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IMAGINATION, CONNECTION, EMPOWERMENT - Key competences for the transition to a sustainable built environment

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Inaugural lecture
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14 november 2024

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IMAGINATION CONNECTION EMPOWERMENT

Key competences for the transition to a sustainable built environment

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Inaugural lecture delivered in abbreviated form on
14 November 2024

PREFACE

How can we create an environment that promotes environmental sustainability as well as people's health and well-being? Is it possible to continue urbanising while becoming sustainable? How can we achieve our ambitions for a sustainable built environment when there is a growing divide in society?

The Netherlands' sustainable ambitions speak for themselves. The aim is to become climate-neutral and fully circular by 2050. International agreements must ensure the conservation of biodiversity. In the meantime, the effects of climate change and the energy crisis are being felt and these are directly and indirectly affecting people's health and well-being. Add to that the challenge of managing urbanisation in order to accommodate population and economic growth.

The impact on the built environment is significant. Transitioning to a built environment that incorporates all these sustainable ambitions requires complex value trade-offs within limited physical spaces. This requires firm choices, a good dose of creativity and, above all, a people-centred approach. An approach where professionals dare to look beyond their own area of expertise and plot boundaries, and work together. Not only with each other, but also with the (sometimes vulnerable) groups at risk of being left behind in the transition.

Through practice-based research, the Sustainable Built Environment research group focuses on developing solutions to facilitate the smoother running of this transition process. To this end, we use the neighbourhood as a spatial scale on which to experiment and innovate. This is the scale at which professionals and residents need each other to drive the transition forward. It is also where new designs, physical interventions, forms of cooperation and courses of action can be initiated and tested. In this inaugural lecture, I demonstrate how the competences of imagination, connection and empowerment can support professionals in this process.

TABLE OF CONTENTS

INTRODUCTION

I am an energy winner. Let me explain why. During the pandemic, I had the luxury of making my home more sustainable. By 'luxury', I mean that I had the time, money, and knowledge to make smart choices. Our efforts were even picked up by the local newspaper. We didn't bother with half-measures. With twenty solar panels, a powerful heat pump and a green roof, we went all out. That green roof... That was something else. We spent €4,000 on pretty succulents that can only be seen from our bedroom window. They should provide high thermal and acoustic comfort, though. During heavy rainfall, the green roof captures water while also providing additional habitat for plants and animals. But was it worth the €4,000? An interesting reflection on sustainable values. One that I was able to afford thanks to our savings in the bank.

Sustainability, a matter of money

As I sat at the dining table in my sustainable home, I had another realisation. The choices we made for our home could set an example for others, but not for everyone. In fact, my 'practice what you preach' mentality has very limited value. The real work, making the built environment truly sustainable, has ony just started. Not every home is suitable for solar panels and a heat pump. If you live in a three-storey building, for example, you depend on collective solutions, resources and decision-making regarding these issues. If you are renting this property and have a low income, you may wish to see these collective resources allocated differently. This is especially true if sustainability measures, such as green roofs or nesting boxes, do not directly reduce your energy bills. In that case, you might be better off with a new washing machine or bicycle.

For many households, sustainability and affordability are at odds. Housing and energy costs often represent the largest expenditure, particularly for those on lower incomes, where these costs have an increasingly significant impact on the budget. Recent research by Nibud (Van den Enden & Veerman, 2024) shows that low-income households, who are struggling to pay their bills and/or rent, often have little control over their energy costs. This group is unable to implement major energy-saving measures, partly because they depend on landlords or owners' associations for sustainability. As a result, households with limited financial resources risk falling further behind. Furthermore, over 27% of residents of social housing indicate that they will only cooperate with the landlord's sustainability efforts if they will benefit from them financially (KWH, 2019). Willingness to contribute to sustainability is influenced by various factors, including income, social norms, environmental awareness, and trust in institutions (Kooger & Langefeld, 2024; Niamir et al., 2020; Umit et al., 2019). Achieving sustainability in the built environment in the coming decades will require widespread support. How do we get everyone on board in a society where disparities are growing? In my opinion, this is a major challenge on the route to a sustainable built environment.

A complicated spatial puzzle

Another challenge lies in making choices in communal spaces, i.e. those areas of land for which we all share responsibility. Collective solutions that contribute to a sustainable built environment rely on the Netherlands' already limited physical space. I was able to make my own home sustainable within the boundaries of my plot. With a few adjustments, I could install a home battery to achieve complete energy neutrality. This would make me virtually self-sufficient in terms of my energy needs.

This is not an option for many residents of urban homes. Instead, they rely on shared facilities, such as heat grids, community batteries, solar farms and wind turbines, to supply green energy. The choices made during the energy transition have spatial consequences. The Ministry of the Interior and Kingdom Relations has calculated that the number of substations in neighbourhoods needs to almost double in order to expand the electricity infrastructure, due to an increase in both decentralised energy production and electricity demand. Another 100,000 of these should be added to the existing 125,000 (Generation. Energy et al., 2021). Energy companies like Enexis are competing for the same neighbourhood space needed for sustainable projects, such as greening, climate adaptation, and biodiversity promotion. We can achieve a lot by making smart use of the available space, for example by constructing roof gardens combined with solar panels or solar boilers and underground infrastructure.

This presents some interesting design challenges. Nevertheless, it remains a complex spatial puzzle that requires careful decision-making and cross-domain thinking. This applies both to the boundaries of the physical domain (plot boundary) and to the boundaries of one's own discipline. Solutions lie not only in spatial or architectural designs, but also in designs for decision-making processes, courses of action, forms of cooperation and new business models.

Sustainable and healthy

If we want to move towards a sustainable built environment, the puzzle becomes much more complex. On top of the energy transition, we will also need to find solutions for circularity, climate adaptation and biodiversity within the same collective space. Concrete tasks with clear policy objectives that contribute to a better environment, in other words: a healthy planet. I would now like to focus on the theme of 'healthy living environments', which are inextricably linked to sustainable built environments. Using the theme of biodiversity, I will explain. Species and ecosystems play a crucial role in producing oxygen, breaking down dead organisms, purifying water and controlling pests. Insects, for example, are essential for the pollination of food crops. The disappearance of plants and animals poses a direct threat to our food production and, consequently, to our health. Or consider the topic of climate adaptation. Failing to sufficiently take flood hazards into account in our built environment will impact the mental health of people living in high-risk areas. For instance, since the floods in the summer of 2021, residents of Valkenburg have continued to live in fear of water entering their homes again (Pointer, 2024). As well as experiencing sleepless nights, some residents have even been diagnosed with PTSD. There is also a general distrust of institutions. Research confirms that the distance between residents, government, and other institutions further hinders the transition to a sustainable built environment (Rocak & Keinemans, 2023; Rodríguez-Pose, 2018).

