THE URBAN LOGIC

A timber processing factory empowering rural areas through value addition

BUYISILE MABASO

PHIWE MPANZA

The Urban Logic;

A timber processing factory empowering rural areas through value addition

A Thesis Submitted to the Faculty of Built Environment in fulfilment of the requirements for the Degree in Master of Architecture (March)

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Fig. 1.1 Image Reference
(Author, 2018)

Acknowledgments

The following research document is a combination of the help from many supportive people in my life.

Thanks to my brother and sister (Ntsako and Amukelani) for the constant motivation to do better, and great deal of thanks to the homies, Thando Mxosa, Nqobile Lombo, Lumkokazi Makhasi, Mlungisi Mathe, Thokozani Mthembu, Similo Ndima, and Jason Nguibeni for the lending hand when in need. Big thanks to Gerald for seeing this thesis before i did. Your crits and guidance played a huge role in completing this thesis.

I dedicate this book to my dear mother (Buyisile Mabaso) and grandmother (Phiwe Mpanza) for all the countless sacrifices and support they have made for me to get this far.

Fig. 1.2 Image Reference
(Author, 2018)

Declaration

I Menzi Ndlovu (491652) am a registered M (Arch)
student in the year 2018 at the university of the Witwatersrand, I hereby declare the following:

I am aware that plagiarism (i.e. the use of someone else's work without permission and or without
acknowledgment of the original sources) is wrong I confirm that the work submitted for assessment for
the above course is my own unaided work except where I have explicitly stated otherwise. I have followed the required conventions in referencing thoughts, ideas and visual materials of others. I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my unaided work or that I have failed to acknowledge the source of the ideas or words in my own work.

08.02.2019

This document is submitted in partial fulfilment for the degree: ***Master of Architecture [Professional]*** *at the University of the Witwatersrand, Johannesburg, South Africa, in the year 2018. Supervised by* ***Gerald Chungu***

Contents

I.
Abstract

The acceleration of urbanization, has increased the interdependence between rural and urban dwellers - the resources they offer each other is the common thread that pulls them closer together. While this has introduced various forms of innovation in underdeveloped parts of South Africa, the balance between what the urban areas remove from the rural land versus what returns in the form of economic upliftment; industrial transformation; cultural and social development, as well as general living standards, is still very much debatable.

This research explores how architecture can improve the value chain between rural and urban areas in order to improve the balance these two areas share, by looking at activities that can be performed in rural areas using the raw material harvested, before the material is moved to urban areas for further processing. The research process begins by looking at a broad social economic plan; the infrastructural plan to make it work; and a small intervention where these issues will be addressed. By moving activities within the supply chain previously only dedicated to and reserved for urban areas closer to rural areas, it not only keeps the supply chain safely intact but improves the context and value found in rural areas. This begins to create an organic platform for ancillary economic movement to start building, in the hopes to improve industrial sustainability.

The building is an industrial timber processing factory in northern KwaZulu-Natal that allows the context to feed into it. The main activity, amongst many others this factory does, is take wood harvested from the forests plantations of northern KZN and add an additional step where it processes it into wood fibers, to be transported in larger quantities than previously possible to the urban industrial areas where the final stage of production takes place. In a social context of poor living standards due to lack of economic activity this building aims to – parallel to wood processing work – lend itself as a community workspace in order to be the focal point for skills development where locals can utilise the timber processing equipment, cultural transformation and most importantly a port for other industries to plug-in. The architecture looks to welcome back the design principles so often lacking in current industrial buildings - these principles present a great opportunity to effect social change over and above industrial functions. Parallel to that, it questions the function of a factory in a rural setting and re-imagines its function through design and program.

The farmer sells his corn for R2.00, after production it is sold back to him as popcorn at R10.00 – the farmer cannot afford the end product of his own labour. The tensions between urban and rural; raw and finished product and, architectural design and industrial engineering, are exposed and given the spotlight in the search for economic transformation and social balance in the value chain.

II.
Research Framework

What is the problem?

Fig. 1.3 diagram illustrating the main themes of the research
(Author, 2018)

Unequal Development

The balance between what the urban areas remove from the rural land versus what returns in a form of:
- Economical upliftment
- Industrial transformation
- Cultural and social development
- Quality of life: general living standards

This research seeks to answer the following key questions:
- Why is there an unequal development between rural and urban areas?
- Can industrial architecture improve the context and value found in rural areas?

Objectives:
When it comes to making vital industry chains of logistics, distribution, community services, and so on, the rural areas are becoming the incubated land via its labour and regional advantages. This projects aims to take advantage of those potentials.

I believe that utopia is actually possible -- but we're led by the least noble, the least dignified, the least tasteful, the dumbest, and the most political.

- Kanye West

KZN Forestry
STATISTICS

229
exports
in the first 8 months of 2007 the Durban terminal exported one million tons of wood chips to Japan

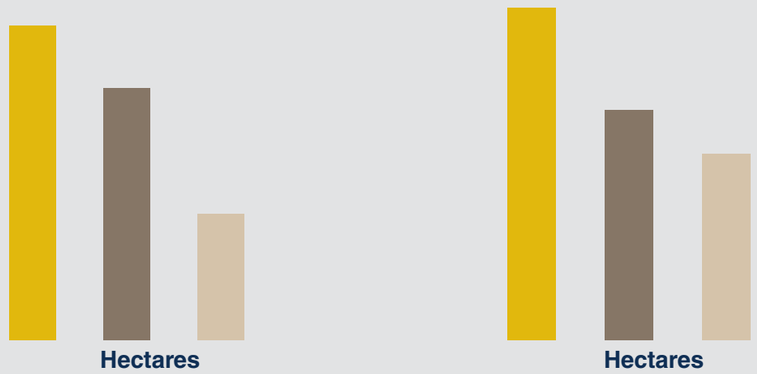
1575
timber
2nd largest pulp and paper mill in SA

71
pulp
the only 2 SA woodchip export plants

57 billion
KZN GDP

6 billion
KZN GDP from forestry

The GDP of KZN amounts to about R 57 billion of which forestry contributes approximately R6.0 billion (10.7%) through forest products and a further 1.5% through forestry.



The forestry industry in KwaZulu-Natal covers about 740,000 hectares (8.2% of the total area of the province) with 560,000 hectares already planted and a further 190,000 hectares of land owned by forestry organisations not planted.

1.

Site

Kwashengeza, Umkhabuyalingana,
Kwazulu-Natal, South Africa

Fig. 1.4 Photograph of the pine tree logs stacked on site for air-drying
(Author, 2018)

Manguzi, KwaShengeza Plantations

Manguzi or KwaNgwanase is a small rural town community in Kwazulu-Natal province of South Africa. The town's location is 15km shy off the Mozambique-South Africa Border neighbouring Khosi Bay. The town is rich with agriculture mostly engraved in pine tree plantations and forestry activities. Most of the Plantations are privately owned by local settlers which becomes the only mains for agriculture economic growth for town

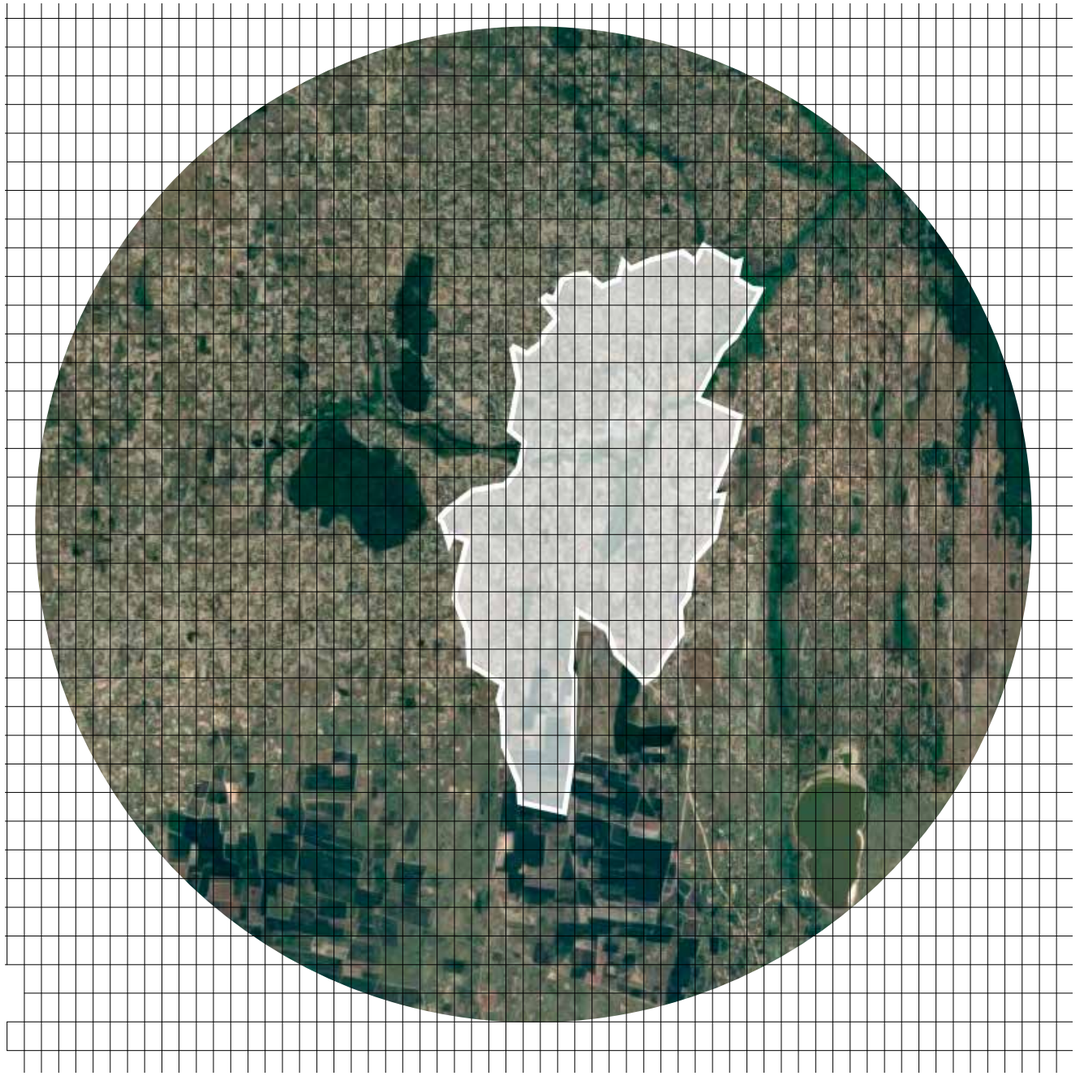
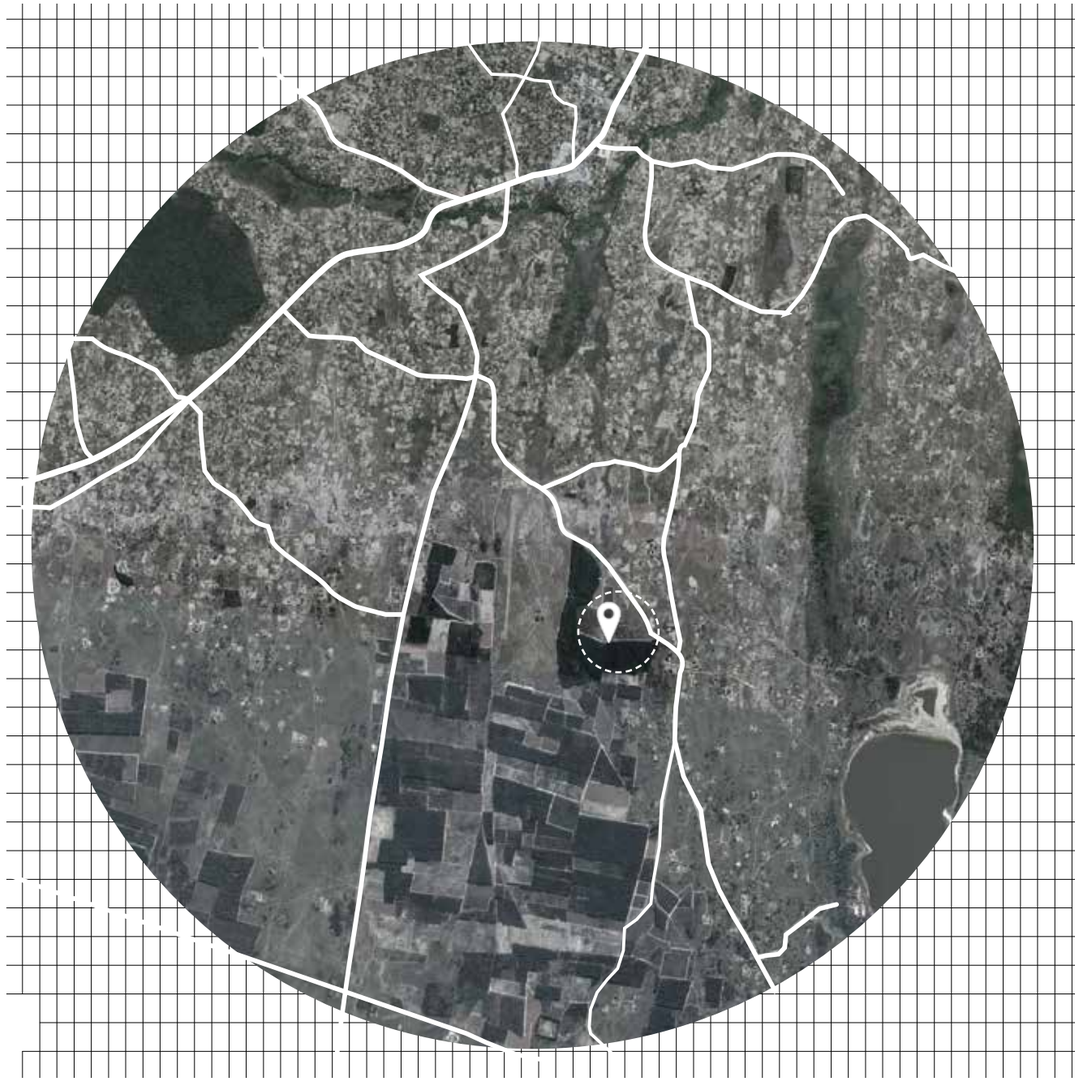


