

REINVENTING THE CRAFTSMANSHIP

**Transforming Indonesia's urban kampungs into
sustainable and circular neighbourhoods**

- Reflection report

Graduation project I reflection report

REINVENTING THE CRAFTSMANSHIP

transforming Indonesia's urban kampungs into
sustainable and circular neighbourhoods

Written by:

Josephine Cornelia van Empelen
Student number 4214684

Tutors:

Design tutor: Monique Smit
Building Technology tutor: Engbert van der Zaag
Research tutor: Pieter Stoutjesdijk

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Faculty of Architecture
Jullanalaan 134
2628 BL Delft

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01

THE RELATIONSHIP BETWEEN RESEARCH AND DESIGN

I entered the Architectural Engineering graduation studio with a fascination for the combination of technology and architecture. I wanted to combine these themes in my graduation project and although I was not sure what my focus would exactly be, I was interested in modular building, flexible or communal living spaces, materialisation and circularity.

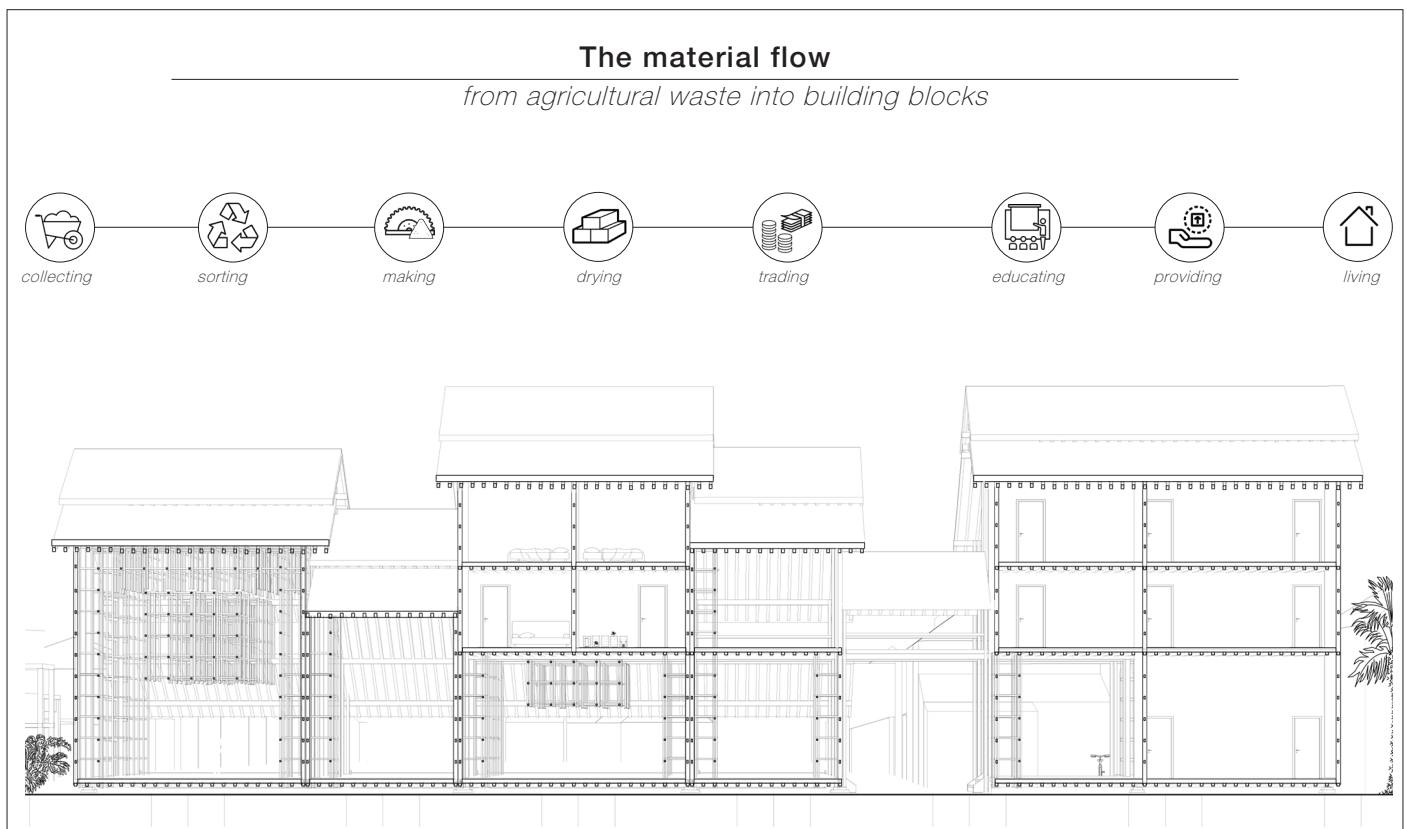
In my graduation project I combined these themes along the way by doing research into materials and implementing them in a meaningful way into the context of the project in Bandung, Indonesia.