The Sustainable Built Environment research group takes a broad view of sustainable building. We believe that a sustainable built environment reduces negative environmental impacts, creates a healthier planet and improves people's health, either directly or indirectly. We therefore adopt a holistic approach, focusing on how government, the market, residents[1] and other social partners can collectively create a built environment that meets the needs of current and future generations. In doing so, we seek solutions to the following: 1) the complicated puzzle of realising as many sustainable values as possible in a limited space, and 2) how to get everyone — both professionals and residents — on board with the transition. I am deliberately shifting the focus away from making individual homes or buildings more sustainable, such as the changes

I made to my own home, and onto a larger scale. This is the level at which parties need each other to move forward in the transition to a sustainable built environment. With that in mind, I would like to refer to Sustainable Development Goal number 11: Make cities and human settlements inclusive, safe, resilient and sustainable. As a research group, let us make our own small contribution to this global goal.

[1]*I opted for 'residents' rather than 'citizens' because the former more accurately conveys the relationship between people and the built environment. As well as residents, of course, there are other end users of the built environment who are involved in the sustainable transition, such as companies, civil society organisations, shopkeepers and associations. As I establish a link between sustainability and the housing challenge in the lecture, I will limit myself to residents for the sake of convenience.*

Sustainable values for the built environment

Which sustainable values are at stake in the built environment? Numerous concepts in the literature define sustainability in terms of social, health and environmental factors. Examples include the United Nations' Sustainable Development Goals (2023) and the Netherlands Environmental Assessment Agency's (PBL) Broad Prosperity indicators (2024). The following ten values can be derived from these concepts. We want to recognise these in a sustainable built environment (see Figure 1). Five of these values directly concern the environment, while the other five concern human beings. These values are interconnected. The question is how we can create them within the limited space available through smart design, collaboration and identifying opportunities for connections.

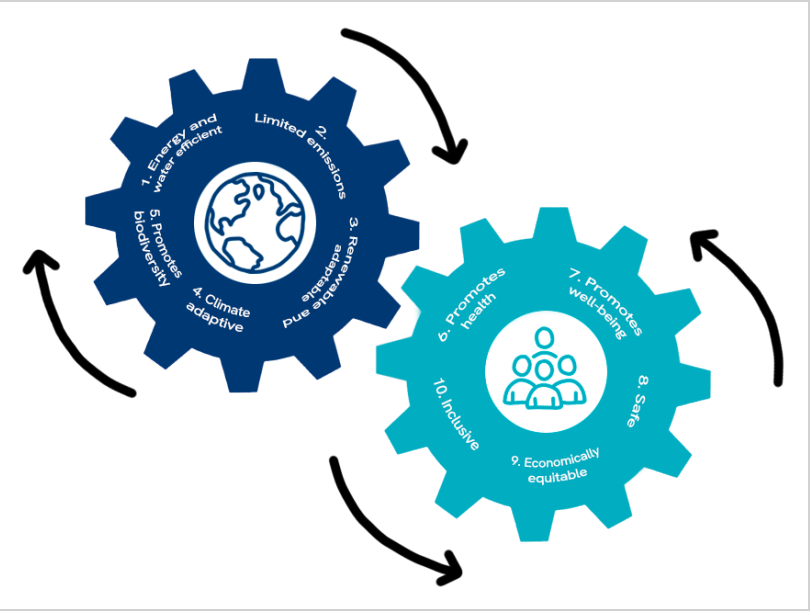

Figure 1. Ten sustainable values for the built environment

Reading guide

In Chapter 2, I present a spatial-scale perspective through which to view the sustainable built environment. I propose that the transition occurs at different spatial scales, but that the greatest impact can be made at the local level, which I refer to as the neighbourhood level. In Chapter 3, I explain this spatial-scale perspective on the task at hand in the Province of Noord-Brabant. This is the area on which I, as an Avans professor, will initially focus. In Noord-Brabant, we have a sustainability task as well as a significant urbanisation task. How do these two tasks relate to each other at the local spatial scale? What issues arise from this and how can the research group address them through practice-based research? In Chapter 4, I successively discuss the three essential competences referred to in the title of this lecture: imagination, connection and empowerment. In my view, these competences are essential for professionals working in the built environment, as they contribute to finding solutions for the transition to sustainability.

2. THE NEIGHBOURHOOD AS A SCALE FOR A SUSTAINABLE TRANSITION

I use the word 'transition' here because I recognise that creating a sustainable built environment requires fundamental changes. It involves changing systems and the way professional parties relate to each other, as well as the way in which they include residents in the sustainability process. It is a highly complex change task that takes place over an extended period of time. As a professor, I act as a guardian of this built environment, which is undergoing fundamental changes. As someone who is all too familiar with the complex systems behind the built environment, I am researching practical solutions that could help make this transition smoother. I consciously choose the neighbourhood as the spatial scale level for research, believing that this is where the distance between the system world and that of everyday life is the most tangible, and where the greatest impact can be made. I will explain why.

2.1 Where the system world and the world of everyday life collide

Making the built environment sustainable can be challenging due to conflicts between interests, regulations, habits and technologies. This clash of systems is a key reason why the advancement of sustainability processes can be hindered. This becomes especially visible when we look at the built environment at a lower spatial scale. Consider all the new technologies introduced to enable the energy transition (the technological system) and the system of laws and regulations designed to preserve the cultural and historical value of the built environment. Recently, this led to confusion in the working-class neighbourhood of De Muntel in 's-Hertogenbosch, where the housing corporation BrabantWonen offered tenants the option of installing solar panels,

which many took up. However, it later emerged that the panels should not have been installed due to the neighbourhood's protected townscape status. According to the Department for Heritage Conservation's explanatory notes (Kuilder, 2024), 'De Muntel is the oldest planned expansion of 's-Hertogenbosch according to the modern urban planning principles in force at the time and can be seen as a response to the housing shortage and the situation in the old city.' A clear example of how the rules surrounding heritage conservation, the energy transition and households wanting to reduce their monthly energy bills by installing solar panels can conflict at a local level.

At the local level, we can clearly see how technological, economic, institutional and social systems can collide. This is where the impact of administrative measures, policy choices and institutional collaborations on people's daily lives in a neighbourhood becomes apparent. Taking a tour of the neighbourhood allows you to see where and why sustainability is being hindered. Take, for example, sustainability initiatives by low-income private homeowners. Despite all the incentives, not every household has the willpower or mental strength to improve their own home. We find these homes, for example, in neighbourhoods with a high proportion of social renters. From the 1990s onwards, corporations sold these properties in order to become more market-oriented. This freed up financial resources for corporations, enabling a diverse housing supply to emerge. Consequently, we now see a variety of ownership types within a single neighbourhood. Furthermore, research shows that home ownership positively affects residents' engagement with their environment (Manturuk et al., 2012). However, this creates challenges for the energy transition, given that the interests of housing associations and private homeowners can differ

significantly. In research, much attention has been paid to this theme in recent years. For example, Anita Busio, one of the last students to graduate from TIAS School for Business & Society under my supervision, conducted research on how Woonstichting Joost can engage private individuals in its sustainability projects (Busio, 2023). Maarten Rutten, who was involved in the research group as a senior researcher, also conducted research on this theme (Rutten et al., 2022). These studies provide tools, insights and processes to promote participation, thereby bridging a small part of the gap between the system world and that of everyday life.

