GROW. FEED. EDUCATE
Sustainable farm growing naturally in time
Introduction

The present paper is my reflection on my Master graduation project within the Explore Lab studio at the Faculty of Architecture and the Built Environment of TU Delft.

For this project I have set out to design a sustainable redevelopment strategy for the farm in Cojasca, Romania, a small village about 40km away from the capital of Bucharest. This farm is one of the many abandoned former Romanian collective farms in the country, part of a large project of the communist regime of the time to collectivize agricultural land and stock in order to increase production. After the fall of the communist regime, due to many problems, these farm have remained mostly abandoned, while the interest for agriculture in the country is growing. The farm in Cojasca is merely an example of how such a facility can be adapted to present conditions and many farms of this typology could be updated according to this example, all throughout Romania. I saw a great potential in this farm, given its location in the proximity of the capital, the existence of many barns and sheds on site, which can either be restored or their material can be reused for new constructions and the opportunity it represents for the growth and revitalisation or the rural life and its activities.

My aim for this project was to design a sustainable and energy efficient farm, which has low energy consumption levels and low-impact on the environment. This meant being concerned with both phases of the project, the construction phase and the use phase. In order to find out more about how I can do that, I have set out to research the theme of low-impact materials and how can they be used in the development of such a project. This led to a series of findings which have been applied in the design process. In the following pages I will explain in more details the process I underwent in this graduation project to create a new design for the farm in the village of Cojasca, Southern Romania.
The research and its relationship with the design

My research question was “How can a former Romanian collective farm be redeveloped using low-impact materials to upgrade its energy performance?”. I must state from the beginning that the research phase and theme have been one of the most pleasant, helpful and informative aspects of my graduation project. During this process, I have researched three main aspects which were of great importance for my graduation project: the historical context of collectivization of agriculture in Romania, the vernacular architecture in the South of Romania, focusing on construction techniques and used materials and the third one, the aspect of low-impact constructions and energy efficiency.

The approach to this research theme was to investigate in what way does the concept of sustainability translate to my project. I have identified that sustainability can be interpreted in two different ways, as durability and as energy efficiency. The two phases which influence the energy usage of buildings are the construction phase and the operational phase.

The operational phase comprises the energy consumed by the users of the building. Most of the sustainable measures to achieve energy efficiency can be applied in the design of the building and aim at limiting the energy used in this phase: sufficient insulation, airtightness, natural ventilation, use of thermal mass, building orientation, alternative and renewable energy sources. The principle of Passive house is a perfect example of how a building can achieve low levels of energy usage.

The phase I have studied in depth in my research was the construction phase, where the embodied energy of materials is the determining factor which influences the amount of energy a building requires to be constructed and maintained. A way of achieving energy efficiency in this phase is by reducing the amount of embodied energy of the materials, which also reduces the damage and the carbon footprint of the construction. This can be done through using low-impact materials, which have one or more of the following characteristics: they are locally available, renewable, natural, biodegradable or have low embodied energy level. With the data I had found out from the chapter on vernacular architecture and further research, I have composed a list of 10 low-impact materials, which I have studied in detail. These materials have then been compared to traditional building materials on a series of criteria, such as: embodied energy, availability, renewability, insulation value, thermal mass effectiveness, lifespan, etc.
From this comparison I was able to draw conclusions regarding the use of low-impact materials in relation to the energy efficiency of a building. It shows that by using low impact materials, the embodied energy of a building can be reduced with at least half compared to traditional building materials. Furthermore, I have compared the materials according to the building part in which they can be used. This has led to proving that each building element (walls, floors, roof, etc) can be built using low-impact materials, as I have identified 3 categories of materials, from self-supportive to insulating ones. The last step of the research was to provide a series of strategies of using combinations of these materials according to a criteria I was interested in, such as: lowest level of embodied energy, highest level of thermal performance, lowest level of maintenance required or most biodegradable solution.

**Construction phase**

**LOWEST LEVEL OF EMBODIED ENERGY**

- **Foundation:** Rubble gabions (rubble trench foundation)
- **Structure:** Timber frame (softwood - oak)
- **Walls:** Hempcrete (cast in-situ) + earth plaster
- **Roof:** Reed (thatched roof)
- **Floors:** Earth (rammed) + straw insulation

**Operational phase**

**HIGHEST LEVEL OF THERMAL PERFORMANCE**

(thermal resistivity + thermal mass)

- **Foundation:** Rubble gabions (rubble trench foundation)
- **Structure:** Timber frame (softwood - oak)
- **Walls:** Earth (rammed) + earth plaster + hemp/ flax insulation
- **Roof:** Reed (thatched roof)
- **Floors:** Earth (rammed) + hemp/ flax insulation

My research had 3 scales of investigation: the general scale (the chapters on low-impact construction), a part which can be consulted and used by any other person interested in finding out in depth information about, the scale of context analysis (the chapters on collectivization of agriculture and vernacular architecture in the South of Romania) which have served as analysis of the context of my project and the
scale of the scenarios of redevelopment using low-impact materials, a scale which is focused on my project in particular and what I want to achieve in it.

For me, the research has become what we could call a “toolbox” for my design phase, as it has provided me with several strategies which could be applied in the design process in order to achieve a sustainable project. I can state that my interest for a sustainable redevelopment of the farm has been a driving factor of this project, as the majority of my decisions have been made in this direction. The design phase has started taking shape around the principles of circular economy, applied to agriculture. This led me to investigate design principles such as Cradle2Cradle, self-sufficiency and organic farming. On the scale of the masterplan, the principles of permaculture have been applied, which is the development of agricultural ecosystems intended to be sustainable and self-sufficient. On the scale of the building, the principle of Passive house has been the driving factor. This is where it all came together. The passive house design, permaculture and low-impact construction all have a common aim - they aim for a sustainable approach to designing, to minimise and reduce waste, carbon footprints and damage to the environment, to achieve energy efficiency and rely on renewable energy and materials and all this in order to create durable and healthy living environments. A farm is a living organism, close to nature and in relationship with it and I believe its activities and construction should reflect this attitude. This is why my research paper has been such an valuable lesson and has provided me with the necessary knowledge to create this project.

