REFLECTION PAPER

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Graduation studio Architectural Engineering
2021-2022

THE ROLE OF EMERGENT AND DEVELOPING COUNTRIES IN THE 21st CENTURY

A VISION FOR SUSTAINABLE HOUSING DEVELOPMENT IN BENIN

Personal Information	
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Studio	
Name/Theme	Architectural Engineering, 1 million homes, Harvest
Main mentor	Ir. Annebregje Snijders
Second mentor	Ir. Paddy Tomesen
Third mentor	Ir. Christien Janssen

Graduation project	
Title of the graduation project	**A vision for sustainable housing development in Benin**
Goal	
Location	West Africa, Benin, Cotonou

Review of the past year

Why TU Delft, why aE Studio?

When I decided to do my graduate studies at TU Delft, I wanted to choose a studio that would enrich and develop my knowledge. Coming from an art school, I learned that it is important for me to take a multidisciplinary approach to my work. I like to develop my thought process through interdisciplinary thinking and am often inspired by design approaches that differ. This is one of the main reasons I chose TU Delft and, ultimately, aE Studio as my graduate studio. The symbiosis of my design-focused undergraduate studies and the technology program at TU Delft and aE Studio helped me develop an original, solid and diverse design process. The aE Studio allowed me to approach my thesis project in a more technical and rational way while retaining some of the freedom I had enjoyed throughout my undergraduate studies at the Savannah College of Art and Design (Savannah, Georgia).

My final project encompasses two of the studio's main guiding themes (1 Million Homes and Harvest), but I adapted them to fit my chosen topic. I address the challenge of 1 million homes (a number derived from housing goals in the Netherlands) and apply it to current goals in my chosen context (Benin, West Africa). Against this backdrop, and in the face of increasing demand, the government of Benin has decided to create 20,000 housing units across the country over the next five years (Bénin Révélé, 2016). These are distributed throughout the national territory. With my project, I present a pilot project that will serve as an example to show a different, more sustainable and higher quality long-term solution compared to current housing developments in the country. In addition, I am looking for sustainable building solutions. So, I am taking advantage of the natural resources that are often already available on the site to improve the indoor environment and, at the same time, promote the local development of the construction industry and, thus, the country's economy. I think this project is feasible within the architecture program of TU Delft and offers me the opportunity to contribute to the architectural discourse of the TU Delft Global Initiative   and beyond by working on a concrete solution to a global problem in a specific context.

The relationship between research and design

The research on passive cooling strategies I conducted during the first half of the year is one of the four pillars of my project. It allowed me to define a set of basic strategic design guidelines that helped me relate to scientifically researched parameters that benefit the inner-city and indoor climate in the context of Benin. Rather than starting the design process with a traditional site analysis to determine the form of the program and then working to integrate the passive design features (research), I considered the research as the starting point for my conceptual approach. All the design decisions I made throughout the project were always made using four design pillars: climate-specific strategies, the urban design concept, user needs/programs, and social context.

At the urban level, passive design strategies were considered to ensure that each building could be adequately ventilated, as this is the biggest challenge in a hot and humid climate. Consequently, the design approach was influenced by my research. The street layout, spacing between houses, overhangs, and tree cover directly reflect the findings I made during my investigation. The main housing concept is another example of the symbiotic relationship between research and design. As part of my research, I analysed the climate for this region and used the Climate Consultant platform to better understand the present climate conditions and challenges. Using annual rainfall data, I determined that rainwater harvesting should be an essential component of this project, as water supply interruptions are still widespread in Benin. The annual rainfall is 1245 mm per year. This is 47% more rainfall than in the Netherlands. Combined with government-backed financing plans, this results in a design strategy where roofs and water tanks are significant (they are built first) to ensure high autonomy. Permanent access to water and a roof (shelter) that protects from rain but also from the sun is guaranteed for every citizen.

My research and design methodology

The framework of the aE studio consists of the so-called ‎triangular approach‎. Within this triangle, there are three main themes within which we make decisions as designers: Context, Design Program, and Technology.

Given the increasingly important climate goals, many study projects revolve more and more around issues such as sustainability, circular economy, energy consumption, and other issues such as the creation of culturally appropriate forms, the social and societal dimensions of projects, the issues of financing and participation are increasingly taking a back seat in the architectural dialogue. This is unavoidable due to the short duration of the design tasks to be completed per quarter; nevertheless, in this dissertation project, I have made it my mission to unite the different levels as best as possible to develop an architectural concept for housing and neighbourhood projects in Benin that embraces not only climate goals but also satisfies cultural, social and societal needs that promote an improved quality of life for its users. In short, the methodology of my project focuses on the relationship between climate, people, and buildings.