2.2 Stronger regulation or greater autonomy?

Perhaps the desire to live in well-ordered terraced or multi-family houses of equal architectural and aesthetic quality is a typically Dutch trait. Ideally, these would also feature neatly landscaped gardens and uniform balconies. I am well aware that it is through the lens of our own (Western) standards of quality in the built environment and customary manners that I view clashing systems. The clash of systems and the solutions that fit them will vary depending on the values, norms and beliefs of the actors involved in the built environment. A recent article on the Woenselse Watermolen neighbourhood in Eindhoven showed that vulnerable neighbourhoods are not the only ones susceptible to clashing systems. In a short time, English-speaking expats from mainly India have settled there (Van Houtert, 2024). Despite statistics showing that this is a safe and thriving neighbourhood, the original residents no longer feel at home here. This example illustrates how people from different cultural backgrounds may perceive liveability differently. For instance, not all expats know how to maintain a quintessentially Dutch single-family house with window sills and front and back gardens. This can lead to squalor and clutter in the eyes of the original residents. Is this a problem, or is it simply a difference of opinion regarding the quality of our environment? Does the situation directly or

indirectly affect residents' social well-being and sense of security? If so, who should take the lead in improving it? The proposed solution of participatory pathways, offered in the previous section on mixed ownership within neighbourhoods, will not improve the living environment in this case. Expats only live in this neighbourhood for a short time. They use the rental property as a stepping stone into the Dutch housing market, quickly exchanging it for an owner-occupied property elsewhere in the region where they will stay for longer. Maintenance of the tenants' private domain could be performed by the landlord, with the costs being passed on to the tenant. That raises the question, however: who is imposing a standard on whom? Or could we force a change to the housing allocation system to ensure that expats are distributed more evenly across the city, rather than living in culturally homogeneous neighbourhoods? This raises ethical and economic dilemmas that are worth exploring, but which I will not discuss further here. The fact is that, in the years ahead, we will encounter an increasing number of cultural differences due to various forms of migration. This is an issue that needs to be addressed in the context of making the built environment more sustainable.

In the Woenselse Watermolen neighbourhood, institutions may be tempted to exercise greater control. However, in other situations, granting residents greater autonomy can speed up the transition to sustainability. According to Rotmans (2021), an alternative democratic system could give people ownership and control over their neighbourhoods or districts at a local level. This means making community and neighbourhood residents financially and organisationally responsible for every aspect of their neighbourhood. On a small scale, we are already seeing great initiatives. For example, residents are taking the lead in greening their living environment. They know perfectly well how to connect sustainable ambitions with neighbourhood projects. There is no need for a drawing board or policy paper. Various studies show that these neighbourhood initiatives lead to a green, healthy, biodiverse environment and contribute to social bonding and increased social well-being (Derkzen et al., 2021; Luttik et al., 2014). Let us take the time to experiment with this, both literally and figuratively. It is interesting to explore – in real life situations – to what extent, in what ways and in what situations autonomy works. For example, it may be effective in a young neighbourhood with many owner-occupied houses, whereas a neighbourhood with a high turnover rate, such as Woenselse Watermolen, or one with many elderly people in need of assistance, may require a different approach.

2.3 A spatial scale perspective

To gain a better understanding of where progress is hindered and where opportunities lie in making the built environment more sustainable, it is helpful to distinguish between different scales and understand how they interact. In transition theory, the Multi-Level Perspective (MLP, Geels & Kemp, 2000) is a key concept. More recently, Rotmans has referred to it as 'the scaling lens' (Rotmans, 2021). The MLP distinguishes three analytical levels: niches, regimes and landscapes. These levels interact with each other and play a crucial role in transition processes. You could describe the levels as follows:

Niches (micro-level):
Radical innovations emerge and develop in a niche. These are typically small-scale projects that differ from the prevailing system. Initially, innovations in niches have little impact on the dominant regime, but they can be protected by special rules, subsidies, or other support measures.

Regimes (meso-level):
The regime is the dominant system of structures, culture and practices. It includes established technologies, policies, markets and user practices, as well

as the interests of dominant actors. The regime is characterised by stability and inertia, which makes change difficult.

Landscapes (macro-level):
The landscape encompasses broader contextual developments that lie beyond the direct influence of niches and regimes. This level includes macroeconomic trends, cultural and demographic changes, political shifts and ecological developments. Although landscape developments usually change slowly, they can exert pressure on regimes and influence transitions.

One strength of the Multi-Level Perspective is that it does not view transitions as linear processes, but as interactions between different scales (Geels, 2011). When developments at different scales reinforce each other in the same direction, a transition really accelerates. Yet critics point to the need for further refinement and adaptation of the MLP (Moore & Doyon, 2023; Hansen & Coenen, 2015; Loorbach, 2022). If we apply the model to the transition towards a sustainable built environment, I agree with the need for some refinements. I highlight three of them here, and use them as a starting point for developing my own spatial scale perspective for practice-based research.

1. Clarify the role of actors:
When studying interactions between scales, more attention should be paid to the role of actors and their ability to act. In the context of the built environment, this involves professionals working for (semi)-public or private parties, as well as the residents, citizens and other users of the built environment.

2. Focus on multiple domains:
Applications of the MLP model usually focus on a single domain or industry. A common example is the transition to electric transport, driven by innovations in the automotive industry. Extending this parallel to the construction industry, however, reveals that a sustainable built environment requires more than just innovations within the industry itself. Technological and process innovations are only one part of the answer. Answers can also be found in other domains such as the social (new residential communities), administrative (new forms of direction and governance) and economic (new business models).

3. Introduction of spatial scale:
Understanding the spatial scale helps to further unravel systems. This is particularly relevant to the built environment, which is location-specific by definition. Different actors move at different spatial scales. For example, while construction projects have a strong location dependency, construction increasingly relies on cross-border supply chains. Institutional property investors operate across borders, whereas housing associations have strong local ties. This affects the actions of actors, which converge at the micro level, where the voices of residents who are rooted in their own environment also deserve to be heard.

Figure 2 illustrates the spatial scale perspective (a proprietary adaptation of the MLP), which can be used as a tool for analysing the transition to a sustainable built environment. The figure is limited to the micro- and meso-levels because these are within the sphere of influence of our practice-based research. At the micro level, I outline the neighbourhood in which the various actors of the built environment meet. In terms of transition theory, the neighbourhood can be viewed as the niche in which innovations are given space. A neighbourhood is a geographically defined area within a municipality that often has its own identity. Such an area is characterised by physical spatial cohesion and its own social structure. A neighbourhood may contain sub-neighbourhoods, as well as one or more additional functions besides housing. The area may be characterised as residential, central or industrial. Networking at the local spatial level could be triggered by construction projects, liveability programmes or other sustainability initiatives.

