

# Graduation plan

## Personal information

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## Studio

Architectural Engineering / Harvest

Main mentor: Mo Smit (Architectural Engineering)

Research Tutor: Eric van den Ham ( Architectural Engineering + Technology - Section Climate Design)

Second mentor: Paddy Tomesen (Architectural Engineering)

Argumentation of choice of the studio

My choice for architectural engineering for my graduation project was motivated by my interest in the environmental and social impact of architecture. The studio offers the possibility to delve into technical solutions which could have a positive environmental and social impact.

## Graduation project

Almeria, a temporary stop on the way for many migrants

## Goal

Location: Almería, Spain

## Design project main problem

*Migrant workers of the agriculture sector living in informal settlements in the province of Almeria.*

In 1963, the Spanish Ministry of Colonisation carried out the construction of the first greenhouse with plastic cover in Campo de Dalías in the province of Almeria (Díaz & Francisco, 2010). The project aimed to study the possibility of developing the agricultural sector in an unpopulated territory that subsisted on the cultivation of grapes for consumption and almonds. The pilot greenhouse tested the productivity of growing vegetables under plastic with open-air plantations and revealed a higher production rate and a shortening of the production process. The early harvesting of the crops made Almeria's vegetables highly competitive on the national and international market. The development of intensive agricultural activity in greenhouses in a territory with an arid and desert climate was possible due to the existence of underground aquifers in the coastal areas of Almería.

The sector experienced a frenetic expansion at the end of the 1960s and the beginning of the

1970s, which is continued at present. The province of Almeria currently has 31,000 hectares of greenhouse surface area distributed among the municipalities of Campo de Dalías, El Ejido, Roquetas del Mar, Campo de Níjar and others.

Due to the high concentration of greenhouses, these territories are referred to as the “sea of plastic”. The development of the agriculture sector increased the demand for workers in the early 70s and towns with greenhouses experienced an increase in national immigration, mainly migrants from the neighbouring province of Granada (Díaz & Francisco, 2010). At the beginning of the 90s, due to the incessant evolution of agricultural exploitations, the sector began to demand foreign labour due to the lack of national workers. Since then, the province of Almeria has experienced a constant flow of immigration, mainly from Africa and Eastern Europe (Díaz & Francisco, 2010). Consequently, the population in areas with intensive agriculture in greenhouses has multiplied due to the influx of migrants in search of employment.

Since the beginning of labour immigration in Almería, the supply of housing in areas with intensive agriculture is insufficient and in many cases economically inaccessible. This problem is evidenced by the establishment of informal settlements in geographic areas with intensive agriculture. In many cases, migrants are living in shacks, abandoned structures and shantytowns. Migrants live under inhuman conditions with limited access to sanitation, water and electricity.



Informal settlement in Níjar (Almeria)

Regarding the demographic characteristics of the migrants who live in substandard housing, most of them come from Africa, with the majority being Moroccans, followed by Senegalese and Malians. In the municipality of Níjar, which concentrates around 18.5% of the greenhouse area in Almeria, the majority of migrants are men who migrate alone and around 25% live with their families in settlements (Ayuntamiento de Níjar, 2017). Most migrants arrive in Spain irregularly following migration routes from the African continent to the Spanish coast (UNHCR/UNHCR, 2019).

### **Specific research problem**

In the province of Almeria (Spain), the lack of passive adaptation of housing to the local climate translates in high dependance on mechanical installations to achieve comfortable interior climates. To cope with the cold and warm temperatures, mechanical installations such as air conditioners are often implemented to acclimatise indoor spaces to comfortable levels, while promoting energy consumption. The energy need of dwellings translates into high costs for the inhabitants. In the case of social groups with low incomes or unemployed, energy costs can be unaffordable. Around 15% of the Spanish population suffers currently from energy poverty (Tirado Herrero et al., 2020). In Andalusia, for 18% of the population, energy costs are disproportionately high in relation to their income, 12% of the population consumes less energy than necessary and 12% live in dwellings with indoor temperatures unsuitable for human health (Tirado Herrero et al., 2020). The high levels of residential energy consumption in Andalusia are also responsible for a significant part of the total CO2 emissions, promoting the greenhouse effect that drives climate change (Junta de Andalucía & Unión Europea, 2021). Worldwide, the construction sector, due to energy consumption and industrial processes, is responsible for 40% of the total CO2 emissions generated (Ménard & Souviron, 2020).

