THRIVE INSTITUTE

KIN Klimaatonderzoek Initiatief Nederland
samen transities versnellen

Catalyzing the innovation ecosystem

EMPOWERING PILOT PROJECTS

PhD authors
Jane Pauline Ramirez (JPR)
Martha Kosters (MK)
Maksim Sitnikov (MS)
Ravi Ramesh (RR)
Rianna Anwar Sani (RAS)
Ugochukwu Orji (UO)
Dani Garcia-Caro (DG)

THRIVE authors
Juliëtte Boughouf
Micha Knoester (edit)
Han van Nieuwaal (edit)

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Executive Summary

To address the global issue of climate change, the Purpose Accelerator Program, a collaboration between KIN and THRIVE, aimed to identify successful climate transition interventions in the Netherlands. As a group of seven PhD researchers from various disciplines, we identified and evaluated pilot projects that can drive systemic climate transitions in the Netherlands. We did this through developing a comprehensive pilot selection framework to assess projects across key sectors—healthcare, agriculture, and energy.

Pilot Selection Framework: An eight-criteria framework was developed to assess pilot projects based on scalability, replicability, continuity, learning potential, social acceptability, stakeholder collaboration, clear goals, and intersectionality.

Selected Pilots: Ten promising pilots across the healthcare, agriculture, and energy sectors were selected for in-depth analysis; two more pilots were examined through desk research. In addition to these ten pilots, two approaches for system change are described: social impact bonds and the doughnut economy. These are based on THRIVE Institute's field-knowledge of what works in the domain of societal transition.

Critical Lessons Learned from the pilots:

- Adaptability and Flexibility: Pilots must be able to adapt in response to operational challenges which is essential for maintaining progress and meeting goals.
- Collaboration is Key but Challenging: Cross-sector collaboration is crucial for success but often hindered by conflicting priorities and limited resources, highlighting the need for clear communication and aligned objectives.
- Financial Viability is a Major Hurdle: Many pilots struggle with financial sustainability, requiring innovative funding models to ensure long-term viability.
- Regulatory and Policy Support is Critical: the need for supportive policies to scale sustainable initiatives cannot be overemphasized.
- Mindset Shifts are Essential for Long-Term Success: The success of most projects relies on changing mindsets, particularly in sectors like healthcare, from short-term fixes to long-term, preventative approaches.

Recommendations for KIN

The report proposes six strategic levels of advice for KIN to enhance climate transition efforts:

1. Conduct research to identify more best practices.
   Don't underestimate the small/bottom-up initiatives, who often have a thorough understanding of their context. Include these initiatives in research to identify knowledge gaps.
2. Promote knowledge sharing among projects and researchers.
   Facilitate collaborations and knowledge sharing through forums and partnerships, fostering trust and systemic transitions.
3. In collaboration with relevant stakeholders, advocate for supportive policy changes.
   Engage policymakers to bridge gaps between theory and practice (including bottom-up initiatives), promoting evidence-based policies and international collaboration.
4. Write proposals to address identified research gaps.
   Prioritize long-term, impact-driven research proposals addressing systemic barriers in areas like planetary health and agriculture.
5. Engage societal actors for insights and contributions.
   Involve society through surveys and focus groups to foster collaborative learning and shape research strategies.
6. Facilitate long-term strategic planning.
   Conduct research on systemic barriers and explore innovations for outcome-based funding and cross-sector sustainability.

The story of the PhDs

Yes, the world is in a messy state right now
Yes, we can do something about it
Yes, there are answers to our challenges
No, we don't know how to unlock all those answers

But we can make a start. We are a collaboration of seven multidisciplinary researchers: from robotics engineering and earth sciences, to artificial intelligence and veterinary sciences. Despite our different backgrounds, we share a deep concern about our planet and its future. We are aware of climate change: from how it affects our daily bike ride to work, to global natural disasters leading to war and resource crisis. We joined this program to try make a difference, however small or big that difference may be.

We started learning about system transitions and discovered it is full of paradoxes. We spent what felt like a million years discussing the framework before we realized how meaningful and educational the interviews were that sometimes only lasted 20 minutes. On the other hand, the framework made us wary of tunnel vision. We had sharp goals to achieve and the framework made that possible, so our slow going in the beginning let us accelerate as we proceeded. We learned we had to go slow to go fast.

We practiced knowledge brokering: bridging the gap between science and practice. We discovered that knowledge brokering in this case was a form of social science: we did qualitative research, something most of us had never done. Although we started the project hoping that we would draw grand quantitative conclusions, we realized along the way that experience cannot be quantified. Thus the conclusions are qualitative: personal stories from which we can gain new insights and learn a new perspective.

Our recommendations stem from these new insights and perspectives. Each interviewee is expert in their own context. Through the conversations we appreciate that we cannot fully understand their world but if we are aware of our own perspective, judgement and bias, we can try to understand the world as they experience it. This is the most important insight from this five month process: **We are all humans with our own unique background that shapes how we see the world. If we connect to each other as humans first and foremost, we can appreciate and learn from everybody.**

Introduction & approach

In response to the escalating impacts of climate change, global stakeholders are focusing on systemic transitions in economic and social systems to operate within planetary boundaries, mitigate global warming, and increase societal resilience against anticipated threats. Achieving these characteristics is critical and relies on the concerted actions of all societal actors. Accordingly, understanding inter-actor dynamics and strengthening cooperation among knowledge institutions, governments, and other social stakeholders is not just important but essential for fostering meaningful change.

The Purpose Accelerator Program, a collaboration between KIN and THRIVE, aimed to identify successful climate transition interventions in the Netherlands. Additionally, the program was designed to help our team of PhDs become knowledge brokers. As a team of PhD's we were tasked with developing an evidence-based framework to classify these interventions and understand their success factors. Through desk research on sustainability transitions and systemic challenges, we followed a reiterative process, identifying ten pilot projects across four themes: 1) Healthcare, 2) Nature, Agriculture, Food, and Water, 3) Energy, Industry, and Economy, and 4) Cities and Infrastructure. This framework will guide KIN in selecting, supporting, and scaling effective climate transition pilots. Two systemic interventions/pilots were added in cooperation with experts of THRIVE, making it a total of 12 best practices that were identified.

The Purpose Accelerator Program is structured around ten bimonthly sessions, during which our group of seven PhD candidates met regularly. Each session typically began with a brief lecture on a topic relevant to climate system transitions, followed by in-depth discussions and collaborative group work to advance our objectives.

From the outset, our primary goal as PhD's was to establish criteria for identifying successful pilots. This required addressing several sub-objectives, such as defining what constitutes a pilot, determining assessment parameters, and ensuring a comprehensive, inclusive search. To support this effort, THRIVE conducted extensive desk research focused on transitions and sustainability literature, including systems thinking and KIN's thematic context.

Our group, composed of PhD candidates from various disciplines (see Table 1), brought diverse perspectives to the discussions. While this interdisciplinary approach enriched our exploration of the topic, it also introduced challenges, as we were accustomed to different theoretical frameworks.

Initially, as a team of PhD's we struggled to align on the best approach for the pilot search. Some members advocated for diving directly into identifying pilots, while others preferred to begin by reviewing existing research to establish a solid foundation. Ultimately, we agreed to use transitions theory to explore the nature of transitions and the role pilots play in driving them. Through this lens, we also identified key sustainability challenges that these pilots aim to address, which will be further explored at the 'Pilot Profiles'.

PhD candidate	Expertise
Jane Pauline Ramirez	Mechanical Engineering, Bionics Engineering, Aerospace Engineering
Maksim Sitnikov	Organization Studies, Interorganizational Relationships and Networks
Martha Kosters	Earth Sciences (BSc, MSc), consultant for SME, former member of Fungi Factory
Ravi Ramesh	Mechanical Engineering, Aerospace Engineering, Chemical Engineering
Rianna Anwar Sani	Veterinary science, Epidemiology, and mixed methods of qualitative and quantitative science
Ugochukwu Orji	Artificial Intelligence and Data Science related to Energy Forecasting and Renewable Energy Integration
Daniela Garcia-Caro	Agroecology, Sustainability Transitions of Food Systems, International and EU Law

Table 1: Overview of the expertise per PhD candidate in our team

Challenges arose from the diverse perspectives within our PhD group, leading to extensive discussions on transition dynamics, overlapping themes, and their influence on pilot criteria. By the fourth session, we had begun identifying qualities that would make certain pilots or interventions particularly interesting for interviews — an essential step in our data collection process (detailed in 'Framework').

Throughout the program we worked with KIN to refine our framework and identify potential pilots. This helped spark discussions on projects beyond traditional pilots that could still offer valuable insights for KIN's strategic approach.

Methods: Pilot Selection

The PhD-group employed an iterative research cycle to develop the framework criteria, while simultaneously identifying pilots (see Figure 1). With the project having open-ended result requirements, we adopted a process of continuously revising our criteria. This approach ensured that the framework remained aligned with KIN's evolving ambitions and reflected ongoing developments in the field. Knowledge brokering became integral early on, as we shaped the content and criteria alongside KIN's strategic objectives.

Key discussions centered on aligning the pilot criteria with the project's aims, such as evaluating how pilots address sustainability challenges, avoiding greenwashing, ensuring scientific support for the approaches, and considering long-term impacts. We also debated whether the criteria should be tailored to specific themes or remain broadly applicable. Ultimately, to enhance pilot selection and mitigate the risk of greenwashing, we agreed to first identify best practices across various societal sectors before initiating the pilot search.

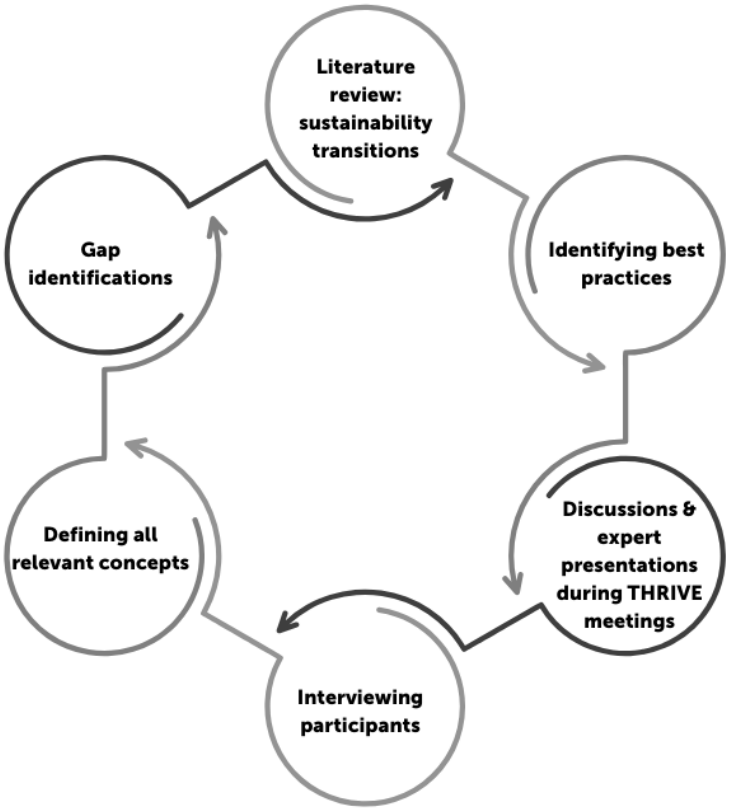

Figure 1: cycle of research process

Once the pilots were selected, interviews were conducted with participants working on these pilots. For clarity, the methods used for conducting the interviews are reported according to the COREQ[1] guidelines in (Supplementary file 1 (S1)).

In our discussions about pilot criteria, we highlighted the significance of applying systems thinking and sustainability transition perspectives. We then view transitions as progressing from unsustainable realities (Point A) to sustainable alternatives (Point B), with a critical gap between them.

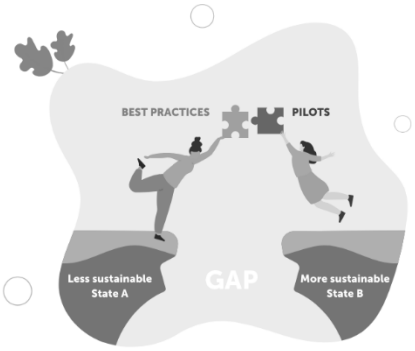

Figure 2: Gap versus best practice and pilots

To bridge this gap, it is essential to understand the unsustainable behaviors within current systems and the recurring patterns that sustain them. Identifying pathways for change and strategies to manage transitions is vital. Therefore, the pilots we seek must operate within this gap, addressing unsustainable aspects of the existing system. By understanding these dynamics, we can identify pilots that effectively target and disrupt persistent unsustainabilities.

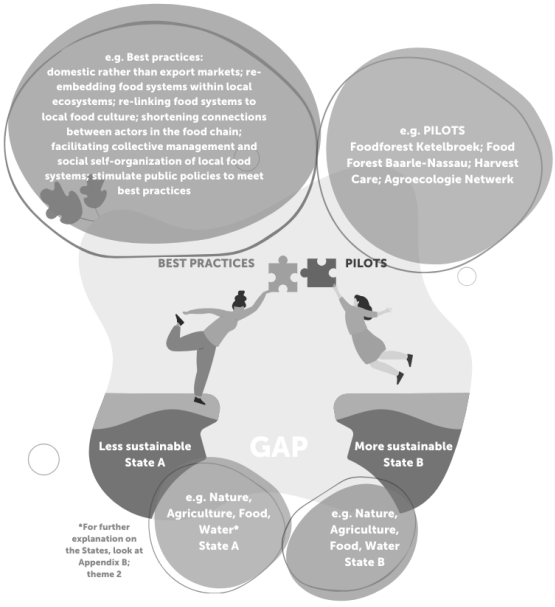

Figure 3: potential for filling the gap

[1] Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. International Journal for Quality in Health Care. 2007;19(6):349-57.

Framework

We employed a design thinking approach to select pilots for further review, integrating insights from existing research on systems transitions, expert opinions from our bimonthly lectures, and our understanding of successful pilots. This process led us to identify eight key criteria through discussions among PhD candidates, leveraging our diverse backgrounds.

One major challenge faced by sustainability initiatives is their upscaling[2]. Therefore, we focused on three critical factors: scalability, replicability, and continuity. These represent the potential to grow the initiative's impact, share its best practices, and ensure it becomes integrated into local communities or organizations.

Additionally in our research, we recognized two other crucial factors for success — learning potential and social acceptability. Learning has the potential to improve governance, decision-making, and legitimacy[3], so we assessed each initiative's capacity to foster a cycle of research, monitoring, and improvement. Similarly, social acceptability — the extent to which local communities embrace an initiative — is essential for long-term viability[4].

Since system transitions require collaboration between multiple stakeholders[5] and benefit from having clear, measurable goals[6], we also included long-term partnerships and well-defined objectives in our criteria. Lastly, we considered whether initiatives address multiple issues and create synergies across different areas, acknowledging the interconnected nature of sustainability challenges. These criteria form the core of our pilot selection framework, which is explained in detail below.

- **Scalability**: assesses the initiative's potential to expand its impact by increasing its scope or depth within the existing context, enhancing its reach, resources, and operations to amplify positive outcomes over time.
- **Replicability**: evaluates whether the initiative's best practices can be adopted by other communities, thereby extending its influence across diverse geographic or institutional contexts.
- **Continuity**: determines the structural integration of the initiative, assessing its embedding within the community or organization to enhance its potential for lasting success.
- **Learning potential**: assesses the incorporation of an iterative cycle of research, monitoring, analysis, and continuous improvement within the initiative.
- **Intersections/interlinkages (with other themes)**: evaluates the initiative's use of systemic approaches to address multiple unsustainable issues, creating synergies across various thematic areas.

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[2] Lambin, E. F., Kim, H., Leape, J., & Lee, K. (2020). Scaling up solutions for a sustainability transition. One Earth, 3(1), 89-96.

[3] 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.

[4] Kluskens, N., Alkemade, F., & Höffken, J. (2024). Beyond a checklist for acceptance: understanding the dynamic process of community acceptance. Sustainability Science, 19(3), 831-846.

[5] Pinkse, J., & Kolk, A. (2012). Addressing the climate change—sustainable development nexus: The role of multistakeholder partnerships. Business & Society, 51(1), 176-210.

[6] Geels, F., Turnheim, B., Asquith, M., Kern, F., & Kivimaa, P. (2019). Sustainability transitions: policy and practice (Doctoral dissertation, European Environment Agency).