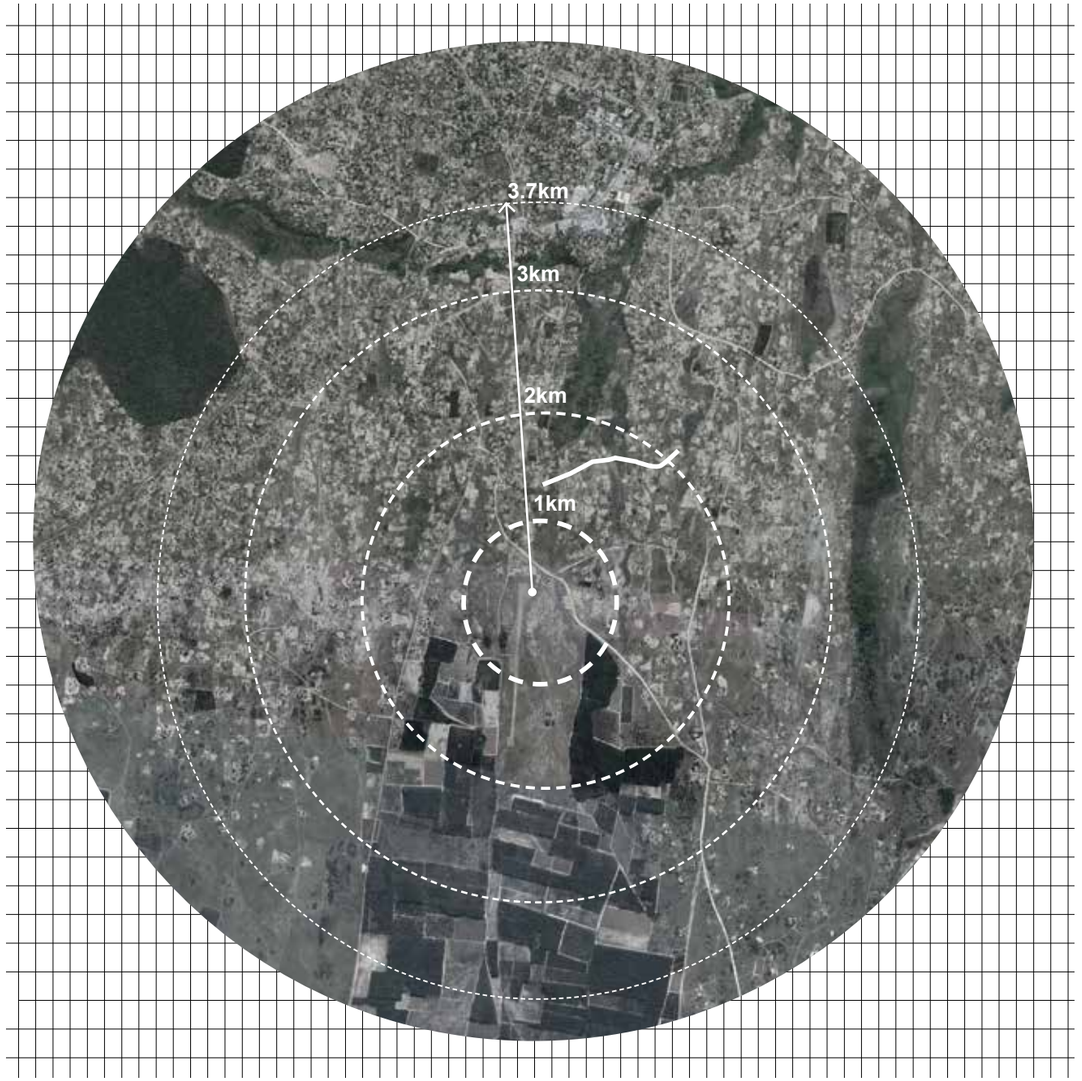
Fig. 1.5 diagram illustrating the site context
(Author, 2018)



Main Road Network Connections

The site has existing road network systems that feed onto the plantation logistics activities. Therefore the site location was strategically feed directly to those networks.

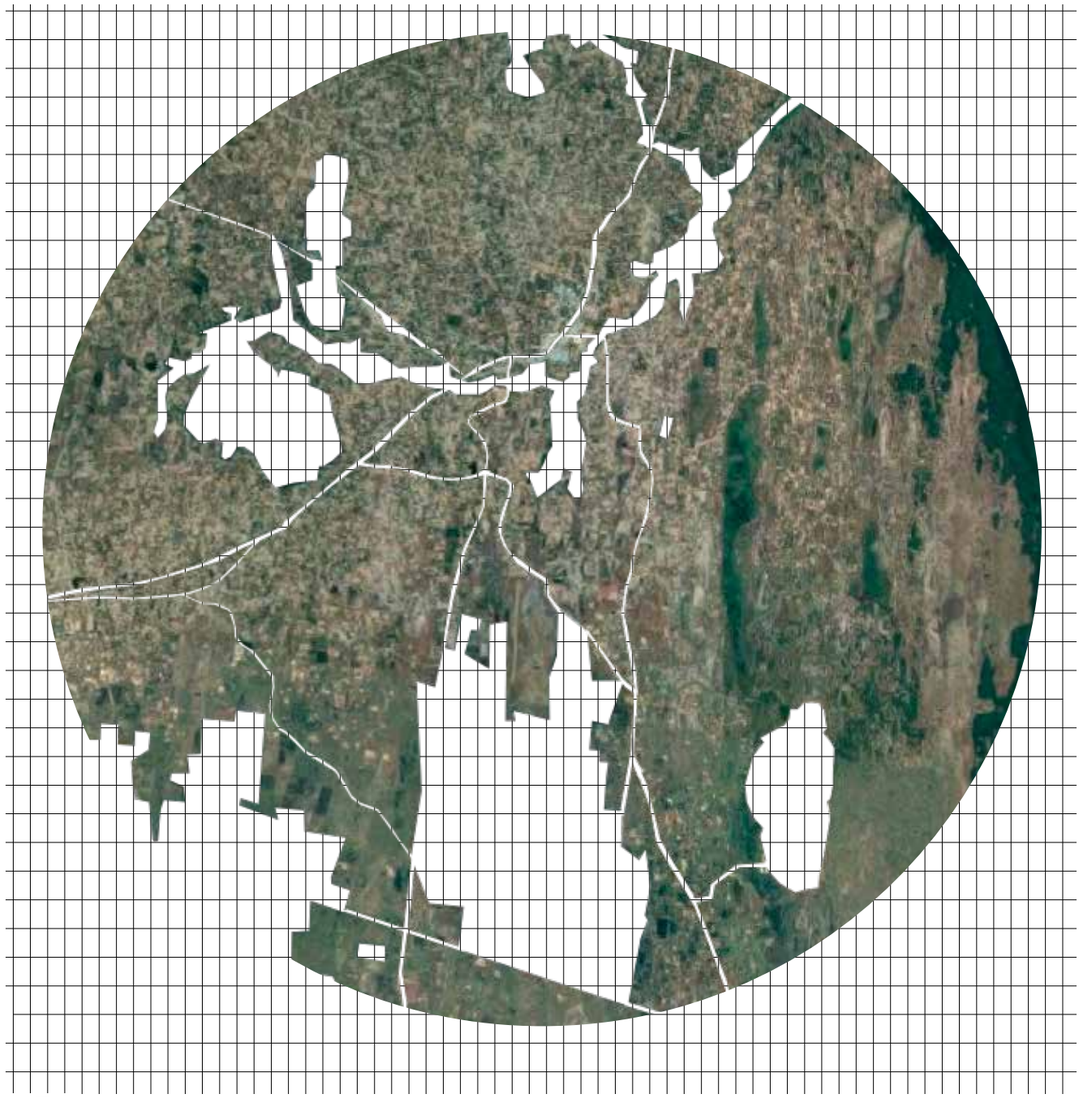
Fig. 1.6 diagram illustrating road networks
(Author, 2018)



Distance covered

The illustrated image shows the plantations in relation to the nearest town, calculating the distance locals will have to travel in and from around town.