As concrete is a main building material in Indonesia and as it is directly and indirectly polluting the environment, I researched alternative materials as a substitute for concrete. These alternatives that I researched are the starting point of my project and can be a start of a circular building economy in the self-built environment of Cigondewah, a Kampung in Bandung, Indonesia. The materialisation and circularity became my personal fascination throughout the graduation project.

Although I started my research semester with the idea to develop a building system (Make of the AE studio), I became interested in the building material

flows of the kampung and the process of building in an informal settlement. Subsequently, my focus shifted from a production focus towards understanding the flows of materials and needs in the kampung for a better building economy. Besides, I wanted to promote a circular economy. Therefore I switched my main research topic into a material research and besides I researched the current way the kampung is functioning, including the materials they use and the ways the people currently build. I also researched the role of the architect in the self-built environment by looking into multiple case studies.

The three different parts of research concluded in a proposal to make a small low-tech factory to produce new building materials from agricultural waste and other biobased materials, combined with housing to include a prototype. This results in a combined working and living environment which is common in the informal environment. On a bigger scale this research developed into a proposal for a circular building material economy, improving the current building method in the kampung and beyond. However, to implement this I did have to think about the consequences it would have for the current building (material) economy.



02

THE RELATIONSHIP BETWEEN MY GRADUATION TOPIC AND THE STUDIO TOPIC

The Architectural Engineering graduation studio has a focus on new technologies, and tries improve social issues with architectural design. Focus areas of the studio are digital manufacturing, product design, material research, circular economy design, building, physics, structural mechanics and computational modelling¹.

Of course one project can't cover all the focus areas of a studio. This project in Cigondewah, Bandung, one of the three contexts of the Architectural Engineering graduation studio, focusses mainly on material research and circular economy design, but also a bit on product design as I design a 'toolbox of building products' for the inhabitants to build their houses by themselves.

The studio's location in Bandung is intertwined with the project 'the Fashion Village Lab' of my tutor Mo Smit. The working and living environment of the urban kampung is important both in Mo's project as well as my graduation project. Although focussed on different economies (building economy vs. textile economy), both projects share the interest into ecological preservation, economic growth with decentralized production and the collective engagement.

The Architectural Engineering studio also makes a division in the fascination topics, being either make, flow or use. Although the original intention to make a prefabricated building system would clearly be categorized under the Make, the final fascination researching the circular economy is typically a Flow topic.

Personally, I consider my graduation project a combination of Make and Flow. On the one hand the building materials are completely degradable and the cycles are closed loops, but on the other hand I do develop a new way of building in the kampung with still a certain degree of prefabrication and easy to handle elements for in the self-built environment.