- **Long-term collaborations with different parties/stakeholders**: the initiative's ability to foster long-term partnerships with universities, government organizations, and other stakeholders.
- **Defined milestones/clear goals with a timeline**: assesses whether the initiative has a viable timeline with clear, adaptable goals.
- **Social Acceptability**: assesses the extent to which the initiative is embraced and adopted by local communities

Results: The Pilots

To identify the most promising pilots for further analysis, we focused on initiatives aligned with three core themes: (1) healthcare, (2) food, agriculture, nature and water, (3) energy, industry, economy, cities, and infrastructure. These themes represent critical areas where sustainability efforts can yield significant, long-term impacts.

Leveraging our diverse expertise, we divided the selection process according to our backgrounds. Our first step involved an initial scan of existing initiatives, specifically targeting pilots that addressed key unsustainabilities, such as the lack of economic circularity and insufficient emphasis on preventive care in healthcare. This process resulted in a database of approximately 20 initiatives per theme.

For instance, in the Dutch healthcare sector, we examined initiatives through platforms like the Green Deal and the Groene Zorg Alliantie (Green Healthcare Alliance), which provide an overview of existing healthcare efforts. From this broader pool, we identified the most promising and relevant initiatives and applied our pilot selection framework. This framework allowed us to refine our list based on criteria such as scalability, learning potential, and social acceptability. Ultimately, this process culminated in the selection of ten final pilots, listed below:

Theme	Pilot project
Healthcare	De groene Veterinair (The green veterinarian)
	De klimaat dokter (The climate doctor)
	De groene zorg alliantie (the green healthcare alliance)
Food, Agriculture, Nature and Water	Foodforest Ketelbroek (Wouter van Eck)
	Food Forest Baarle-Nassau (Nicolaas Geijer)
	National Monitoring Programme Food Forests Netherlands (Jeroen Kruit)
	HarvestCare
	Agroecologie Netwerk (Agroecology network)
Energy, Industry, and Economy/Cities and Infrastructure	Waterrotonde Eerbeek (Water Roundabout Eerbeek)
	Foenix Circulair Ambachtscentrum (Foenix Circular Craft Center)

Table 2: Pilot Projects

Pilot profiles

The Green Veterinarian

FOUNDING YEAR: 2022
WEBSITE: WWW.DEGROENEVETERINAIR.NL

The green veterinarian wants to offer one platform for all veterinarians on becoming more sustainable. Through this platform the green veterinarian wants to create awareness, share information (e.a. regarding responsible use of antiparasitic drugs and antimicrobials, reducing use of disposables, and developing a practice scan that can give insight into the sustainability of your practice and how it can be improved).

Challenges	How to overcome them
The organization is run on voluntary basis, the high turnover of volunteers creates the challenge to keep the organization running smoothly.	• Perseverance of a few individuals • Accept that progress can be slow, don't try to rush and go too fast
To get sufficient financing.	• The foundation achieved an ANBI status, making it more appealing to donate • The foundation found sponsors through networking
Greenwashing (Chains in the veterinary sector can sometimes do greenwashing and claim sustainability).	• Creating awareness on what is and what is not sustainable through accurate information on the website
Consumers prefer "easy" over "best practice".	• Creating awareness of consequences for both owners/farmers as well as veterinarians (antiparasitic drugs)
Industry seems hesitant to research green solutions (often results in bad publicity).	• Create an incentive for the Industry (the green veterinarian hasn't been able to do that yet).

Lessons learned
Progress in the climate transition often stems from the perseverance of a few dedicated individuals. Achieving environmental goals doesn't necessarily require million-dollar subsidies; starting small can lead to impactful change. A major challenge in moving towards more sustainability, can be the discrepancy between the goals of green initiatives and quality committees. Finally it is important to recognize that research can lead to new insights and we should remain flexible to adjust our initiative accordingly. An example is the initial goal of decreasing the use of isoflurane anesthesia gas, which recent research found to be less harmful to the environment (due to the short lifespan), than nitrous oxide ("laughing gas"), which is far more damaging to the environment (due to the longer time it remains in the environment).

Ideal future
In the ideal world, all veterinary healthcare workers are aware of the need to make the sector more sustainable. In addition, the practice scan is developed in such a way that practices can be compared with each other so you can know how you are performing compared to other practices (and try to improve your ranking).

Recommendations

To create a sustainable practice, form a dedicated green team with shared responsibilities. Begin by analyzing your operations to identify where the greatest environmental benefits can be made. Focus on "low-hanging fruit" at first—starting with smaller, more achievable goals can build momentum for greater change. This advice applies both to KIN as well as people who want to start their own initiative.

The climate doctor

FOUNDING YEAR: 2019
WEBSITE: WWW.DEKLIMAATDOKTER.NL

The climate doctor was founded by three medical doctors with the goal to make healthcare more sustainable. Climate doctor is an information platform that bundles the available knowledge and tools to make healthcare more sustainable in the hope to inspire health care professionals to make their practice more sustainable.

Challenges	How to overcome them
Healthcare workers have a lack of knowledge on sustainability.	• The climate doctor strives to provide knowledge on sustainability through their website, a podcast, and workshops/lectures
Reluctance for high investment for long-term results.	• Ideally: by creating an incentive/awareness

Not-invented-here syndrome (hospitals prefer reinventing the wheel over applying proven initiatives from other hospitals).	• Connect workers across different health disciplines. People have good knowledge of their own workspace but make (sometimes incorrect) assumptions about other workspaces/hospitals
Restrictive laws and legislations (example: opium law).	• Revision of the rules to allow for less waste of medication (current practice is that when a name sticker is placed on medicine, it cannot be used for anyone else but the patient on the name sticker)
Sustainable initiatives are often started by ambitious people working in practice, resulting in lacking finances and lacking time.	• Provide easy access to software (website building tool for example), or an easy method of applying for funding.

Lessons learned

The most sustainable care is the care that was not needed. A shift towards preventive care is needed, and for this to take place a multitude of stakeholders should be involved (from supermarkets to schools to government to insurance companies). Take for example the chain approach in medical residue in surface water[7].

Ideal future

In the ideal world the healthcare system is reorganized into a less profit based system, where the focus lies on preventive care. Furthermore, all healthcare professionals are aware of the need to improve sustainable care and know how to find the tools that are provided through platforms such as the climate doctor.

Recommendations

A role for KIN could be to conduct research into funding of bottom-up approaches and methods to make it easy to apply for. Connecting different sectors would also facilitate a cross-sectoral approach in shifting towards preventive care. As there is already much research being done, exploring how to connect with existing research projects and how to communicate the results to the wider audience (also health-care professionals not doing research) could be very effective.

[7] https://www.rijksoverheid.nl/documenten/beleidsnotas/2019/02/12/ketenaanpak-medicijnresten-uit-water

The green healthcare alliance (GZA)

FOUNDING YEAR: 2021
WEBSITE: WWW.GROENEZORGALLIANTIE.COM

The Green Healthcare Alliance supports the healthcare sector in its transition towards sustainability and acts as an idealistic green healthcare voice within society. It does so by facilitating cross-pollination between green healthcare professionals, connecting green healthcare professionals with supporting organizations, and driving and monitoring systemic change through (political) lobbying.

Challenges	How to overcome them
Limited capacity and resources	• Through sponsors and collaborations the GZA has increased their own capacity and resources
Resistance within the healthcare system	• Through education, workshops/lectures and lobbying and awareness of healthcare professionals a shift towards more sustainable healthcare is starting.
Lacking coordination within the healthcare chain	• Through education, workshops/lectures and lobbying and awareness of healthcare professionals a shift towards more sustainable healthcare is starting.
International issues regarding regulatory barriers and regarding raw materials	• A permanent lobbyist at EU level could be a good start to address regulatory barriers for more sustainable healthcare
How to address circular financing?	• Research into this from KIN would be very valuable

Lessons learned
Effective sustainability efforts require collaboration across sectors, but this can be challenging as stakeholders, such as hospitals and insurance companies, often have different interests and face different barriers. The healthcare sector is also slow to adopt external solutions, preferring to develop their own, which delays progress. Limited resources and the voluntary nature of much of the work further hinder the pace of change. To address these challenges, a focus on practical, achievable steps, or "low-hanging fruit," can help drive meaningful progress toward sustainability.

Ideal future
Similar to the dreamworld of the Climate doctor.

Recommendations

KIN could play a vital role in fostering cross-sector collaboration among healthcare providers, industries, and policymakers on sustainable healthcare initiatives. It could help scale up efforts by coordinating stakeholders, providing resources, and supporting research into circular financing models to ensure these initiatives are profitable or at least cost-neutral for all parties involved. Additionally, KIN could contribute to knowledge development and dissemination on the link between planetary and human health, ensuring this information reaches healthcare education and policy. Finally, KIN could help address international challenges by connecting stakeholders with international partners and advocating for policy changes at the European level.

Food forest Ketelbroek

FOUNDING YEAR: 2009
CAN BE FOUND ON: HTTPS://WWW.FACEBOOK.COM/FOODFORESTKETELBROEK/?LOCALE=NL_NL AND HTTPS://WWW.LINKEDIN.COM/IN/WOUTER-VAN-ECK-A9634924/

The founder of Food forest Ketelbroek dreamed of starting a food forest for a long time. In 2009 he decided to dive in after seeing a “for sale” sign next to a corn field in Groesbeek. Food forest Ketelbroek is 2.2 hectares and is one of the oldest food forests in the Netherlands.

Challenges	How to overcome them
The food forest experienced its first very cold winter in 2012 and the first extremely hot and dry summers in 2018, 2019, and 2020. These stress tests were not expected so early on in the existence of the food forest. They lost a number of species, but also learned valuable lessons about which plants can endure these things and how the water security of a diverse forest floor is organized.	• The farmers of Food forest Ketelbroek are the least hands-on farmers of the Netherlands. They will let things go their natural course. An example is not touching a cherry plum tree that is almost breaking its branches due to the amount of fruit it has grown. Given that energy used for taking care of the farm is important, they don’t prune or water. Rather they hope that the tree will make different choices next year, and see what survives.

Lessons learned
Over 400 species have been piloted in the Food forest Ketelbroek, and the head farmer knows or suspects if and why each type was or wasn't successful in the food forest. In order for this information to be valuable for future food forest farmers, this knowledge is being implemented in a database for Dutch food forest farmers to use in their design process.

Ideal future
By converting 170,000 hectares of agricultural land around nature reserved into food forests by 2030, we could capture 14.6 million tons of CO2 - more than the 14.3 million tons the Dutch Industry needs to offset. This transformation would also produce food for about 1 million people and help mitigate nitrogen issues affecting nature reserves.

Recommendations

Food forests, like Ketelbroek, demonstrate that species richness can be achieved much faster than previously believed. In just 10 years, Ketelbroek had reached a level of biodiversity similar to a neighboring Natura 2000 area that had 100 years to develop. Food forests not only restore ecosystems and biodiversity, but they also produce food.

Food forest Baarle-Nassau

FOUNDING YEAR: 2020
WEBSITE: WWW.MANDIUS.NL

In Food Forest Baarle-Nassau, healthy food is harvested while providing space for flora and fauna of all shapes and sizes. Water is retained in soil that enriches itself with carbon over the years. The boundaries between agriculture and nature blur, The food forest is a cultivated landscape where food for humans is produced in an extensive manner. Ecological knowledge is used to maintain a plant community that can provide food for people over time and space, while simultaneously increasing productivity and resilience.

Challenges	How to overcome them
The Netherlands' zoning regulations require a single function for each plot of land - such as production, storage, resale, nature reserve, or housing. This separation complicates the establishment of a food forest, which inherently combines production and nature, impacting the height of agricultural subsidies. An example of this would be the eco-medal reward system.	• Food Forest Baarle-Nassau is determined to prove that a food forest is economically viable. It focused on getting into the eco-medal reward system, and is tracking its economic development to prove that it is a viable alternative to traditional farming.

Lessons learned

The food forest is now 4 years old, and it is currently in a waiting stage. The first few years are challenging, only light upkeep is needed to maintain pathways, but no significant produce is available. Most of the early harvest is consumed by animals and insects, which are essential for establishing a balanced ecosystem before the food forest produces enough for both humans and wildlife.

Ideal future

The plan for Food Forest Baarle-Nassau is for it to fully fund the living of its primary farmer, and housing a future family on the plot. They estimate that a 5-hectare food forest can provide about 2 full-time equivalent (FTE) jobs and income after 15 years, with 80% of the work focused on harvesting. In comparison, a traditional farm typically offers 1 FTE for every 30 to 40 hectares. Food forest farming yields more produce, greater variety, and more employment per hectare.

Recommendations

Establishing more food forests is most quickly achieved by starting a food forest on current agricultural land. This ensures that the zoning does not have to be changed and can be done by encouraging existing farmers to convert a part of their land to food forest. This also ensures that there is income to bridge the gap between planting and the first substantial harvests.


Purpos
elerator

The National Monitorings program Food Forests

FOUNDING YEAR: 2021
WEBSITE: HTTPS://WWW.MONITORINGVOEDSELBOSSEN.NL/

Food forests combine food production with nature development. Much scientific theory has already shown that food forests improve soil health, have large water buffers, store significant amounts of CO2, and increase biodiversity, quality, social cohesion, and the resilience of the surrounding environment. Additionally, they require little maintenance while yielding high harvests in the long term. The goal of the National Monitoring Program for Food Forests (NMPFF) is to investigate these theories on a national level using standardized scientific methods.

Challenges	How to overcome them
It is much harder to find funding for long-term monitoring than it is for piloting studies. This means that it's hard to build the science backed evidence base that some policy makers are looking for.	• No clear solution. Sometimes EU funded projects are focused more on long-term, so the NMPFF looks for them.

Lessons learned
NNPFF hopes to secure funding for long term monitoring of the food forest biodiversity development, especially the forest floor. We have discovered that some classic methods such as worm counting do not work for a food forest, as the underground biodiversity is mainly made up of fungi, bacteria and nematodes. The research methods for measuring those are much less well developed, and much more expensive. It would be valuable to develop standards for these methods and fund long term monitoring of the effect of food forests on their own forest floor, the biodiversity within and surrounding the food forest, the drought and flood resistance, as well as the productivity, potential earning and better social cohesion.

Ideal future
The National Monitoring Program Food Forests dreams that alternative agricultural systems are embraced by funding and subsidy programs. Long-term monitoring is standard practice to get a multi-year overview of production, soil-health and biodiversity across different soil types (clay, sand, acidic), and various climatic years (dry vs wet, hot vs cold).

Recommendations

KIN could play a vital role in advocating for long-term funding with the National Monitorings program Food Forests. The system transition of the current agricultural standard practices to alternative agricultural models (not limited to Food Forests, although the NMPFF focuses on food forests) can happen more quickly if the research to back up the claims is done on a long-term and larger scale. Almost all alternative agricultural systems operate on a longer time-scale because they focus on long-term viability, usually with minimal input. Thus the cycle of 'it has not been proven so we cannot fund it' must be broken so alternative agricultural systems can be implemented in, for example, subsidy systems.

HarvestCare

FOUNDING YEAR: 2022
WEBSITE: HTTPS://WWW.HARVESTCARE.EU/

HarvestCare's mission is to create projects connecting regenerative farms with healthcare initiatives. HarvestCare facilitates "Food as Medicine" models using the framework of Food Pharmacy, which provides patients with chronic diseases food prescriptions, and support from health professionals to successfully change dietary behavior. HarvestCare works with pioneer farmers, community members, and doctors to create a healthcare system rooted in the heart of communities.

Challenges	How to overcome them
Preventative approaches to medicine, i.e. food as medicine, do not inform the status quo approach taken within existing healthcare systems. They are therefore confronted by many barriers in becoming established within healthcare systems I.e. Prevention within healthcare (and other transition arenas) has a hard time fundraising needs to prove, via scientific/medical studies, that its assertions are factual within the NL.	• This is a huge barrier to the intervention's scaling, but one that has been addressed via the planning of the pilot's 3 clinical trials (the first of which is now recruiting participants). The municipality wants to see results before they provide any funding or support. The monitoring and follow up of patients participating in these studies, where workshops are important to providing the education behind dietary changes and preventative healthcare approaches through food, is important. However hosting workshops for an increasing number of people is foreseen to be a challenging issue.

Profitability is a necessity and an incredible barrier within existing systems for innovative pilots: ideas can be classified as best practices and not be profitable within existing market systems, leading them to failure. It takes time to gather the data needed to entice more helpful support/donations, but pilot founders/managers also need to make an income during this time. Grant writing is a never ending job, on top of the primary job of managing the pilot. You really need to teach people how to approach this with the correct mindset.	• HarvestCare initially received funding by participating in a venture building program addressing systemic food system issues called Fresh Ventures Studio[8], which connected the founder to much needed funding and connections to get started. • Pilots should be able to access, or receive help accessing, these programs.
It took a while for HarvetCare to make connections with key collaborators: Erasmus MC, Leiden University, a dozen General Practitioners (and patients), and local organic farmers.	• Connections made via their venture funder helped HarvestCare get their foot in the door with Erasmus MC. This opportunity is identified by the founder to have been instrumental in the pilot's current successes.

