RESEARCH PLAN ARCHITECTURAL ENGINEERING GRADUATION

# REVITALISING RURAL HERITAGE

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MSC 3/4 ARCHITECTURAL ENGINEERING

# **RESEARCH** PLAN

## CONTENTS



## CHOICE OF THE STUDIO

Architectural engineering offers a wide range of topics with a focus on sustainable and innovative design. The studio allows you to discover more of your own fascinations. My interest to dive into the technical facets of the design to find innovative solutions on a detailed scale that can result in a more sustainable design on a bigger scale, meets with the focus of the studio.

# GENERAL PROBLEM STATEMENT

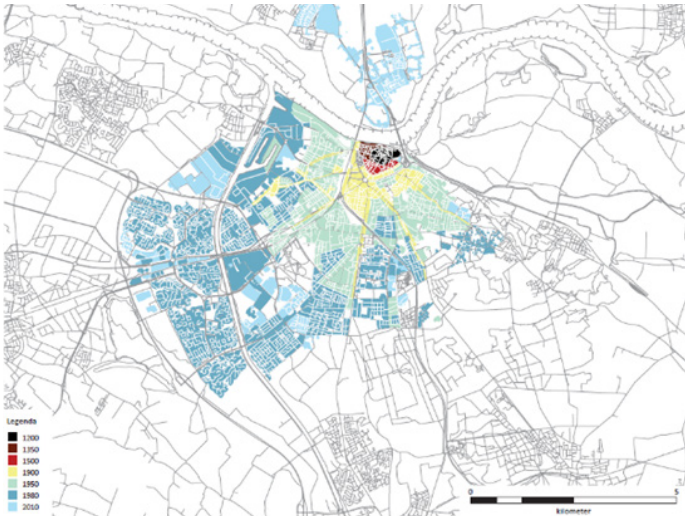
## Shifts in the use of our landscape?

The last few decades people seem to be alienated from the countryside and its purpose. Contrary to what many seem to believe, the countryside is not limited to food production. It also fulfils a wide range of other functions including an ecological function and the identification of cultural heritage typical for a certain region (Andreychouk, 2015, p.18).

From the mid-20th century there has been a trend of urbanisation and a decline in the rural population in the Netherlands, as seen in many developed western countries during the post-World War II period (Bresser-Pereira, 2020, p.4). People were increasingly moving to urban areas for better employment opportunities, education and other amenities (Rutte & Abrahamse, 2014, p.237). Compared to 1990, the number of rural residents in municipalities decreased by 30% in 2001, while the number of urban residents increased by over 40% (CBS, 2001). This trend was driven by various factors, including but not limited to (Ekamper, 2010) (Rutte & Abrahamse, 2014, p.224)(CBS, 2001):

- Industrialisation
- Mechanisation of agriculture
- Urbanisation
- Infrastructure development
- Changing lifestyles
- Real estate development

While these trends have depopulated some rural areas in the Netherlands, they have also brought economic growth, increase of living standards and the development of urban regions due to the so called "Golden Age of Capitalism." This period lasted roughly from the late 1940s to the 1970s.



*City extension Amsterdam, Atlas van de Verstedelijking van Nederland (Rutte & Abrahamse, 2014, p.119)*

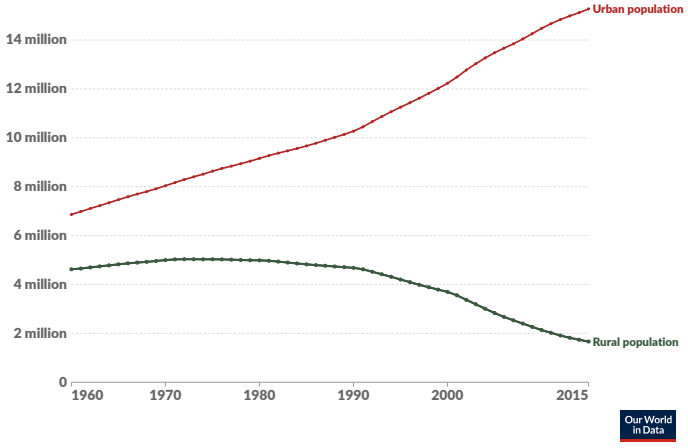
(Bresser-Pereira, 2020, p.4) However, the trend of population growth in urban areas and shrinkage in rural areas continued as more than a third of Dutch municipalities experienced rural population decline between 2001 and 2015 (CBS, 2023).

The last decade there seems to be a counter movement . Efforts to revitalise rural areas and promote sustainable agriculture have been made by the government and various organisations to counteract the negative effects of rural depopulation (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2023)(Possible landscapes, 2023). An environmental research rapport of Wageningen University addresses the negative effects as the loss of cultural heritage, the trend of economic decline and the abandonment of buildings. The loss of cultural heritage describes the typical architecture, craftsmanship and ecological structures of an area. (During et al., 2023)

Additionally, events like COVID-19 and the climate change, resulting in the urban heat island effect, polluted cities, etc., have influenced people's preferences for living in rural areas, as remote work and the desire for more space and a healthy environment became more important considerations for some (Traanman, 2021, p.24) (Farbotko & Kitara, 2021). The migration of urban buyers to rural areas increased from 8 percent in 2009-2011 to 11 percent in 2018-2020. In absolute figures this means a migration of more than 14 thousand people in 2009-2011 and almost 37 thousand people in 2018-2020 (Hans et al., 2022).

The desire to leave city life and return to the countryside or seek a more rural lifestyle is often driven by several factors (Traanman, 2021, p.24) (Hans et al., 2022):

- Quality of Life
- Nature and Environment
- Space and Privacy




*Number of people living in urban and rural areas in the Netherlands, 1960-2015 (Our World Data, 2023)*

- Cost of Living
- Work-Life Balance
- Community and Social Factors
- Health and Well-Being

Governments and urban planners are also increasingly recognizing the importance of providing options for both urban and rural living to accommodate diverse lifestyle preferences (NOS, 2021). This recognition has led to efforts to improve rural infrastructure, support remote work opportunities and promote sustainable rural development to cater to those who want to leave the city and experience rural  living. The Harwoonie project, for example, offers seven residential units that have been placed in a former pigsty through adaptive reuse.