Fig. 1.7 diagram illustrating site relation
(Author, 2018)



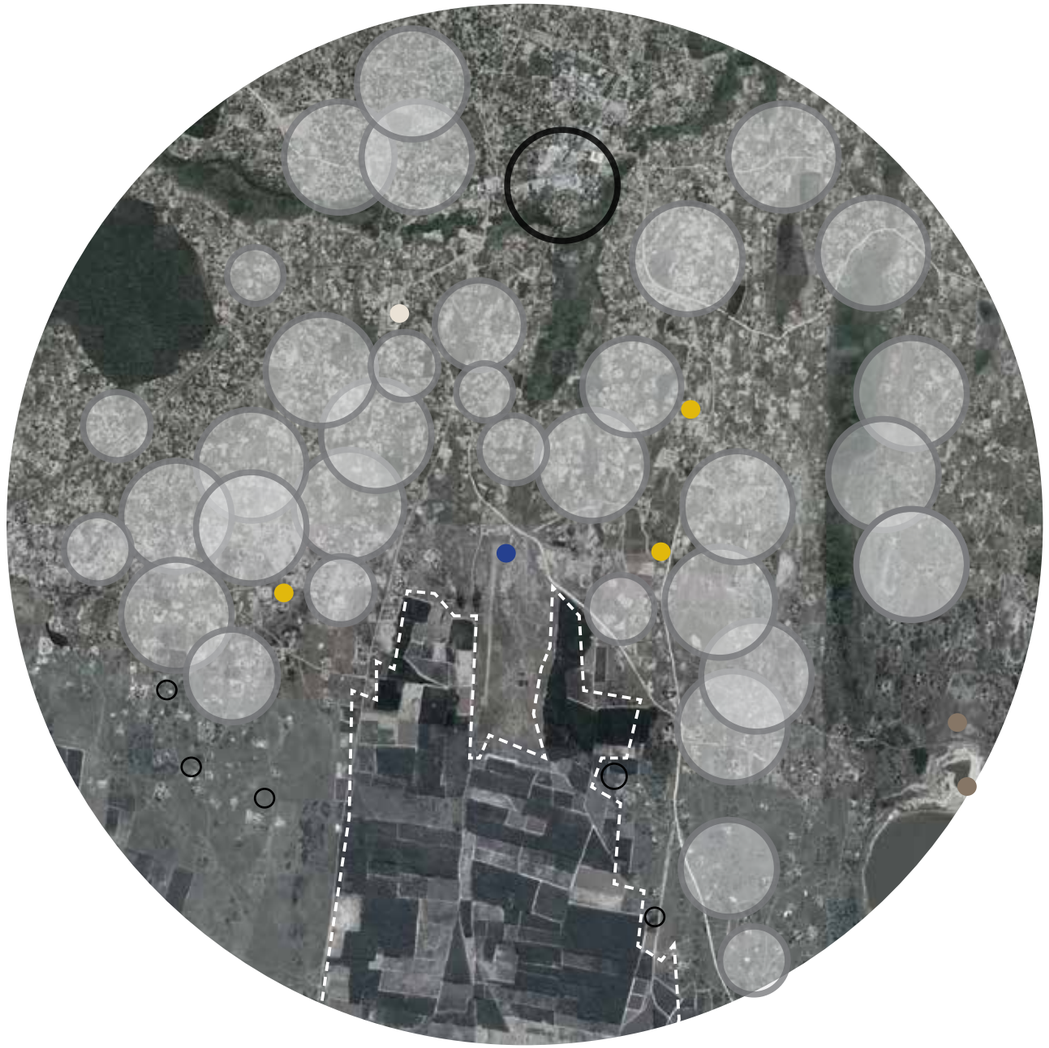
N

- Site Context

Residential Populated Land

Image illustrating white patches where the land is occupied by plantations as well as road links linking them together.

Fig. 1.8 diagram illustrating the plantation zoning (Author, 2018)



Land Use

- Schools
- Tourist
- Airport
- Post Office
- Commercial (white)
- Residential (white)

Fig. 1.9 diagram illustrating the zoning in Manguzi (Author, 2018)

Fig. 1.20 diagram illustrating landscape
(Author, 2018)

Manguzi

The town is rich with vast land and forestry activities, Manguzi's sole economic impact comes from the plantations that surround the town's vast rich land. It is almost impossible to drive 5km without finding yourself within tall rich pine-trees lined up systematically on the side of the road.

The plantations became a phenomenal when the town, which was once a pause space for people traveling in and out of Mozambique to coastal part of South Africa, because of its beautiful forestry sceneries and vegetation. Local travelers started noticing growth in potential to develop the town, introducing settlers.
The land was vast, rich and flat which influenced the area being named Umhlabuyalingana, directly translated in English to "Flat Land". The flat land drove agricultural influence for local settlers to make a living out of, and that was the start of plantations.

Fig. 1.21 diagram illustrating landscape section
(Author, 2018)

Plantation Site

Image illustrating grid patterns within the pine-tree plantation structures. Within the main connecting service roads, you find internal road links that divide plantation zones by harvesting maturity and ownership.

Fig. 1.23 diagram illustrating the plantation connections
(Author, 2018)

Fig. 1.22 diagram illustrating the plantations road-links
(Author, 2018)

Visual Diary

Fig. 2.0 image of the local butchery (Author, 2018)

Visual Diary

Manguzi Town


Mkhuze


EXPRESS STORES
CAPITEC BANK
CAPITEC BANK
Sanlam

Fig. 2.1 image of local puplic butcher braai area. (Author, 2018)
Fig. 2.2 (accompanying page from left to right): local petrol station intersection, tourist market intersection, wood hand crafted objects for tourist attraction, main road that connects the town, office building used as rent space, commercial business centre. Shopping centre corridor, supermarket building, wholesale building for construction supplies, (Author, 2018)

Manguzi Town Story

The hybrid culture which resulted from dwellers settling in town from Mozambique and South Africa, has introduced new interesting dynamics in living standards and cultural transformation in Manguzi.

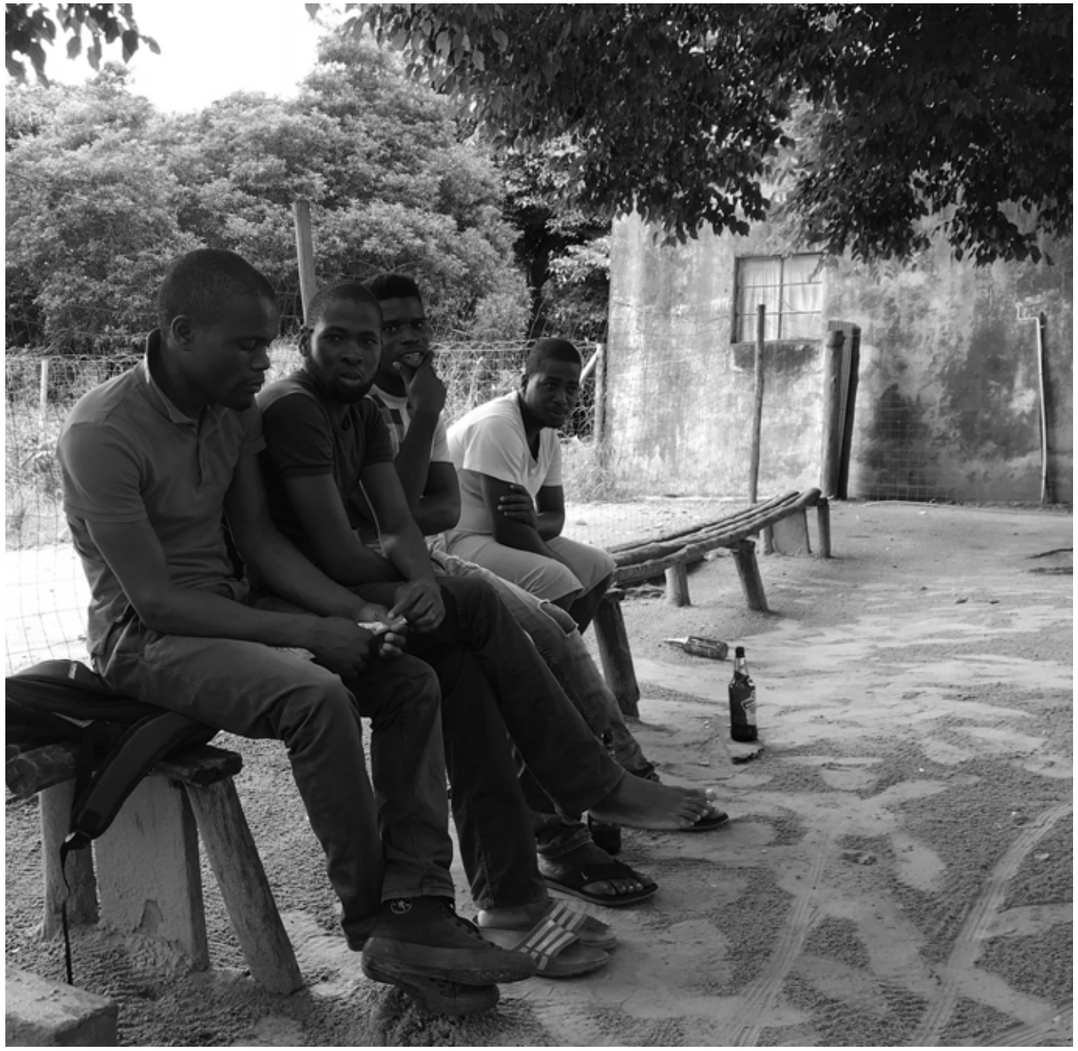
The people of the town live a very much simple day to day life with minimum daily needs, which resulted in the youth of the town to migrate to urban areas for a better living standards. This has resulted in Manguzi being a “ghost town” most of the year and only becoming vibrant in December where most migrated dwellers come back to visit their families during the festive season.
Although migration is still a huge factor, the town itself continues to grow in scale due to tourist attraction in the surrounding borders, bringing in new services and employment.

To try and meet the daily needs of the locals, the town’s main development chain is headed by retail infrastructure. Boxer supermarket being the first and only major retail for the town, has accelerated potential for more retail developments in town as population rises. The town has become the only space locals can exchange services and interact.

Visual Diary

The people


BUZI
STUDIO
BUZI
ISUZU



The People of Manguzi

For those who can’t find means to migrate to urban areas, the town offers little to live by and even less to get entertained with. Therefore locals find themselves having to turn to alcohol abuse and soccer tournament during weekends.
With little employment options and high poverty rate, fresh graduates have to settle for jobs such as supermarket security guards and small scaled local mechanics, for as little as nothing salaries.
.

Fig. 2.3 (accompanying page from left to right): **Local kids socialising after school hours in the local park within the town**, Man fixing his vehicle, **Recreational sport field**, Local hanging spot to pass time during the day, street market on the main road, local second hand clothing street market, Main entrance to mall, main public transport interchange (taxi rank), locals socialising under a tree shade (Author, 2018)

Plantations
process

1. Plantation
The pine-tree plantation is very low maintenance process, where once planted, the tree grows on itself with little to no attention. Road network allow for the service trucks to operate within the plantation

2. Maturity
Before harvesting can take place, pine-tree maturity levels have to be moderated to meet the standards of the commercial industries.

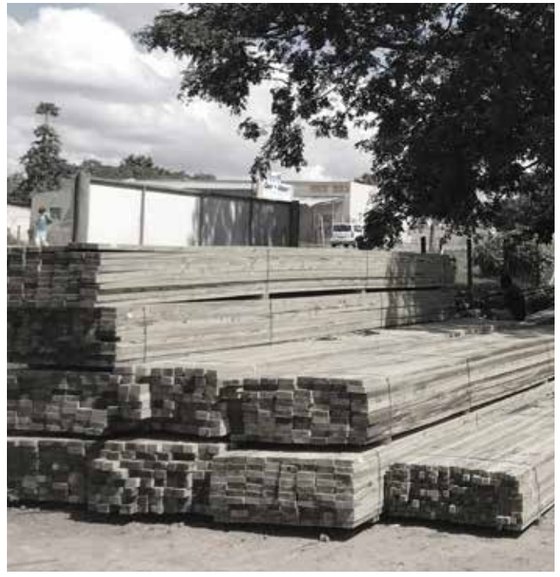
3. Size Chopping
The trees are then cut into specific sizes based on the manufacturing standards and maturity

4. Debarking
The logs are then debarked manually using an ex by the labourers. The logs are then laid out on the ground in different sizes and specifics, ready for the truck to load them

5. Replanting
This is a natural process where careful note is taken when chopping the trees. The trees are not chopped any less than 200mm from the ground. This allows for the sterm to regrow on its own without any replanting involved. The only risk is that the more it's done, the less thickly the log.

6. Air-drying
The logs are then transported on the side of the main road network and left to air-dry unmonitored, before the next stage can take place.