Lessons learned

1) Unsurprisingly, paradigmatic shifts present major barriers when it comes to systems transition.

There are interventions that are early transition agents, attempting to find other actors that are receptive to their messages. While this can be a tough assignment, intervention/pilot founders, and the personal qualities that help them find success and persevere in the face of rejection and uncertainty, have been found by our team to be an incredible resource to facilitate transitions.

2) Best practices are often not seen as profitable (this needs to be accounted for when evaluating pilot success)

3) Networking and connections (possibly ecosystems) are critical to pilot success

Networking and connections to influential institutions, like universities and hospitals, can either make or break a good pilot. Validation in the eyes of power holding structures is a promising role that can also make differences for innovation,

When it comes to the framework criteria for pilot selection, connections can be draw between the kinds of partners the interventions have and their social acceptability. The more public and local the partners for each pilot, the greater the likelihood that it will experience social acceptability and community support.

4) Replicability of interventions within system transitions is a challenging concept.

In theory, HarvestCare's approach is one that can be taken to other places, but its contextual nature is dependent on specific local actors, meaning that any additional HarvestCare pilot's would need to start from scratch. This requires substantial time investments to create connections with key societal actors, hospitals, GPs, and farmers willing to participate within this scheme. This is particularly problematic when the managers of the pilot also have to

[8] https://www.freshventures.eu/

consistently invest large chunks of their time writing grants and securing funding to cover costs of living for themselves.

Ideal future

"Let the food - and the soil it came from - be your medicine." - HarvestCare

For HarvestCare, an ideal world is one that takes a OneHealth approach: where food is grown within the planet's biophysical boundaries, in ways that prioritize planetary health and create local supplies of nutritious and affordable food for surrounding communities. "The food we consume daily will steal from most of us a few years of healthy life. Too often the responsibility for the choices we make is put on individuals. For a thriving society, we need first to create thriving food systems that prioritize healthy soil, producing nutritious food that is accessible to local communities. Let's make it the reality of the XXI century."[9]

Recommendations

Paradigm shifts are required, that the pilot is trying to begin addressing, in order for this pilot to be successful in broad terms. (i.e. for health insurance companies to recognize this shift; etc.) Much of transitions solutions are focused on changing from reactive to anticipatory approaches throughout varied societal domains, so there is great overlap in helping the healthcare transition bridge the gap from reactionary to systemic, anticipatory/preventative healthcare approaches. A key opportunity to more easy replication identified by HarvestCare's founder is the absence of/research and establishment of an insurance company focused on preventative/regenerative care.

Finding, providing, and facilitating practical solutions for profitability problems, like a "pay for success" model or some other outcome-based payment model, can really make a difference in transition niches. Targeting policy at the EU level, also proposed by HarvestCare's founder, can help secure stable funding for anticipatory/preventative projects that would benefit from outcome-based payment schemes. This project takes a lot of inspiration from projects and pilots in the US, where food pharmacies have had some degrees of success. Food pharmacies in the US received USDA funding that allowed the aggregation of knowledge from 2010-2020.

There should be an easier way to connect researchers and other actors wishing to support impact driven interventions and interventions themselves needing something from those researchers. These relationships could easily be mutually supportive, where researchers actively help in the data collection for their science and pilots receive research results and legitimacy from other institutional partners.

[9] https://www.harvestcare.eu/

Agroecologie Netwerk

FOUNDING YEAR: 2022
WEBSITE: HTTPS://AGROECOLOGIE.NL/

A network of farmers, scientists, social entrepreneurs, activists and civil society organizations that advocate for powerful food communities rooted in agroecology and food sovereignty. They organize around the vision, voice and experience of farmers' organizations in the Netherlands, and we are part of the international "Nyeleni" movement for agroecology and food sovereignty. They aim to strengthen agroecology in the Netherlands and beyond - both in farming practice and the broader food networks - by collective learning, organizing, forging alliances, through research and policy advocacy, and by making this story known in the wider community. Our working groups hold regular meetings and actions. We demonstrate what agroecology means in practice, we put our finger on the sore spots of the industrial system, we set up new food networks, we develop knowledge in the service of farmers and society, and we build a solidarity movement for agroecology towards food sovereignty.

AgroecologieNetwerk is a collaboration between many organizations/ research institutions, etc. that AgroecologieNetwerk is the Dutch branch of La Via Campesina which has groups all over the world. There are various projects that are looking into future dynamics between all of the actor groups within the Netwek, Like Mycelia van Hoop, which connects activists, farmers, and researchers together.

Challenges	How to overcome them
Inclusion of agroecological/transitioning farmers in decision making is challenging. Those who design research projects or research themes are not the farmers themselves. This is due to unstable funding schemes, where lack of funds leave you unsure of at what stage farmers will be able to come in, which excludes them from a lot of planning and design	• There should be funding available to encourage farmers to participate, or better yet, lead the design of a research project. • The Netwerk focuses on securing funding on individual scales as well as for broader Netwerk administration.
Working with many actors can be challenging when everyone comes from different perspectives. Moreover, researchers also currently take up too much space	• Rather than taking on the role of mediators within society, they need to address their position transparently and not represent actors they should not be representing; rather, researchers

	should be facilitating those actors taking up those positions. • The Netwerk has created a group specifically meant to contain its researchers in order to try to channel their perspectives and specific skills more appropriately.
Wishy-washy policy developments in the EU have impacted farmer livelihoods and political action.	• The farmers have shifted away from law and policy to working on local scales where they themselves have more influence (eg agricultural territories, regional farmer networks, the building up of regional identities, bottom-up approaches that bring in various institutional levels.

Lessons learned

1) Funding structures, and the "projectification" of research makes long-term research impossible that is needed for transitions. This negatively impacts the relationships and dynamics most researchers can build with any territory at a time, as well as the monitoring and evaluation of transition dynamics.

2) Researchers should be asking other actors, like farmers, how they would like to collaborate with research institutions/researchers/universities/NGOs/etc. There was a time when farmer organizations had their own research, where they didn't have to depend on organizations to legitimise themselves. What can be done in order to provide legitimacy for this kind of useful, citizen science?

3) There are many research organizations out there that are currently engaging with specific transition approaches, and already acting as "actor mediators" within their fields. KIN could already learn a lot by engaging with these organizations.

Ideal future

For the AgroecologieNetwerk, agroecology is a way of life:

“Agroecology is a practice, movement, and science that supports life rather than destroys them. We are part of the international Nyeleni movement that describes agroecology as follows:

Agroecology is a science and a socio-political movement, but also a living practice, which has been built by humans for thousands of years. Farmers who work according to the principles of agroecology use ecological processes in nature and see a living soil as the basis of their autonomy. Agroecology is based on diversity, synergy and co-creation.

Agroecology means a food system that is sustainable and equitable. Humans, nature, and agriculture reinforce each other. Many forms of small-scale, agroecological food production provide local knowledge, form identity and culture and strengthen the livelivability of the countryside. Agroecology offers solutions to the major environmental, social, economic and political challenges we face.

Agroecology connects us in a profound way with each other and with our natural environment. Agroecology therefore concerns not only agriculture, but also the transformation of our entire society. It is based on collective rights, norms and customs that contribute to dignity and autonomy for farmers and their wider community.

We see agroecology as a path to food sovereignty: the democratic right of people to healthy and culturally appropriate food produced in an ecologically responsible way within a society that they shape themselves. Agroecology is therefore diametrically opposed to the unequal balance of power in industrial food systems, in which elites and large companies have too much influence.

We are wary of the danger of a diluted definition of agroecology and its opportunistic use. Agroecology is often reduced to a limited range of technical innovations that do not fundamentally change the industrial agricultural model. That is why we protect these principles and remain consciously connected to the international movement."[10]

Recommendations

Research design is currently not helpful in tracking (food system) transition evidence/successes: Continuity within (agricultural) transitions research is key, and this can only be done with the participation of researchers. How we consider including farmers and how research requires long-term perspectives can really be improved when it comes to food system research. Long-term funding opportunities present an excellent avenue for how to better carry out transitions research. Providing funding opportunities for long-term projects would be key for any project to apply iterative research processes that could help correct blind spots/assumptions/and perspectives that were not consented on by project participants.

[10] https://agroecologie.nl/agroecologie/

Waterrotonde Eerbeek

FOUNDING YEAR: 2023
WEBSITE: HTTPS://WATERROTONDE.NL/

The Waterrotonde Eerbeek pilot was launched by papermills, Industriel Water Eerbeek, and KWR to tackle water stress in the Veluwe region, a Natura 2000 area. The papermills have historically extracted large amounts of groundwater, filtered it, and discharged it into the IJssel River, raising environmental and operational concerns. This pilot aims to reduce groundwater extraction through advanced water reuse strategies, promoting sustainability and resilience.

Challenges	How to overcome them
The Waterrotonde Eerbeek pilot encountered several intertwined challenges. When one papermill closed, it caused fluctuations in paper production and wastewater output, complicating the project's business case and scalability. Tight planning constraints added to the pressure, as coordinating sampling and treatment processes required seamless collaboration among partners. Furthermore, selecting the right treatment technologies demanded careful attention to energy consumption and costs, particularly for brine treatment and disposal, given Eerbeek's inland location and strict environmental discharge regulations.	• While the closure of one papermill impacted continuation plans, the pilot concluded as scheduled, successfully achieving all deliverables thanks to thorough planning. Following the pilot's end, KWR evaluated progress and shared insights from research work packages, fostering opportunities for replication in other locations. Findings presented at various conferences underscored the project's relevance to sectors facing similar water stress. Continuous monitoring allowed stakeholders to assess achievements and adapt strategies. KWR also connected with the agricultural sector to highlight the impact of water quality on local farmers. Overall, the project's clear goals and structured timeline contributed to its success and potential for broader sustainable water management transitions.

Lessons learned

First, operational stability and adaptability are crucial for the success and scalability of pilot projects. The closure of one papermill during the pilot introduced substantial uncertainty, disrupting continuation and long-term scalability plans. Second, the definition of success can largely vary among stakeholders. While all pilot objectives have been achieved in a timely fashion, making it a success in the eyes of the KWR, the lack of continuity could be seen as less of a success by other stakeholders.

Ideal future

Well-assembled teams will secure adequate funding and remain flexible to adapt to uncertainties. Clear success metrics will guide evaluations, accommodating varying stakeholder definitions of success, ultimately fostering collaboration and paving the way for replicable, sustainable solutions in water management and beyond.

Recommendations

Engaging relevant stakeholders is vital for pilot project success. Knowledge institutes like KWR can provide essential expertise and innovative solutions, so it is vital to bring them onboard. Clear communication and the involvement of all relevant parties, including local communities, foster support and facilitate smoother implementation. Actively including stakeholders in planning and execution helps address concerns, gather insights, and build ownership. This collaborative approach enhances legitimacy and increases the likelihood of achieving desired outcomes and long-term sustainability.

Foenix Circular Craft Center

FOUNDING YEAR: 1982
WEBSITE: HTTPS://WWW.FOENIX.NL/CIRCULAIR-AMBACHTSCENTRUM/

Foenix, a social enterprise in Apeldoorn, is dedicated to reducing waste and promoting the circular economy through upcycling and reuse. At the heart of their efforts is the Circular Craft Center, which employs 38 staff members and over 200 volunteers. In 2023, Foenix collected 4,431 tons of items, saving 3,666 tons of CO2 — equivalent to the emissions of 2,292 homes. The sale of reusable goods funds social initiatives, benefiting over 800 people annually. Additionally, Foenix operates a Repair Café, a textile studio, and a bike workshop, where they repair items and create new products from discarded materials.

Challenges	How to overcome them
Foenix faces several key challenges in its operations. Regulatory constraints, particularly the Dutch interpretation of EU legislations, prevent the reuse of parts from broken appliances, forcing the organization to order new parts instead, which leads to more waste and frustration among volunteers. This change has resulted in the departure of five volunteers and increased financial strain. Financial sustainability is also a challenge, as Foenix operates without municipal support. Although it is self-sustained, reducing waste further proves costly, and many customers are unwilling to pay the higher prices for labor-intensive upcycled products. Lastly, Foenix struggles to find qualified personnel, especially given its mission to employ individuals from marginalized groups, as the labor market tightens.	• Foenix addresses its challenges with a combination of adaptation and innovation. While they have no choice but to comply with new regulatory constraints, leading to increased repair times and costs, they are finding ways to boost efficiency in other areas. For financial sustainability, they've invested in new machinery and introduced improved organizational practices, including digitalization. By scanning items upon reception and storing them in an internal database, they've streamlined their sales and pricing processes, generating higher revenues. To tackle the scarcity of qualified personnel, Foenix actively maintains and builds partnerships with labor suppliers, such as educational institutions, to secure a steady flow of skilled workers.

Lessons learned
Key lessons learned include the impact of differing national interpretations of EU legislation, which present significant barriers to achieving economic circularity. Additionally, upcycling demands a societal shift in perception, as many consumers struggle to understand the higher costs of upcycled items compared to second-hand goods. The willingness to pay a premium for these products remains limited, highlighting the need for greater awareness of the environmental and social benefits of upcycling, alongside efforts to align regulations more effectively across countries.

Ideal future
The circular economy thrives as thrift stores adopt Foenix's upcycling practices, fostering a collective rethinking of waste production and utilization. Legislation evolves to support, rather than hinder, circularity, creating an environment conducive to repair and reuse initiatives.

Recommendations

Researching cost-efficient waste reduction methods tailored to craft centers like Foenix, could help such initiatives meet their sustainability goals without prohibitive costs. Additionally, an educational campaign is essential to raise public awareness about the value of upcycling, encouraging consumers to understand and support the higher costs of these products. Finally, lobbying for changes in Dutch legislation to better align with EU regulations is critical, as this would facilitate more effective repair and reuse practices, enabling Foenix to further advance its circular economy initiatives.


Projections of the future: climate models
Global climate models

INTERMEZZO

Two Systemic Interventions

This intermezzo contains two cases of systematic interventions, and is an independent contribution of THRIVE Institute to this report. The systemic interventions can serve as an extra inspiration for KIN to explore ways of accelerating climate adaptation via research. These cases are considered to be systemic, because they do not necessarily apply to one particular (niche in the) field. Instead they concern intervention on the broader level of the socio-economical system via which they can lead to concrete impact, such as the ones explored in the pilots above.

Social Impact Bonds
new value models for impact

As the demand for solutions to societal issues grows, alternative streams of funding are becoming increasingly popular. One of those alternative funding mechanisms are Social Impact Bonds (SIBs). A social impact bond is a type of performance-pay contract for public services in which government buyers collaborate with private for-profit investors or social for-impact investors to fund interventions of (social) entrepreneurs addressing social problems (Tan et al., 2021[11]).

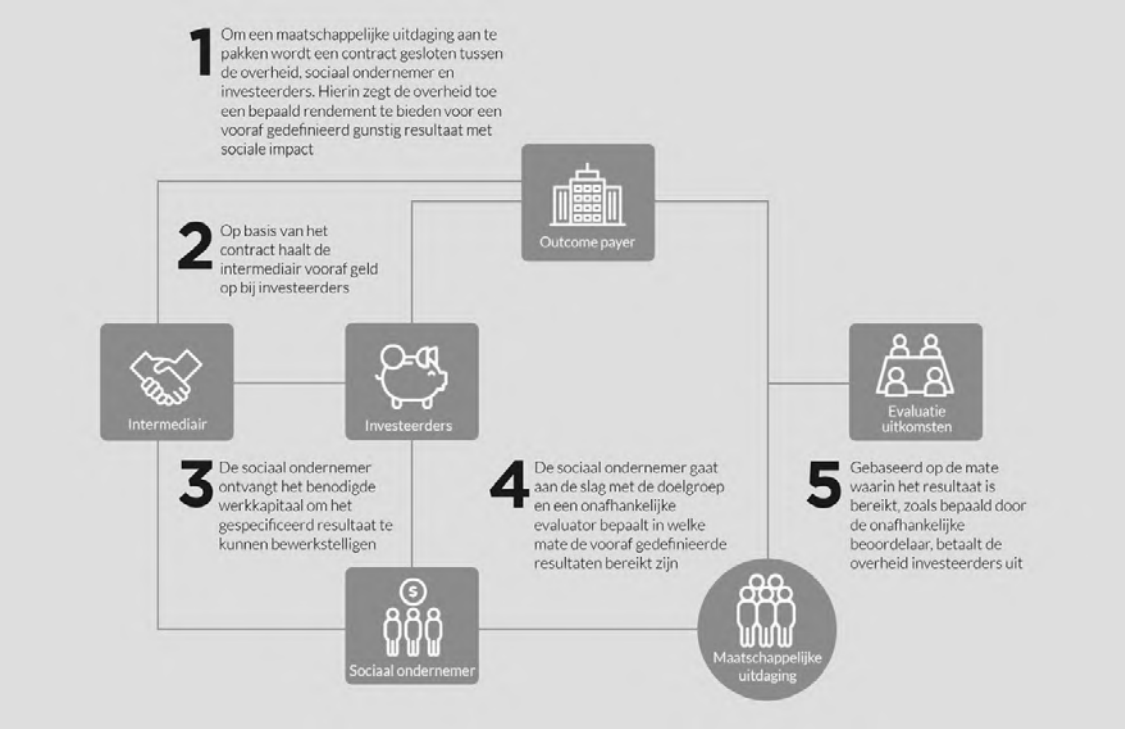

Figure 4: Social Impact Bond Structure (Social Finance NL)

[11] Tan, S., Fraser, A., McHugh, N., & Warner, M. E. (2021). Widening perspectives on social impact bonds. *JOURNAL OF ECONOMIC POLICY REFORM, VOL. 24, NO. 1*, 1-10.