The potential for rural development is a call for architects and engineers to develop innovative ways of working with this valuable land to accommodate the need for rural living.

## KEYWORDS

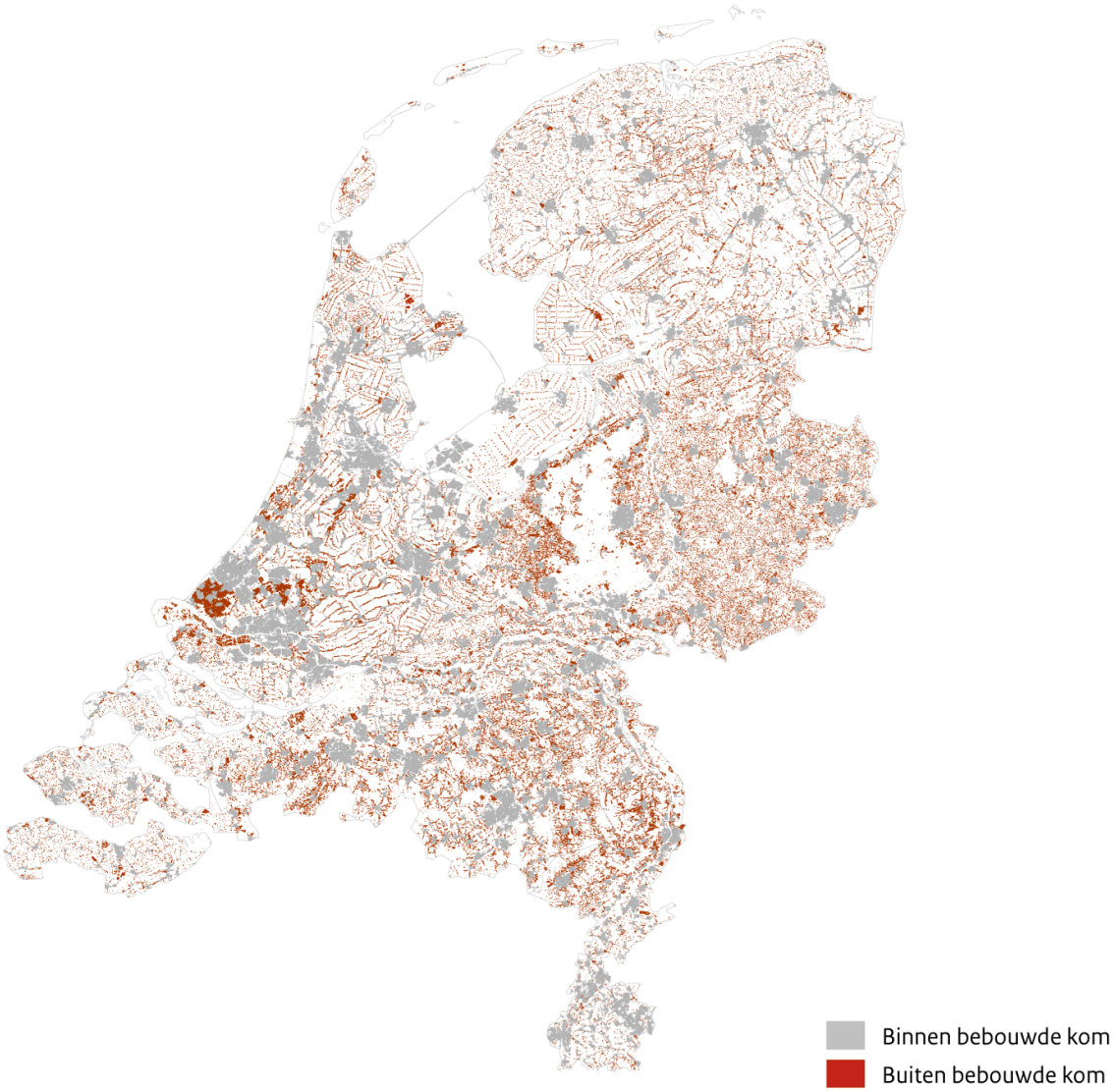
**Rural Heritage**

**Adaptive Re-use**

**Community Engagement**

**Sustainability**

**Biobased Materials**




*The increase of buildings in the rural area in the Netherlandsof visualised. (Compendium voor de Leefomgeving, 2018)*

# OVERALL DESIGN OBJECTIVE

## A reinterpreted country estate

The objective of the graduation project is to develop a methodology for the revitalisation of Dutch country side areas. This will be done by combining literature, anthropological data, case-studies, excessive on-site studies and the design of a transformed country estate and its accessory buildings as a multifunctional, sustainable and community-oriented space that not only preserves cultural heritage but also addresses contemporary needs and ambitions, encouraging a reconnection between urban dwellers and the countryside. Thereby mixing tradition with innovation, reverse trends of abandonment and creating new business opportunities.

This design objective aims to develop a methodology to revitalize and repurpose existing rural structures to serve as viable hubs of activity and centres of cultural significance. By doing so, it seeks to utilize and preserve the historical and ecological value of these structures and areas while aligning with the modern desire for quality of life, creating a connection to nature and encouraging community engagement .

The adapted space should facilitate a range of functions, it being educational purposes, cultural and recreational activities and sustainable agriculture initiatives, promoting a more complete understanding of the countryside's role in contemporary society.