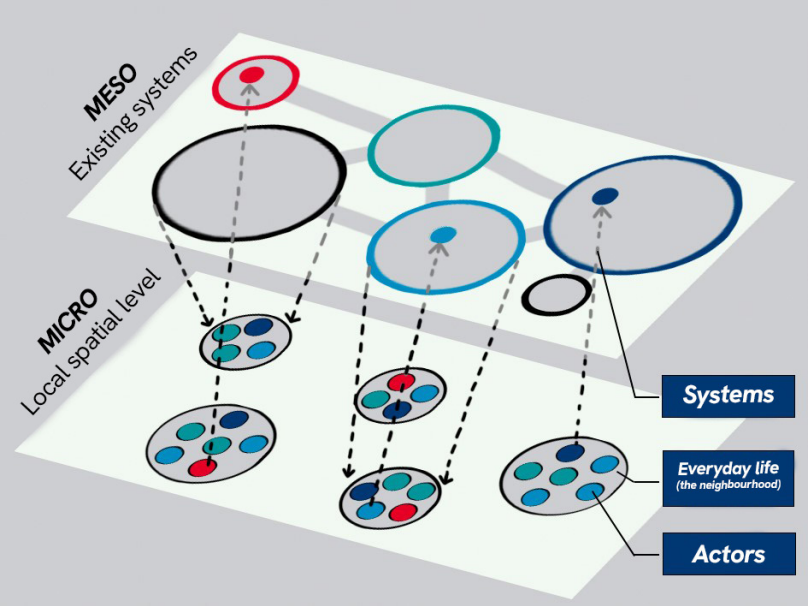

Figure 2. A spatial scale perspective (own adaptation inspired by the Multi-Level Perspective)

This is where representatives of municipalities, housing associations, property owners, developers, and other social organisations interact with each other and with residents involved in these projects. Sometimes they work against each other when the system world and that of everyday life clash, but sometimes beautiful new forms of cooperation emerge.

At the meso level, actors are part of existing institutions. Consider, for instance, a housing consultant employed by a housing association who is familiar with the needs of housing tenants at the micro level and knows what is going on in a neighbourhood. At the meso level, the housing consultant is part of an institutional network where innovative solutions to improve liveability are not supported due to other interests (e.g. precedent or financial reasons).

Ultimately, the focus is on the interaction between the actions of actors at the micro and meso levels. If the meso level (i.e. the system) consistently prevents action at the micro level, this impedes transition. Therefore, it is not just about innovative solutions at the micro level, meso-level system adjustments also contribute to the acceleration.

2.4 The neighbourhood as a living lab

To ensure resident involvement in the transition to a sustainable built environment, the spatial scale level should not be much larger than the neighbourhood. This is the level at which residents directly experience the impact of changes, because this is where they live their daily lives. The neighbourhood is small enough to allow direct involvement, yet large enough to enable collaboration with other parties. In terms of transition theory, this scale level can be seen as the niche environment where innovations take place. It's where we can initiate and test new designs, forms of cooperation and courses of action. This is where we will look for new solutions on: 1) how to achieve as many sustainable values as possible within a limited space, and 2) how to engage all actors in the transition. The goal is to facilitate a smoother transition to a sustainable built environment. The deliberate choice of neighbourhood as the scale level aligns with the concept of living labs as practice-based research environments. It is the built environment that becomes the laboratory, rather than the technological or business environment. The research group focuses on this place where systems from the construction, real estate and housing sectors, the systems of governance and government policy and everyday life intersect. This is a cross-domain approach. To this end, we explicitly seek collaboration with other research groups within the Centre of Expertise Safe & Resilient Society. Within the Centre, there is wide range of knowledge on the social and administrative environment, and we will contribute our knowledge on the built environment and related systems.

3. SUSTAINABILITY IN URBAN NOORD-BRABANT

Earlier, I mentioned my holistic view of sustainability. Rather than focusing on the development and implementation of sustainable, circular and energy-neutral construction methods, it considers the complex change process required to achieve a sustainable built environment. We study this change process at the neighbourhood level. As we search for living labs where we can observe and support this process by providing practical solutions, we cannot ignore another important issue that Noord-Brabant is facing. In the coming decades, the province will have to undertake significant urbanisation, which could be at odds with its sustainability ambitions. I will now explain this urbanisation challenge and then consider it in the context of sustainability. Finally, I make a suggestion as to how these challenges can be studied together in living labs in Noord-Brabant.

3.1 The urbanisation task

The province of Noord-Brabant is facing its own particular challenges when it comes to making the built environment more sustainable. It is one of the twelve improvement areas in the national NOVEX programme (Ministry of the Interior and Kingdom Relations, 2022). The programme pays particular attention to the significant housing challenge. As well as making up for the housing shortage, the region is facing an additional housing challenge related to the strong economic growth of the Brainport area. A total of 130,600 new homes are set to be built in Noord-Brabant's towns and villages by 2030. The province is opting for a scale-up of the Brabant City Belt ('Brabantse stedenrij'). This approach has already been implemented in the rail zones of Eindhoven, Helmond, Breda, Tilburg and 's-Hertogenbosch, and will continue in the surrounding urban areas (NOVEX Urban Brabant Steering Group, 2023). Ideally, we would like to see this development in conjunction with other space-requiring tasks. Unfortunately, it's not that simple. Claims on space are increasing, yet the area in which these functions must be accommodated is not expanding. In addition, strict environmental and natural requirements, such as the nitrogen standard, dictate

the game rules. At a regional level, we will increasingly have to make trade-offs between housing and business development, nature conservation and wind farm construction, and infrastructure and agriculture. The Preliminary Draft Spatial Memorandum (Ministry of the Interior and Kingdom Relations, 2024) provides a great example in this regard that relates to our region: 'The ambition for urbanisation in various urban regions in Noord-Brabant conflicts with the Ministry of Defence's expansion of helicopter training areas in some places. Additional solutions are needed to address this issue.'

These spatial choices are now being made in spatial plans at national and regional levels. To ensure the sustainable development of the urban network in Noord-Brabant, the state, province, regions, municipalities and water boards have developed a strategic plan (NOVEX Urban Brabant Steering Group, 2023). One important development principle, now more explicitly stated than in previous papers, is that urbanisation will be guided by water and soil. At the time of writing this lecture, no implementation agenda has been established for these spatial plans. I will follow the decision-making process with interest. The current plans are mainly directional; clear-cut choices have yet to be made.

Knowing that urbanisation and sustainability will clash in a limited physical space, I am curious to see what compromises will be made.

3.2 Urbanisation as an opportunity for a future-proof neighbourhood

Spatial plans at national and regional level provide important frameworks for a sustainable built environment. The actual elaboration is context-dependent and varies greatly from place to place. At the local spatial scale, sustainable values are actually translated into programmes and projects. Where choices have to be made at a regional level, we can try to incorporate multiple sustainable values into programmes, projects and other initiatives at a neighbourhood level. This enables us to densify and increase green spaces at the same time. We can combine functions and promote multifunctional use of space. We can also use the urbanisation task to bring together multiple sustainable ambitions. Are the possibilities endless? No, difficult choices will have to be made at the local, spatial level. Nevertheless, I see this as an important first step, given our creative ability and the willingness to work together to combine multiple values into one solution.