This thematic research paper is part of the development of an architectural design proposal for a graduation studio project of architecture. The proposed project consists of the design of housing for migrant workers attracted by the agricultural sector of the province of Almeria. Migrant workers in Almeria, particularly African migrants, are a social group suffering and at risk of energy poverty due to their low purchasing power and high levels of unemployment.

This research seeks to nourish the architectural project with low tech strategies for the passive design of housing on the following levels: spatial distribution of the architectural volumes and the inbetween spaces, morphological characteristics of the volumes and materialisation.

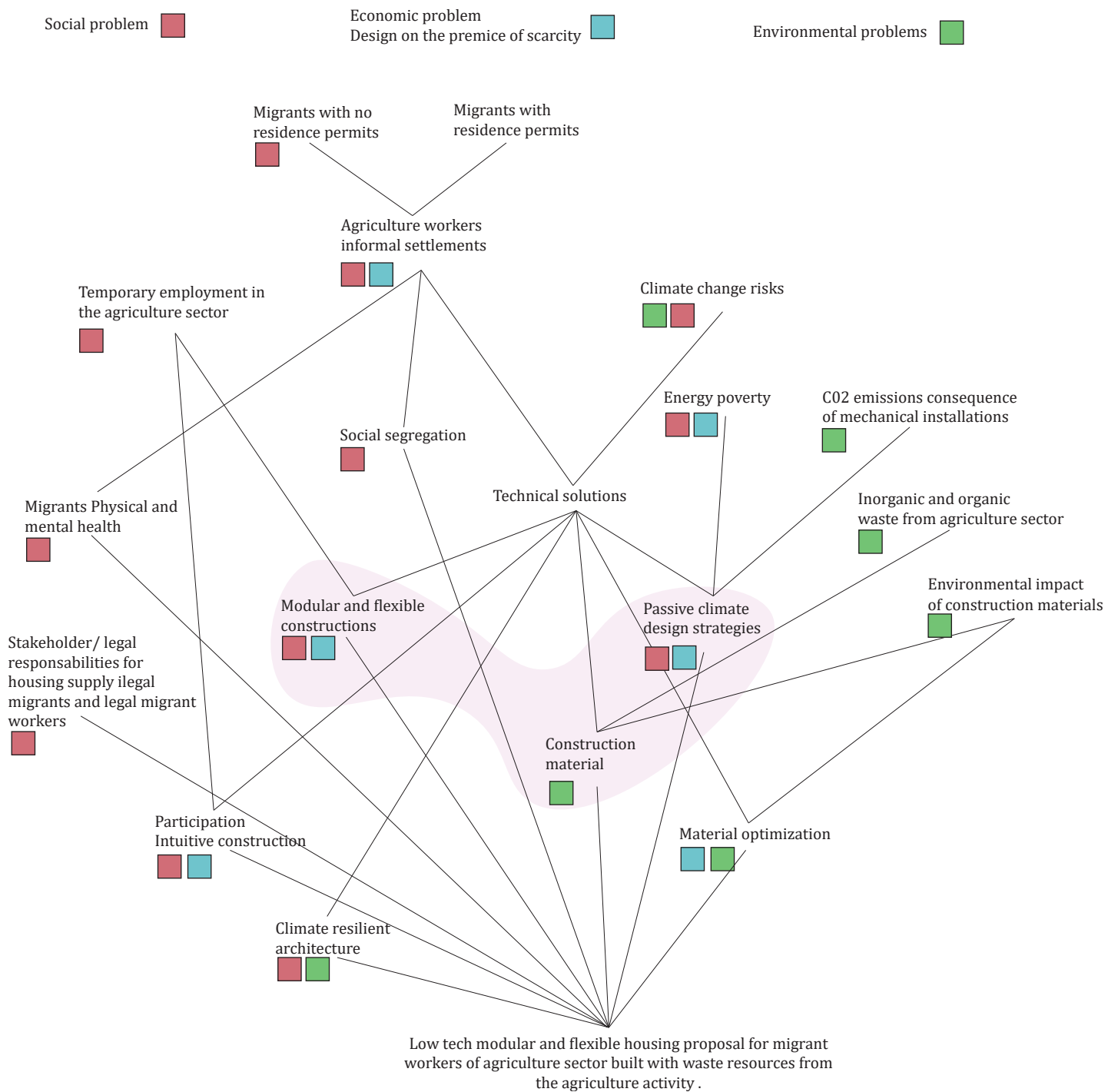
With this objective in mind, the following question is formulated: ***How could low-tech passive urban and housing design achieve comfortable exterior and indoor climates in the arid hot desert climate of Almeria?*** To answer the main question, the following sub-questions are defined:

- What are the climate characteristics of the region of Almeria, Spain?
- What are the desirable climatic conditions for housing interiors?
- What lessons can be learned from passive climate design of vernacular architecture in the region of Almeria, Spain?
- Which passive climate design strategies could achieve a comfortable interior climate in the region of Almeria?

