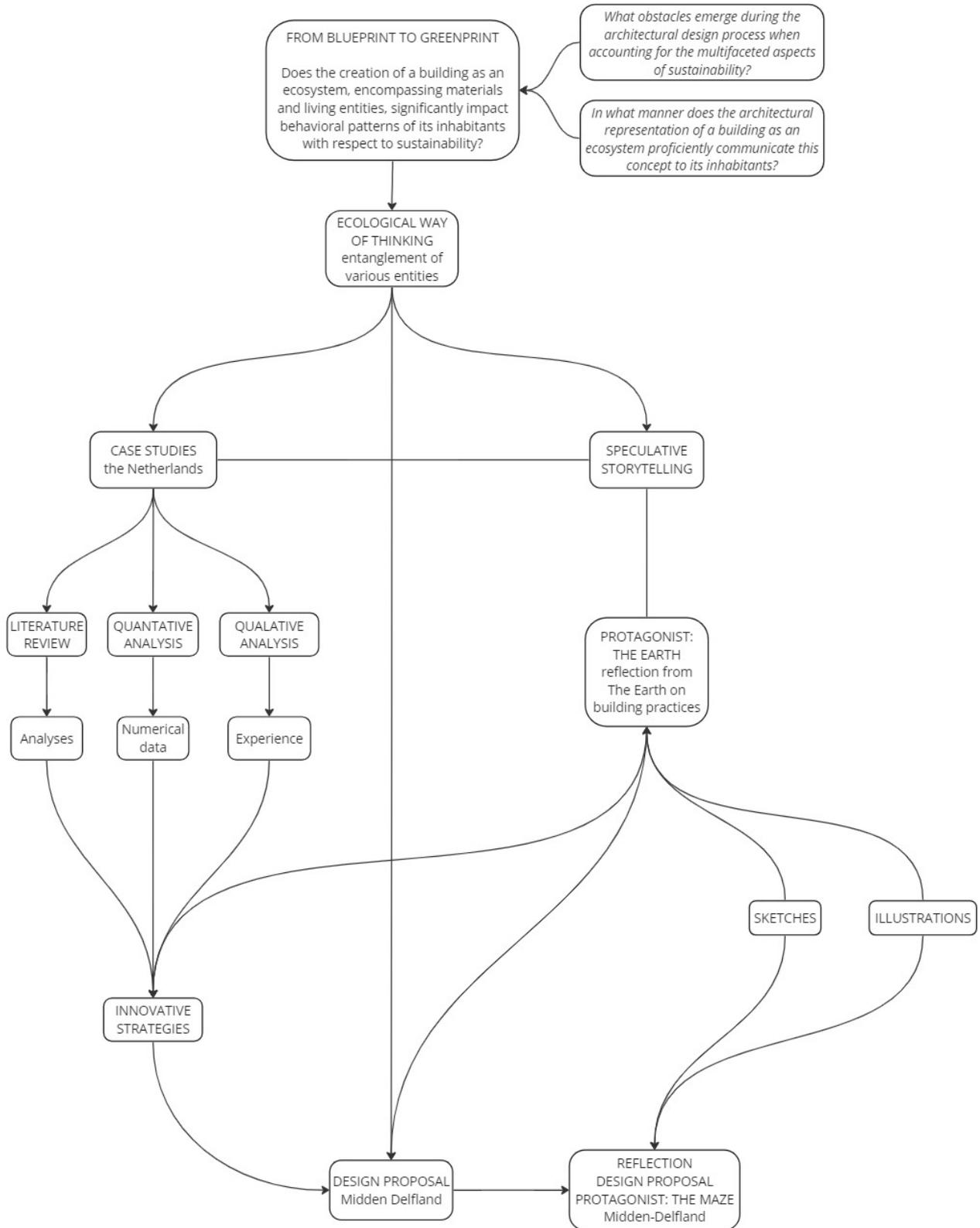### 3.1.3   Qualitative Analysis – Inhabitants behaviors

In order to bridge the gap between theoretical and practical environmental performances, experiential aspects of sustainable architecture will be captured through surveys and interviews administered by inhabitants of sustainable buildings. This human-centric perspective will gather insights into inhabitants' behavior, perspectives, and comfort levels, aiming to ascertain if sustainable architectural practices encourage sustainable behavioral patterns.

3.2   Speculative Storytelling

Through the case study analysis, a narrative will intertwine, featuring The Earth as the protagonist. This story aims to underscore the influence of the current built environment and its inhabitants on The Earth. Given that it matters what stories tell stories (Haraway, 2016), The Earth's narrative will establish a framework for my design proposal. The validity of the innovative design techniques in my proposed design, as well as their role in promoting sustainable practices within buildings and among their inhabitants, will be presented from the perspective of The Maze.

These speculative stories will employ a variety of mediums, including case studies, sketches and illustrations. Through this approach, my goal is to offer a perspective on the impact of the built environment on the protagonist and a vision on the practical implementation of potential future innovations within the constructed environment. By constructing scenarios through storytelling, I aspire to inspire architects to proactively engage in shaping a sustainable future co-developed through thinking, writing, and researching.

4.   DIAGRAM OF RESEARCH DESIGN

FROM BLUEPRINT TO GREENPRINT

Does the creation of a building as an ecosystem, encompassing materials and living entities, significantly impact behavioral patterns of its inhabitants with respect to sustainability?

What obstacles emerge during the architectural design process when accounting for the multifaceted aspects of sustainability?

In what manner does the architectural representation of a building as an ecosystem proficiently communicate this concept to its inhabitants?

ECOLOGICAL WAY OF THINKING
entanglement of various entities

CASE STUDIES
the Netherlands

SPECULATIVE STORYTELLING

LITERATURE REVIEW

QUANTATIVE ANALYSIS

QUALATIVE ANALYSIS

PROTAGONIST:
THE EARTH
reflection from The Earth on building practices

Analyses

Numerical data

Experience

SKETCHES

ILLUSTRATIONS

INNOVATIVE STRATEGIES

DESIGN PROPOSAL
Midden Delfland

REFLECTION
DESIGN PROPOSAL
PROTAGONIST: THE MAZE
Midden-Delfland

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Figures

Figure 1: Own illustration

Figure 2: Gallery of "Nine Dragon" Housing Complex / YKH_LAB - 28. (z.d.). ArchDaily. https://www.archdaily.com/182446/nine-dragon-housing-complex-ykh-lab/010_idea-draw?next_project=no

Figure 3: Haraway, D. J. (2016). Staying with the trouble. Duke University Press.