03

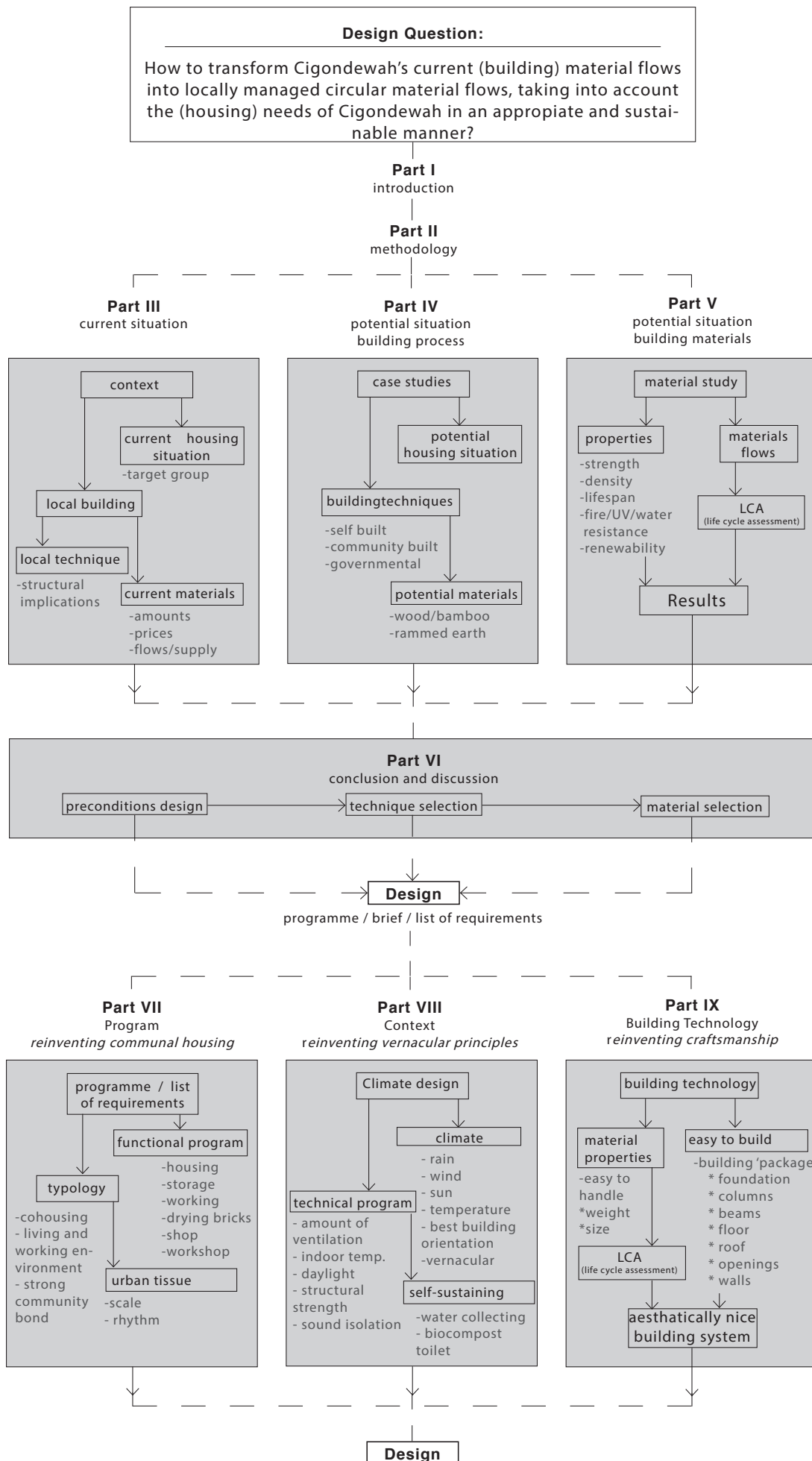
ELABORATION ON RESEARCH METHOD AND APPROACH CHOSEN BY THE STUDENT IN RELATION TO THE GRADUATION STUDIO METHODOLOGICAL LINE OF INQUIRY

The Architectural Engineering graduation studio is divided into two parts: the thematic research in the first semester and the design in the second semester. Personally, I do like that approach and although I usually merge the two parts earlier in the design process, it did work out quite well for me. To dive into the research part and to discover the subject was a good way to start, although I had difficulties with narrowing down my thematic research topic. Finding that specific fascination was harder than I expected. The pre-fabricated elements that I started with as fascination turned into a fascination for materialisation and a circular building economy - but combining this two this is also about detailing and being able to take the building apart again.

The shift from research to design right before and after the P2 phase proved to be difficult, as I got very focused in the material research. I struggled to also research the site, typologies, building processes and building methods. To make this topics more clear to myself, I decided to make another research report - a longer one with more topics and a lot of illustrations.