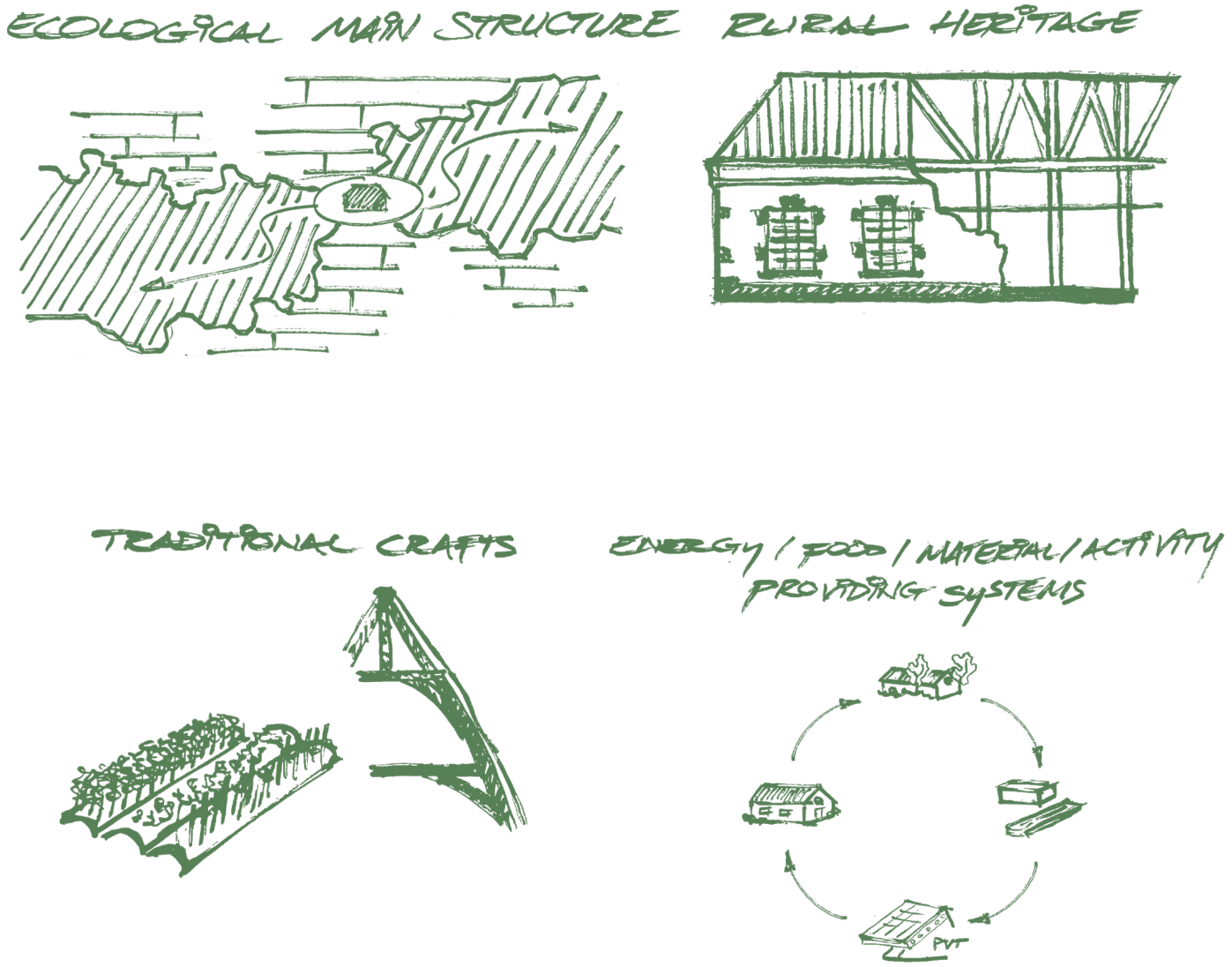
Additionally, it should encourage urban residents to visit and actively engage with the countryside, ultimately contributing to the preservation and appreciation of rural landscapes and heritage.

Furthermore, there will also be a housing function that aims for community-oriented living. This housing can accommodate elderly people or those who are working on returning into society, fostering inclusivity and a sense of belonging within these revitalized rural communities.

The design will focus on a rural area in Limburg, Noord-Brabant or Gelderland and more specifically Berg en Dal, Nijmegen. The exact location will follow from the on-site studies. A location will be determined that fits best with the requirements for a successful project.

The material use of the project will focus on the intersection of high tech and low tech building technologies. The research paper will provide input for the design by diving into the potential of locally sourced building materials, with a particular focus on agriculture as a resource for biobased construction materials. It investigates the possibility of future farmers transitioning from solely food production to also providing sustainable building materials.

*View towards Reichswald (Germany) from intended design location of the abandoned country estate (By author, 2023)*




*Architectural fascinations concerning the overall design objective. (By author, 2023)*

**Mangmi Farm, South Korea, 2023**
Site within a forest with a community facility and a glasshouse along with a campsite. Wooden construction made of birch found around the area. The main exterior materials are designed and selected to resemble the silver bark of birch trees. Owners maintain the forest and grow fruit trees.

**Het Predikheren, Belgium, 2019**
The programming, the spatial design, the technical installations and all structural interventions are intended to preserve and reinforce the characteristics of this 17th century monastery. The building owes its charm to the timeless power of the former monastery enhanced by the smart modern interventions.

*Case studies of rural revitalisation and adaptive re-use.*

## Overall design question

A methdology for the revitalisation of Dutch rural heritage by making a design for the redevelopment of a country estate in Nijmegen through adaptive reuse of rural heritage and the use of innovative contemporary building methods to accommodate a viable, self sufficient, multifunctional, sustainable and community oriented project.

*How can Dutch rural countryside areas be revitalised and transformed into multifunctional, ecological sustainable and community-oriented spaces, while preserving cultural heritage and addressing contemporary challenges?*

## Hypothesis

The revitalisation and transformation of Dutch countryside areas **will effectively result** in multifunctional, ecologically sustainable, and community-oriented spaces, while **usefully** preserving cultural heritage and addressing contemporary challenges through comprehensive planning, sustainable design strategies, and active community involvement. This approach will lead to improved social cohesion, environmental sustainability and a more resilient and vibrant rural landscape.