Instead of a one-sided design outcome, my research methodology and the resulting design approach allowed me to develop a project proposal that considers measurable (scientific) and non-measurable (cultural, social patterns…) components. Looking at the project from a distance, all of the design decisions I made during the design process served multiple purposes that allowed me to strengthen the narrative and reasoning behind the decision-making process.

Relationship between the graduation project and the broader social, professional, and scientific framework

Within a larger framework, this graduation project addresses the unique role that developing and emerging economies possess in the 21st century. As indicated by the UN-Habitat projection, Africa's urbanisation rates will increase by more than 50% by 2040. This also means urban housing will triple from 400 million to 1.26 billion by 2050. The context I have chosen, Benin, serves as an example project that can be used as a reference or treated as a case study for projects in other developing and emerging countries with similar climates.

My project, because it focuses on improving quality of life on a long-term basis rather than quick high monetary returns, is an opportunity to show the governments, developers and the population what other ways urbanisation in the West African region can be accomplished.
My design took its specific form from the particularities of my environment in terms of climatic conditions and cultural and social conditions or needs. These variables could be replaced by the appropriate contextual data for a subsequent project and ultimately result in a different outcome. However, the project approach and conclusions from my research can generally be applied and serve as a strategic planning basis. Since almost all developing and emerging countries are geographically located in tropical climates (Central America, Caribbean, Southeast Asia, Sub-Saharan Africa, Indian subcontinent), many similarities or comparisons can be made.

Challenges in the research design process and application

While working on this project, I faced several challenges. First, access to information in Benin is minimal. One of the first things that stood out right from the start is that the data from google maps is often outdated and that there is no google street view nor GIS data in the entire country, even in the biggest cities. Scientific data and academic papers about the country are also limited, so I had to get creative. Luckily I speak French and German, which turned out to be really helpful because, through that, I could access more valuable information, mainly because the official language of Benin is French. Many local researchers and academics write in French.

Knowing the challenges, I planned a month-long research trip to do my field research. I documented the entire journey through photo series that I compiled into a booklet about themes I am addressing in my project. Additionally, I documented the climate via a measuring device provided by my research tutor to understand better what factors have an impact or not on the temperature. I also tracked how my body adapted to the climate over time and what factors or things I could do to cool down the building I was staying in. During the trip, I stayed in two different houses designed very differently. It quickly became apparent that one design was much more successful regarding cross ventilation and overall room temperatures. Additionally, before my trip, I contacted many architectural offices, construction companies etc. I was fortunate enough to visit a few current construction sites and interview the architectural and construction worker personnel in a few of them. This helped me substantiate my research's written portion and gave me a solid foundation for the design process. With my newly acquired expertise, I could better and realistically define the user profile that I would like to direct my projects toward, which I would not have been able to present without my site visit and prior knowledge of the country.

Now that I had a relatively clear picture of the country's climatic, social and cultural conditions, the next challenge was to share this knowledge with my team of tutors, who have great expertise in similar contexts. Still, when you go in-depth, the conditions for design are very different. I quickly realised that I had to consider many more aspects of my project than just designing a purely residential project, a living environment. I had to depict the context in which I was working and then develop a social and cultural approach to the project. Therefore, I had to constantly juggle different design goals from the other users, stakeholders, clients… The additional challenge of my project was continually shifting between the city scale, the urban cluster, and the individual housing situation. Therefore, my design scope encompassed the city's scale, the building's scale, and the components' scale. My 4-pillar approach helped me make rational decisions during this process. Every decision I made at one scale affected the project at the other scales, so it was essential to analyse every decision at all scales, which took a significant amount of my design time. It took me much longer than expected to arrive at a satisfactory, well-rounded result for the urban cluster strategy, balancing all aspects of climate, urban infrastructure, and the social dimension. Therefore, I do believe that this project is only a starting point. It can and indeed will be further developed beyond this graduation year.

Towards P5

Looking ahead to P5, I will work on finalising my drawings and focusing on showing the atmosphere and value I add to the city with my project through rendering, model making, etc. I will sharpen my presentation so that my vision comes across as clearly as possible.