Although I had the functions of my programme at the P2, I had for a long time not really an idea or feeling of how much space this building needed. The flows and materials of the research were largely conceptual and although this indicated the materialization of my project, I still had to calculate the actual production in- and output. What impact can the building have on the scale of Cigondewah? How much can be produced in this small scale 'factory'? What does the material choice have for impact on the LCA of the building - how much better for the environment is the building system?

1. EMMA feedback and assessment tool, August 2017



04 ELABORATION ON THE RELATIONSHIP BETWEEN THE GRADUATION PROJECT AND THE WIDER SOCIAL, PROFESSIONAL AND SCIENTIFIC FRAMEWORK

Since 2014 more than half of the worldwide population lives in cities, and this is expected to increase up to 66% in 2050. During the next two decades, the urban population of the world's poorest regions - including South Asia - is expected to double. Also Indonesia struggles with the enormous amounts of people coming to the cities in search for a better life. Over the last few decades, Indonesia has been experiencing high economic growth and people left the countryside in search for work in factories. Country wide there was already a backlog of 11.4 million houses in 2015 and there is an additional need for 800,000 new houses annually. Although from an official point of view Indonesian informal settlements - called *Kampungs* - are no slums, there most definitely are similarities. Many urban *kampungs* have problems with the durability of dwellings, overcrowded dwellings and lack of drinking water and sanitation.

In this project, the main emphasis is placed on the transformation of the building industry and the building process, as well as the building materials and its production cycle. The current building practise in Indonesia is a very linear process, in which a building is constructed by unskilled workers on site from (reinforced) concrete and red fired clay bricks. After the lifespan of the building it is demolished and materials are re-used or end up on a landfill. With a relatively short lifespan of the slum buildings due to their low building quality, this building practise is responsible for up to half of the waste that ends up in landfills. The highly polluting materials used in the building process do influence the living environment of the slum inhabitants both directly and indirectly with pollution.

Transforming this industry into a sustainable and circular industry using wood, bamboo and agricultural waste streams to produce building materials has the potential to provide better housing quality. Besides, it does less harm to the living environment, gives an economic boost to the self-built environment, creates jobs, and it promotes a consciousness of sustainability. Useful local agricultural waste streams in Indonesia include wood chips and sawdust, cassava waste, rice husks, corncoobs, coconut fibres, ba-

gasse and palm oil waste.

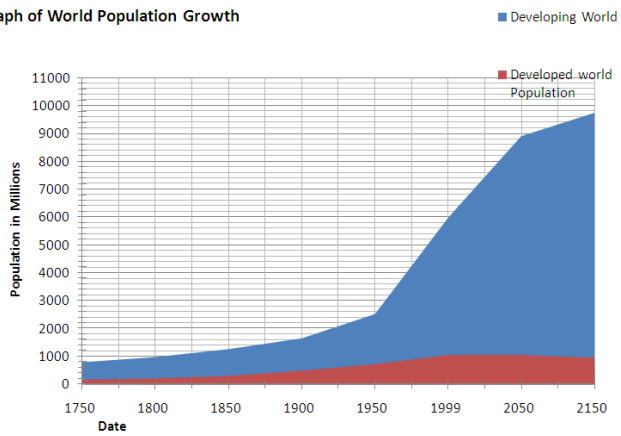
The intention of this project is to develop a suitable building system that opts for the use of alternative building materials in support of better structures, less construction- and demolition waste and a healthier living environment. It is not a measure to solve the construction and demolition waste problem in its core essence, but merely a method to motivate the local community to care more about their environment and introduce a different approach to materials and waste in their day to day life. It is a way of experimenting with new or less respected materials within a strong structural framework and it showcases the potentials of the materials in the specific environment. The building system will form the basis for a business model for a circular building material economy in Cigondewah, focussed on replacing the current building methods with reinforced concrete and bricks.

Besides, the use of agricultural waste streams to produce building materials creates an additional income for the farmers. This can also preserve the value of agricultural fields and preserves the openness of rice fields and gardens in the densification of the city.