The roles of the three main actors in a Social Impact Bond are as follows:

1. Impact investor – provides the capital for the implementer.
2. Implementer – focuses on solving a societal problem (e.g. reducing unemployment)
3. Outcome payer – often a (local) government body or philanthropist who has committed to repaying the investment, including the agreed-upon return, to the investor once the agreed-upon results are achieved.

The governmental actor defined the conditions for the agreement, while investors provide upfront funding for the programs by transferring money to the project managed by the service provider (Smeets, 2017[12]). Social investors go beyond generating financial returns and also value social good through their operations. An example of a Rotterdam based social investor is the Social Impact Fund Rotterdam (SIF-R[13]). By investing in social entrepreneurship, substantial improvement is pursued in some of the city's most persistent challenges, such as helping people with a distance to the labor market find employment.
Each type of SIB uses different collaboration processes. To make these partnership work some key principles that are required include support, leadership, interdependence and trust (Smeets, 2017).

If the agreed-upon results are not achieved, the government buyer does not have to pay the investor. This shifts the risk from the government buyer to the investor.

In the Netherlands, impact investing is gaining popularity with the aim of pursuing social and environmental objectives while generating financial returns. The majority of social impact bonds are on the topics of social welfare and employment (ABN AMRO, 2015[14]). Another impact investing mechanism that is gaining attention is the Environmental Impact Bond (EIB), although the full extent of knowledge on this topic has not yet been established in theory or in practice. Environmental Impact Bonds (EIBs) are financial tools created to support environmental projects by tying financial rewards to the achievement of specific environmental goals. Investors contribute initial funding for these initiatives and earn returns if the projects meet the set environmental objectives (Trotta, 2024[15]).

Although SIBs have gained traction across academia, the public sector, and industry, technical implications and the complex nature of these performance-pay contracts raises questions about how effective these agreements are in pushing through on their promises (Tan et al., 2021). Both Social and Environmental Impact Bonds hold considerable potential to speed up the climate transition by channeling private investment into meaningful environmental initiatives.

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[12] Smeets, D.J.A. (2017). Collaborative Learning Processes in Social Impact Bonds:A Case Study from the Netherlands. *JOURNAL OF SOCIAL ENTREPRENEURSHIP, VOL. 8, NO. 1*, 67-87.
Social Finance NL. (n.d.). *SOCIAL IMPACT BONDS*. Social Finance NL. https://socfin.nl/social-impact-bonds/

[13] www.sifr.nl

[14] ABN AMRO. (2015, oktober 1). *Social Impact Bonds: Opportunities and Challenges in the Netherlands*. Social Impact Bonds: Opportunities and Challenges in the Netherlands. https://assets.ctfassets.net/1u811bvgvthc/1Na1AHV9VPryISF443garA/934a6b6938c211602ddc9619447749c5/ABN_AMRO_Rapport_Social_Impact_Bonds.pdf

[15] Trotta, A. (2024, Februari). Environmental impact bonds: review, challenges, and perspectives. *Current Opinion in Environmental Sustainability*, *Volume 66*, 1-8.

The Doughnut Economy
a new governance model in line with earth's means

The Doughnut Economy, introduced by economist Kate Raworth, is a framework designed to balance human prosperity with ecological sustainability. It envisions a world where everyone has access to life's essentials—such as food, housing, health care, and education—while ensuring that our collective activities stay within the planet's ecological boundaries.

The central idea is captured in the image of a doughnut: the inner ring represents the social foundation beneath in which no one should fall (the "hole"), while the outer ring represents the nine planetary boundaries we must not overshoot to maintain Earth's stability, such as a stable climate, biodiversity, and clean water. Humanity's challenge lies in thriving within this safe and just space (Raworth, 2017)[16].

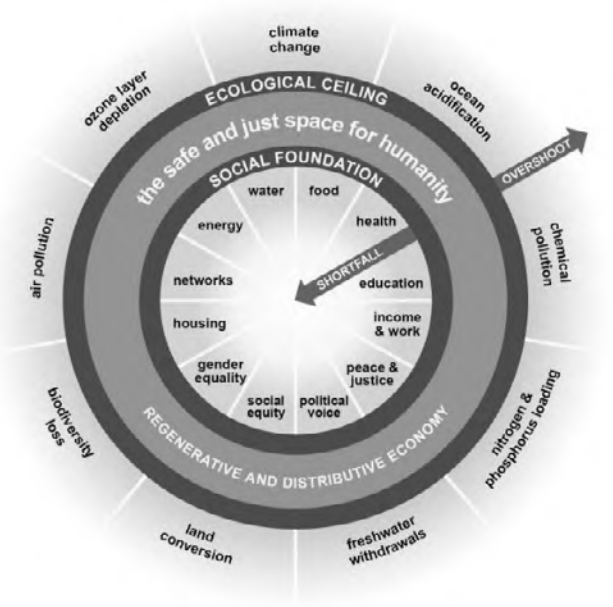

Figure 5: Doughnut model (Climate Hero n.d.)[17]

The Doughnut Economy challenges traditional growth-focused economic models by emphasizing balanced development within social and ecological boundaries. Current systems frequently overshoot planetary limits, driving climate instability and environmental degradation (Raworth, 2020[18]). Recognizing that economies are human-made constructs, the Doughnut framework advocates reimagining economic systems to prioritize well-being and sustainability. This approach aligns with global calls to move beyond GDP as the primary

[16] Raworth, K. (2017). Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist.

[17] "What is Doughnut Economics?" Climate Hero. https://climatehero.me/doughnut-economy-2/.

[18] Raworth, K. (2020). Doughnut Economics: Creating a Safe and Just Space for Humanity. [YouTube video]. Retrieved from https://www.youtube.com/watch?v=talXb1wiEFY.

measure of success, incorporating holistic indicators that balance social and environmental health.
Addressing these challenges requires tackling social deficits while reducing ecological overshoot to create a safe and just space for humanity. Cities, as hubs of innovation, are central to this transformation. Tools like the Thriving City Portrait provide practical frameworks for urban areas to integrate social equity with environmental goals, driving systemic change at the local level (C40 Cities, 2020[19]).

Figure 6: Four lenses (Doughnut Economics Action Lab, 2020) [20]

With the help of Raworth, Amsterdam has downscaled this approach to the size of a city (Florian, 2021[21]). Amsterdam is the first city to implement the concept of the Doughnut Economy as a 'City Portrait' which tends to integrate social and ecological goals into local policies (C40 Cities, 2020).

There are four interconnected lenses which together form the City Portrait. These lenses are designed to evaluate the city's well-being from different angles. As shown in figure 6.

By using these lenses, Amsterdam can align local policies with both social and ecological sustainability, creating a balanced strategy for a thriving urban future (C40 Cities, 2020; Raworth, 2017). But how does this work in practice?

In their exploration of the Doughnut Economy model, Amsterdam authorities found that 20% of city residents were unable to meet their basic needs after paying rent, while only

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[19] C40 Cities. (2020). Creating City Portraits: A Methodological Guide from the Thriving Cities Initiative. Retrieved from C40 Knowledge Hub.

[20] Doughnut Economics Action Lab (DEAL), Biomimicry 3.8, Circle Economy, and C40. Amsterdam City Portrait. March 2020. https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000kUVB/RiDzhMCQNASG0eAJ_AwRpqJjZ43zy4b5DeQqVjtlUEc

[21] Florian, M. "How Amsterdam Uses the Doughnut Economics Model to Create a Balanced Strategy for Both the People and the Environment." ArchDaily, 2021. https://www.archdaily.com/997291/how-amsterdam-uses-the-doughnut-economics-model-to-create-a-balanced-strategy-for-both-the-people-and-the-environment.

12% of the approximately 60,000 applicants for social housing were successful, as reported by The Guardian (The Guardian, 2020[22]). While increasing the housing supply might seem like a simple solution, the city's recent rise in carbon dioxide emissions highlighted the need for a more sustainable approach. Marieke van Doorninck, Amsterdam's deputy mayor, emphasized that although investment in the construction sector is essential, it must be coupled with strict regulations to ensure the use of sustainable materials and construction methods (Florian, 2021).

An example of the implementation of the City Portrait in practice is Strandeiland, part of IJburg, a new archipelago of six islands reclaimed from the sea on the southeastern edge of the city. Throughout the project, various sustainable decisions were made to minimize its environmental impact. These included transporting materials by boats powered by low-emission fuel and employing construction methods that protect local wildlife while safeguarding residents from rising sea levels.

By implementing the Doughnut Economy through its "City Portrait," Amsterdam sets a precedent for other cities to align growth with sustainability. This approach not only addresses housing and social inequalities but also ensures that urban development respects ecological limits. The model could inspire other cities to adopt comprehensive, systems-thinking strategies that promote long-term urban well-being while reducing their ecological footprints, encouraging innovation, and fostering collaboration across sectors (Raworth, 2017; C40 Cities, 2020).

It is important to keep in mind that The Doughnut Economy is not a prescriptive model that provides a one-size-fits-all solution. Instead, it outlines an aspirational goal: ensuring a good quality of life for all while staying within the Earth's ecological limits. The approach to achieving this goal will differ across regions. This means that the methods that are used in Amsterdam are place based and do not automatically work for the development of other cities. As an example, for wealthier cities, the primary challenge may be addressing the outer ring of the doughnut by reducing their environmental footprint to fit within the planet's boundaries. In contrast, low- and middle-income regions may face a different struggle, focusing on lifting people out of the doughnut's center, where basic needs like food, education, and opportunities are insufficient. For these regions, the priority is ensuring access to essential resources and fostering social equity (Florian, 2021).

In conclusion, place-based and locally focused policies are crucial because they ensure that solutions are tailored to the unique challenges and opportunities of each region. By addressing the specific needs of local communities, these policies are more likely to be effective in creating long-term, sustainable change.

[22] "Amsterdam's Doughnut Model Could Help Mend Post-Coronavirus Economy." The Guardian, 8 April 2020. https://www.theguardian.com/world/2020/apr/08/amsterdam-doughnut-model-mend-post-coronavirus-economy?utm_medium=website&utm_source=archdaily.com.

Key Takeaways

This section highlights key insights from our exploration of sustainability initiatives in healthcare, food and agriculture, and energy, industry, and economy/cities and infrastructure. We identified critical lessons on the importance of prevention, the rapid restoration of biodiversity, and the need for collaboration and supportive policies. These findings aim to illuminate effective pathways for transitioning toward a more sustainable future.

Theme 1: Healthcare

Prevention is the most sustainable form of care.

As highlighted by The Climate Doctor, "The most impactful healthcare interventions are those that prevent the need for treatment in the first place." By reducing unnecessary care, we not only cut costs but also lessen the environmental impact of the healthcare system. The Green Healthcare Alliance echoed this, emphasizing that effective prevention strategies reduce the burden on healthcare providers, allowing them to focus on long-term sustainability rather than short-term reactive care.

The healthcare sector tends to be slow and resistant to adopting external practices.

The healthcare sector often exhibits a slow and resistant approach to adopting external practices. Many providers prefer to create their own solutions instead of embracing innovations developed elsewhere, a tendency commonly referred to as "not-invented-here" syndrome. As followed from the interview with the Green Healthcare Alliance, collaboration, while crucial, is challenging because many providers are resistant to adopting practices from other sectors. This reluctance to consider outside ideas can significantly delay the implementation of sustainability practices. To accelerate the transition to more sustainable systems, it is essential to overcome this mindset through collaboration and the sharing of proven models.

Human healthcare can gain valuable insights into sustainability from veterinary healthcare.

Veterinary practices such as reusing surgical instruments that are typically single-use in human healthcare (e.g., suture scissors) offer potential for reducing waste. According to the Green Veterinarian, these practices foster a more sustainable approach to medical care, and perseverance is key to implementing such changes.

Collaboration is crucial but challenging.

According to the Groene Zorg Alliantie, collaboration between healthcare providers, policymakers, and sustainability experts is essential for scaling sustainability practices. However, limited resources and capacity make it difficult to coordinate efforts across different organizations. Successful collaborations often hinge on leadership and clear communication of sustainability goals.

Theme 2: Nature, agriculture, food, and water

Biodiversity and ecosystem health can be restored relatively quickly.

Food forests, like Ketelbroek, demonstrate that species richness can be achieved much faster than previously believed. In just 10 years, Ketelbroek reached a level of biodiversity similar to a neighboring Natura 2000 area that had 100 years to develop. Food forests not only restore ecosystems and biodiversity and simultaneously can produce food. This suggests that sustainability initiatives like food forests can play a crucial role in restoring ecosystems and enhancing biodiversity in relatively short time frames.

Alternative agricultural forms are economically robust because they give a variety of produce regardless of weather events.

Monoculture croplands rely heavily on external inputs like artificial fertilizers, fossil fuels, labor, and irrigation, and they are vulnerable to precipitation changes. In contrast, alternative agricultural methods—such as regenerative farming (regenerative farm Schevichoven), row farming (Lenteland farms), syntropic farming (Den Food Bosch), food forests (FFK, FFBN), and paludi culture—promote crop diversity. This diversity enhances resilience to climate change, as if some crops fail, others can thrive. It also supports a varied fauna, reducing the risk of pest outbreaks. However, such diversity requires more adaptable clients, such as food box services, restaurants with flexible menus, or the wilder land initiative.

Alternative agricultural forms contribute to solving the current nitrogen crisis and upcoming phosphate crisis.

Different crops have varying nutrient needs, meaning alternative agricultural systems use significantly less external input like fertilizers and water. These systems often involve multi-year crops, contrasting with mono plantations that deplete nitrogen and require fertilizer phosphate supplementation. By converting 170,000 hectares of agricultural land around nature reserves into food forests by 2030, we could capture 14.6 million tons of CO2—more than the 14.3 million tons the Dutch industry needs to offset. This transformation would also produce food for about 1 million people and help mitigate nitrogen issues affecting the nature reserves.

Alternative agricultural forms contribute to the protein transition and ensure future food stability.

Our current diet in the Netherlands is largely based on animal protein (add source). Finding alternative sources of plant-based protein that can be grown in the Netherlands will reduce animal suffering, GHG emissions, nitrogen emissions, phosphate requirements and make the Netherlands less vulnerable to production line crises, both in export and import. Alternative agricultural systems can produce a wide variety of plant-based protein from perennial plants such as pecan nuts, walnuts, Toona sinensis[23], Caragana arborescen, as well as high protein content annual crops for human consumption (legumes, green leafy crops).

[23] Factsheet Voedselbossen (chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://netwerkvoedselbosbouw.nl/wp-content/uploads/2020/10/Factsheet-Voedselbossen_2020.pdf

Alternative agricultural systems increase water safety.

Alternative agricultural systems by their more diverse nature and largely perennial crops grow in organic soil content and thus are able to absorb peak precipitation, reducing the water stress downstream. Furthermore the ability to absorb and hold water reduces outflow of nutrients balancing the cycle of micro and macro nutrients, further reducing the system's fertilizer requirements. Vice president of Stichting Voedselbosbouw: 1 percent organic matter per hectare has a water retention capacity of 170,000 liters. Over a period of ten years, this can accumulate to 1 million liters of water. This means that in a food forest, plants can continue to develop and produce even in dry years[24].

Alternative agricultural systems increase community.

https://open.spotify.com/episode/0IVYfZQZjkqj5bHEMiVFUr: Large scale farmers that export/produce to large corporations, only hear from those corporations if something is wrong. A large 'soft' payment that CSA's and other communal agricultural initiatives get is the compliments and appreciation of customers.