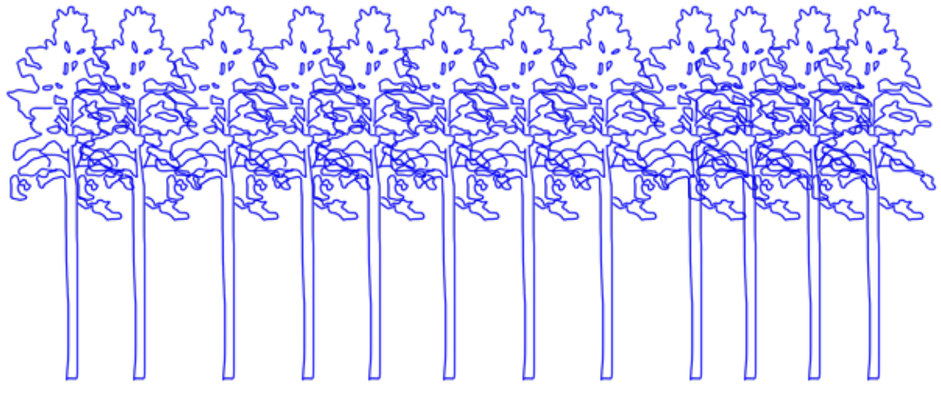
7. Transportation
Once the logs reach a certain level of being dried, they are loaded to the truck and transported to big paper-making industries and construction manufacturing companies.



8. Processing
Some of the logs are further processed into Lumber for construction.

Fig. 2.4 (accompanying page from top to bottom): **Privately own plantation site. Pine-tree bark, Site haversting process, size organised logs, Tree stump, Piled logs air-drying, Lumber at a local warehouse shop.** (Author, 2018)

Farming



Farming in the plantations

As settlement developed on the town of Manguzi, agriculture and farming still remains the main source of income for a large portion of dwellers and the town's identity. Given the recent land compensation and drought in agricultural activities which led to South Africa recension scare, questions arise on whether it is still economical viable, and if not, what does that mean to the local dwellers who farming still play a huge role in putting food to the table at homes.

Fig. 2.5 Image of a farmer debaking a log (Author, 2018)
Fig. 2.6 Illustration of a plantation (Author, 2018)


a


b


c


d


e


f

Fig. 2.6 from left to right (Author, 2018)
House 1: House of Phiwe, House 2: Ngubane residents.
House 3: Dudu residents, House 4: Manzini residents,
House 5: Mthembu Residents, House 6: Ngubane Residents

Visual Diary
Local Architecture Series

Residential Architecture

The common residential architecture found in the town consists of a local material called “Umhlanga” which is dried and sewed onto the walls, acting as insulation, then cement plaster is applied both on the interior and exterior.

Many of the homes are of humble proportions, mainly due to limited income sources. In some cases, the house is one room with open plan organisation of spaces. (See image e)
Local materials are utilise to their full potential to cut building costs and that has translated and defined the architectural language commonly found in the town.

The government has tried to help locals by supplying RDP houses which are a basic 3 room 6x6 block houses, which consist of two bedrooms and one open plan lounge and kitchen space. (See image C)

Detailing: Timber Materials

This series is to analyse how timber is used in local contruction methods, in hopes to adapt and develop these techniques further.

Fig. 2.7 from left to right (Author, 2018)
roof bean support, door framing, window framing, cladding detail, plastered vs unplastered facade, rock cladding light difuse, umhlanga wall detailing, timber ledder to building roof.

Umhlabuyalingana District

Industrial Municipal Planning

Manguzi town falls under the Umhlabuyalingana district located in the northern parts of KwaZulu-Natal.
The Spatial Development Framework for Umhlabuyalinga aims to address the imbalanced formed during the apartheid era in South Africa focusing on the specific rural context of the area. Understanding this framework will help align and understand needs and visions for Umhlabuyalingana municipality, in order to align them with the research project.

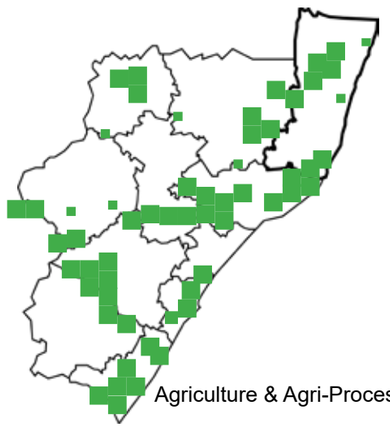
South Africa - KZN

KwaZulu-Natal - Northern

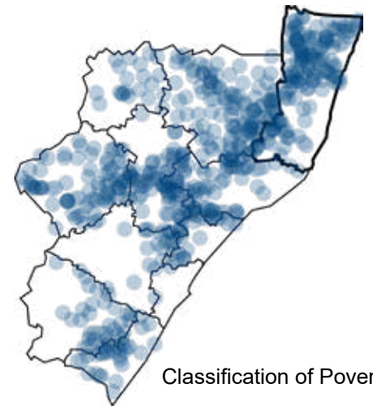
Umkhanyakude - District

KZN - Municipal Divisions

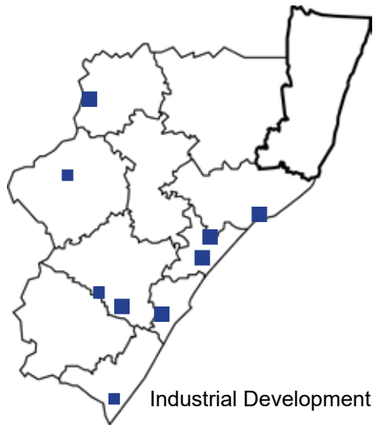
- Umkhanyakude
- King Cetshwayo
- Zululand
- Amajuba
- Umzinyathi
- Ilembe
- Ugu
- Harry Gwala
- Ethekwini
- Umgungundlovu
- Uthukela



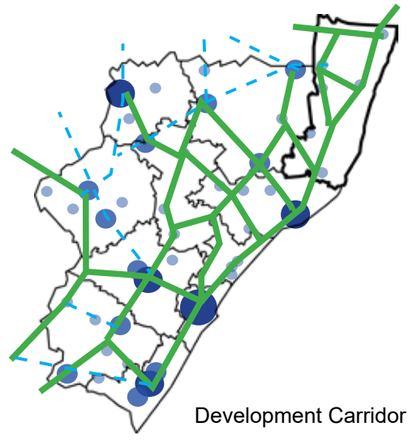
Agriculture & Agri-Processing



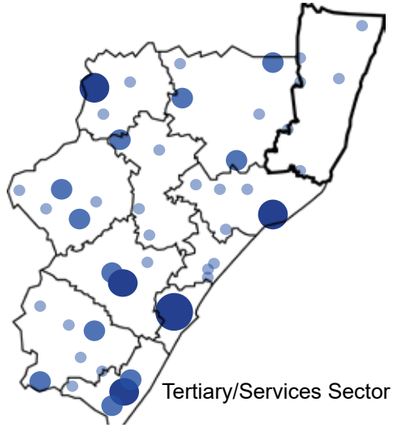
Classification of Poverty/Need



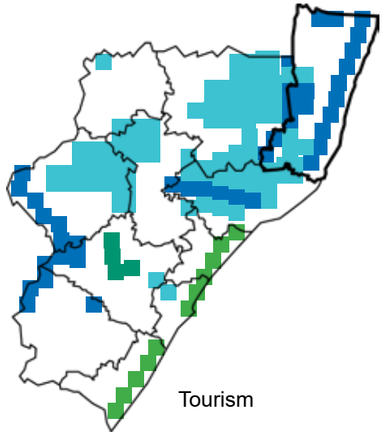
Industrial Development



Development Carridor



Tertiary/Services Sector



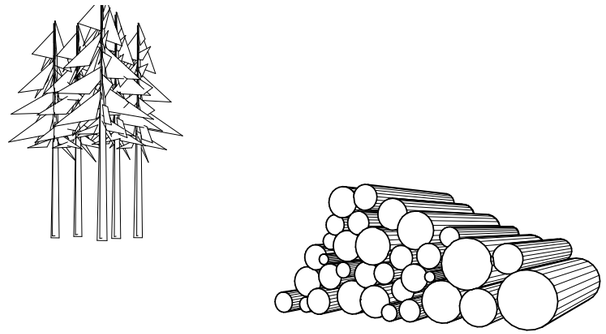
Tourism

1. Library
2. Manufacturing Supply
3. Mixed used Centre
4. Shopping Centre
5. Informal Market
6. Shopping Centre
7. Cambridge Supermarket
8. Spar Supermakert
9. Proposed New Mall
10. Boxer Hypermarket
11. Manguzi Hospital
12. Primary School

Fig. 2.8: arial shot image of Manguzi town via Google Maps

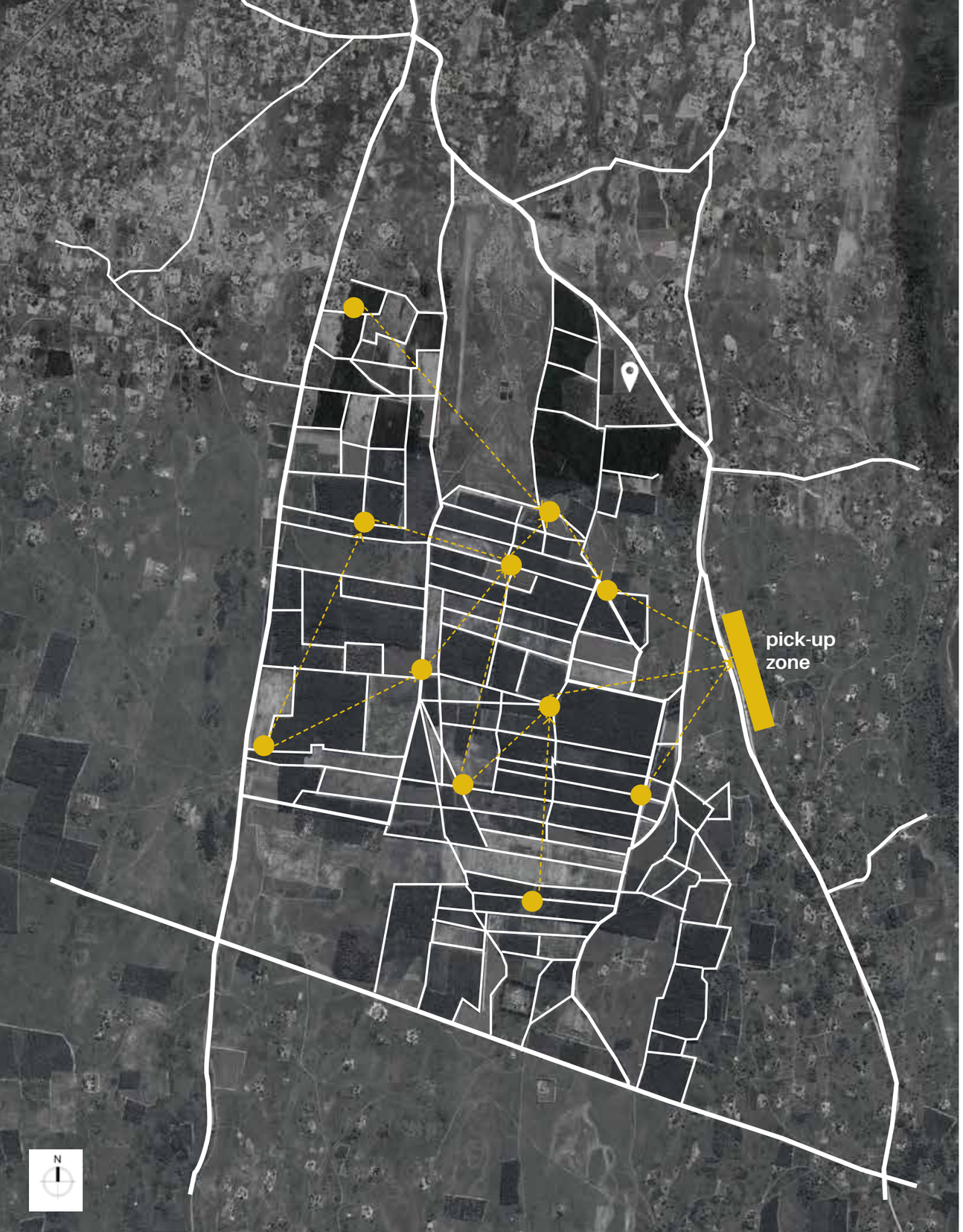
Fig. 2.9: Image of farmer debarking a log on site
(Authors Own, 2018)

Workers Story Telling



Workers

- working conditions are not fair
- lack of working equipments
- work in a group of 12 workers per plantation plot
- no lunch break
- long hours
- hard labour
- often resort to sleeping on site for productivity
- traveling long distances to site
- little salary
- debarking of the wood logs is manual



Farmers Story Telling

Harvesting

- cutting of the pine trees once matures
- 5-8 year cycle
- farmers hires sub-contractor to cut and harvest the wood
- wood logs are left on the side of the main roads to dry up
- Sappi transports the wood to RichardsBay 300km away
- Sappi/Mondi pays farmer who pays his sub-contractor and is left with little profit to sustain another cycle.