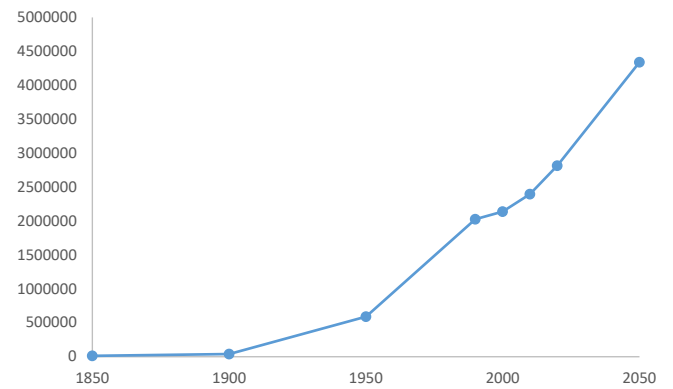
As there are informal settlements all around the world, this research might be useful to see it as a way the people in this areas can be empowered. Most slums already have a big informal economy and with a higher building quality and a higher possible density due to taller structures, the spare land can be saved or gained back to be social places, giving the area an higher value and better living conditions. The proposed small scale building material factory can increase the economic activities in the area, being beneficial to the slum inhabitants.

Transforming the informal settlements into circular settlements, they become sustainable instead of polluting. The living quality of the slums thereby can increase and the slums become healthier environments. The raised awareness about the inhabitant's own influence on their living environment can have an impact on how they deal with their waste. The project tries to eliminate pollution from the urban areas.

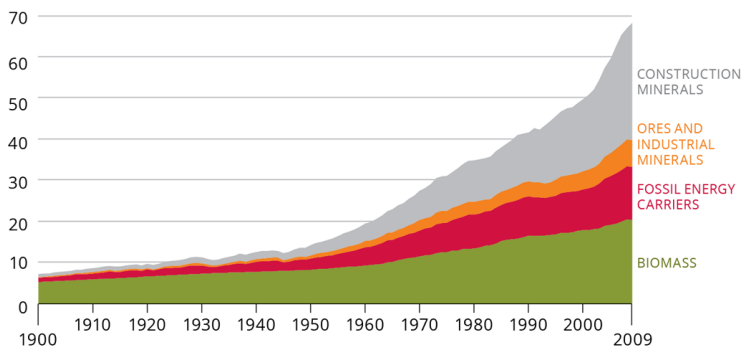
A Graph of World Population Growth



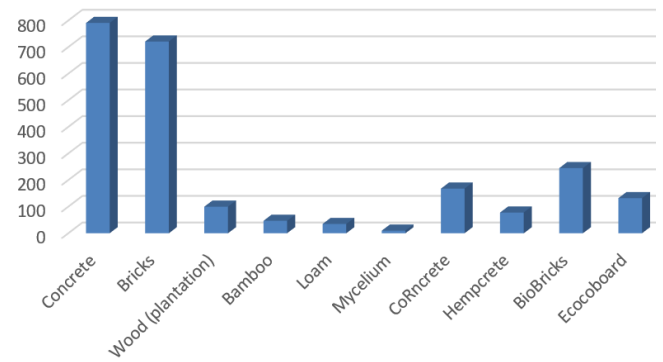
Population growth in Bandung



Billion tonnes



Material consumption worldwide



Comparison of eco-costs, euro per m³



The United Nations Sustainable development goals

On September 25th 2015, countries adopted a set of goals to end poverty, protect the planet and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years. For the goals to be reached, everyone needs to do their part: governments, the private sector and the civil society.

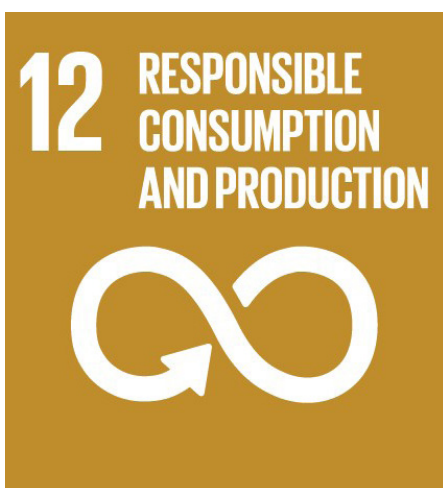
Also this project sets goals to pro-

vide better quality of living and buildings and in the mean time protect the planet and ensure prosperity.