## **Design assignment**

Design of a housing alternative for migrant workers of the agriculture sector in Almería, who currently live in informal.

## Problem scheme and research topics for overall design



## Process

### Method description for Specific Research

Sub research question	What data do you need?	How can this data be collected?	How will this data be analyzed?	What will be the expected results?
What are the climate characteristics (parameters) of the region of Almeria, Spain?	Quantitative data. -Temperature, Solar radiation, wind, humidity, % cloudiness and rain distribution.	-Internet -Climate data stations	The data will be analyzed in relation to desirable climate conditions in dwellings.	List of climatic parameters of the region of Almeria, Spain.
What are the desirable climatic conditions (parameters) for housing interiors?	Quantitative data. -Desirable temperature, humidity, ventilation, light (day light and artificial light) and solar radiation in a conventional dwelling program.	-Literature -Case studies	The data will be analyzed in relation to the exterior climate of the region of Almeria, Spain.	List of climatic parameters for interior climate in relation to a standard dwelling program.
What lessons can be learned from passive climate design of Vernacular architecture in the region of Almeria, Spain?	Passive climate design approaches present in the vernacular architecture for the region of Almeria.	-Case studies -Literature -Site analysis	Effectiveness of the analyzed vernacular passive climate design strategies.	List of vernacular passive climate design strategies for the region of Almeria, Spain.
Which passive climate design strategies could achieve comfortable interior climate in the region of Almeria?	Quantitative data. Design strategies for passive climate design suitable for the climate of Almeria on urban, building and material level.	-Literature -Case studies of passive climate design of housing in the region and areas with similar climatic conditions.	Impact of the passive design approaches on the exterior climatic conditions and the translation of the parameters to interior climates.	List of passive design strategies for the urban and building level and their impact on their effect on exterior climate for adequate interior climates.

## Literature and general practical preference

### *Specific research / Research paper literature*

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### **Research for overall design**

Migration / Informal settlements in Almería / State of the art / Material flows agriculture sector Almería

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## Reflection

The housing proposal alternative for migrants living in substandard housing seeks the social integration of a vulnerable group that is indispensable to the agricultural economy of Almeria. The project seeks to contribute ideas for the dignification of the housing of the migrant workers and to strengthen their economic and social development. The project also aims to create spaces for social interaction and the confluence of identities, the relationship between the native population and the migrant population.

Furthermore the project involves as well the search for solutions to minimise the environmental impact of the housing proposal. Through the study of the flow of materials in the agricultural system, synergies and opportunities are sought for the agricultural system and the construction of housing in this environment.

It also proposes strategies which aim to reinforce the resilience of the agricultural sector, the population and the environment. How to cope with the problems arising from climate change, drought, torrential rains, increased immigration and the loss of bio-diversity. Even so it will envisage how to reverse and reduce the environmental impact of the agricultural and construction sectors. These issues will be addressed in the project, closely related to the principles of action of the harvest architectural engineering studio.

## Relevance

The problem of access to decent housing affects migrants in multiple places in the south of Europe. This project is conceived in relation to the activity of the agricultural sector but can be understood as a response to a migration problem in general, that may increase over time. Therefore, the design of affordable modular housing with good levels of comfort will contribute to more decent living conditions for their temporary inhabitation.

The poor living conditions of agricultural migrant workers form a problem in the regions with intensive agriculture activity in Spain. The chosen context is one of many places in the country with intense agriculture activity and with informal settlements. The design of modular structures which allow for flexible design can help to extend the implementation of the project in different contexts.

The specific research of the project will be contextualized in the arid climate of Almeria and could therefore be relevant for different locations in the province. As a consequence of climate change, large areas of Spain will experience a transition from a mediterranean climate to an arid hot desert climate. Therefore the research of methods for passive climate design in the arid climate may become more and more relevant to achieve comfortable climates while aiming to reduce the carbon foot print of the built environment.