## Anti-Hypothesis

The revitalisation and transformation of Dutch countryside areas **may not significantly result** in multifunctional, ecologically sustainable, and community-oriented spaces, with **insufficient** preservation of cultural heritage and implementation of contemporary. These limitations could be caused by financial constraints, resistance to change from traditional practices, insufficient community engagement and potential conflicts in land use. As a result, the desired outcomes of such transformation may not be fully realized, and the process may fall short of achieving its intended goals.

*The Nederrijk area, renovation of roof structure of farm on Watermeerwijk estate (By author, 2023)*

# THEMATIC RESEARCH OBJECTIVE

## Farmers of the future

More and more people try to participate in the sustainable transition in the Netherlands, including farmers. Still, there is a need for a drastic change in the way we use our landscape.

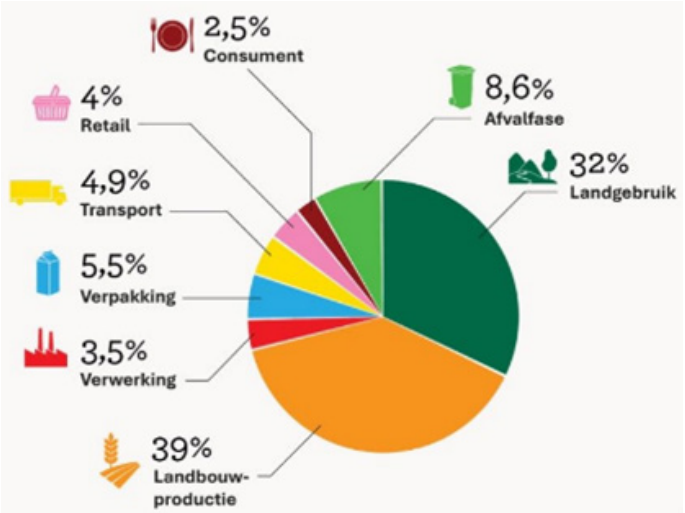
Alongside the post-World War II urbanization trend, this period is also know for a notable trend towards land consolidation, sometimes radically transforming the often small-scale cultivation of the countryside. More efficient larger plots, new straight roads, and newly constructed farms created a rational landscape, aggravated by the disappearance of the old characteristics, such as tree ribbons, dikes and bushes. (Rijksdienst voor het Cultureel Erfgoed, 2022)

The consolidation of land has, together with industrialisation of agriculture, resulted in giant monocultural fields. The consequence: destruction of biodiversity, soil degradation and vulnerability for disease (Bourke et al., 2021). However, solely local and diverse foodscapes aren't necessarily the perfect solution, according to the study of Schmitt et al. (2017). The study essentially concludes that emissions from the agricultural production process are more important factors than transport emissions and therefore local products are not always preferable in terms of the sustainability. For this reason, governmental policy needs to focus on both diversified local agriculture as well as carbon footprint-aware import (Chiffoleau et al., 2015). As a result, agriculture should be organized into local, ecological and diverse systems. This might sound progressive, but it appears to be quite similar to historically traditional agriculture.

A preliminary conclusion is that the farmer is no longer only responsible for our daily food but in the future will also become an important local supplier of raw materials for the built environment (Nieuwe Oogst, 2022). The local cultivation of crops, plants and trees would offer fibres and material that are very useful for the production of constructive (composite) products. The challenge is how to responsibly implement this organic matter in the current farmlands and define its value.

An important part of this value comes from the long term capture and storage of CO2 in the future biobased housing by utilizing these plants. The biobased materials allow for building towards CO2 negative instead of emitting CO2, thereby contributing to more efficient waste flows and recycling chains (Sinka et al., 2018).

The thematic research aims to explore the potential of locally sourced building materials, with a particular focus on agriculture as a resource for biobased construction materials. It investigates the possibility of future farmers transitioning from solely food production to also providing sustainable building materials. Farmers in the Netherlands have gone through several major transitions over the centuries, such as the appearance of mega stables, milking robots and the new nitrogen emissions policies, and now too they pass through major changes to meet our climate goals.




*Share of greenhouse gas emissions in the global food chain. (Crippa et al., 2021)*


*Poster from 1946 by the government to convince farmers of the benefits of land consolidation. (Stadsarchief Rotterdam, 2023)*

The thematic research is linked to the overarching problem statement and design objective outlined in the project. It aligns with the goal of revitalizing the Dutch countryside by redefining the role and function of rural areas beyond traditional food production. By exploring the use of locally sourced building materials, the research expands agriculture's role, addressing a multifunctional approach and reversing trends of rural abandonment by creating new business opportunities. Additionally, the thematic research aligns with the sustainability aspect highlighted in the design objective by addressing questions related to energy management and waste flows.

## Thematic Research Questions

*To what extent can the cultivated growth of crops and other plant varieties be utilized as a viable source of biobased building materials and what are the implications for the prospective role of agriculture contributing to sustainable construction practices?*

## Hypothesis

The hypothesis for the research is that controlled cultivation of crops and plant varieties holds the potential for the utilization of biobased building materials in innovative and sustainable architectural design projects, thereby promoting a climate conscious construction industry.

## Anti hypothesis

The anti-hypothesis states that controlled cultivation of crops and plant varieties may not substantially contribute to possibility to utilize biobased building materials in innovative and sustainable architectural design projects, thus potentially having limited impact on promoting a climate-conscious construction industry.