Fig. 2.10: Image of local plantation owner (Authors Own, 20118)
Fig. 2.11: Image showing the plantation working system network from the harvesting to the drop-off, pick-up zone (Authors Own, 2018)

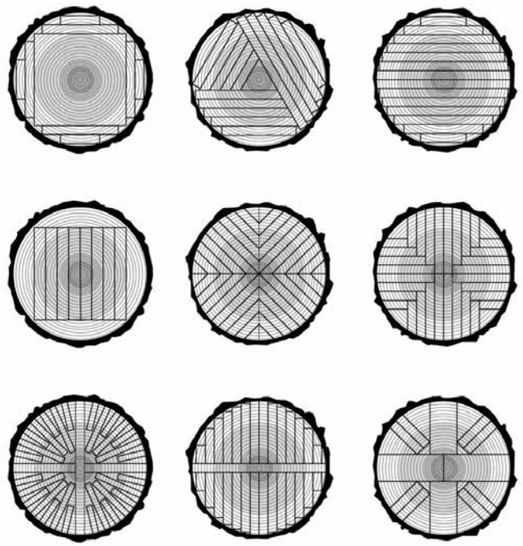
Pine Tree as a Resource

Timber from Pine Tree

As the image on the right illustrates, pine tree is the most common tree type used in most timber manufactured products such as construction lumber, pulp and biomass and affordable furniture.

Fig. 2.15: Illustration showing product made out of pine tree.
(Authors Own, 2018)

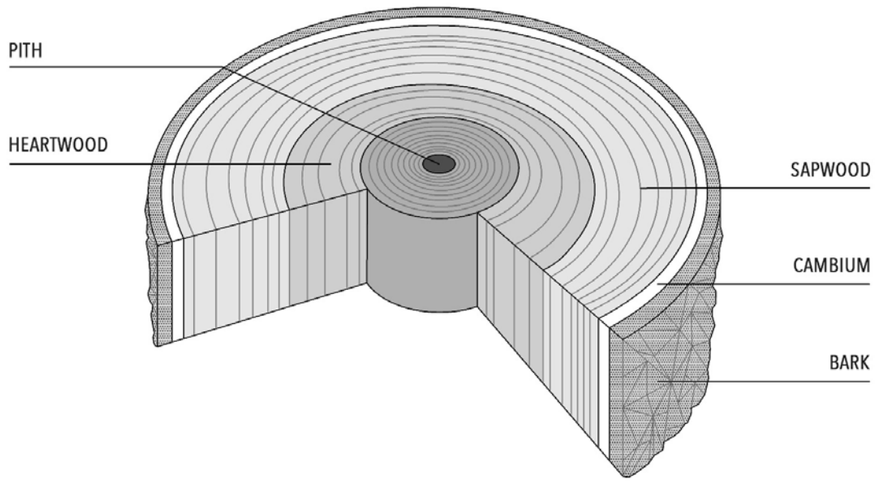
Different Ways to Saw a Tree Trunk



How Tree Trunks are cut into Lumber

Wood is probably the most widely used material in the world, very much is known about its manufacturing process to determine appearance, performance and dimensions. Lumber can be extracted from a wide range of tree species but i chose to look at pine tree as a resource, because it is the main tree type found within the Manguzi Plantations. Each wood section has its own different functionalities based on the cut and tree type.

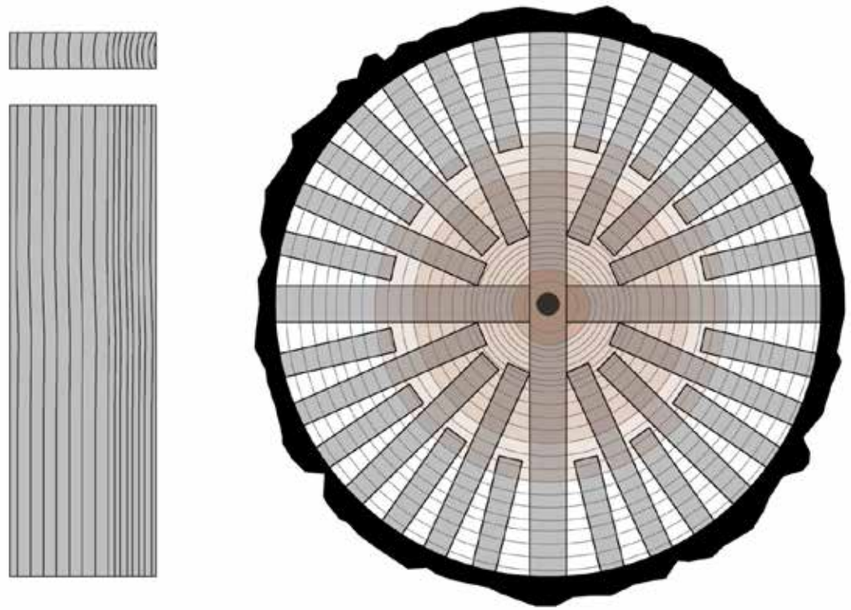
Left to Right
Fig. 2.16: Illustration of different tree section cuts. (archdaily.com, 2018)
Fig. 2.16.1: Illustration of different tree trunks in section showing different layers found within a trunk. (archdaily.com, 2018)



Parts of a Tree Trunk

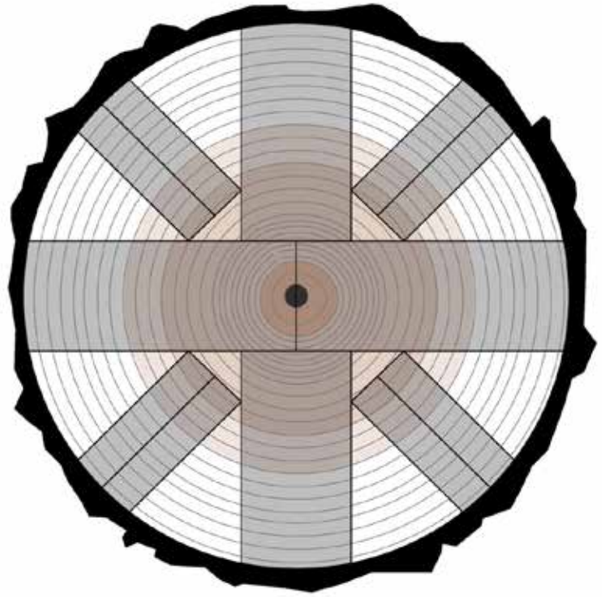
Analysing a tree trunk from outside to inside, one can identify the following parts:

Bark: Exterior layer acting as skin to protect the inner layers.
Cambium: A layer that creates new cells which increase the tree diameter yearly.
Sapwood: A layer of the wood with high water content.
Heartwood: A matured, hard and rigid layer of wood.
Pith: core trunk, very rigid and has little to no humidity.



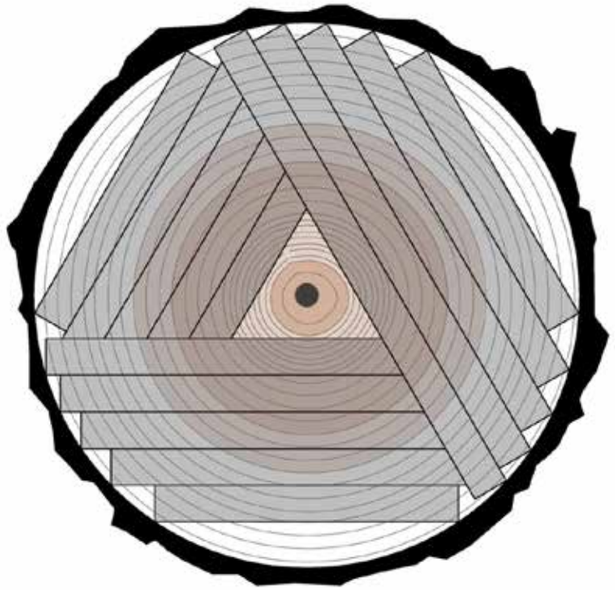
Rift Sawn

The cut is perpendicular to the ring of the tree bark. With this cut, the wood grains are exposed and a lot of material is wasted in comparising to other cuts.



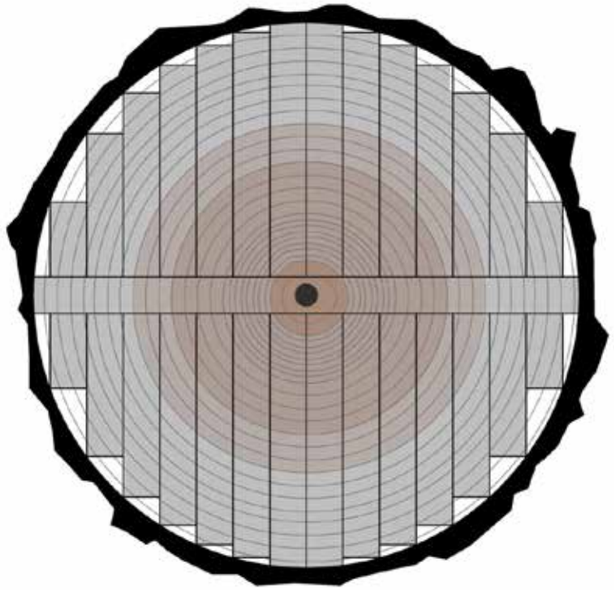
Cross Cut

The main focus of the cut is to utilise the heartwood to its full potential, in order to have very resistant pieces. Smaller pieces are cut from the remaining wood.



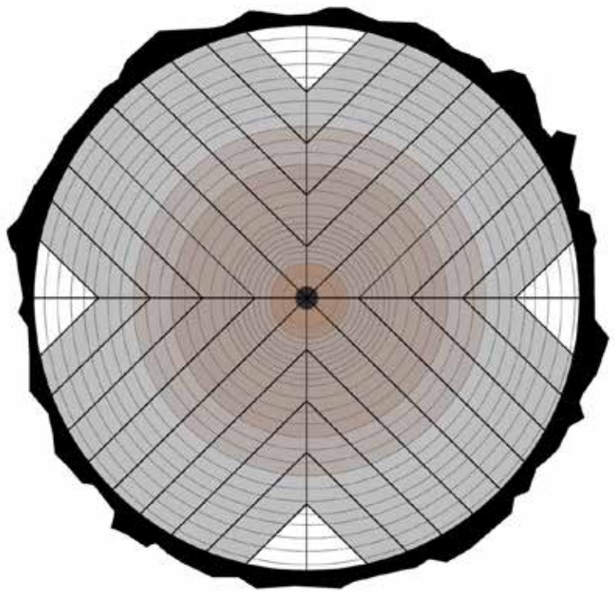
Cantibay Method

This type of cut utilises the use of wide boards with minimum waste, while eliminating the core trunk.