Let's revisit the housing challenge in Noord-Brabant. It is expected that the number of Brabanders will grow to 2.8 million by 2050 (Province of Noord-Brabant, 2023). According to policy plans, this means adding a city the size of Eindhoven within that period. By then, as many as 40 per cent of households will be single-person households while three-quarters of the current housing stock consists of family homes. Therefore, making the existing stock more sustainable and transforming it to meet a more diverse range of housing needs is perhaps the biggest task. This is precisely why choosing the neighbourhood level is so interesting. There, we can use the construction of new housing to strengthen the neighbourhood and make it more sustainable.

KAW architects came to this conclusion in a study advocating the strengthening of post-war neighbourhoods through the addition of housing (KAW, 2020). 'Plenty of space in the city,' was the study's appealing title. The complexity of densification means that not all of the province's new construction can be realised in existing neighbourhoods. However, as a construction and real estate sector, we could take responsibility for creating opportunities for linkage here. Despite population growth, the population of post-war neighbourhoods has decreased over the years as households have become smaller, while the number of houses has remained the same. As a result, support for facilities has also declined.

These neighbourhoods are especially vulnerable because they consist predominantly of homogeneous social housing, sometimes with a concentration of disadvantaged groups. We could strengthen these neighbourhoods by increasing the housing supply by adding an extra floor to existing houses, building within existing buildings, or splitting properties. This process is highly customisable and complex, but ultimately makes the neighbourhood more resilient, liveable, sustainable and suitable for all ages. This can also increase support for neighbourhood facilities. These facilities are within easy reach, which reduces car use and encourages healthier alternatives such as walking or cycling. In addition, a more diverse housing supply ensures that older people can remain in the neighbourhood for longer and that young people who are progressing in their careers do not have to leave.

3.3 An integrated neighbourhood approach

It is extremely difficult to perform large-scale physical interventions in existing neighbourhoods. However, in a new neighbourhood expansion, you can start with a virtually blank canvas. In an existing neighbourhood, you have to consider the interests of residents and other property owners, as well as the area's cultural and historical significance, and the existing urban planning structures. While plans on paper and data analyses suggest significant opportunities for expansion and densification, practical experience in Amsterdam (NUL20, 2023) shows that this is not always possible. A hefty dose of design power to fit new housing into existing urban structures, a profitable business case in neighbourhoods where rents are usually limited, and support from existing residents who will have to adapt to a different environment (sometimes literally a different view) are prerequisites for infill development in existing neighbourhoods. In fact, we are faced with the same two challenges that I outlined earlier in my introduction. 1) how do we solve the complex puzzle of incorporating sustainable values into limited spaces? and 2) how do we ensure that everyone is included in this transition? This requires a different approach: one that shifts from sectoral to integral. It challenges us to engage in collaborations that extend beyond our own plot boundaries and domain.

The Netherlands has a great deal of experience with neighbourhood renewal. For over a century, we have been investing preventatively to stop neighbourhoods from deteriorating. Recently, Platform31 compiled a chronological list of all policy programmes (Van der Velden et al., 2024). The two main long-term programmes that emphasised physical intervention were the urban renewal programmes, which ran from 1970–1995 and 1995–2012 as part of the urban policy initiative. A strategy involving demolition, rehabilitation and reinvestment was supposed to improve the socioeconomic position of vulnerable neighbourhoods. From 2012 to 2022, we see a period of locally driven neighbourhood renewal. As with spatial planning, the central government takes a step back, leaving local government agencies responsible for neighbourhood renewal. It is up to municipalities themselves to form local coalitions and tackle the social and physical challenges faced by neighbourhoods that do not benefit sufficiently from economic prosperity. Following the introduction of the National Liveability and Safety Programme (NPLV) in 2022, the neighbourhood approach has received renewed attention from central government due to an increasing awareness that it can help to prevent further division and inequality of opportunity between different areas (Ministry of the Interior and Kingdom Relations, 2022). The NPLV takes an integrated neighbourhood approach, meaning that several local issues are tackled together. Organisations such as housing corporations, educational institutions, the police, the justice system, health organisations and welfare organisations work closely together.

The NPLV lists twenty urban focus areas including the Noord-Brabant neighbourhoods of Tilburg Noordwest, Breda Noord, Eindhoven Woensel-Zuid and Roosendaal Ring. While the NPLV indicates neighbourhoods by name, this does not happen in housing deals agreed by government agencies. It's time to bring these tasks together, and to make the physical component more prominent, so that urbanisation and sustainability can reinforce each other.

3.4 Contributing to sustainable values with physical interventions

Over the past year, I have had the opportunity to meet many professionals and fellow professors from the social and security domains. It always takes time to adjust because you don't speak the exact same language and you approach the built environment from different assignments. When the conversation turns to neighbourhood issues, social and safety concerns tend to take precedence.

For me, however, the most important issues are sustainability and urbanisation. Of course, these issues overlap. This is especially true if you take a broad view of sustainability. Together, we are looking for physical interventions in the neighbourhood that contribute to a sustainable living environment. Professionals from the social and security domain prefer to refer to 'active principles or components' when discussing interventions. The jargon differs but the premise is the same. Knowing what these principles or components are, makes it easier to convince others to join in and solve the complicated spatial puzzle together. After all, you will then know which interventions to prioritise in terms of time, space, money and human capital.

What gives me great confidence is that this need is being recognised not only by professionals from the social domain, but also by private investors in the built environment, such as developers, property investors and individuals. Among these professionals, however, I see a reluctance to invest in green and public spaces because the benefits of such investments are realised further into the future (after all, they do not generate a monthly cashflow) and are therefore more difficult to measure or monetise. Nevertheless, these investors are also aware of the growing importance of investments that pay off not only economically, but also contribute positively to the environment and society (Kempeneer et al., 2021). Mandatory ESG reporting, in which companies account for their environmental impact, social responsibility and governance processes, naturally contributes to this.

3.5 Experimentation and co-creation in living labs

In our practice-based research, we view the neighbourhood as a living lab and use sustainability and urbanisation as our starting point. Naturally, not all of the housing challenges in Noord-Brabant can be solved in existing neighbourhoods. Nevertheless, there are opportunities to use the urbanisation challenge to strengthen and improve the sustainability of existing neighbourhoods, which are sometimes vulnerable. This will kill two birds with one stone. For example, as researchers, we are watching developments in Breda Noord and Tilburg Noordwest with interest. In addition, the housing challenge in Noord-Brabant by itself is worthy of attention. In the coming years, new neighbourhoods will emerge with their own ambitious plans for high-grade, sustainable development. Take the developments around 't Zoet in Breda and the Spoorzone area in 's-Hertogenbosch, for example. Here, the focus is shifting from an integrated neighbourhood approach to large-scale area development, where different laws apply and different interests come into play. This makes these new neighbourhood developments interesting as living labs as well.

Table 1 Overview of the working principles of physical interventions for sustainability

Physical interventions and working principles
The table below summarises the impact of physical interventions in a neighbourhood on sustainable values in the built environment. The physical interventions are based on making the existing built environment, which also has an urbanisation task, more sustainable. The physical interventions will eventually be reflected in projects, programmes and (citizen) initiatives.