## Sub questions

*1. What are the specific types of crops, plants and trees that can be effectively cultivated for biobased building materials looking on the design location?*

*2. How does the cultivation of these crops, plants and trees for biobased materials impact traditional food production on farms?*

*3. What is the process of extracting and processing biobased materials from crops, plants and trees?*

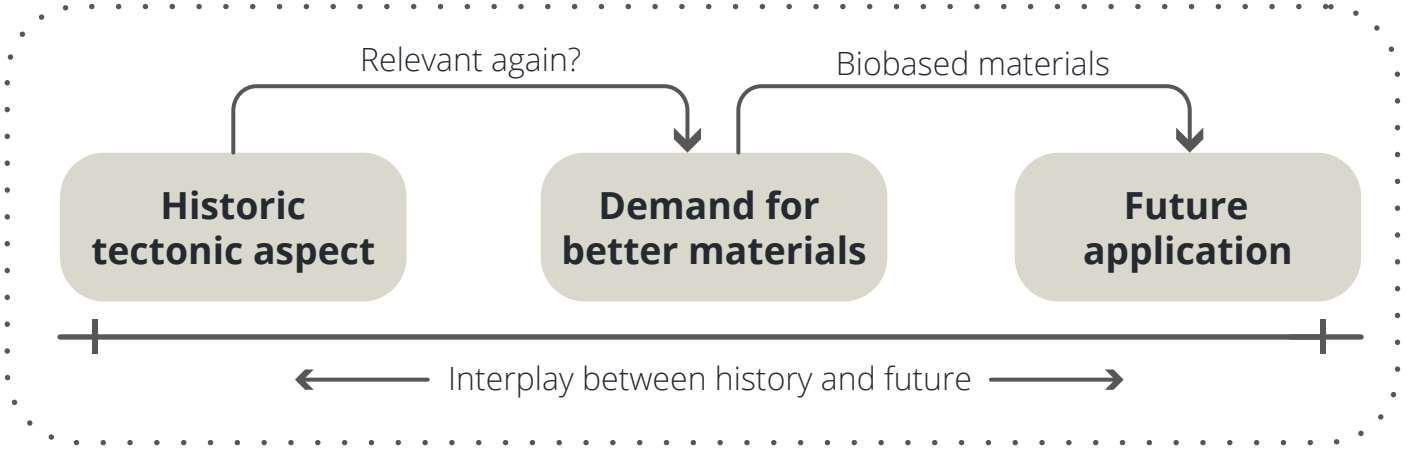
*4. What kind of product would be the result of the processed cultivated crops, plants and trees?*

*5. What are the economic and environmental benefits of using locally sourced biobased materials in construction compared to traditional building materials?*

*6. What are the challenges and opportunities for scaling up the production of biobased building materials in the Netherlands, and what infrastructure changes may be needed?*

*7. What are the preferences and perceptions of consumers, farmers and the construction industry regarding biobased materials in building projects?*

*8. What case studies can be considered as models for the sustainable transition of agriculture into the biobased construction materials sector in the Netherlands?*




*Scheme of the elboration of sub question 2, that can help the design project by looking at possibly usable historical agricultural tectonics. (By author, 2023)*

# THEMATIC RESEARCH METHODOLOGY

## An atlas full of options

To comprehensively address the main thematic research question, a multifaceted approach using various research methods and techniques is proposed.

A literature study will provide a strong theoretical foundation by examining existing research and historical contexts related to agricultural transitions and the use of biobased materials in sustainable construction practices. Qualitative case-study analyses will be essential to delve into specific Dutch farms that have successfully transitioned to producing biobased building materials. Interviews with farmers, architects, construction professionals and policymakers will further enrich the understanding of the potential of biobased materials and the obstacles they face in practice. This will result in insights into their experiences, challenges, and economic outcomes.

If possible, quantitative field trials and experiments will be executed to assess the availability and yield of crops and plant varieties used for biobased materials, providing an understanding of the possibilities on the design location.

An environmental impact assessment, combining quantitative and qualitative data, will help to understand the ecological effects of using biobased materials, including carbon capture. Research by design in combination with a stakeholder analysis will investigate the possibility to cooperate with farmers and entrepreneurs to develop a closed chain of the cultivation, production and distribution of new biobased building materials, collecting qualitative and quantitative insights.

Lastly, to combine all information, a concluding design atlas shows the performance of different locally sourced biobased materials against each other and against traditional construction materials, highlighting the products most suitable to use in the design project, regarding building physics.

*Vision for the development of clay soils in Zuid-Holland into fields that produce crops for the production of locally sourced biobased materials. (BOOM! Landscape, 2020)*

*Harvesting grass for the production of biobased insulation material. (Bell, 2018)*

# EXPECTED RESULTS OF THEMATIC RESEARCH + DESIGN IMPLEMENTATION

## A reinterpreted country estate

The expected outcomes and deliverables of the thematic research will serve as important resources for informing and shaping the overall design approach of the countryside revitalisation project. These outcomes will not only guide the design process but also provide solutions and insights to address contemporary needs and challenges.

The outcome of the thematic research will be substantiated by achieving key performance indicators (KPIs) from the researched plants, crops and trees. By doing so, an uniform concluding atlas shows the usability of each individual product. The KPI's will be related to energy cost, recyclability, ease of production and constructive application. However, these KPI's can change, depending on the preliminary research. These KPIs will provide measurable benchmarks for evaluating the effectiveness of the proposed solutions.

Overall, the knowledge and insights gained from the thematic research will be integrated into the overall design approach, ensuring that the project is not only culturally and socially responsive but is also technically and environmentally sound. The research outcomes will be instrumental in guiding the project towards its objectives.

*Visual translation of locally sourced biobased materials atlas. (By author, 2023)*

*The Nederrijk area, meadows divided with authentic hedgerows.(By author, 2023)*

# REFLECTION ON THE RELEVANCE

## Topical perspectives

The design objective has significant relevance and value from both a societal and user point of view.

The project emphasizes the preservation of cultural heritage, which is important for maintaining a sense of identity and continuity within Dutch society. It contributes to the conservation of historical structures, craftsmanship and ecological structures that define the country's rural character.

The project supports economic, environmental and social sustainability in rural areas. By tackling contemporary problems concerning rural vacancy and the need for more sustainable construction, the transformation of rural heritage contributes to society. The project hits the mark by giving a solution to these problems, thereby creating a bridge between both topics. Sustainable construction and the vacancy of rural heritage meet each other in the overall societal goal to strive for a better built environment.

The focus on community-oriented spaces promotes social cohesion and community building. It encourages interaction between urban and rural populations, accommodating a more mutual understanding and collaboration.