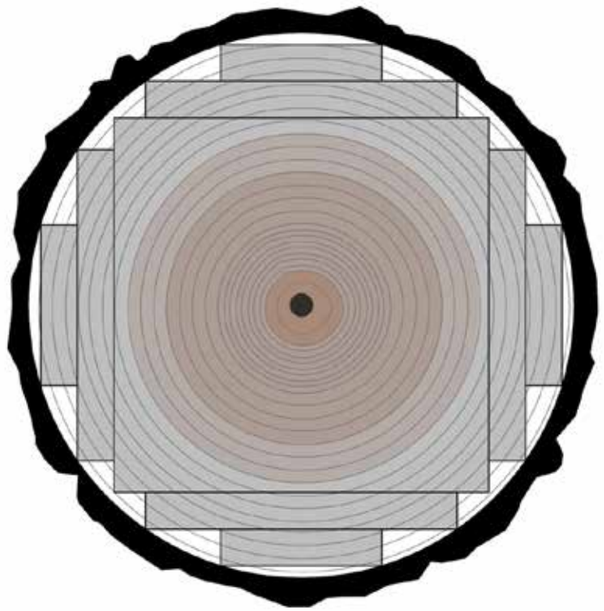
Interlocked Cut

The first pieces cut are the ones that intersect the core trunk. This method provides thin boards that are resistant deformation and strong.



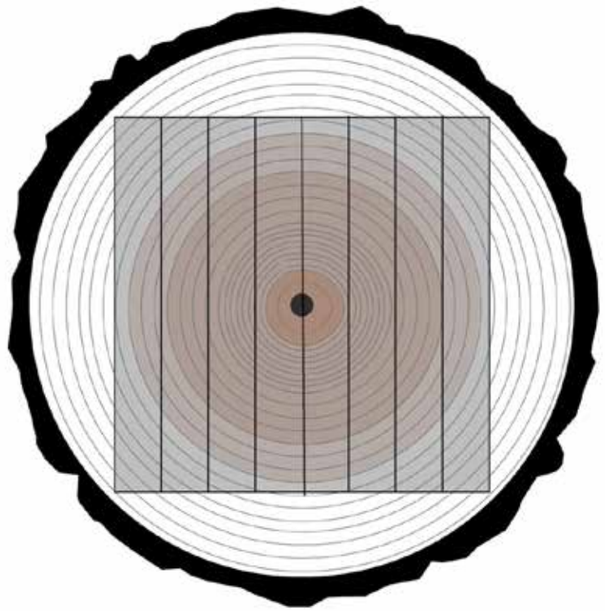
Quarter Sawn (Alternative Method)

Pieces of good strength and quality are obtained through cutting the trunk into four quarters.



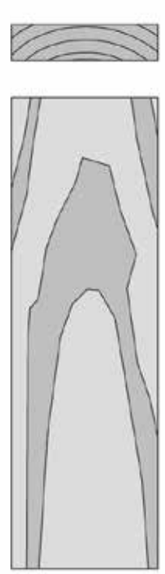
Whole Piece

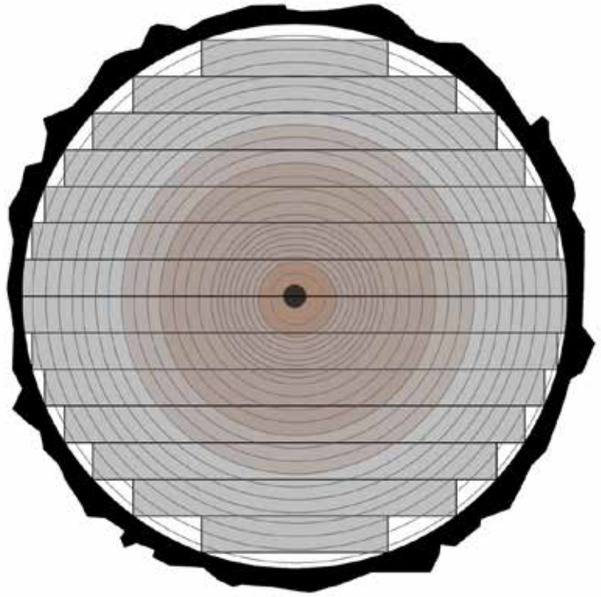
This cutting method aims at utilising the full potential of the trunk to obtain a single square log.



Parallel Boards

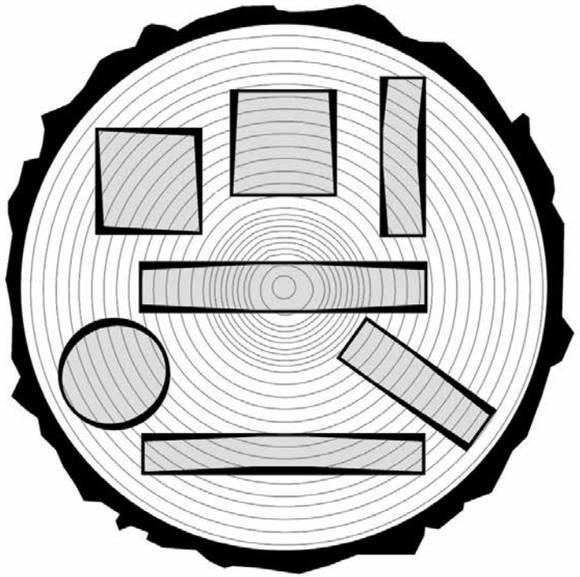
Similar to the Flat Sawn system, but the only different is that smaller sections are cut, leaving less difficulties when it comes to warping.





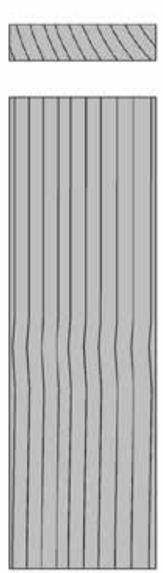
Flat Sawn/Live Sawn

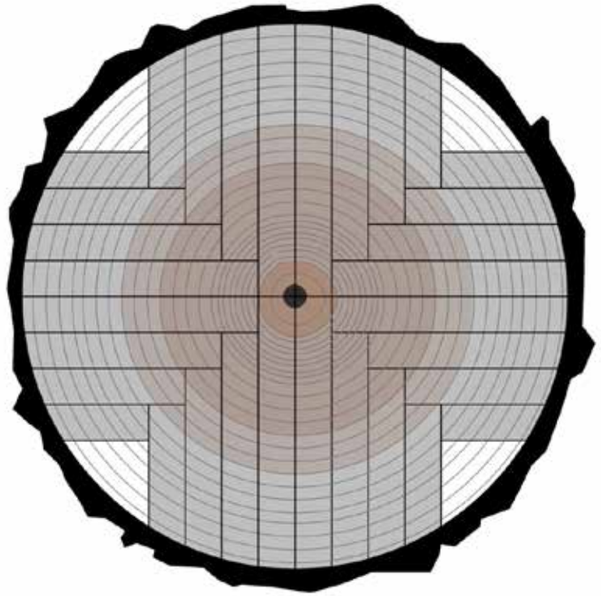
The most commonly used method, even though the resulting pieces are not of the best quality since most pieces are cut from the sapwood and heartwood. This method those obtain most number of pieces cut.



Deformations

Different contractions occur when wood dries up, depending on the type of cut. The direction tangential to the rings commonly results in deformation, therefore each piece strength is depended on that.



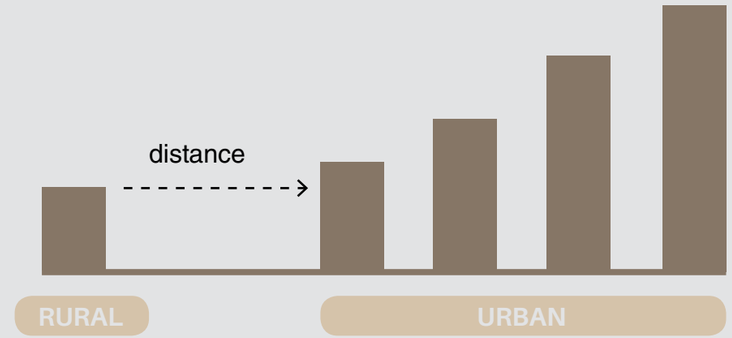


Qaurter Sawn

The four axes of the trunk influence the direction of the cuts, obtaining pieces that are not to prone to warping.

Design Question

Located Northern KZN in a rural Manguzi village, the building complex is a processing and manufacturing facility for pine tree timber. When it comes to making vital industry chains of logistics, distribution, community services, and so on, the rural areas are becoming the incubated land via its labour and regional advantages. This projects aims to take advantage of those potentials.



VALUE CHAIN

Fig. 2.12: Illustration of Industrial value chain showing economic gap between rural and urban areas (Authors Own, 20118)

Industrial value in rural context

The diagram above illustrate the current issue of the structures of the value chain in the sharing of resources between urban and rural areas. The project aims to shorten the distance between the raw materials found in the rural and the production industry.

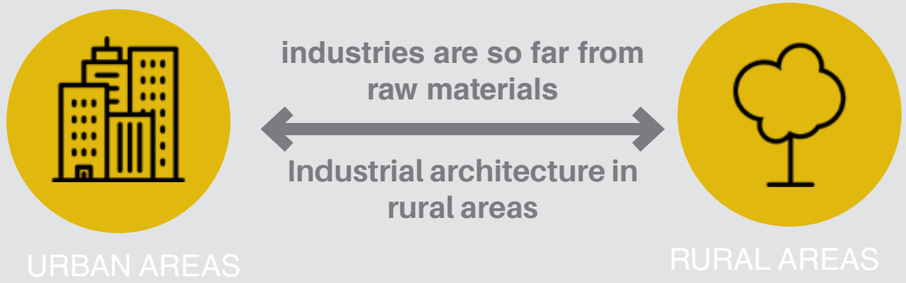
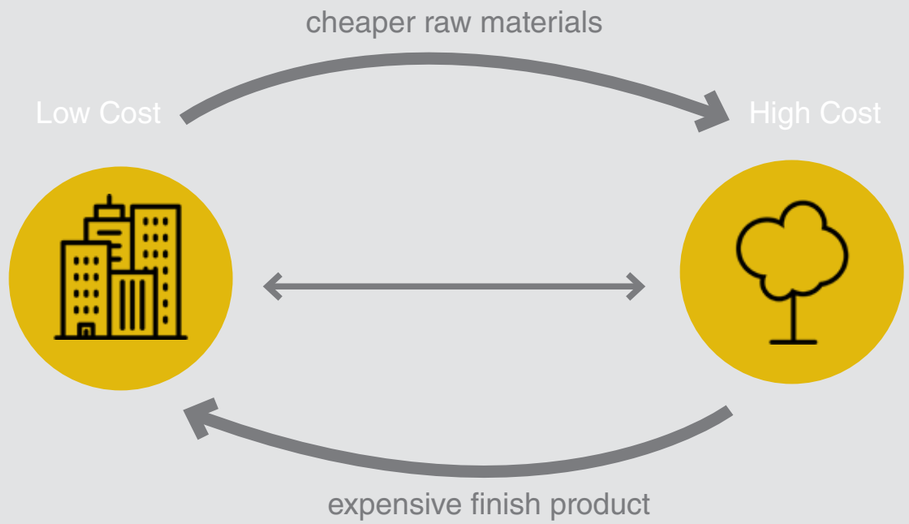


Fig. 2.13: Illustration showing industrial gap between rural and urban areas (Authors Own, 20118)

Flow of Resources



RAW MATERIALS
Primary

INDUSTRY
Secondary

PRODUCT
Tertiary

Fig. 2.14: Illustration showing industrial flow of resources between urban and rural (Authors Own, 20118)

2.
Theoretical

A timber processing factory empowering rural areas through value addition

Argument

Introduction

Urbanisation that is accelerating rapidly, has increased the interdependence between rural and urban dwellers, through the resources they offer each other. While this has introduced forms of innovation in underdeveloped parts of South Africa, the balance between what the urban areas take from the rural areas verses what returns in the form of economic up-liftment, industrial transformation, cultural and social development, as well as quality of life, is still very much unbalanced.