Alternative agricultural systems have a larger yield per area.

In a podcast episode featuring Martijn Ballemans (Puur Permacultuur), Wouter Veer (Lenteland farms), and Geert van der Veer (Herenboeren), they discuss that 35,000 farms are needed to support the Dutch population through collaborative farming. We could use a third of the current agricultural land to feed all 17 million inhabitants of the Netherlands.

Each farm would be 20 hectares, requiring 700,000 hectares—about a third of the country's agricultural land. The current lengthy zoning changing process hinders rapid growth of these initiatives, demanding significant perseverance and resources from participants when wanting to start a farm on new land. To facilitate progress, it's suggested that government-buyout farms near Natura 2000 areas be made available to alternative agricultural projects. This approach would bypass zoning delays and promote practices that reduce chemical use, enhance biodiversity, and mitigate nitrogen impact.

Theme 3: Energy, industry, and economy & Cities and infrastructure

National differences in interpreting EU legislations pose significant barriers to achieving economic circularity.

A major challenge arises from the inconsistencies in how various EU countries interpret and implement regulations, which can impede the progress of circular economy initiatives and make scaling solutions across borders difficult. For instance, at Foenix Circular Crafts Center, Dutch regulations, which differ from those in other EU countries, prevent the reuse of parts from broken appliances. This regulatory barrier has forced Foenix to order new parts

[24] Source: https://www.nieuweoogst.nl/nieuws/2024/10/11/voedselbossen-kennen-nog-veel-onzekerheden

for repairs, leading to higher costs and increased frustration among volunteers. The differences in the Dutch interpretation of EU legislation created significant operational hurdles for Foenix, preventing it from maximizing its circular economy potential and reducing waste effectively. To overcome such barriers, it is essential to align policies and promote their greater harmonization at the European level.

Operational variability and adaptability are critical to pilot project success.

Operational stability is crucial for the success and scalability of pilot projects. Variations in production inputs or outputs can significantly disrupt ongoing processes and affect long-term plans. For instance, one of the paper mill factories unexpectedly closed during the Waterrotonde Eerbeek pilot. This disrupted the flow of wastewater, which was integral to the pilot's business case for advanced water reuse technologies. The reduction in wastewater posed challenges for both scaling the project and evaluating the potential for replication. The variability in output, triggered by the factory's closure, made it difficult to plan follow-up pilots, as the business case had been built on more consistent operational levels. As a result, for pilots aimed at promoting sustainability, maintaining consistency in operations becomes even more critical since these projects often rely on steady production or resource flows to implement and test new technologies. Without this stability, it becomes difficult to accurately assess the scalability and future viability of such initiatives.

Social acceptability hinges on education and transparency.

For pilot projects to gain widespread acceptance, especially those promoting sustainability, it is crucial to foster understanding and support from local communities. Projects should prioritize transparency, educating the public on the benefits of new practices and addressing concerns that may arise from innovation. For instance, at Foenix, despite there being broad local support for the center's initiatives, some customers do not fully understand why upcycled products, like pillows made from old clothing, are priced higher than similar new items. The labor-intensive nature of upcycling is not immediately apparent to customers, highlighting the need for better education and communication to build public understanding of circular economy processes and their value. Accordingly, effective communication can enhance the social acceptability of projects, ensuring that the public aligns with the long-term goals and is willing to embrace the necessary changes.

Cross-Theme Takeaways

Financial viability is still a significant barrier to the success of the pilot initiatives.

While the analyzed pilots show promise in terms of environmental and social impact, most of them struggle to maintain financial sustainability. Implementing sustainable practices frequently entails additional upfront costs—whether for new technologies, processes, or the time needed to retrain staff. This challenge can limit the scalability and longevity of pilot projects, particularly when external funding comes to an end. To address this issue, it is crucial to establish financial support mechanisms, incentives, and clear long-term business models that can bridge the gap and ensure pilots evolve into sustainable, scalable solutions.

Supportive policies can unlock the potential of pilot projects.

Policy frameworks play a crucial role in enabling sustainable practices. In agriculture, for example, subsidies and legal recognition of innovative methods like food forests empower farmers to explore new approaches while maintaining their financial support. Similarly, healthcare initiatives can thrive under policies that fund preventive care or incentivize sustainability efforts. However, policy alignment at regional, national, and international levels is often inconsistent, particularly in sectors such as industry and circular economies. Harmonizing these policies can significantly accelerate the adoption of sustainable practices across the board.

Mindset shifts are necessary for successful systems transition.

Achieving transitions in healthcare, agriculture, and industry necessitates a fundamental change in how problems and solutions are perceived. For instance, prevention is often undervalued in healthcare, while upcycling and sustainable agriculture encounter resistance from entrenched traditional paradigms. Changing this mindset is crucial for scaling innovative practices and new models. Fostering this shift requires education, effective communication, and time, as well as platforms for sharing success stories and learning from early adopters.

Persistence and leadership drive pilot success.

Persistence and leadership are essential for the success of pilot initiatives. Individual perseverance and strong leadership play a crucial role in advancing sustainability efforts. Whether launching a green team or piloting small-scale projects, the dedication of a few can ignite broader systemic change. However, relying solely on one person poses a risk; establishing a supportive team structure is vital for maintaining momentum and ensuring the longevity of these initiatives.

Small, practical steps can lead to significant change.

A key lesson across all themes is the value of starting with manageable, actionable initiatives rather than attempting large-scale transformations from the outset. Focusing on "low-hanging fruit" allows projects to build momentum, demonstrate their value, and inspire broader change. For instance, healthcare providers have successfully made progress by prioritizing waste reduction and implementing energy-saving measures before pursuing more ambitious goals. This approach not only secures quick wins but also fosters stakeholder buy-in and strengthens the case for scaling up efforts.

Certification systems should be meaningful.

Many healthcare professionals and organizations are pursuing certifications to highlight their sustainability efforts, but these certifications need to be thoughtfully designed to prevent greenwashing and ensure they deliver genuine value rather than merely serving as a profit-driven model. Similarly, existing certification systems often fail to adequately recognize initiatives like food forests, which struggle to achieve high Eco-score due to the structure of existing certification systems.

Pilot success is in the eyes of the beholder.

The definition of success can differ significantly depending on the perspective of each stakeholder. For example, one group may view a pilot's outcomes as successful based on environmental impact, while others may prioritize criteria such as economic feasibility or social acceptability. To navigate these differing expectations, it is essential to establish clear success metrics and cultivate strong relationships with a diverse range of stakeholders.

Interventions for System Change (by THRIVE)

THRIVE, drawing from their extensive research and experience, highlights key interventions aimed at driving systems change. While our pilot analysis focused on lessons from looking at the successful initiatives, THRIVE offers a broader perspective on how different interventions target various elements of the current system:

Public policy: From intuition to evidence-based.

THRIVE emphasizes the importance of transitioning from intuition-driven to evidence-based policymaking. Public policy can serve as a powerful lever for system change, as seen in examples like Rotterdam's Inclusive Climate Action initiative, which integrates inclusivity into governance. What Works Centres in the UK provide another model, highlighting how evidence can guide policy decisions to address societal challenges.

The organization and use of science: From publications to impact.

Shifting from academic, publication-focused outputs to science that directly addresses societal issues is critical for system change. An example of that - THRIVE's Purpose Accelerator program - demonstrates how purpose-driven innovation can connect research to real-world climate transition needs.

Governance: From institutions to commons.

Collaborative governance, where local governments, businesses, and communities co-create solutions, is essential for system change. THRIVE points to initiatives like Amsterdam Smart City and the application of the Doughnut Economy as pioneering examples of this transition towards shared governance.

Metrics for success: From KPIs to broader values.

THRIVE highlights the need for new metrics that go beyond traditional KPIs to encompass broader societal and environmental values, thus offering a more comprehensive assessment of success in system transitions.

Financial structures: From project-based to outcome-based.

Financial mechanisms must also evolve to reward long-term impacts. THRIVE underscores the potential of models like outcome-based financing and Social Impact Bonds, which incentivize measurable, sustainable outcomes.

Empowering citizens: From exclusion to inclusion.

A key component of system change, according to THRIVE, is empowering citizens. Programs like Rotterdam's Burgerberaad give citizens real ownership of policy processes, demonstrating how inclusion can drive transformative change.

Bridging Practice and System Change

By combining the practical lessons we've learned from the analysis of the pilots with THRIVE's vision for system change, we gain a comprehensive understanding of what is needed to foster sustainable transitions. While our analysis points to the immediate challenges—financial viability, policy support, and mindset shifts—THRIVE's input provides a roadmap for deeper, systemic transformation through evidence-based policymaking, collaborative governance, and inclusive metrics. Together, these insights offer a robust framework for designing and scaling sustainability initiatives. In the next section, we outline practical strategies KIN can take to operationalize these.


PUMA

Six Levels of Success KIN

Drawing from our shared experiences and insights, we have outlined practical, scalable action steps that KIN can take to amplify its impact via pilot support. These strategies are organized by their level of complexity and resource needs, starting from foundational initiatives and advancing to deeper systemic transformations. Each level provides KIN with clear pathways to sustainable growth, collaborative solutions, and measurable outcomes.

Level 1: Research and Curate Best Practices

Objective: Continue our targeted desk research to identify more sustainable and unsustainable practices in current systems, enabling KIN to create a knowledge base for effective, positive change.

Action: Build upon the insights outlined in this report by developing a more comprehensive study on best practices in sustainability. While our report serves as an initial foundation, further research is essential to deepen KIN's understanding of actionable tools and methods across diverse sectors. This research should be shared with key stakeholders such as researchers, policymakers, and practitioners to drive systemic changes.

Example: Create an accessible online tool for farmers, providing tailored recommendations to support transitions to sustainable agricultural methods.

Level 2: Building Connection and Trust and Sharing Knowledge

Objective: Facilitate mutually beneficial collaborations between pilots and researchers, fostering trust and a sense of belonging among all stakeholders to build a collaborative ecosystem of shared knowledge and support.

Action: Establish regular forums—such as symposiums, excursions, and roundtable discussions—that bring together diverse stakeholders to foster intersectoral trust and collaboration. These platforms should highlight successful models (e.g., Foenix's upcycling practices), support the development of circular craft centers, and set clear goals for knowledge exchange. KIN can strengthen partnerships, particularly with initiatives like the Green Healthcare Alliance, to facilitate connections between sectors and drive sustainable transitions. By helping bottom-up initiatives access funding and sharing research-based validation, KIN will empower underrepresented groups to thrive. Moreover, KIN's role in scaling sustainable healthcare solutions and advancing research on the connection between planetary health and human health is essential for addressing complex challenges like circularity and healthcare logistics.

Example: Soil monitoring of food forests is more difficult than biodiversity monitoring - based on macroorganisms, which are not directly linked to the health of your soils. It's best to look at microorganisms (yeast fungi bacteria) but there are no current protocols for how

to determine this or get appropriate results. Long term monitoring for this is really hard to prove, circling back to the length of projects (at least 7 years but preferably 10 for most food forest systems). KIN could connect the parties needed for this kind of long-term funding, and connect monitoring of all other alternative agriculture types to be able to research and connect.

Level 3: Policy Engagement and Lobbying

Objective: Strengthen the connection between theory and practice to influence policy in support of sustainable transitions.

Action: Engage with policymakers to bridge the gap between theory and practice by enhancing evidence-based and data-driven policy initiatives. Appoint dedicated individuals to manage and update research, ensuring that findings are compelling for policymakers. Foster participatory governance by involving societal input through interviews and collaborative approaches to shape policy in ways that meet real-world needs. KIN can also lobby for changes in Dutch legislation to align better with EU standards and collaborate with international partners, such as the Green Healthcare Alliance, to address regulatory challenges that impact sustainable healthcare initiatives.

Example: The process of obtaining permits frequently presents significant challenges for pilot projects, which can hinder their overall success. To tackle this issue effectively, KIN could conduct targeted research to identify and develop practical solutions tailored to specific regional needs, making these resources readily accessible to project stakeholders.Additionally, establishing a presence in The Hague is vital for influencing long-term EU agrifood policy planning. By engaging directly with policymakers, KIN can ensure that the voices and needs of pilot projects are heard, fostering an environment where sustainable initiatives can thrive.

Level 4: Research Proposal Development to Address Gaps Identified

Objective: Take strategic steps to advance large-scale issues by identifying and addressing systemic gaps through long-term project and collaborative action.

Action: Prioritize multi-year, impact-driven research proposals that focus on critical areas like planetary health and sustainable healthcare. Establish long-term research and monitoring as the standard practice, ensuring project continuity by developing frameworks that address key barriers in agricultural transitions and circular economy initiatives. Engage in strategic planning to identify systemic obstacles and paradigm shifts that need to be tackled for sustainable progress.

Example: The current research design often fails to effectively track evidence of successes in food system transitions. Continuity in agricultural research is essential, and this can only be achieved through active participation from researchers. Improving the inclusion of farmers in research processes, along with adopting long-term perspectives, is crucial for advancing food system research.

Long-term funding opportunities are vital for facilitating comprehensive transitions research. By providing financial support for extended projects, we enable iterative research

processes that can identify and address blind spots, assumptions, and perspectives that may not have been considered by project participants.

Historically, farmer organizations conducted their own research, allowing them to operate independently without relying on external validation for research credibility. It is essential to explore ways to restore legitimacy to this valuable form of practical and useful citizen science.

Moreover, existing food labeling systems, such as eco medal reward systems and crop-based funding—including carbon capture strategies—often exclude transition pilots and alternative agricultural initiatives. This lack of inclusivity adversely affects funding and growth opportunities.

To truly support food system transitions, we must prioritize long-term monitoring and secure funding for sustained projects. Investing in these initiatives is crucial for fostering innovation, ensuring accountability, and ultimately achieving our sustainability goals.

Level 5: Implement Previous Levels and Ask Society How they Can Contribute

Objective: Involve society in shaping research and action strategies, encouraging a participatory approach to sustainable transformation.

Action: Engage the public through surveys, interviews, and focus groups to understand their perceived roles in contributing to sustainable initiatives. Foster collaborative learning by encouraging a reflective approach among KIN and other organizations, recognizing the importance of diverse perspectives in defining success and enhancing societal impact.

Example: Akin to exit polls for elections, involve stakeholders to analyze the results. Collect feedback from diverse stakeholders to identify which results resonate with them and ask them to put themselves in the shoes of the public to see how long standing impact could be realized.

Level 6: Facilitate Broad System Transition and Conduct Barrier Research

Objective: Conduct comprehensive research to identify and address systemic barriers to outcome-based funding in various sectors.

Action: Test innovations by synthesizing international and cross-industry knowledge across all themes.

Example: Research into the possible "unsustainability" of the current Dutch interpretation of the EU-level legislations on the re(use) of components extracted from old devices (e.g., if a vacuum cleaner needs to be fixed, Foenix currently has to order new components instead of using those from some old vacuum cleaners that could not be repaired, which likely results in a greater carbon footprint).

Reflections from THRIVE

The wish stemming from the initial posed challenge, is to see how science-driven pilots can be scaled up towards becoming the new practice. Throughout the research process and from expertise and experience the reason why many pilots won't scale can be found in many aspects of our current system. We try to dissect those reasons and give practical advice on how KIN can take action on it.

If we make a very basic sketch of the general (!) process in which a pilot can lead to system change, it gives us a lens that uncovers multiple focal points on where to intervene.

Starting point

- An insight is found by a researcher.
- A researcher combines their gained knowledge, insights and sometimes a somewhat activistic demeanor.

Pilot development

- The insight is developed into an idea, tool, programme, initiative that is tested in the shape of a pilot. Usually because a researcher wants to bring it into practice, believing it will have a positive impact on society. This pilot will be insight-based.
- The researcher combines their insights and knowledge and translates that knowledge and applies it to a pilot. This pilot will be research-informed.

Scaling

- The pioneering pilot will lead to a qualitative alternative to existing practice, giving actors in the system the option to choose a serious climate-friendly option. Usually, working around and from outside the current system.
- The pioneering pilot will replace the current status quo. Leaving the climate-unfriendly practice behind. Usually working together with the current system.

Then, for the advice, we recommend the following:

Strengthen the pilot holder

Many of the pilots and solutions created, challenge our current system in many ways. They create values that cannot always be financially feasible (financial aspect), they create ecological and societal value that will be somewhat apparent after a longer period of time (time aspect), and they challenge the way we look at our practice (mindset aspect). To create climate-friendly alternatives pilots have to be quite strong.