Looking from a more individually orientated perspective, the design objective addresses the contemporary need for an improved quality of life. It offers users, under which urban dwellers, residents and recreational visitors, an opportunity to experience the countryside's benefits, such as clean air, green spaces and a slower pace of life, whilst also promoting a more sustainable building industry. On the other hand, the project is valuable for the rural communities as it can lead to economic and cultural opportunities, such as tourism, cultural activities and local agriculture initiatives.

*The Nederrijk area, tree-lined avenue near historic farm-country estate (1652) with a camping. (By author, 2023)*

# **RESEARCH** PLAN

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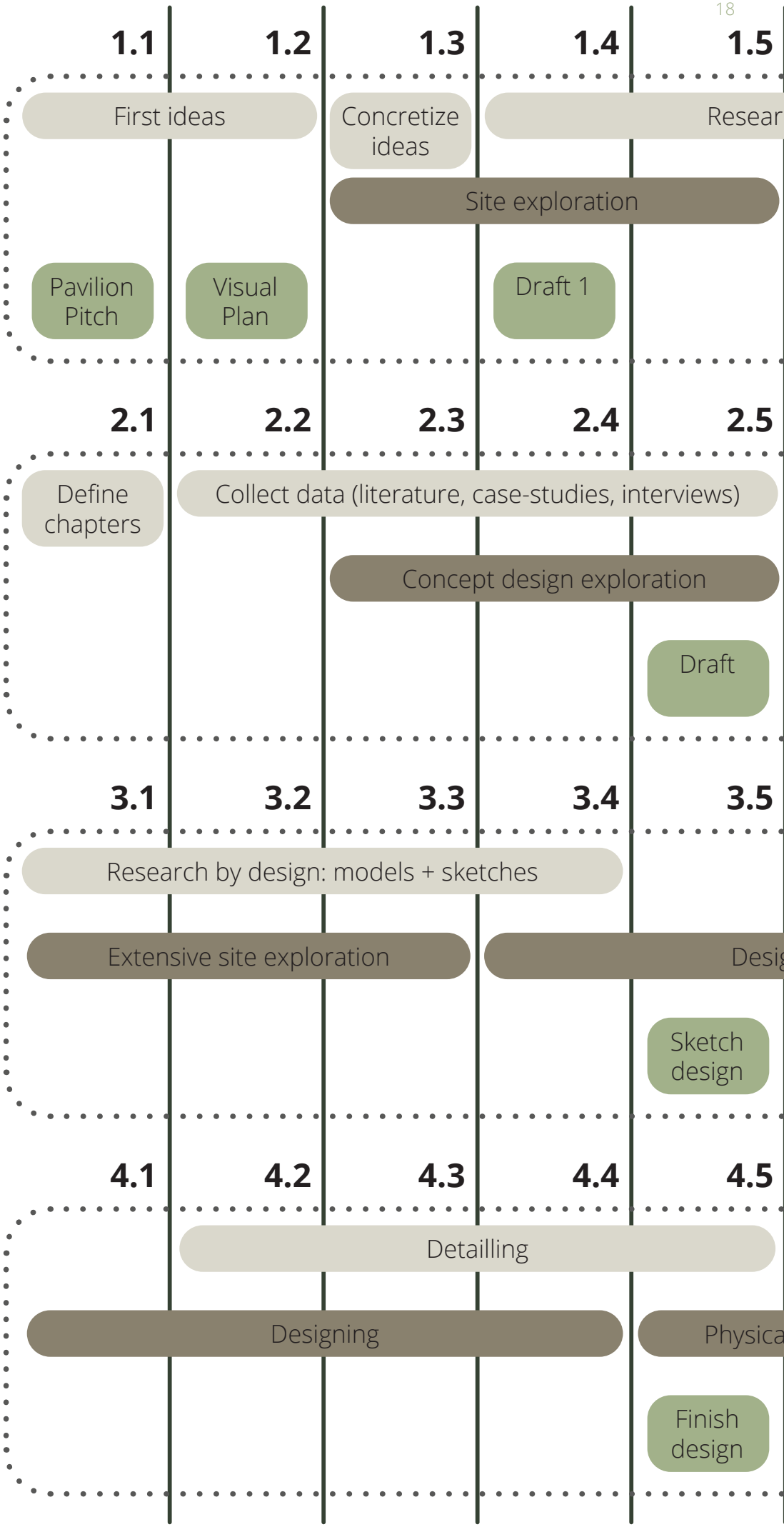
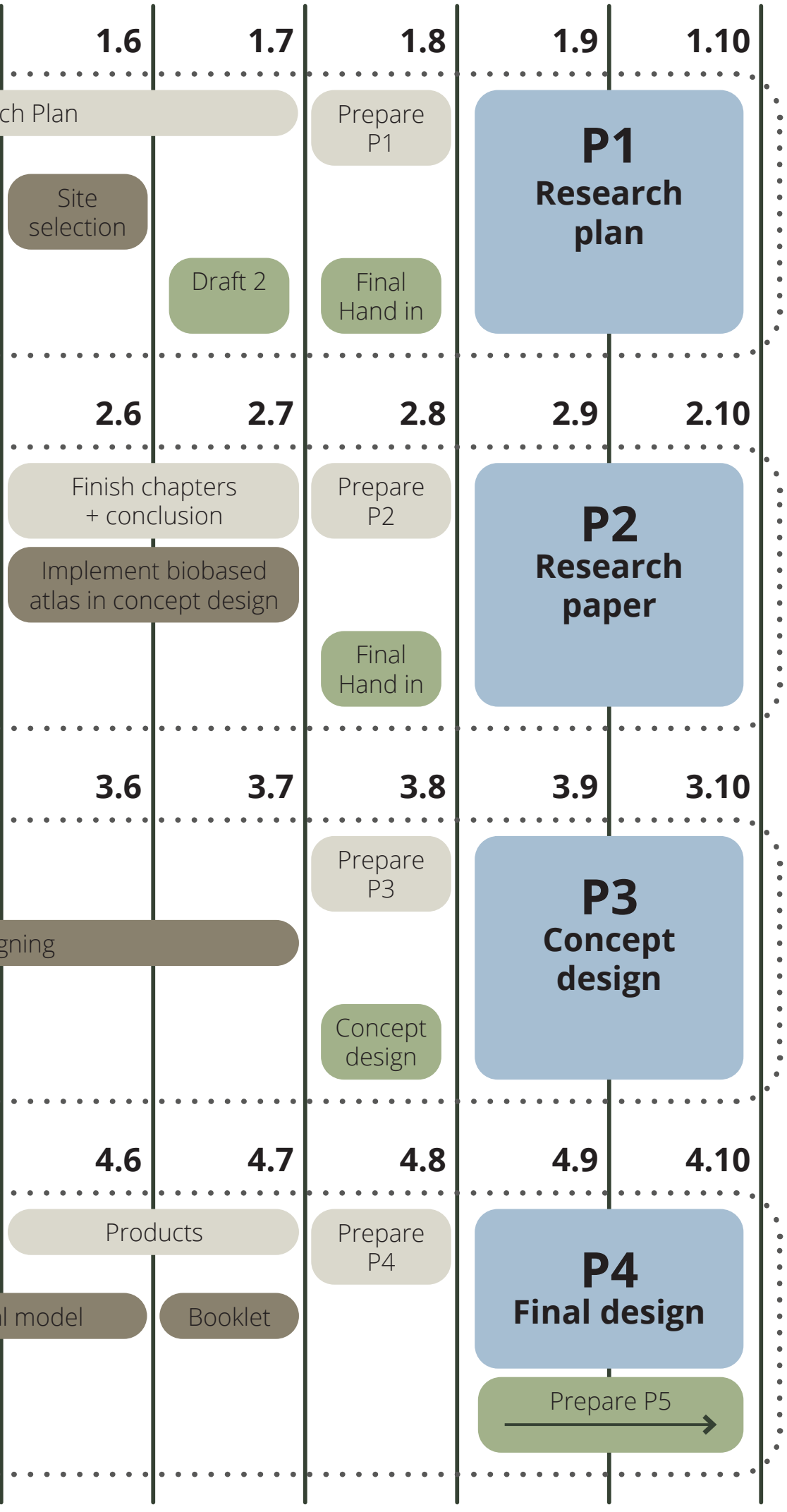
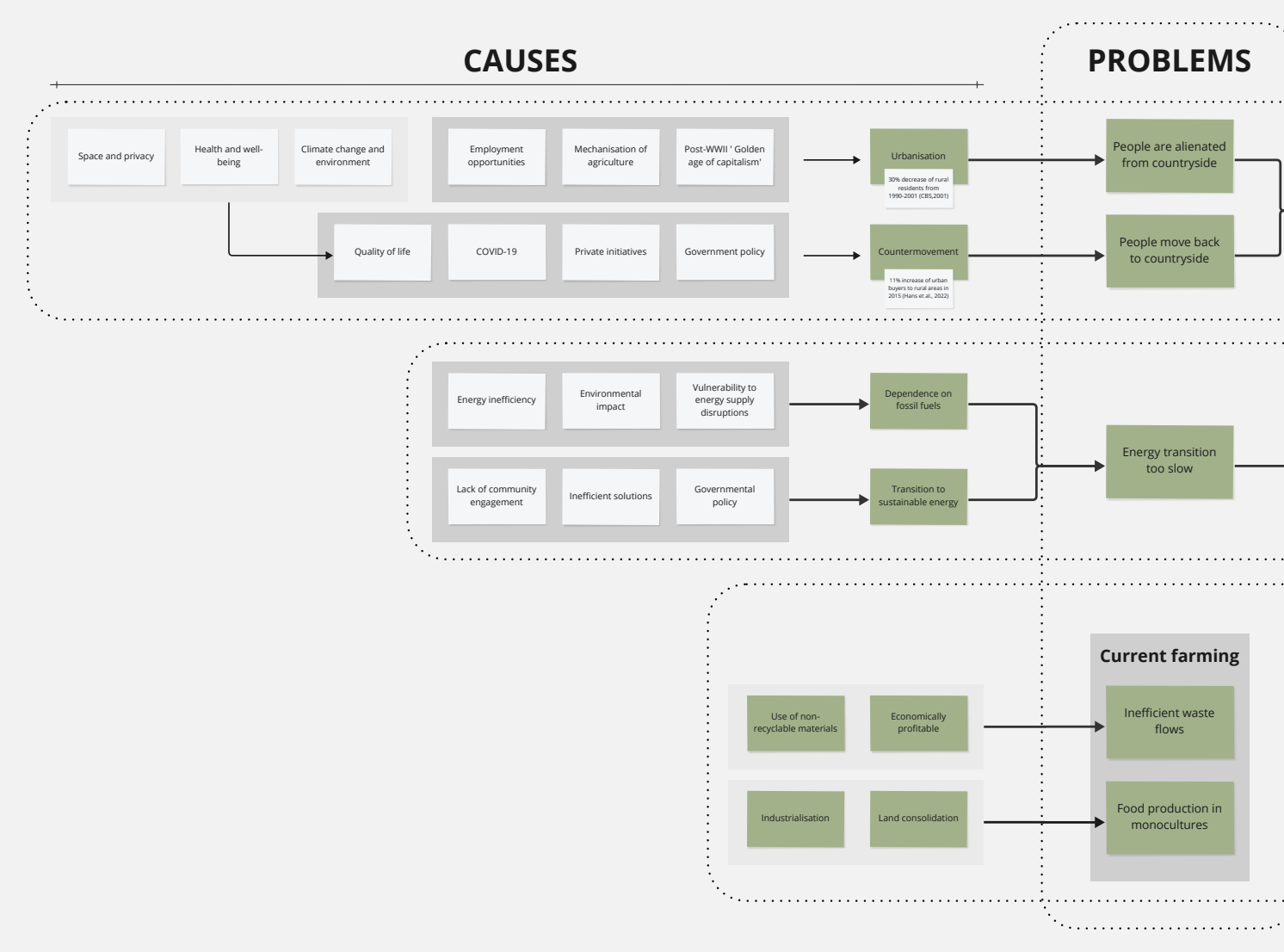
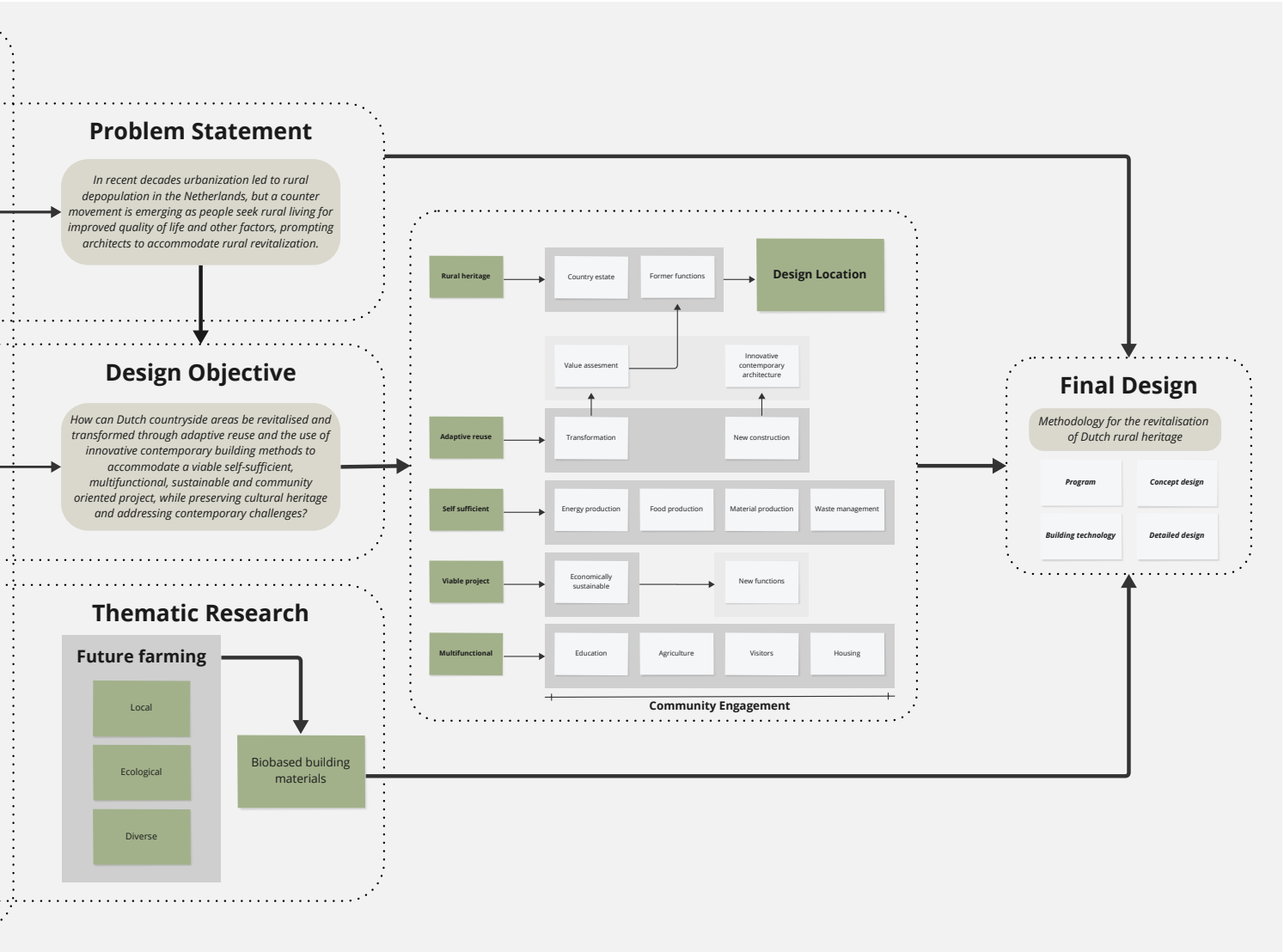
# APPENDIX A: PLANNING