Despite this imbalance there remains, still, a strong connection between urban and rural spaces when it comes to the harvesting, processing and packaging of raw materials such as timber into paper, however the income that on-the-ground workers receive from rural farming, especially small based producers, has decreased as more people engage in non-farming activities .

This is closely linked with an increase in rural dwellers migrating to urban areas to seek better living standards. Available studies suggest that 80-90 percent of workers in certain regions of southern Africa will at some point migrate to more urban areas looking to increase their household income via non-forestry sources (Tacoli, 2007).

What is forestry all about you may be asking yourself at this point. Well, put simply, forestry is the art and practice of understanding, managing and using wisely the natural resources associated with, and derived from forest lands. These resources include timber, water, fish, wildlife, soil, plants, and recreation. This research specifically focuses on the timber product of forestry,

and looks at a region in northern Kwa Zulu Natal (KZN) known as Mhlabuyalingana where a town by the name of Manguzi exists. Manguzi, as one will discover more and more as the paper continues, is best example to illustrate the concepts introduced above in a practical sense, as well demonstrate how we can possibly begin to resolve these issues that are strangling the economy of rural areas. But before that, some context on KZN forestry must be highlighted.

The KZN forestry statistics state that 55 percent of all timber used in South Africa is processed in KZN, contributing 10.7 percent of the Provinces Gross Geographic Product (GGP) through forestry products and a further 1.5 percent through forestry (Kzntransport.gov.za, 2005). This clearly demonstrates the enormous role forestry has on the KZN economical value, yet there is still a large portion of rural dwellers who depend solely on non-forestry income sources. Why is this a reality? To answer this, the research takes a sharp look at current profit-focused chain of production from the initial timber growth right down to final packaging as branded paper, furniture or other retail product, to uncover where the gaps, and opportunities for transformation may exist.

The challenge found in the industrial value chain system is that the foundational structure is built on capitalist ideologies. This profit-driven, and single-minded mode of production, creates an unsustainable foundation in which the value chain is built upon, making auxiliary functions near impossible to implement, thus ultimately limiting community growth.

As can be expected, the current above-mentioned form of the value chain between the rural forestry sector, which grows and harvests the timber, and the urban industry that is the final seller of the processed product (as branded paper, or furniture, for example), has resulted in an imbalance of scales when it comes to economic distribution, creating a wide income gap.

An easy example: the farmer sells his corn for R2.00, and after it goes through the value chain it is sold back to the farmer as popcorn at R10.00 – the farmer cannot afford the end product of his own labour. This is because the end-point of the value chain has stretched itself so far away from where it began that the final cost when brought back to the farmer (who is at the starting point of the value chain) is too high for them to afford.

As the paper continues, other value chain based insights are exposed that can help usher in transformation to cure the economic stranglehold urban areas have over rural through architectural tools. At this point, it must be emphasised and made clear that it is not possible for architecture to improve the value chain – The value chain is a set of activities of production within the economic system. Architecture does not in any way shape the value chain. Therefore one cannot use architecture to fix or change the value chain. Therefore, the question here is how can one use architecture to reduce the locational gap in the value chain by shifting the location of value-addition to raw materials in places of extraction. This further sparks the question regarding Industrialisation and architecture in a rural context. The question being, which typology of Architecture is best to achieve this objective of reducing the locational gap? The answer is Industrial Architecture.

The Architectural question that then emerges is: How can Industrial Architecture reduce the locational gap in the industrial value chain, to improve the economic state of rural areas creating the opportunity for supporting activities to be included?
The answer presented must clearly demonstrate why Industrial Architecture is the best architectural typology, when applied to an area such as Manguzi (that has a strong economic reliance on the timber product of forestry), to play a role in ultimately releasing the neck-clutch urban areas have on rural economies.

The research aims to demonstrate this by looking at activities that can be performed in rural areas using the raw material harvested, before the material is moved to urban areas for further processing. The research will further explore possible ways to restructure the industrial value chain through re-specialisation. This means examining the entire chain, from the primary stages of labour (the labour of raw material harvesting) to the industrial production stages.

By moving activities within the supply chain previously only dedicated to and reserved for urban areas closer to rural areas, not only keeps the supply chain safely intact but improves the context and value found in rural areas.

This then becomes the genesis of the program where the architecture is an industrial factory that shelters harvesting and processing of timber in northern KZN, to allow for the surrounding context to feed into it.

The main activity, amongst many others the building does, is take wood harvested from the forests of northern KZN and processes it to be transported to the urban areas where the final stage of production takes place. This activity adds value to the raw material, which in return uplifts the rural economy.

In a social context of poor living standards due to lack of economic activity this building aims to – parallel to wood-processing work – lend itself as a community workspace in order to be the focal point for skills development, cultural transformation and most importantly a port for other small local industries to plug into.

The chosen site is Manguzi, a small town nestled and tucked away neatly in a remote part of northern KZN. The site also sits very close to my heart, as it is the town I was raised in under the guiding hand of my beloved grandmother. It is a place I call home. A place where my roots found fertile soil to grow as a child, and many of my fondest memories remain of that small town, Manguzi.

Growing up in a small town with limited daily resources, I had to leave my friends and extended family and migrate to urban areas to seek a better quality of life, thus making me part of Tacoli's statistic of those who leave rural towns seeking non-forestry work for a improved quality of life.

For those dwellers, many of whom are my hometown friends, who are not as fortunate as I was to migrate to urban areas, what is left of their reality? Well, the town has timber activity, mostly matured pine, established to supply raw materials to well-known companies such as Sappi and Mondi with the material they need to produce paper.

A high portion of the site plantation has been bought, from local farmers, by big industry companies, limiting access to the farming land forces dwellers to engage in non-farming activities mostly found in urban areas (Tacoli, 2007).

Based on these points, the site in Manguzi allows the use of architecture as a common thread to address the town's social economic context and its industrial value chain, in hopes to mitigate. The research is divided into three sections. The first is an

examination of the social movement in Manguzi, to give insight as to why different members of that society are moving from rural to urban areas, in order to bring to light the linkages between both areas. The second, investigates the imbalance caused as a result of current profit-focused value chain process. The third section considers how Industrial Architecture, via a building intervention, can be part of the answer to the economic issues the current value chain structure causes in rural areas.

The research thus, layer by layer, peels away the underlying tensions between urban and rural; raw and finished product. Architectural design and industrial engineering, are given the spotlight in the search for economic transformation and social balance in the value chain. The hope is to turn the one-sided arm-wrestle between the rural and urban areas to a partnered hand-shake where both areas work for the benefit of the other.

2.1
Rural and Urban Interactions

Essay Structure

01
- Introduction

02
- The Interlink flows of Rural-Urban Linkages

03
- Global Scale

04
- Local Scale

05
- Rural-Urban Linkages Influence on Dwellers

06
- Conclusion

Rural and Urban Interactions

The linkage, created by the supply-chain stemming from the harvesting of raw material such as timber into a final retail product such as furniture or paper, that rural and urban areas share has increasingly become significant in the development of the two areas.

This supply-chain linkage has created an economic interdependence between urban dwellers and rural resources. Urban areas need the raw materials, such as timber, rural areas grow, and rural areas need the final products (such as paper) often packaged and sold in better developed, urbanized areas.

The difficulty in this rural-urban bond is that urban areas are able to receive the raw material from rural areas at a very low price. Then through the value-addition that the raw material undergoes away from rural areas (closer or within urbanized areas) from which they are found makes the final price when it finally returns to the rural areas too exorbitant for most to afford.

While it is easy to imagine this unfortunate circumstance only applies to few products, the reality paints a far more grim portrait. Reality shows us that this circumstance applies to many products, many of which are a daily necessity. This strains the pockets of rural dwellers who find themselves being able to afford less and less the more the value chain is stretched away from them as the suppliers of raw material (Lesetedi, 2003).

Migration into urban areas, which have stronger economies, then becomes the only reasonable option in finding better livelihoods for rural dwellers. Although migration may introduce economical upliftment for individuals and their families (through accessing better education systems, healthcare facilities, employment opportunities etc. In the urban centres, it is must be noted that employment security is often uncertain due to many of those who migrate from rural areas being unskilled, unqualified, poorly educated or lacking the monetary strength to get to where the opportunities lie in the cities.

Therefore most rural migrants continue to keep in touch with the rural areas as means of security – they use it as soft ground for them to fall back on during bad times, as well as staying in touch with family.

This chapter unpacks the urban-rural bond from a social and economic perspective, and uses the rural town of Manguzi, in northern KwaZulu-Natal (KZN), South Africa as the field-scope to find how these linkages play a role in influencing migration to urban areas and its impact on social and cultural transformation.

How things flow creating links between rural and urban areas
The different flows that exist between urban and rural areas must be understood in order for us to get a firm grasp of the driving factors influencing the economy and migration between a rural area such as Manguzi and urban areas. The various flows are listed below.

There exists the flow of commodities, mainly forestry, from Manguzi-grown raw materials to urban industries, both on a global and national scale. This supplies urban areas the needed resources for products such as paper and furniture at a very low price.

There also exists the flow of end-products from urban industries into rural areas. Because of the process of value-addition that took place before the end-product was transported into the rural areas such as Manguzi, many of these end products cost a lot of locals to afford.

There is the flow of people migrating from rural settlements such

as Manguzi to urban areas in search of better living standards. This is due to low number of opportunities to improve their economic standard.
There is also the flow of information from urban areas to rural areas such as Manguzi. Information on the better employment opportunities, lower cost of goods, skills development opportunities, greater availability of living resources, as well as information on more efficient industrial processes for small businesses looking to improve their processes.

Global Scale

On a global scale, the trading of raw materials found in rural landscapes, for example, timber harvested and manufactured in South Africa to international producing industries, can have an economic impact on both rural and urban areas.
In the forestry sector, the trade of exporting raw materials is largely controlled by international traders, who overlook, hardly invest and restrain from adding value to local based producing industries. Moreover, the increase in highly developed products and quality requirements linked with international retailers often means the small scale farmers who have little access to infrastructure and financial capital to produce a high standard product, are overlooked in the marketplace.

It's a tough reality that hits hard for local manufactures. More common than not, the young generation who notice this find little to no interest to follow in their elder's footsteps, thus often find themselves working in the local tourism sector.

Manguzi, being deeply rural yet close to the sea finds itself rich with wildlife and nature, attracting its fair share of tourists during in-seasons. This is where the younger generations seek employment in hopes for a better future. Tourism when loosely controlled and regulated, and conducted in the same areas over a long enough period is known to negatively impact the environment. This is a negative outcome indirectly linked to the weak economy found in the primary local activity of timber production.

Local Scale

On a local scale, Tacoli (2003) notes that the relationship between rural-urban interactions can be influenced by a number of factors,

factors such as:
1. Geographical and demo-graphical nature, including nature of forestry land, population density of a settlement and the patterns of distribution).
2. Farming systems based on land tenure and access to natural resources.
3. The availability of roads and network platforms which link settlements to urban frameworks, where markets and services are based. (Tacoli, 1998)

All these factors play a role in reinforcing rural-urban interactions. Taking these factors into consideration, the timber town of Manguzi shows great potential for growth because of its geographical location, sitting right in the main connecting road from Mozambique to the southern parts of KZN.