Yet, in all cases it seems that success depends on the capability of the pilot holder to fight against the system barriers. This can be a draining endeavor, so you would want to cherish and empower them. A way to do this would be to unite these pilot holders and let them learn from each other. Just like entrepreneurs in different fields - even when sectors differ - impact makers go through many of the same questions and quests. In a field where pilot

holders are in many ways worked against, uniting these impact makers can reinforce them with energy, knowledge and even function as a powerful unit on its own.

Another reason why bringing them together is a sensible thing to do, is that applying a solution in one context often differs greatly from another context. It also happens more often that circumstances change during the pilot period, or afterwards. In the design and execution of the pilot it is therefore essential to be able to make it adaptable. It would already help to discuss these tactics during meetings with other change makers.

Burst the bubbles by new narratives
Usually when a pilot is created outside of the current system, it stems from an annoyance with a symptom of our system-malfunction. A (usually somewhat activistic) researcher then uses their knowledge and creates a movement in a specific field. In many cases, a community of like-minded people gathers around these ideas. Think of green veterinary care, this leads to momentum surrounding the pilot, enabling it to grow and scale to a certain level within the bubble of like-minded people, but it usually gets halted because the majority of people who could or should adopt it are not yet like-minded.

Here we see the example where the majority of people are not yet in the mindset of adopting greener practices. The innovations that the pilots offer are in many cases not understood by the broad public, nor is the urgency felt; even in a time where everyone has heard of the necessity of greener choices in the broadest sense. It seems that being a greener option is not attractive enough. In the broader field, innovations are offered more sustainable versus not sustainable: but what if that narrative is not the one that counts anymore?

We need to steer the new solutions away from being defined as ‘the greener solution’. It would help to create alternative narratives for pilots individually, but also for our subtransitions. Making their individual goals understandable, accessible and urgent. A beautiful example is that of tackling the loss of biodiversity: not having as many bees in our garden brings broader environmental changes extremely close, in a very clear (and numerable!) way.

Starting point of pilots are rarely insight-based
Most pilots involving research are based on a combination of insights and expertise. Less so the starting point is a specific scientific insight that seems to teach us about a new mechanism to explore in practice. Usually because the transition involves a lot of social aspects that have more unexpected behaviors than, for example, technical solutions. It is valuable to explore and actively search for specific mechanisms that are found in research that could help the sustainability transition. Think of mechanisms that close the intention-action gap, broadly explored in behavioral economical topics like nudging and boosting.

In the end, it leaves us exploring scientific findings that go beyond the more classical solutions. A task that scientists should embrace with a copernican ambition.

Support the professionalization through offering administrative support
Many of the researched pilots can’t scale, partly because of lack of time due to administrative tasks and people that can help them scale. A successful pilot leads in many cases to more opportunities to scale. But, this also means that the amount of administrative work that needs to be done, grows. Also, because it can take time to find a fitting financial model, it is not yet feasible to hire employees. This catch-22 is well known by entrepreneurs as the ‘valley of death’: the moment that the success of a business requires more resources to

grow and standardize, without being commercially fruitful enough to provide these resources for itself.

In the case of the researchers, the time that goes into administrative tasks and standardization, takes away from the focus on impact. These are tasks that could be done by others. KIN could help by facilitating administrative support or helping pilot holders navigate on where to find (e.g. administrative) help.

Value space and agility to create results
When a pilot is financed, there are often (strict) requirements attached to it. A certain result must be achieved and if these are not achieved, the pilot is usually not continued. In many cases, the financial structure does not offer room to make adjustments to the pilot, to take advantage of other opportunities that arise, or to finance tasks that were not foreseen in advance, but turned out to be important during the pilot period. Due to the often strict structure of financing, many opportunities are missed that pilot holders recognize, but do not feel and have the time to anticipate on.

A lot of magic can come from people who have the space to commit themselves to the matters that they feel are important at that moment, with a financier who trusts them. An additional fund with which hours are covered for the further exploration of impact from pilots, could be very valuable. Pilots should already be covered by funding, but the KIN could co-finance for a relatively small amount with the idea of creating space for a researcher to engage in conversations, tell their story, develop further plans, conduct experiments, to increase the impact during the pilot and to have more insight into what might work after the pilot period is over.

Create evidence on the pathways from science to policy
An ever-lasting challenge for pilots within the climate and impact domain is that the value they create can often only be seen in the long term, far beyond the pilot period. In itself, this means that it is difficult to finance, because no definitive result can be promised yet. People are also not literate in recognizing the smaller effects that can indicate that the long-term impact is already taking place in the short term.

Helping to scale up pilots on a large scale cannot be done without bridging the gap between short-term promises versus long-term effects. KIN can help with explaining cases in which they explain how short-term pilots contribute to long-term transitions, and in what way. Because this is not yet the current way of evaluating, skill development will also have to take place here. KIN can choose to put this to the test together with scientists and look for ways to measure how long-term impact can be made visible in the short term. In very practical terms, KIN can combine different experts who will focus on a specific pilot and let them indicate which micro-effects they believe are relevant for the creation of larger effects. Evaluating these short-term micro effects that indicate long-term impact in different fields, also has the effect of creating an evidence-base on what mechanisms for impact we can prove.

Another means that KIN can use is to write blogs or social media messages, explaining which proven effects have been identified during a pilot, and how these micro-effects indicate that a larger movement is taking place in the longer term.

Push or invite policy makers from relevant fields to adapt current policies
KIN has a unique position in the field, because it is both between and next to researchers and institutions. KIN already reaches policymakers, and can invite them and hopefully more to collaborate more explicitly with scientists. This requires them to be open to interaction

with scientists, knowing that policymakers are often not aware of the possibilities and potential of science. An accessible way to involve policymakers is to let them become part of the Communities of Practice (COPs) that KIN hosts. By bringing scientists into contact with policymakers in a learning way, they can meet each other in a natural and inspiring way.

From the multidisciplinarity of the research group from the Purpose Accelerator program, it also became apparent what value 'unexpected' sciences can have on other fields. This only emphasized the importance of involving both policymakers and scientists from very different fields.

Crystallize paths from science to system change

How a pilot leads to ultimate impact and embedding in the system has not yet been fully crystallized in the Dutch context. The lack of insight into these pathways means that each pilot holder often has to find their own examples and gradually find out what the most important activities were. There will never be golden roads, but more insight into the routes to desired impact gives pilot holders more support to set the right priorities. This asks for more monitoring, and experimentation on different solutions and their (micro) effects.

Limitations

This project faced several limitations, the most significant being its short duration. With less than three months of effective working hours available, it was challenging to fully address the broad research question. In fact, a PhD project over several years could be dedicated to this topic and still likely conclude with the need for further research.

While the candidates selected for the project were highly engaged, they were not yet experienced qualitative researchers, nor were they from the field of system transition. For future studies, we recommend ensuring that expertise in qualitative research is included, to ensure interviews are conducted to the highest standards. Although we aimed to follow evidence-based methods, our expertise lies in quantitative rather than qualitative science, and there may be opportunities for improvement in our approach.

Lastly, given the limited time, the team's effectiveness was occasionally hindered by varying feedback between individuals and across timepoints. This sometimes led to unclear expectations, which impacted the ability to consistently meet anticipated outcomes.

Appendix

A. Relevant definitions

After extensive group discussions we defined the most important concepts relevant for this project as follows:

- Pilot: A proof-of-concept with a clear path to scale (scale = impact * size), utilizing scientific insights to accelerate systems transitions toward a sustainable, climate-neutral future.
- Best Practice: A method or technique generally accepted as superior to alternatives, typically based on comparative evaluations rather than full evidence-based research. In our work with KIN, we classify common themes and techniques from pilot projects as best practices to avoid greenwashing and ensure contributions to sustainability.
- System: According to *Martijn Bart*, a system is a group of interconnected elements that influence each other's behavior as a whole. This can apply to various contexts, such as the human body (organs or cells as elements), societal systems (people, animals), or natural systems (water, food).
- System Transition: As defined by Könnölä et al. (2008), system transitions are complex societal processes that evolve gradually, typically without visionary management, but coordination of policies, regulation, and corporate strategies can drive innovations and overcome barriers.
- Climate Mitigation: Efforts to reduce greenhouse gas emissions to limit climate change's severity. This involves cutting emissions from power plants, factories, vehicles, and agriculture, while also enhancing natural carbon sinks such as forests and oceans.
- Climate Adaptation: Actions taken to manage the risks and impacts of climate change. These measures help communities and systems cope with unavoidable climate-related challenges.
- Sustainability: As per the United Nations Brundtland Commission, sustainability involves meeting the needs of the present without compromising future generations' ability to meet their own needs.
- Overpopulation: Refers to a situation where human populations exceed the environment’s capacity to support them long-term. This issue affects food security, water supply, shelter, healthcare, and economic prosperity.
- Boundaries in Systems: In urban ecosystems, boundaries are established for assessing major inputs like energy and materials but must remain flexible, acknowledging that external factors and influences often extend beyond defined boundaries (Stan’s perspective).
- Efficiency: The ability to achieve the maximum output using minimal energy, effort, or resources, as defined by the Cambridge Dictionary.

- Climate Resilience: The capacity to anticipate, prepare for, and respond to hazardous climate events or disturbances, helping systems and communities maintain functionality.
- Just Transition: Ensuring that the shift to a sustainable, climate-neutral economy is fair and inclusive, addressing social inequalities and protecting vulnerable communities.
- Healthcare and Sustainability: The Dutch healthcare sector is committed to sustainability goals and signed the "Green Deal". This includes CO2 reduction (55% by 2030), promoting health among patients, clients and employees, reducing raw material consumption, and minimizing environmental harm caused by medication. Specific actions include promoting plant-based diets and embedding sustainability into healthcare education programs.
- Co-Creation: The process of collaborating across various stakeholders to generate solutions, typically involving shared decision-making and mutual benefit.
- Energy, Industry, and Economy: These sectors play crucial roles in the transition to sustainability, involving circular economy practices, renewable energy implementation, and reducing industrial emissions.
- Climate Mitigation vs. Adaptation: While interventions typically aim for mitigation (reducing emissions), climate adaptation measures are equally important to cope with inevitable changes. Examples include local food production, which reduces emissions and strengthens food security.

B. Analysis of Themes and Gap Identification

Theme 1: Health care

The Dutch healthcare system performs quite well compared to other European countries when it comes to amenable deaths. Amenable mortality refers to deaths that could have been prevented with timely and effective medical care. It includes deaths from conditions that are treatable with appropriate healthcare interventions, such as certain types of cancer, heart disease, and infections. The concept is used as a measure of the effectiveness of a healthcare system—lower amenable mortality rates indicate that the healthcare system is effectively managing and treating diseases that should not result in death if properly addressed. For a thorough overview of the Dutch healthcare system you can consult: https://www.argumentenfabriek.nl/media/3929/quickguidedutchhealthcare-definitieve-uitgave-15-juni-2021.pdf

There is no clear overview available of the Dutch veterinary healthcare system. What is available is the number of animals present in the Netherlands (2019)[25]:

- 100 million chickens
- 35 million companion animals (dispersed across 4 million households[26])
- 12 million pigs
- 4 million cattle

It is estimated that 60% of the 1,400 infectious diseases affecting humans originate from animals. Additionally, 75% of all emerging infectious diseases globally are of zoonotic origin[27]. Worldwide, this has led to more emphasis on the concept of One Health, which is defined as[28]:

One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent.

The approach mobilizes multiple sectors, disciplines, and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for healthy food, water, energy, and air, taking action on climate change and contributing to sustainable development.

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[25] RIVM. (2024). *GGD-richtlijn Medische Milieukunde veehouderij: Veehouderij en gezondheid omwonenden in Nederland*. Retrieved October 15, 2024, from https://www.rivm.nl/ggd-richtlijn-mmk-veehouderij/veehouderij-nederland

[26] KNMVD (2024). *Aantal gezelschapsdieren in Nederland*. Retrieved October 15, 2024, from https://www.dierenarts.nl/aantal-gezelschapsdieren-nederland/

[27] Shaheen, M. (2022). The concept of one health applied to the problem of zoonotic diseases. *Reviews in Medical Virology*, 32. https://doi.org/10.1002/rmv.2326.

[28] One Health High-Level Expert Panel (OHHLEP), Adisasmito, W. B., Almuhairi, S., Barton Behravesh, C., Bilivogui, P., Bukachi, S. A., Casas, N., Cediel Becerra, N., Charron, D. F., Chaudhary, A., Ciacci Zanella, J. R., Cunningham, A. A., Dar, O., ... & Zhou, L. (2022). One Health: A new definition for a sustainable and healthy future. *PLOS Pathogens*, 18(6), e1010537. https://doi.org/10.1371/journal.ppat.1010537

Key underlying principles including

1. **equity** between sectors and disciplines;
2. sociopolitical and multicultural **parity** (the doctrine that all people are equal and deserve equal rights and opportunities) and inclusion and engagement of communities and marginalized voices;
3. socioecological **equilibrium** that seeks a harmonious balance between human–animal–environment interaction and acknowledging the importance of biodiversity, access to sufficient natural space and resources, and the intrinsic value of all living things within the ecosystem;
4. **stewardship** and the responsibility of humans to change behavior and adopt sustainable solutions that recognize the importance of animal welfare and the integrity of the whole ecosystem, thus securing the well-being of current and future generations; and
5. **transdisciplinarity** and multisectoral collaboration, which includes all relevant disciplines, both modern and traditional forms of knowledge and a broad representative array of perspectives.

The most important **gap** in the Dutch healthcare system is the disconnect between human-, animal- and environmental health. With the importance of connecting these three healthcare systems evident from the text above, this stresses the potential role KIN can play in level 3, 4 and 6: to connect the different sectors together and address the need for comprehensive policies, that include a One Health approach.

In the Netherlands, the healthcare sector is responsible for 7% greenhouse gas emissions, 4% of waste and 13% of raw materials usage. In other words, through the delivery of care, the sector is contributing to the climate crisis. It is this paradox that healthcare sector is keen to resolve.

The healthcare sector is therefore working on 'sustainable care'. Agreements on this have been made in the Green Deal Working together towards sustainable healthcare. This Green Deal has five goals[29]:

1. Promote health among patients, clients and employees
2. Raise awareness and understanding of the impact of healthcare on climate and vice versa
3. Reduce CO2 emissions by 55% by 2030 and to be climate neutral by 2050
4. Reduce consumption of primary raw materials by 50% by 2030 and maximise circularity in healthcare by 2050
5. Reduce environmental harm caused by (use of) medication

[29] Green Deals. (2022). *The five goals of the Green Deal for sustainable healthcare*. Green Deals. Retrieved from https://www.greendeals.nl/sites/default/files/2022-12/The%20five%20goals%20of%20the%20Green%20Deal%20for%20sustainable%20healthcare_0.pdf

These try to address the unsustainabilities (**gaps**) in the current system:

1. Employee shortage[30]
2. Financial deficit
3. Healthcare is responsible for 7-8% of greenhouse gas emissions[31]
4. Lack of preventive care[32]

A lot of research into the unsustainability of healthcare has already been conducted. In line with the lessons gathered from the interviews we conducted, it is important to realize that addressing unsustainabilities in healthcare is not only relevant for health of living beings, but also crucial in addressing planetary health. A nice overview of both positive and negative influences of animals and veterinary services on planetary health was made by Debnath et al.(2021)[33]:

[30] EY. (n.d.). *Nederlandse gezondheidszorg in crisis: Einde van stelsel nabij?*. EY. Retrieved October 15, 2024, from https://www.ey.com/nl_nl/health/nederlandse-gezondheidszorg-in-crisis-einde-van-stelsel-nabij#:~:text=Het%20is%20duidelijk%20dat%20de,pati%C3%ABnten%2C%20personeel%20en%20zorgaanbieders%20lijden.

[31] Maastricht UMC+. (n.d.). *Miljoenensubsidie voor onderzoek naar duurzame chirurgie*. Maastricht UMC+. Retrieved October 15, 2024, from https://www.mumc.nl/actueel/nieuws/miljoenensubsidie-voor-onderzoek-naar-duurzame-chirurgie

[32] Sociale Vraagstukken. (n.d.). *Gemeenten moeten met preventie aan de slag gaan*. Sociale Vraagstukken. Retrieved October 15, 2024, from https://www.socialevraagstukken.nl/gemeenten-moeten-met-preventie-aan-de-slag-gaan/#:~:text=De%20Wetenschappelijke%20Raad%20voor%20het,de%20gangbare%20sturingsaanpakken%20werken%20onvoldoende.

[33] Debnath, N., Schipp, M., Alders, R., Chadag, M., Howden, M., Meza, F., Swai, E., & Wingett, K. (2021). Planetary boundaries and Veterinary Services.. *Revue scientifique et technique*, 40 2, 439-453 . https://doi.org/10.20506/rst.40.2.3236.