1.6
1.7
1.8
1.9
1.10
ch Plan
Prepare P1
P1 Research plan
Site selection
Draft 2
Final Hand in
2.6
2.7
2.8
2.9
2.10
Finish chapters + conclusion
Prepare P2
P2 Research paper
Implement biobased atlas in concept design
Final Hand in
3.6
3.7
3.8
3.9
3.10
Prepare P3
P3 Concept design
gning
Concept design
4.6
4.7
4.8
4.9
4.10
Products
Prepare P4
P4 Final design
l model
Booklet
Prepare P5

# APPENDIX B: CONCEPTUAL FRAMEWORK




Problem Statement
In recent decades urbanization led to rural depopulation in the Netherlands, but a counter movement is emerging as people seek rural living for improved quality of life and other factors, prompting architects to accommodate rural revitalization.
Design Objective
How can Dutch countryside areas be revitalised and transformed through adaptive reuse and the use of innovative contemporary building methods to accommodate a viable self-sufficient, multifunctional, sustainable and community oriented project, while preserving cultural heritage and addressing contemporary challenges?
Thematic Research
Future farming
Local
Ecological
Diverse
Biobased building materials
Rural heritage
Country estate
Former functions
Design Location
Value assesment
Innovative contemporary architecture
Adaptive reuse
Transformation
New construction
Self sufficient
Energy production
Food production
Material production
Waste management
Viable project
Economically sustainable
New functions
Multifunctional
Education
Agriculture
Visitors
Housing
Community Engagement
Final Design
Methodology for the revitalisation of Dutch rural heritage
Program
Concept design
Building technology
Detailed design

**AR3AE100**
**Graduation studio**
**Architectural Engineering**

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BK Bouwkunde

MSC 3/4 ARCHITECTURAL ENGINEERING