Physical intervention:	Explanation working principle:
Improving green and blue structures	Introducing or simply protecting green and blue structures in the neighbourhood to cope with the effects of extreme weather (heat, extreme precipitation). This measure also promotes health (both mental and physical), well-being (by creating opportunities to socialise), a safe living environment for everyone, and biodiversity.
Building collective facilities for the energy transition	Constructing and connecting collective facilities for the generation, transmission and storage of renewable energy. For example, a heat grid or neighbourhood battery. Contributes to reducing CO2 emissions. This can include installing energy management systems to reduce energy consumption and improve efficiency.
Improving infrastructure for mobility	Constructing and improving infrastructure in a way that encourages the use of sustainable modes of transport and reduces emissions. Cycling and walking contribute to good health. Also guarantee accessibility to the built environment for all. This makes the built environment inclusive and safe, and promotes well-being.
Sustainable (re)constructing of homes and buildings	Using sustainable building materials and methods (circular and/or bio-based). Implementing sustainable systems to reduce water and energy consumption at a building level. CO2 emissions are minimised, energy costs reduced, waste streams reduced and comfort improved. Applying design principles that promote health, climate resilience and biodiversity.
Adding housing	Adding housing to existing neighbourhoods by transforming, restructuring, densifying, splitting properties, and adding layers. This increases support for facilities and diversifies the housing supply. Also increases the chances of finding affordable and suitable housing in a tight housing market.
Adding facilities	Adding social and commercial facilities increases neighbourhoods' liveability and economic resilience. There are more opportunities to meet each other. These facilities can be covered or installed in public spaces.
Introducing new housing concepts	Enriching existing stock with, or transforming it into, new housing concepts. This will meet the demand for greater differentiation in the housing supply, as well as the demand for inclusivity and community spirit.

The above areas in the Brabant City Belt ('Brabantse stedenrij') could be used as living labs for the practice-based research of the research group. It would be an impossible task to investigate all the effects of physical intervention on the broad concept of sustainability within these living labs, in order to arrive at a kind of blueprint for developing a sustainable built environment. Nor is it the research group's ambition. The relationship between a physical intervention and its effect on sustainable value is a research project in itself. As a research group, we are looking for solutions that can create multiple sustainable values. In our research, we emphasise the two challenges of transitioning to a sustainable built environment. These challenges, which we refer to as 'the puzzle' and 'the support', form an underlying theme throughout this lecture.

The puzzle: How can we create multiple sustainable values within the constraints of limited physical space?

The support: How can we ensure that both professionals and residents are included in the transition to a sustainable built environment?

For these two challenges, we create designs, develop prototypes, propose new areas of cooperation, develop business cases and suggest new courses of action. In doing so, we harness the power of imagination, connection and empowerment, tailoring it to the specific needs and issues of these living labs. This way, we offer concrete solutions for creating multiple sustainable values for the neighbourhood. These solutions could then be replicated or scaled up in other locations.

4. ESSENTIAL COMPETENCES: IMAGINATION, CONNECTION, EMPOWERMENT

The challenges on the route to a sustainable built environment require different competences. I classify these as: imagination, connection and empowerment. At first, you might think that these are competences that structural engineers (like me) in particular possess. This could be true if 'imagination' refers to the architectural design, 'connection' to an innovative timber connection and 'empowerment' to the structural calculation. This, however, does not align with a holistic view of sustainable construction. Instead, I am referring to the softer competences that every professional working in the built environment should possess, and which should therefore also be covered in their education. These are competences that should be deployed at the local spatial scale, within the professional's sphere of influence. In this chapter, I will explain the rationale behind each competency and demonstrate how we implement it through practice-based research within the research group.

4.1 Imagining

By 'imagination', I mean the creativity required for all actors to envisage a sustainable future. This will increase support for sustainable choices. Sometimes, the transition to a sustainable built environment requires us to fundamentally change the way we think. As Rotmans (2021) puts it so nicely: 'Making a mental leap of scale requires imagination, and imagining the nearly impossible is perhaps our biggest task.' In the construction and real estate industries, imagination is second nature to us. Artist impressions, spatial

scale models, and new technologies
such as virtual reality (VR) and augmented reality (AR) are important tools for enticing potential buyers and convincing clients. These technologies could be used much more widely to stimulate people's imagination and creativity. The possibilities of new technologies to transport people into virtual or simulated environments, also known as immersive technologies seem endless. For example, various studies have shown that using immersive technologies to immerse stakeholders in an imagined future increases awareness of climate change and the willingness to change behaviour (Markowitz et al., 2018; Fauville et al., 2020). Professionals should also use the power of imagination much more often to explore risks and look for solutions outside their own ingrained thought patterns (Janssen, 2022). As well as raising awareness of sustainable choices, immersive technologies can be used to encourage stakeholders to get involved in designing, planning and managing a sustainable built environment.

Visualising a future construction project only shifts our time horizon slightly. To truly grasp the long-term consequences of our sustainable choices, we need to consider the impact on future generations. The future scenarios for the layout of the Netherlands produced by the Netherlands Environmental Assessment Agency (PBL) are a good example of this. In four scenarios, the agency depicts what the Netherlands might look like in 2050 (Kuiper et al., 2023). Researchers at Wageningen University are looking even further ahead. They created a map of the Netherlands in 2120, showing the impact of climate change and urbanisation (Wageningen University & Research, 2019). I personally find this mapping material fantastic to study. It is, however, somewhat removed from the world we know on a neighbourhood scale, where the consequences are really felt in everyday life. In the New Canterbury Tales research project, Nina Kramer, a senior researcher attached to the research group, demonstrates how imagination can be used to envision new futures (Kramer, 2024). She uses

immersive technologies such as storytelling to design imaginary life-worlds. She introduces different audiences to these imaginary worlds to explore how people can be included in these shared images and whether doing so will adjust their ideas about the future.

Another reason to familiarise ourselves with these technologies is so that we can work together to design solutions for a sustainable built environment. This enables us to anticipate the consequences of our choices. Within a virtual copy of the built environment — a digital twin — we can search for ways to solve complex spatial problems. Within the research group, we are collaborating with partners on a study that uses gaming technology to engage with future residents and identify the community values that should be reflected in collective housing. This technology can support designers in the co-creation process.

4.2 Connection

By 'connection', I mean the art of engaging in new forms of collaboration to create sustainable value within the built environment. The implementation of sustainable solutions in the built environment is not hindered so much from flaws in the (often technical) solutions, but rather due to a lack of understanding of where interests, rules, institutions and habits conflict. The built environment involves numerous stakeholders, each operating within their own systems, on their own land, and with their own business models. Meanwhile, the social task associated with a sustainable built environment transcends these systems, properties and business models. Implementing sustainable solutions in the built environment requires new forms of collaboration that go beyond traditional systems and business models. Adopting a broader perspective on the sustainable built environment as a societal responsibility, rather than the usual approach in the construction and real estate sectors, can generate opportunities for creating shared values (Janssen & Maas, 2022). This involves a shift from transactional collaboration with cards on the table to open collaboration based on trust. A multi-party collaboration that looks beyond 'one's own plot boundary'.