Looking back on this process, I am first of all very grateful to have had the opportunity to gain all this knowledge and apply it in a design project. Second of all, there are a few aspects I would have treated differently. During the period of time that I was involved in my research, I had become so fascinated by it, that I didn’t give enough attention to the design process, meaning that I consider that I only started designing after I have completed my research. I found it a bit difficult to combine the two different activities, the investigations, reading and writing a paper, with the creative process of sketching and designing. Later on in the graduation project, this gave me the feeling that I had produced a very informative and interesting research paper, while being slightly behind on my design process.

At the moment, I consider my research paper one of my most important steps in this project, as it has helped me to decide about the the strategy and phasing of the project, the construction techniques and the detailing of the building. The answer to my research question was not given is a sentence, a paragraph or another form of text, but in scenarios and calculations, which were later on applied in the design of the building.
The project and the wider social context

The motivation behind starting this project was first of all my personal fascination with these sites of former collective farms. Coming from a Heritage&Architecture background, the idea of working with existing situation and buildings was very interesting. Second of all, as a Romanian myself, I am familiar with the current situation of these former farms. On the one hand, the farms have been abandoned after the fall of the communist regime, the constructions on site are in different states of decay and on the other hand there is great interest in internal and foreign investment in the agricultural field overall around the country. Furthermore, the rural areas are confronted with high levels of migration, due to the lack of economic activity, the poor qualification or training of the villagers, all this leading to an overall loss of identity of these areas. Even though there are obvious weaknesses and threats to the project, I saw these as opportunities for development, as problems which can be used to improve to rural life.

There are multiple aspects in which my graduation project can impact the wider social context. First of all, this site is not a singular one, but it is a typology, as former collective farms are spread all around Romania, with almost every village hosting a similar settlement. Therefore, my intention was to design a project which can serve as an example to future redevelopments around the country, with variables which can be adapted to the specific situation of each and every single place. Firstly, this can be seen in my project in what regards the attitude towards the building techniques. As I have mentioned, many buildings on site are in an advanced state of decay, while some of them are almost functional, if some improvements are made to them. There are 3 types of approaches to the buildings: some are demolished and the material obtained from them is sorted for reuse, some are refurbished and some are new buildings.

Building materials on site (to be demolished buildings)
In the construction of the last 2 types, materials can be reused from the demolished buildings. The new materials are locally sourced and are inspired by vernacular architecture, specific to the area or are low-impact materials. In this way, the buildings will match the architecture of the area, while a Cradle2Cradle approach is being used, meaning that some materials are recycled, some are biodegradable, some locally sourced, eliminating therefore large amounts of energy spent on transport, etc. This approach anchors the project in the site, while having the minimum impact on the environment.

Secondly is the community aspect and what can this project mean for the village of Cojasca and, by extrapolation, to other villages of Romania. The area around the village of Cojasca has agriculture as the main economic activity, with large arable surfaces and high agricultural potential. Its proximity to the capital makes is a great advantage. However, there is a high academic drop-out rate, resulting in poorly qualified/ trained individuals. A poorly performant agriculture and the lack of work places has led to high levels of migration towards urban areas. In the long run, this leads to the loss of identity of the area. The redevelopment of the farm can fight back these aspects, by creating work places, by offering specialized agricultural education on site and by attracting tourists to the area. The farm has been designed in such a way that it will have as main function the production of goat dairy and products and agricultural crops. Moreover, new functions were added, such as a shop, an education facility, a restaurant and accommodation. Moreover, workshops will be held in order to teach visitors about the production processes of dairy, fruits, vegetables, etc. All these aspects aim to revitalise and improve the rural life, its activities and economy.
Last but not least, the farm has been designed according to the principles of permaculture, a development of agricultural ecosystems intended to be sustainable and self-sufficient. This is a conciously designed landscape which mimics the patterns and relationships found in nature. It involves zoning a land from the most intensively accessed facilities in the middle to the wildest and least maintained ecosystems in the borders. While the central zones are used for constructions and agricultural activity, the border areas are intended to be left as wild as possible in order to maintain a natural ecosystem. One of the border areas is intended for timber production, meaning that the timber resources which will be used during the construction of the buildings on site, will be replaced by the ones which will grow over time on site. The farm aims to be a sustainable development, meaning that the impact on the environment should be kept to a minimum.

Zoning principle of permaculture and application on the site of the farm in Cojasca
Conclusions

The aim of my graduation project was to create a sustainable redevelopment strategy for integrating a former collective Romanian farm into the modern society and its current needs.

My planning in main lines went through the following subjects: context analysis, research, site analysis, design. The lines between these subjects have been blurred throughout the process, as no subject can be regarded separately from the others. The themes of redevelopment and sustainability have been driving factors of the process and they have each produced questions and answers for each other. The research driven design approach was a very helpful one for me, as it has both helped me shape the direction of my design project and it provided valuable knowledge to be applied in it. My approach has led me to learn a great deal about subjects that I knew rather little about, such as low-impact materials, vernacular architecture in Romania or permaculture and to deepen my knowledge about themes such as Passive design or Cradle2Cradle. This has meant being able to make informed decisions in my design process and I can say I am pleased with how this approach worked and what I have managed to achieve in my graduation project.