The proposed little building material factory fights poverty by providing work in the kampung. It also makes sure the kampung gets a little less dependent on the textile industry which heavily affects the environment. It is financially beneficial if the kampung gets more independent as the textile factories might move to

cheaper areas in the future. Being very dependant of them makes the future for the kampung inhabitants unsure. The factory provides decent work and economic growth in the area.

The adjacent food- and production gardens provide the kampung with food and building materials as well as with a water buffer (resilient city). The gardens in combination with the workshops try to raise awareness for a responsible consumption and production.



4 QUALITY EDUCATION



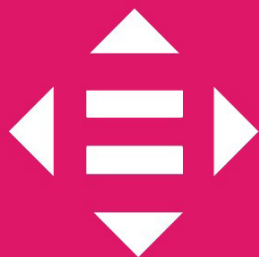
5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



Inside the building there is proper sanitation, the water storage and Nazava filters provide the inhabitants with clean water and the biogas toilets provide the building with affordable and clean energy.

Of course all this sustainable development goals are intertwined. The main aim of this project therefore stays goal 11: create sustainable cities and communities. The project provides a startingpoint to develop sustainable cities and communities - like the traditional kampungs were.

15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS



05 ENCOUNTERED ETHICAL ISSUES AND DILAMMAS IN THE RESEARCH, DESIGN PROCESS AND POTENTIAL APPLICATIONS OF THE RESULTS IN PRACTICE

Although my graduation project is quite a small intervention, it has big implications for the building economy as it proposes a change towards a circular economy. This not only means the building materials will become different, but also the current building economy will be affected. The current market will run out of work and has to be adapted to the new system. Work in the traditional places will be lost, and work in new places will be created. Of course this transition will be difficult and even harder to justify to the established economy and companies related to it.

However, there are parts of the current economy that can be maintained in a slightly different function. For example the current building material shops can be transformed from a linear material provider towards a recycle point of building elements where people can buy new products as well as bring back their used materials, no matter if they are worn out or if they can be re-purposed in another building. From the material shops this returned products can be either used as fertilizer on the fields or they can be sold as secondhand products, making the building system even more available for the lowest incomes.

Also, the project hopefully encourages farmers to stay in their profession. The farmland gets more value as also the residu is getting a purpose and creates income. Farmland therefore gets valued more and will be protected for their existence in the outskirts of the city, like Cigondewah. This farmland is also very important for the livability and resilience of the city.

In my research, the first dilemma I came across is to choose the right materials for my project. I concluded that the most sustainable materials are the regenerative (growing) materials, meaning there is no mining involved at all. However, this materials are very unestablished and there is needed a lot of extra research in the production process and to assure the quality of the product. Also the production currently requires a very strictly controlled environment. As my project is situated in a self-built environment without a lot of (HVAC) technology, it would be very unlikely this would succeed. Therefore I had to decide against materials like Mycelium and I chose for Hempcrete. Even though lime grout needs to be mined for the material, it can be

produced from local available materials and therefore the eco-costs are low. However, it would be preferable that the proposed factory can switch to a material like Mycelium once this material is developed further.

Using regenerative materials does possibly reduce the lifespan of the building. However, with the right building design and good construction quality, the buildings are likely to last easily as long as the average lifespan of buildings in the relatively rapid changing kampung environment. Besides, the building system should make it possible to re-use the parts like the wooden columns and beams that are still good.

This is leading to the third issue I came across with my research: using wood massively will cause problems as it is growing slower than we use it. There needs to be invested a lot in replanting trees, and healthy, certified plantations where it is assured they do replant. The same accounts for bamboo, in case bamboo is used. To be sure to overcome this issue there has to be a governmental ruling or law to replant trees and there must be made sure this rules will be implemented. This might be an obstacle as corruption is relatively common in some Indonesian areas.