To illustrate this, I will use an example related to the energy transition and the built environment. Many households lack the ability to generate, store and return energy within their own plot boundaries. Technical solutions for a more efficient and equitable distribution of energy are now available. For example, a neighbourhood battery combined with an energy management system helps to distribute energy more efficiently, reducing strain on the grid and costs. Many households do not have access to these technologies, which makes it more

difficult for them to reduce their energy bills. However, a housing association could now invest in such a system and allow its tenants to benefit from it. Such a local energy system could also be developed through broader collaboration with neighbourhood owners. Together with fellow researchers from MNEXT and BWNO in the Spoorzone in 's-Hertogenbosch, we are currently exploring how households, businesses and educational institutions in the area can form an energy community together. We want to know how we can arrive at a business model and form of cooperation and what the effects would be on sustainable behaviour, energy savings and affordability.

As a research group, we are also considering new forms of collaboration within the built environment in other studies. For instance, we are looking at the question posed by COA on how to establish small-scale refugee accommodation in resilient neighbourhoods. Could a collaboration be established between the COA, the municipality and the housing association to provide more permanent shelter? With the help of students, we are developing a collaborative housing model that can be integrated into existing living environments with due care and contribute to a wide range of sustainability goals. The aim is to retain public funds that are currently being used to rent expensive temporary shelters from private landlords for public housing purposes.

The central theme of this line of research is to utilise new forms of cooperation to bring together various interests and, consequently, engage multiple stakeholders in the broader social endeavour of making the built environment more sustainable. This involves establishing new connections among professionals themselves and also between professionals and residents. This raises the question of the extent to which you, as a public or private stakeholder, should take the lead on sustainability tasks, collaborate with residents, or give citizens' initiatives all the space they need. The new Environment Act, which came into force in 2024, emphasises the importance of participation. Under this law, participation is not only the responsibility of local government agencies. Private initiators of spatial plans are also required to facilitate participation effectively. However, the law does not prescribe how participation should take shape. Researchers therefore argue that we are not yet well prepared for this obligation in the built environment (Verheul et al., 2021). This was reaffirmed in a personal conversation with the director of a housing association: 'We have to see participation as a sport'. Participation is a discipline in itself. While you can view it as an obstacle, it also provides opportunities to establish new collaborations and gain support for the sustainable built environment. That is why it deserves our attention.

4.3 Empowerment

By 'empowerment', I mean, first and foremost, the realisation that strengthening society on several fronts is essential for the transition to a sustainable built environment. By prioritising groups that are vulnerable, we bridge multiple gaps, including the gap between citizens and institutions. Research shows that vulnerable groups, such as lower-income groups, people in need of care, and people from different cultural backgrounds or with lower levels of education, have less trust in institutions (WRR, 2017; De Voogd & Cuperus, 2021; Uyterlinde et al., 2021). This is the result of negative experiences, or simply because mental strength or the ability to take action is lacking. This trust is essential in order to get these groups on board with the measures needed to make their neighbourhoods more sustainable. It is a vicious circle, which I will illustrate with an example.

Making homes more sustainable leads to fewer draughts, moisture and mould, which directly improves the health of residents. It also helps to keep housing costs down, leaving more money for other necessities such as food, healthcare and sports. Sustainability projects implemented in collaboration with residents foster a greater sense of belonging and community spirit. This, in turn, can strengthen the social fabric of the neighbourhood, enabling vulnerable groups to receive support from other community members. Ultimately, a sustainability project can thus increase trust between residents and institutions. Ironically, the level of trust should be high at the start of sustainability projects rather than afterwards. It is only then that participation in projects can be enhanced. Prioritising and including these vulnerable groups in sustainability programmes can help to break the vicious cycle.

By 'empowerment', I also mean knowing how to use physical interventions in the built environment to empower vulnerable groups. In many neighbourhoods, we observe a mismatch between housing types and the needs of the people living there. The housing stock has not adapted to the increase in smaller households or to the growing number of elderly people requiring care who are living independently at home for longer. Public spaces and neighbourhood facilities also require realignment to changing needs and behaviour. By designing the physical environment in a certain way, we can encourage healthy behaviour and socialising in a society where unhealthy food choices are around every corner and social contact increasingly takes place virtually. Many studies emphasise the importance of strengthening this physical environment to reduce health inequalities and foster a stronger sense of community (Van Velze et al., 2020; Hin & De Hollander, 2023; Leidelmeijer et al., 2024). The question is: what physical interventions can we implement to achieve this?

There is already a great deal of knowledge available on the relationship between specific physical interventions and factors such as health, inclusion, social well-being and safety. Nevertheless, we still have to learn what works in real-life situations within a given context and how to engage vulnerable groups in physical interventions. The research group views the neighbourhoods in Noord-Brabant mentioned in the National Liveability and Safety Programme as ideal living labs for addressing these issues. The research group is also involved in the development of Park Voorburg in Vught as a knowledge partner. Over the next few years, these former Reinier van Arkel GGZ grounds will be transformed into a community with a mix of housing types and residents, with and without care needs. The question is how choices regarding the physical and spatial design of the grounds can add value to the care process and improve the overall health of groups of users. The built environment is in transition. The same is true of the healthcare sector (Janssen, 2023). The redevelopment of these grounds brings these transitions together. In an initial study, we explore how the addition of new housing can increase inclusivity in the area while simultaneously addressing local housing issues. We aim to identify where urgent housing needs conflict with other priorities relating to healthcare, inclusiveness, and community spirit. To this end, we draw lessons from similar developments in other healthcare areas.

4.4 A research agenda

The ability to imagine, connect and empower are not just competences that professionals in the built environment should master. They also form the basis of the research conducted by the Sustainable Built Environment research group. We use these competences to formulate new research questions related to the two challenges. 1) How can we create multiple sustainable values within the constraints of limited physical space? 2) How can we ensure that everyone is included in the transition to a sustainable built environment? These research questions, as shown in Table 2, guide our research agenda.

Table 2 Relevant research questions

	Puzzle	Support
Imagination	How can imaging techniques be used to find solutions for a sustainable built environment?	How can imaging techniques be used to increase support for sustainable solutions?
Connection	What system adaptations, forms of cooperation or business models can we use to create solutions for a sustainable built environment?	In what ways do different forms of collaboration, participation and direction influence support for sustainable choices within the built environment?
Empowerment	What physical interventions in the built environment can empower vulnerable groups and make the environment more sustainable?	What methods can we use to involve vulnerable groups in shaping a sustainable built environment to increase support for sustainable choices?

The three competences also deserve a place in education, where we train aspiring professionals to work in the built environment. The first collaborations within two minors demonstrate how we do this. In the 'City for the Future' minor, for example, we let students experience how they can use immersive technologies to create alternative scenarios for a sustainable urban environment. In the 'Disruptive Events' minor, we introduce students to vulnerable groups from different cultural backgrounds, as well as to the complex housing system. And this is just the beginning. Given the complex sustainability task and the concrete challenges in the living labs, I am convinced that there are still plenty of great connections to be made between education, research, and practical questions.