Examples of the range of positive and negative effects of aquatic and terrestrial animals on Earth processes that could feasibly be influenced by veterinarians and NVS, and can result in either exceeding or staying within planetary boundaries
Includes the effects of changing boundaries on animals

Boundary (i.e. Earth system process) *(Possible actions by individual veterinarians)*	**Positive examples** (i.e. relieving strain on planetary boundaries)	**Negative examples** (i.e. placing strain on planetary boundaries)
1. Biosphere integrity *(Action: be an advocate for productive agriculture within sustainable and diverse ecosystems)*	Sustainable, safe harvesting of animal species well adapted to local environments (I) (12) Adaptation of welfare-friendly livestock production practices that enhance plant and animal biodiversity and ecosystem function (I) (12) Nutrition-sensitive aquatic food production systems (I) (13, 14, 15) Sustainable aquaculture and fisheries management; poly-culture systems farming multiple compatible species adding to diversity and reducing inputs (I) (16) Companion animals that do not kill or otherwise displace indigenous animals and plants (I) (17)	Animal-source food produced by a limited number of species and breeds at the global level (I) (12) Feed demands for intensively raised animals requiring the expansion of livestock and crop production into new landscapes, including forests and wetlands (e.g. for soy and other feed), has frequently led to loss of biodiversity (18) and increased risk of pathogen spillover events from wild animal and bird reservoirs to domestic animals and humans (e.g. avian and swine influenzas and severe acute respiratory syndrome coronavirus 2 or SARS-COV-2) (I) (19) Living conditions of local people are deteriorating as livelihoods, socio-economic institutions and cultural values are affected (I) (18) Environmental and genetic hazards associated with escape of aquatic species into the wild (I) (20) Impact of domestic cats (and feral animals) on indigenous animal and plant species (I) (12, 17) Transboundary movement of aquatic and terrestrial animal diseases with live animal trade and their products (I) (21) Over-harvesting including dynamite or poison harvest techniques for coral fish (I) (22) Disruption of food chain by selective harvesting of predator species (I) (23)
2. Biogeochemical *(Action: consider animal waste and its means of disposal for environmental impact)*	Integrated aquaculture–agriculture closed circular systems (I) (12) Appropriate use of manure for organic fertiliser (I) (12) Maintaining wetlands as part of an integrated aquaculture–agriculture closed circular system and ecological balance of ecosystems (I) (16) Farming seaweeds and filter-feeding marine bivalves (extractive species) benefits the environment by removing waste materials including waste from fed species, thus lowering the nutrient load (I) (16)	Excessive use of nitrogen fertiliser to grow feed for aquatic and terrestrial animals and subsequent spillover/leakage of excess fertiliser into water ways (I) (24) Inefficient and improper management of livestock manure and aquaculture waste generated by intensive production systems (I) (25)
3. Ocean acidification *(Action: reduce atmospheric carbon dioxide and waste run-off into coastal waters)*		Ocean acidification caused by global warming, biogeochemical run-off and atmospheric loading will negatively affect aquatic life and shellfish production (E) (26)
4. Land-use change *(Action: be an advocate for better use of existing agricultural and efficient use of all of the animal carcass)*	Introduction of agro-ecological/regenerative livestock and crop production systems that reduce net greenhouse gas (GHG) emissions and improve overall soil health (I) (16, 27) Greater yields per hectare into the human food chain from livestock in high-income countries – both by weight and nutrient yields – through enhancing animal genetics and husbandry practices and reducing pre-consumer losses, i.e. eating more of the animal, including offal. This leads to less land clearing and fewer flow-on effects (on the biosphere, atmosphere, etc.) (I) (28). NVS surveillance and assistance to producers to economically prevent and minimise pre-consumer losses (I) (29)	Clearing forests for livestock production (30) and coastal mangrove forests for coastal shrimp farming (31) for human and companion animal food chains (I) Arable land, particularly near cities, being built on for housing or industry and becoming urban (I) (32) Poor land/agricultural husbandry practices leading to land degradation, fertility loss (I) (33)
5. Global freshwater use *(Action: be involved in animal selection for long-term survival)*	Selection of animals for heat tolerance and efficient water use (I) (34) Efficient use of water by growing aquatic animals and sea-based food production helps to reduce freshwater footprints and the need for terrestrial animal production (I) (35)	Increased water consumption by animals due to increasing numbers of domestic aquatic and terrestrial animals, and raising animals poorly adapted to local agro-ecological conditions (I) (34)

Boundary (i.e. Earth system process) *(Possible actions by individual veterinarians)*	**Positive examples** (i.e. relieving strain on planetary boundaries)	**Negative examples** (i.e. placing strain on planetary boundaries)
6. Stratospheric ozone depletion *(Action: support and promote low methane animal production systems)*		Skin cancers in animals expected to increase until 2070, in association with ozone layer depletion due to human-made ozone-depleting substances (E) (36)
7. Atmospheric aerosol loading *(Action: consider grazing pressure, species suitability and crop types)*	Silvopasture production systems that reduce ground-level wind speed and enhance soil cover (I) (37) Production systems that conserve soil moisture, reducing the impact of bushfires (I) (38)	Overgrazing, leading to loss of vegetative cover and dust generation by wind (I) (33)
8. Chemical pollution *(Action: contribute to genetic selection of healthy, robust livestock)*	Breeding to reduce livestock pests and diseases (flystrike susceptibility/intestinal worms) and hence reduce pesticide/drench use (I) (39, 40) On-farm biosecurity measures and use of vaccines that reduce the need for veterinary medicines and pesticides (e.g. grazing management to reduce environmental worm burdens, isolating new stock to manage the risk of lice and ticks, selection of specific-pathogen-free seeds for aquaculture) (I) (41, 42) Use of organic fertilisers and soil amendments on land used to grow fodder (I) (43)	Heavy metal pollution affects animal health and the safety of aquatic and terrestrial animal-source foods (I) (44, 45) Some farmed fish have a much higher body burden of natural and human-made toxic substances, e.g. antibiotics, pesticides, heavy metals and persistent organic pollutants, than wild fish (I) (20) Antibiotic pollution of the environment including water ways (I) (46)
9. Climate change *(Action: model good environmental behaviour in transport, purchasing, dining, etc. Adopt healthy and sustainable diets for oneself and promote these to clients)*	Well-managed perennial pasture and silvopasture can sequester carbon, reducing atmospheric levels; good animal husbandry and efficient use of animal products can reduce GHG emissions per unit of production (I) (37) Companion animals with low GHG emission footprints (I) (47) Integrated aquaculture–agriculture and integrated multi-trophic aquaculture could play a significant role in sequestering carbon. Fisheries and aquaculture have a key role to play in feeding a growing world population with nutritious and low-carbon-footprint foods (I) (16)	Emissions of methane and nitrous oxide and the loss of organic carbon in the soil and biomass carbon associated with animal raising and animal feed production and supply lines. Energy consumption associated with heating and cooling intensive rearing enterprises. Transport of feed in and animals out for slaughter (I) (48) Decreased animal welfare due to increased heat stress, pathogen circulation, droughts and bushfires (E) (3)

E: effect of changing planetary boundaries on aquatic and terrestrial animals
I: impact of positive and negative contributions to processes that can result in either exceeding or staying within planetary boundaries
NVS: national Veterinary Services

This once again stresses **the need to connect stakeholders across sectors**, also across the different themes that KIN has identified in attempting to accelerate the system transition towards a climate neutral one.

Another study also states key lessons which are similar to the ones we gathered from our interviews[34]:

1. Successful reforms typically involve seed funding, strong collaboration, sustained momentum, and political will to support change over time.
2. Effective reforms are built on strong stakeholder engagement, clear governance, leadership, and accountability, which often outweigh the challenges of difficult political and socioeconomic environments.
3. Reform efforts cannot be attributed to any one factor, as success is typically driven by interrelated elements, including skilled participants and an engaged culture open to change.
4. Small, local initiatives can lead to large-scale system-wide improvements over time, exemplifying the "acorn-to-oak tree" approach to reform.
5. The effective capture, analysis, and communication of information, particularly through IT systems, is essential to achieving sustainable reform.

[34] Braithwaite J, Mannion R, Matsuyama Y, Shekelle P, Whittaker S, Al-Adawi S, Ludlow K, James W, Ting HP, Herkes J, Ellis LA, Churruca K, Nicklin W, Hughes C. Accomplishing reform: successful case studies drawn from the health systems of 60 countries. Int J Qual Health Care. 2017 Oct 1;29(6):880-886. doi: 10.1093/intqhc/mzx122. PMID: 29036604; PMCID: PMC5890865.

6. The most critical principle for any reform is ensuring that it improves care for patients, placing their experience and well-being at the center of the initiative.

In conclusion, the Dutch healthcare system performs well in many areas but faces significant gaps, particularly in connecting human, animal, and environmental health, which is vital for addressing One Health challenges and the global rise of zoonotic diseases. The healthcare sector's contribution to climate change highlights the urgent need for sustainable care, as emphasized in the Green Deal's goals to reduce emissions and environmental harm. Lessons from healthcare reforms suggest that success depends on strong collaboration, stakeholder engagement, and a culture open to change, with small initiatives driving larger systemic improvements. Integrating sectors and disciplines is key to addressing both human and planetary health. KIN can play a crucial role in bridging these gaps to foster comprehensive, sustainable policies.

Successful initiatives worth further investigation:

1. Iceland Healthcare reforms: https://national-policies.eacea.ec.europa.eu/youthwiki/chapters/iceland/76-mechanisms-of-early-detection-and-signposting-of-young-people-facing-health-risks
2. Acknowledged effective interventions to improve lifestyle, list of interventions per topic ranked on efficacy: https://www.loketgezondleven.nl/interventies-zoeken-tegelpagina#/Overview
3. Acknowledged effective interventions for care of handicapped persons and elderly people: https://www.databankinterventies.nl/interventies
4. 14 interventions that can improve the working conditions of healthcare workers: https://www.venvn.nl/nieuws/met-deze-14-interventies-kun-je-zeggenschap-versterken-in-jouw-organisatie/

The Circular Pig, a method to make pig farming circular (more sustainable): https://hetcirculairevarken.nl/

Theme 2: Nature, Agriculture, Food and Water

The Problem

Agrifood systems account for approximately **thirty percent of global energy consumption,** and result in **twenty percent of global greenhouse gas emissions**, making the global food system an active contributor to climate change[35]. Food systems have also contributed to **breaching various planetary boundaries**, in particular those concerning climate change, biosphere integrity, and biogeochemical flows related to nitrogen and phosphorus cycles[36].

Examples of the effects of nitrogen breaches are strongly felt in the Netherlands, where the effects of excessive nitrogen deposition due to livestock and agricultural production, transport, and other sectors, is described as an ecological and legal crisis[37]. This peak

[35] Corigliano, O., & Algieri, A. (2024). A comprehensive investigation on energy consumptions, impacts, and challenges of the food industry. *Energy Conversion and Management: X*, *23*, 100661. https://doi.org/10.1016/J.ECMX.2024.100661

[36] Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, *347*(6223). https://doi.org/10.1126/science.1259855

[37] The Government of the Netherlands. (n.d.). *The nitrogen strategy and the transformation of the rural areas*. Retrieved October 16, 2024, from https://www.government.nl/topics/nature-and-biodiversity/the-nitrogen-strategy-and-the-transformation-of-the-rural-areas

came in May 2019 after a ruling by the Administrative Jurisdiction Division of the Council of State, which stated that the government's use of the Integrated Approach to Nitrogen (PAS) was invalid when granting permits due to the anticipation of future reductions in nitrogen deposition. This ruling lead to the immediate suspension of various projects[38].

Moreover, in addition to global agri-food systems being incredibly energy-intensive and resource-dependent, relying greatly on fossil fuels and other nonrenewables for production, they also **disregard externalities and costs to the environment**. Examples of this include the fact that global food systems are major drivers of land-use change and biodiversity loss, and land degradation and eutrophication of water through heavy use of fossil fuels and synthetic fertilizers[39]. In addition to its on-going pollution, water as a resource is also becoming more scarce: in cases where its extraction rates exceed rates of replenishment it classifies as a nonrenewable resource[40]. By 2050 about half a billion people are likely to be subject to water-stress, increasing the pressure to intervene in water systems[41].

The impacts of climate change on food systems are also expected to be widespread and complex, affecting yields, quality and safety, threatening food security. Extreme weather, storms, erosion, and landslides can delay or adversely impact crops and livestock, leading to large economic losses for farmers, potential food insecurity and food price volatility. Extreme weather will also lead to water scarcity, which can easily damage or destroy crops, dry up soils, and make it difficult to sustain livestock. Less predictable seasons, especially warmer growing seasons that start earlier, results in confused crops that bud early and experience frost or grow before the soil holds enough water and nutrients and increases in pest populations. Less predictable, warmer seasons also lead to worsening wildfires, which result in negative health impacts for farmers and farm workers, charred grazing lands, decimated food stocks, and loss of livestock. Additionally, rising temperatures can alter exposures to pathogens and toxins that thrive in warmer environments[42].

The issues plaguing our food systems are not only environmental, however. They are also experienced by all people, especially those who produce our food. An effect of efficiency within food production and the globalization of food systems is the commodification of food. In other words, rather than seeing it as an important need, food is considered like any other product that corporations produce, sell, and trade: access to food is primarily now seen as a market transaction. Conceptualizing food through monetary terms has resulted in incredible dependence on market forces, leaving entire countries highly vulnerable to market speculation, rising oil prices, and other unpredictable factors and making food security for much of the world's population incredibly elusive. Additionally, the focus on increasing the quantity of food produced, rather than its quality, combined with its increased

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[38] *Uitspraak 201600614/3/R2, 201600617/3/R2, 201600618/3/R2, 201600620/3/R2, 201600622/4/R2, 201600630/3/R2 - Raad van State*. (n.d.). Retrieved October 16, 2024, from https://www.raadvanstate.nl/uitspraken/@115602/201600614-3-r2/

[39] UNEP (2014) Assessing Global Land Use: Balancing Consumption with Sustainable Supply. A Report of the Working Group on Land and Soils of the International Resource Panel. Bringezu S., Schu¨tz H., Pengue W., O´Brien M., Garcia F., Sims R., Howarth R., Kauppi L., Swilling M., and Herrick J.

[40] Taylor, R. (2014). When wells run dry. *Nature*, *516*(7530), 179–180. https://doi.org/10.1038/516179a

[41] Rockström, J., Steffen, W. L., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E., ... & Foley, J. (2009). Planetary boundaries: exploring the safe operating space for humanity.
Rosin.

[42] A Shepon, PJG Henriksson and T Wu, 'Conceptualizing a Sustainable Food System in an Automated World: Toward a "Eudaimonian" Future' 5 (2018) Frontiers in Nutrition 104

availability has resulted in a variety of food related epidemics, such as starvation for one in ten people[43] and malnutrition for one in three[44].

This insecurity applies just as strongly to our producers. As of 2019, close to 750 million people the majority food producers and workers in precarious working conditions,[45] were exposed to severe levels of food insecurity, heavily undermining the human right to food. The instability felt by farmers worldwide is supported by observable changes within rural demographics, highlighting various problematic trends. While urban populations are expected to continue increasing in tandem with overall population growth, rural populations are not projected to grow much at all. Rural to urban migration flows are mostly a response to available economic opportunities, overwhelmingly so in low- and middle-income nations and plague farming communities to a great degree. Agricultural communities worldwide are also ageing and many of them have no successors, especially in Europe; as of 2013, the EU Farm Structure Survey indicated that 55.8% of European farmers were over 55 years old[46]. This generational renewal issue present in European agriculture is a result of various social and economic factors, including low-income expectations, the difficulty in achieving economic viability for small farms and need for high initial investments, trouble accessing land and credit, and poorly adapted and updated public policy tools[47]. The long-term costs and risks associated with food systems as they are is calculated to be around $13 trillion in hidden costs per year, indicating an urgent need for transitioning towards more sustainable alternatives[48].

The Vision

During the past decade, agroecology has gained international momentum as a strategic approach to fighting global instability and climate change issues[49]. Generally understood to include three components in its definition, agroecology is simultaneously considered a science, a set of practices, and a social movement. It is a 'transdisciplinary field that

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[43] United Nations. (2023, July 12). *Hunger afflicts one in ten globally, UN report find*. https://news.un.org/en/story/2023/07/1138612

[44] HLPE, 'Agroecological and Other Innovative Approaches for Sustainable Agriculture and Food Systems That Enhance Food Security and Nutrition' (a report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security) (2019)

[45] HLPE, 'Agroecological and Other Innovative Approaches for Sustainable Agriculture and Food Systems That Enhance Food Security and Nutrition' (a report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security) (2019)

[46] Eistrup, M., Sanches, A. R., Muñoz-Rojas, J., & Correia, T. P. (2019). A "young farmer problem"? Opportunities and constraints for generational renewal in farm management: An example from southern Europe. *Land*, *8*(4), 1–13. https://doi.org/10.3390/land8040070

[47] Żmija, K., Fortes, A., Tia, M. N., Šūmane, S., Ayambila, S. N., Żmija, D., Satoła, Ł., & Sutherland, L. A. (2020). Small farming and generational renewal in the context of food security challenges. *Global Food Security*, *26*. https://doi.org/10.1016/j.gfs.2020.100412; Sroka, W., Dudek, M., Wojewodzic, T., & Król, K. (2019). Generational changes in agriculture: The influence of farm characteristics and socio-economic factors. *Agriculture (Switzerland)*, *9*(12), 1–27. https://doi.org/10.3390/agriculture9120264

[48] Sroka, W., Dudek, M., Wojewodzic, T., & Król, K. (2019). Generational changes in agriculture: The influence of farm characteristics and socio-economic factors. *Agriculture (Switzerland)*, *9*(12), 1–27. https://doi.org/10.3390/agriculture9120264

[49] International Assessment of Agricultural Knowledge, Science and Technology for Development, 'Agriculture at a crossroads - Global report.' (2009) <https://wedocs.unep.org/20.500.11822/8590>; UN Human Rights Council, 'Report by Special Rapporteur Olivier De Schutter on the Right to Food' 17 December 2010, A/HRC/16/49, <https://digitallibrary.un.org/record/704715?ln=en>; UN Human Rights Council, 'Resolution adopted by the Human Rights Council on 28 September 2018 - United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas' 8 October 2018, A/HRC/RES/39/12, <https://digitallibrary.un.org/record/1650694?ln=en>; HLPE, 'Agroecological and Other Innovative Approaches for Sustainable Agriculture and Food Systems That Enhance Food Security and Nutrition' (a report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security) (2019); IPES-Food & ETC Group, 'A Long Food Movement: Transforming Food Systems by 2045' (report) (2021).

[encompasses] the ecological, sociocultural, technological, economic and political dimensions of food systems, from production to consumption'[50].

Enacting systemic change within the context of agroecology requires the engagement of politics: agroecosystemic sustainability is not only composed of environmental properties, it also reflects power relations. As such, scaling up agroecology presents the biggest challenge to transitions, but can be tackled in two ways.

1. Converting alternative food networks into Agroecologically-based local food systems. The characteristics of such systems include:
   - a focus on domestic rather than export markets;
   - striving towards food autonomy while upholding biophysical and cultural links to the territory;
   - ensuring close connection between all actors in the food chain;
   - and being managed through collective action and social self-organization.

2. Making sure public policies facilitate local agroecological food system behaviors, coordination with social movements, and the politicization of food. Political agroecological strategies include[51]:
   - focusing on improving conditions for peasant agricultural production, promote more sustainable and resilient forms of productive management of agroecosystems according to each country's characteristics
   - promote access to land and increase the incomes of peasants and small farmers to reduce pressure on resources and keep people in the countryside;
   - reduce the consumption of energy and materials in the food chain, opting for shorter chains, encouraging fresh and seasonal consumption, reducing packaging, etc
   - adopting a healthy diet with a lower content of meat and dairy products, which reduces the food footprint; and
   - promoting the redistribution of resources on a global scale that mitigates unequal ecological trade-offs.

Moreover, creating an environment that is favorable to these policies is key to making sure these changes can take root. As a result, reducing the socio-environmental impact of conventional agriculture and food by making sure externalities are included in their costs is important.

[50] HLPE, 'Agroecological and Other Innovative Approaches for Sustainable Agriculture and Food Systems That Enhance Food Security and Nutrition' (a report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security) (2019)

[51] M González de Molina et al., *Political Agroecology* (CRC Press 2019)

Theme 3: Energy, Industry and Economy

The journey towards climate neutrality is fraught with significant challenges rooted in unsustainable practices across energy, industry, and economic systems. These core unsustainabilities form critical barriers to a sustainable future and require immediate and coordinated action. Below, we layout some these unsustainable practices within the current system.

Unsustainabilities in Current Systems within Energy, Industry, and Economy and potential way forward

1. Resource Depletion and Planetary Boundaries

Unsustainability: Current systems overlook planetary boundaries in policy making, leading to unsustainable resource depletion[1]. This oversight causes increased demands that outstrip available resources, creating persistent energy imbalances.

Gap: Policies do not account for planetary limits, leading to overconsumption of resources.

Low-Hanging Fruit: Incorporating planetary boundaries into policy frameworks, such as integrating environmental targets into existing regulations.

Strategy Forward:

- Establish policy mandates prioritizing resource efficiency, biodiversity, and waste reduction.
- Introduce impact assessments that consider planetary boundaries for new projects and industrial developments.

2. Population Growth and Technological Advancements

Unsustainability: The global population growth, driven by advancements in healthcare and other technologies, intensifies demands for housing, goods, and services[2]. Meanwhile, industries prioritize production over reuse and recycling, generating vast waste and emphasizing consumption over sustainability.

Gap: Overproduction, combined with inadequate recycling and resource reuse, leads to unsustainable waste generation.

Low-Hanging Fruit: Scaling up recycling initiatives and introducing extended producer responsibility (EPR) programs that require producers to handle the end-of-life of their products.

Strategy Forward:

- Promote EPR schemes that hold producers responsible for recycling or disposal.
- Encourage eco-design principles that reduce waste in production and ensure recyclability.
- Support local circular economies where materials are reused within local production cycles, reducing resource inputs.

3. Economic Paradigms and Global Inequalities

Unsustainability: The entrenched belief that economic growth is essential for prosperity undermines sustainable development efforts[3], particularly in the Global South, where intersecting industries (plastics, fuel, healthcare) exacerbate sustainability challenges.

Gap: The current economic growth paradigm disregards sustainability, perpetuating global inequities.

Low-Hanging Fruit: Encouraging green growth models and non-GDP development goals, which promote sustainable business practices and social equity.

Strategy Forward:

- Shift economic policies towards well-being economies that prioritize human development, resource efficiency, and environmental health.
- Introduce tax incentives for businesses adopting circular economy models.
- Implement green finance initiatives to channel investment into climate-positive industries.

4. Material Availability and Supply Chain Resilience

Unsustainability: The transition to climate neutrality is impeded by material scarcity[4], particularly critical raw materials (CRMs) needed for renewable energy technologies. The fragility of global supply chains further complicates the shift toward sustainable energy systems.

Gap: Material scarcity and inefficient recycling of CRMs obstruct the renewable energy transition.

Low-Hanging Fruit: Promoting alternative materials and improving recycling of CRMs.

Strategy Forward:

- Increase recycling infrastructure for CRMs used in renewable energy technologies (e.g., lithium, cobalt for batteries).
- Invest in research and development of material substitutes that are more abundant and easier to recycle.
- Strengthen international partnerships to ensure sustainable sourcing and recycling of CRMs.

5. Energy Demand and Storage Solutions

Unsustainability: Rising electricity demand, coupled with inadequate energy storage capacity, presents significant challenges. The high costs of developing advanced storage technologies exacerbate the issue[5], emphasizing the need for efficient energy transmission systems.

Gap: Inadequate storage and grid flexibility hinder the growth of renewable energy adoption.

Low-Hanging Fruit: Short-term improvements in energy storage and grid flexibility through investments in existing technologies and smart grids.

Strategy Forward:

- Expand research into emerging energy storage solutions such as flow batteries, hydrogen, and grid-scale storage.
- Implement smart grid technologies for real-time energy distribution adjustments.
- Encourage the development of microgrids and distributed energy resources (DERs) to support local energy resilience.

6. Ensuring a Just Transition and Fair Pricing

Unsustainability: Achieving a just and inclusive energy transition requires addressing social inequalities across regions while pursuing deep emission reductions[6]. Fair and transparent pricing of industrial products and energy is essential to maintain economic and social sustainability during the transition.

Gap: Energy transitions often leave vulnerable populations behind, particularly in regions dependent on fossil fuels.

Low-Hanging Fruit: Implement targeted subsidies and energy access programs for disadvantaged regions to ensure equitable access to renewable energy.

Strategy Forward:

- Design policies that prioritize access to renewable energy infrastructure in marginalized communities.
- Implement subsidies for low-income households to adopt clean energy technologies.
- Develop regional support programs to help communities reliant on fossil fuel industries transition to sustainable economic models.

7. Circular Economy and Carbon Removal

Unsustainability: Transitioning to a circular economy remains a challenge, particularly in industries reliant on finite resources. Moreover, carbon removal technologies are critical for achieving climate neutrality[7] but require further research, development, and integration into industrial processes.

Gap: Current industries struggle to shift to circular models, and carbon removal technologies are still underdeveloped.

Low-Hanging Fruit: Promote cross-sectoral mutual adaptation to enhance material reuse and reduce waste, while advancing research into carbon removal technologies.

Strategy Forward:

- Accelerate the transition to a circular economy by incentivizing industries to adopt material reuse and recycling practices.
- Prioritize research and development in carbon removal technologies and their integration into industrial processes.
- Foster cross-sectoral collaboration to align carbon removal initiatives with industry needs.

8. Stranded Assets and Emerging Technologies

Unsustainability: Traditional industries face the risk of stranded assets as reliance on fossil fuels diminishes[8]. Emerging technologies like hydrogen and general-purpose technologies (GPTs) offer promising solutions but require new business models and societal frameworks.

Gap: Stranded assets in traditional industries create resistance to transitioning to cleaner technologies.

Low-Hanging Fruit: Encourage the development of business models that integrate emerging technologies and promote a transition away from stranded fossil-fuel assets.

Strategy Forward:

- Create incentives for industries to adopt emerging technologies such as hydrogen and GPTs.
- Develop new societal frameworks that encourage the deployment of clean technologies across sectors.
- Implement policies that de-risk investments in clean technologies for traditional industries facing stranded asset risks.

9. Regulatory and Social Barriers

Unsustainability: The path to climate neutrality by 2050 is slowed by inadequate regulatory frameworks, limited public knowledge, and varying levels of public acceptance of clean energy solutions[9].

Gap: Regulatory hurdles and a lack of public engagement impede the transition to renewable energy systems.

Low-Hanging Fruit: Simplifying regulatory processes and increasing public engagement through education and community-led renewable projects.

Strategy Forward:

- Streamline regulatory processes to accelerate the deployment of clean energy technologies.
- Increase public education and awareness on the benefits of renewable energy and energy efficiency.
- Foster community-led renewable projects to encourage local ownership and engagement in the energy transition.

Long-Term Vision: A Holistic Strategy for Climate Neutrality

The strategies outlined above could help provide immediate actions and low-hanging fruits to achieving climate neutrality and system change. However, long-term sustainability requires:

- Redefining economic growth through sustainable development and green metrics.
- Cross-sector collaboration to ensure energy, industry, and economic goals align with planetary boundaries.
- Investing in research and innovation for next-generation clean technologies.
- Prioritizing circular economy principles to reduce waste and material use.
- Ensuring global cooperation to address supply chain fragility and material dependencies.

By combining immediate actions with structural changes, we can drive the transformation toward a sustainable, equitable, and climate-neutral future.

Theme 4: Cities and Infrastructure

Unsustainabilities in current system:

- Heat Stress / Droughts (Also overlapping to Nature, Health, and Water). In large cities the temperature can be up to 3 degrees higher than the rural areas (https://www.epa.gov/heatislands/learn-about-heat-islands). Heat is dangerous for older adults, young children, low-income populations, people with outdoor jobs, people with poor health. Heat in cities also leads to an increased use of airconditioning, which in turn leads to extra heat (AC's produce heat on top of the heat they extract from buildings) and extra greenhouse gas emissions and extra air pollutants. The heat also penetrates and affects aquatic life as the heated runoff water flows into surface water. Nature in cities has an effect on many of these unsustainabilities. Shade created by trees creates a cooling effect, evaporation of water from trees gets rid of heat, trees take up GHG and filter air pollution. The amount of precipitation run off is decreased by vegetation taking up water and evaporating it. Water also infiltrates which reduces the peak stress during (heavy) precipitation. (https://www.rivm.nl/klimaat-en-gezondheid/klimaatadaptatie/groene-adaptatie#:~:text=De%20meest%20effectieve%20strategie%C3%ABn%20om,oppervlakken%3B%20zie%20Stedelijke%20adaptatie).)
- Lack of an efficient recycling & waste collection system in place for waste materials for the circular economy to function better (from Foenix Crafts Center)
- Retrofitting old buildings to shrink energy use (This Dutch construction innovation shows it's possible to quickly retrofit every building – Energiesprong)
- Usage of biodegradable materials for use in making buildings (Circular Reno: Unlocking the potential of biobased insulation in Wallonia – Energiesprong)
- Lack of energy-neutral hospitals (Groene Zorg Alliantie)
- Patient-centric design of hospitals to make sure that it is less stimulating and stressful (Groene Zorg Alliantie)
- Medicine waste disposal & improving waste management from hospitals (Groenezorg Alliantie)

Supplementary file 1: overview of our materials and methods using the COREQ guideline

Topic	Question	Method applied
Domain 1: Research team and reflexivity		
Personal characteristics		
1. Interviewer/Facilitator	Which author/s conducted the interviews?	All authors except for UO and JPR conducted interviews.
2. Credentials	What were the researcher's credentials?	All researchers hold a Master's degree and are in the process of obtaining a PhD.
3. Occupation	What was their occupation at time of the study	All researchers are employed as a PhD candidate.
4. Gender	Were the researchers male, female or other?	Three researchers (MS, RR, UO) are male, Four researchers are female (DGC, JPR, MK, RAS).
5. Experience and Training	What experience or training did the researcher have	RAS: participated in a mixed-methods course by the institute of tropical medicine Antwerp and has experience in qualitative research. Other researchers are quantitative scientists in various fields (Engineering, Geoscience, Law, Veterinary science).
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement	No, due to time constraints.
7. Participant knowledge of the interviewer	What did the participant know about the researcher?	An introductory email or message was sent explaining the background of the researcher and the objective of the project.
8. Interviewer Characteristics	What characteristics were reported about the interviewer?	See response to point 7

Domain 2: Study Design		
Theoretical Framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Sustainable transitions theory was consulted to get a better idea of the context of our study. Subsequently, interviews were analysed thematically, based on emergent themes.
Participant selection		
10. Sampling	How were participants selected?	Purposively based on our discussions and literature research.
11. Method of Approach	How were participants approached?	Most participants were approached via email. If we did not get a response via email we used LinkedIn.
12. Sample size	How many participants were in the study	10
13. Non-participation	How many people refused to participate or dropped out?	None 2 potential participants were excluded because they requested financial compensation, which was not available to us.
Setting		
14. Setting of data collection	Where was the data collected?	Five were conducted through online video- or audio-call. On three occasions we visited the participant at their preferred location.
15. Presence of non-participants	Was anyone else present besides the participant and the researcher(s)?	No
16. Description of sample	What are the important characteristics of the sample? E.g. demographic data, date	See Table 2

Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	A topic guide with prompts was developed (annex 1). Due to time constraints it was not pilot tested.
18. Repeat interviews	Were repeat interviews carried out?	No
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	All interviews were audio recorded. One recording was lost due to technical issues.
20. Field notes	Were field notes made during and/or after the interview?	This differed per researcher. Most researchers made notes during the interview and summarized the interview within a week after the interview was conducted.
21. Duration	What was the duration of the interviews?	The duration varied from 30 minutes to 4 hours. Average length was 60 minutes.
22. Data saturation	Was data saturation discussed?	It was discussed. Due to the broad objective of this study, the different themes involved, and the limited time data saturation was not reached.
23. Transcripts returned	Were the transcripts returned to participants for comments and/or correction?	Due to time constraints not every interview was transcribed, but only summarized. Therefore, transcripts were not returned to participants.

Domain 3: Analysis and findings		
Data analysis		
1. Number of Data coders	How many data coders coded the data	Six
2. Description of the coding tree	Did the authors provide a description of the coding tree?	No
3. Derivation of themes	Were themes identified in advance or derived from the data?	Both. Prior to the interviews, the researchers brainstormed on probable themes, and formed the topic guide accordingly. During the interviews, new themes emerged and were added/our framework was adjusted accordingly.
4. Software	What software, if applicable, was used to manage the data?	Microsoft word
5. Participant checking	Did participants provide feedback on the findings?	No
Reporting		
6. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? E.g. participant number	Yes
7. Data and findings consistent	Was the consistency between the data presented and the findings	Yes
8. Clarity of major themes	Were major themes clearly presented in the findings?	Yes
9. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Yes