5. CONCLUSION

Afterthought

As I reach the end of my lecture, it is time to apply these insights and reflect on where I started: the sustainability of my own home. Although I'm happy with my energy-efficient, sustainable home, I often find myself pondering my choices. I'm happy with the self-generated green power, although I now have to pay to feed back the part I don't use. I now have a smart app that reminds me when to use the washing machine and dishwasher, as well as when to charge my electric car using self-generated electricity. Overall, a sustainable and profitable investment. And that green roof? It remains a tough balancing act as a private homeowner. A trade-off in terms of value, and I can't oversee the long-term effects, so I choose to trust the supplier's advice and my impression that living under the green roof is more comfortable. Perhaps we should treat green roofs in the same way as solar farms and heat grids, i.e. as collective amenities, where the investment is justified up-front by quantifying the added value in terms of water storage, heat stress and biodiversity at neighbourhood level? I see inspiration for a new research project here.

All things considered, my biggest contribution to a sustainable built environment could actually have been a very different one: moving to a smaller home. What I did not mention at the start of this lecture is that making my home more sustainable involved extending it with a garden room that doubles as an office. Was this extra space really necessary now that all four of our children have left (or are close to leaving) home? Solutions that I have not touched upon, but do not want to leave unmentioned in the closing of this lecture. Although we are becoming more sustainable, our overall consumption of materials and energy is not declining. Together, we are taking up an ever-larger portion of the Earth. To live on and to meet all our needs. As I was writing this lecture, the population of the Netherlands reached 18 million. The end of this growth is not yet in sight. With this in mind, should our primary focus not be on more conscious consumption? Would that not be the most significant step towards achieving a sustainable built environment?

It is with great interest that I follow demographic trends, our growing prosperity and the impact on our landscape. I find it concerning, and I believe that we need

to make firm choices regarding both our limited space and our consumption behaviour. Nevertheless, I also believe in our ability to be creative and find solutions that create multiple values. To combine multiple sustainable ambitions into a single design, action or form of collaboration. My job is to identify and exploit these connection opportunities. That will be the focus of my efforts in the years to come.

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In fact, the origins of this story go back much further. It started when my TIAS colleagues and I were looking for a way to enter the new realm of multiple value creation. We developed teaching programmes, attempted to measure added value, and wrote articles translating the concept of value creation to the construction and real estate sectors. Thank you, Dirk Brounen and Menno Maas, for these inspiring years that provided the foundation for my new adventure.

A strong home front is essential for any professor. Let me now say a special word of thanks to my parents for opening my eyes to the challenges they face in the built environment, now that with age, daily things do not always come easily or naturally. More than anything else, I'm thankful for the sense of pride you convey. Then there's my very own living lab, of which I'm extremely proud: Anne, Nora, Isa and Ruben. Your different views on society and life always lead to surprising conversations. I find this enriching both personally and professionally, and I'm very grateful for it. Finally, I would like to thank Oscar, my husband, with whom I shared the job description for this research group and who motivated me to take a new step and embrace this beautiful university of applied sciences after working at a research university for many years. Thank you for your unwavering support.

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COMPOSITION OF KNOWLEDGE NETWORK

Bas van der Horst is a lecturer at the School of the Sustainable Built Environment, specialising in construction engineering and spatial design. He is a lecturer-researcher at the Centre of Expertise Safe & Resilient Society. Bas also works as an architect with a focus on social issues.

Dr Ingrid Janssen is professor in Centre of Expertise Safe & Resilient Society. Ingrid draws on her extensive work experience as a researcher and lecturer, as well as her practical experience as a property manager, consultant and supervisor. She began her academic career at TU/e, obtaining her PhD in 2011 for a study on complex decision-making processes in spatial choices, particularly in relation to new retail locations. She then spent twelve years as an associate professor at TIAS School for Business & Society. At TIAS, she also served as academic dean responsible for the executive master of Real Estate. This period allowed her ideas on creating multiple values in the built environment to mature. As a researcher, sparring partner and speaker on this theme, her clients include both public and private parties from the real estate sector.

Nina Kramer is a senior researcher at Avans' Centre of Expertise Safe & Resilient Society. She graduated from the Design Academy Eindhoven with a degree in industrial design and from the Jan van Eyck Academy Maastricht with a degree in visual arts. Following various roles in the business world, including as a communications consultant, she has now been working for Avans University of Applied Sciences for almost twenty years. Initially as a lecturer of creative techniques and storytelling at the Communication and Multimedia

Design programme in Breda, and later also as a researcher. She is now fully dedicated to the research group. She developed and led the New Canterbury Tales project, which uses storytelling and other immersive techniques to co-create possible scenarios for sustainable futures, particularly focusing on longer-term visions.

As a senior researcher within the research group, Tom Kretschmann, aims to bridge the gap between social science and the physical environment. He is also one of the developers of a new cross-sectoral master's degree, which aligns with the DGO research group's focus on a social, sustainable and green living environment. He enjoys supervising graduate students and sharing his knowledge and experience with them at the School of the Sustainable Built Environment (ADGO) for the Real Estate and Spatial Development Atelier. Tom is also an architect and combines his research work with various inner-city area transformation projects. In addition, he is interested in shaping smart programmatic and spatial organisation of living and care.

Fenna Rooijakkers, is a lecturer at the School of the Sustainable Built Environment and teaches on the Disruptive Events minor. She is also a researcher for the research group. She has a background in social design and healthy ageing. During her master's degree, she conducted participatory research into how loneliness could be alleviated among residents of a care home by increasing their familiarity with the neighbourhood. Fenna is currently working on the international sUser project, which aims to develop education on sustainable housing for older people, and she is collaborating on research into inclusive living environments. She has a particular interest in participatory research and co-creation processes involving people in vulnerable positions in society.

Dr Maarten Rutten is a senior researcher at Avans' Centre of Expertise Safe & Resilient Society. Prior to joining Avans, he worked at the Faculty of Engineering Technology at the University of Twente. Maarten has a PhD in research on the creation of collaborative innovations in the built environment. His research within the Sustainable Built Environment research group includes the development of inclusive living environments. Besides research, Maarten has extensive experience in teaching as well.

Dr Michiel Smits is a senior lecturer and researcher within the Research Group and at the School of the Sustainable Built Environment. He is also a practice-based research lead at Curio, building bridges between intermediate vocational education (MBO) and higher professional education (HBO) research. His area of expertise is climate-positive and circular construction. Michiel received his PhD from TU Delft in 2018 for his study of a new methodology to advise Kenyan residents on how to build and maintain their own improved homes. He is currently applying his affinity for methodologies to support design processes within the sUser project, which is piloting a methodology for designing and developing sustainable senior housing.

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Image

1. Electrical substation. Loes van Duijvendijk.
2. Court with a solar panel. Omroep Brabant.
3. Two houses without a solar panel. Susanne Agterbosch.
4. Neighbourhood garden. Sprinklr.
5. Sustainable flat. Annet Delfgaauw.
6. Neighbourhood clean-up Maassluis. Own photography.
7. Exhibition New Canterbury Tales. Ron Magielse.
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