This connection magnifies the potential network platforms that the site possesses but hasn't fully unlocked to benefit surrounding settlements. The proposed site in this aims to take full advantage of this in addressing the research question.

How rural-urban linkages influence Manguzi town dwellers
The contribution of rural–urban linkages to livelihoods varies depending on:
1. households' and individuals' wealth and status
2. their gender
3. age
4. ethnicity and, in many cases
5. religious and/or political affiliation" (Lesetedi, 2003).

Based on the above, the need to seek better livelihoods has increased migration to urban areas. Many dwellers are influenced by the basic need to access urban based resources such as market goods, services and labour which becomes an important factor for migration.

In conclusion

It is clear that a link exists between rural and urban areas. However the relationship between rural and urban areas is very much imbalanced as urban areas enjoy the most resources, yet these are supplied by rural areas that suffer from difficult living standards as they do not have a varied list of activities.
This is a driving factor for migration of rural dwellers to urban

areas, however there remains a social connection of migrated rural dwellers to their hometowns. Many migrants stay in touch with their families which remain in the rural areas and often visit during holiday seasons or when they fall on bad times. This suggests that if there was a better living standard in such rural areas perhaps there would not be such a high migration rate.

This leads us to believe that it is not the geographic location that is the issue, nor an issue driven by culture, but much rather due to the resources and economic opportunities the location offers that is driving dwellers away and into more urban areas.

It is imperative that the site is able to cater for a varied number of activates over and above the primary timber-related function.

2.2
Unequal Development

Essay Structure

01

- Introduction

02

- Capitalists Mode of Production

03

- Conclusion

Unequal Development

This section puts under the microscope the current value chain and the foundational ideologies it is built upon. This is to give insights on what can be manipulated or shifted through architecture to give influence or change into the chain.

The current chain starts at the point of extraction in Manguzi, where timber raw material is grown and harvesting.
The harvested timber is then transported away from Manguzi to Richard's Bay where the next step in value addition takes place. In Richard's Bay, which is further down the coast from Manguzi, the raw timber enters the paper mill where it undergoes a number of processes including being chipped and pulped.

Thereafter it leaves the paper mill to continue down the coast to a paper and paper-based packaging facility where it enters a finishing machine.
The final arrival point after leaving the packaging facility, is the big city of Durban. Here the refined and packaged paper sits in warehouses waiting to be sold to other suppliers and wholesale shops.

The process of vertical channel distribution then occurs to move the paper back into where it originated from (Manguzi), where suppliers sell to wholesalers, and wholesalers sell to nodal retailers who sell to other retails who likely then sell to other retails. Each time in this process cost rises as each seek to make a profit.
By the time this same paper finds itself back in retailers shops in Manguzi, the cost has increased to a point where most cannot afford to buy.

In Durban, the paper. While in the hands of the manufacturer Sappi and Mondi is sold at a much lower cost. In a robust city with many differentiated activities and strong buying power this system without a doubt boosts the areas economy as wholesalers and retailers are able to maximize their bottom lines.

However, because of the many steps home the paper takes, and in a town where the main activity is that of harvesting timber for paper, the return of this paper at a significantly higher price hurts the pockets, and ultimately the economy of those that reside in the area.

The opportunity to build an economy are extremely reduced in Manguzi as the timber leaves the town immediately, allowing no other activity to related to the timber to exist. In Durban the paper enjoys its hearty share of channel distribution from manufacturer to retail, allowing for healthy economic activity to take place.

This is how the current value chain structure creates, or at the very least perpetuates, unequal development between the timber-harvesting town of Manguzi and its urban counterpart Durban.
Capitalist Mode of Production

According to Amin (1976) the "capitalist mode of production" refers to the systems of organizing production and distribution within capitalist societies (such as ours).

It is characterized by private ownership of the means of production (in our case Sappi and Mondi own the factories in Manguzi), extraction of surplus value (value in our instance being the timber) by the owning class (Sappi) for the purpose of capital accumulation. The purpose of this system is clearly stated as capital accumulation. Not skills upliftment. Not area development. Not sustainable growth.

Not anything that may help the community and residents of the area.

What tends to happen in such a mode of production is that factory technology eventually becomes so advanced that local labourers are left incapable of handling, what was once a “simple” means of production because they have not grown their skills due to lack of resources.

Because of this system, the local the industrial workers could never hope to one day build their own factories for production. The system leaves the workers and labourers without any avenue to improve their situation (Amin, 1976).

There is a challenge in influencing the capitalist to reimagine their structure or at least, build a sufficient relationship with the labourers in order to share information and resources.

The power structures that go beyond the small town of Manguzi over and above the unequal sharing of the commodities make it even harder to restructure the value chain. This leads one to the idea that the solution perhaps doesn’t lie in the re-specialisation of the value chain but more in the idea of intervening to mitigate the negative impact.

“The organization of the social division of labour (between the productions of “capital goods” and that of consumer goods) and the time needed for going over from a given structure of this division to a different structure, corresponding to a .higher level of development, of the productive forces (a period of time governed in the last resort by the time taken to train and transform men: technical training, reorganization of production, etc.) have to be considered from the standpoint of a single choice to be made - that of the solution capable of reducing to the minimum the necessary social-labour time within a given time-prospect.”

(Amin, 1976)

2.3
Industrialisation and Urbanisation

Essay Structure

01

- Introduction

02

- Modernisation through Industrialisation

03

- Structuring through Decentralisation

04

- Conclusion

Industrialisation and Urbanisation

Introduction

This chapter looks at industrialisation and how in South African society, where class, ethics, and different linguistics overlap, it tends to obscure the industrialisation as a process.

(Trapido, 1971) when it comes to industrialisation, it is an accepted view that the circumstances of an area must be considered .
With that said, a lot of research in the past years has been centred on the balance between the forestry and industry. The concern is about the changing relationships between forestry and industry and the right allocation of investment between the two sectors (Tacoli, 1998).

The allocation of investments in the timber sector can provide surplus for industrial and urban development. Whereas the allocation of funds in the industry sector, Escobar (1995) points out that industrial and urban growth are necessary for a modern forestry sector that includes timber. What is important to note is that

these are the two approaches that policies aim for when looking for economic growth.

Modernisation through Industrialisation

Modernisation processes are a big part of industrialisation and urbanisation. Tacoli (1988) defines Industrialisation as economic change brought about by technology – “technology being the sources capable of continuous development as a result of applied scientist research.” (Tacoli, 1998).

Until the mid-1960’s (Tacoli, 1998) when urban migration became the new wave, rural dwellers were migrating to urban settlements for a better living standards, as well as finding modernised employment away from the traditional farming methods.

Studies were done to try an implement urban settlements for the labour migrants. However this introduced new problems, where the influx migrants overflowed the urban sectors and the industry sectors could not absorb the fast growing population.

This dilemma highlights an interesting debate on the interdependence of the rural agriculture sector and the urban industry sector, previously discussed by Lewis (1954).

The ongoing debates on the development marginalised sectors where, on one side, there are concerns on the over population in the urban areas and, on the other hand, there rural areas are experiencing slow timber production because of migrations.
The common misused notion is that the rural areas contain the poor and low sources of incomes, but the urban areas contains vast wealth and powers (Tacoli, 1998).

As much as this is true is some instances, it still ignores the poor who live in urban areas and the rich that settle in rural communities. These notions were described by Bates (1981) where an analysis, based of industrialisation, was done on the urban elite who take control of the economies and direct it all in the urban sectors, distorting the developments structures based in the rural African economies that is forestry production such as timber (Tacoli, 1998). This notion points out the displacement in the industrialisation and the dominant elites have in controlling the flows. Which opens an opportunity for restructure adjustment within the industry and open

new opportunities through decentralisation, to find a balanced system for all.

Restructuring the value chain by decentralising activity
It is expected that the removal of a distorted pricing system associated with import-substitution industrialisation and other single-minded, profit-focused approaches to building the value chain, that long timber production will blossom and expand (Tacoli, 1998).

Much of the reality for small farmers such as those in Manguzi, structural adjustments can result in cost implications for forestry produce.

In order to counter this, small scale farmers rely on government support. But with most departments cutting down on municipal budgets, it makes it even more of a stretch for small scale farmers, and in turn only benefiting large scale farmers.

Large scale farmers are able to buy in bulk to produce at a demanded need, while also cutting down on transport costs – or they can also wait and only sell their produce some time after the materials have harvested, benefiting from price fluctuations (Tacoli, 1998).

By creating an intervention that moves functions closer, or into, the timber extraction area we are able to circumvent some of these challenges small scale farmers face.
An even better approach is to transform facilities to be multifunctional. This approach promotes the better flow of information over and above shared resources between activities. This has a better chance of upskilling labours, further mitigating the need for workers to migrate as they can look to doing more than set of work in the same industry.

Conclusion

History shows us how migration of rural dwellers affects urban populations and leaves rural areas unmanned to cater for the labour needs of those same urban areas. This demonstrates the need for solutions to be implemented to curb the rate at which rural areas are being abandoned.

The architectural solution we must explore is the restructuring the value chain by means of shifting the activity that would've traditionally occurred outside of the rural town, to now take place at the same place where the raw material is extracted.

This idea allows for the cross-pollination of information and skills between labourers. This create a further opportunity for other activities, that are a result of a labourer being better skilled, to occur naturally, potentially sparking new economies to grow.

2.4
Architecture Cognition through Mechanisation

Essay Structure

01
- Introduction

02
- The extent of Industrial Architecture

03
- Manufacturing production objectives

04
- Architectural Objectives

04
- Conclusion

Architecture Cognition through Mechanisation

Introduction

The nature of factories developed through the phenomenon of industrialisation and mechanisation. These phenomenon's introduced ground breaking engineering experimentations which resulted on breakthroughs on technical calculations, advanced construction methods such as steel concrete and iron standarsation in building processes. (Caldas, 2008) These techniques started influencing other architectural buildings other than factories, such as skyscrapers. However, these engineering achievements open a debate on whether they may have effected architectural artistic design elements, since technical thinking is the forefront of most industrial buildings spatial planning demands, backlogging the form of a building. However there has been cases where construction techniques and architectural principles complement each other. This is mostly found in fabricated factory buildings. Therefore in consideration to various industrial problems which have been raised on various extensive studies on industrial buildings, bearing in mind that Industrial Building designers such as engineers, architects and technical experts, to mention a few, have gathered adequate information on technical, construction and economic considerations on making industrial buildings function efficiently. This chapter plans to examine industrial buildings from an architectural perspective only by looking at basic technical, social and economic issues that can be solve and addressed through architectural solutions.

The extent of Industrial Architecture

Industrial production mainly consists of three stages; Primary Industry (extraction of the raw materials); Secondary Industry (manufacturing of products); and lastly Tertiary Industry (distribution of materials and products) and these stages require a degree of facility depended on the demanding operating nature in each individual stage (Odeleye, 1967). Although the extraction of raw materials doesn't necessarily require a facility, and the distribution industry is the link from commercial to business operations, therefore this leaves the manufacturing production sector the stage that will require a infrastructure. Industrial Architecture may therefore be involved in providing facilities for the processing and manufacturing stages of industrial production. (Odeleye, 1967) Therefor a few industrial objectives have to be addressed.

Manufacturing production Objectives

There are two main objectives at play when its directed to manufacturing. 1) Economic and 2) social. The economic objectives commonly being the need and desire to stay on top of business to see profit margins at rise. If these objectives fail, with regards to keeping the profit margins afloat and the demand of products, it does not matter what other desires the company has, the company will fall. (Odeleye, 1967) These profit objectives demand the need for sustainability in improving efficiency and productivity. Socially the industry broadly aims to focus on prompting social progress in hopes to re-inforce foundations of human well-being, from education on health hazards to skills developments on handling certain equipment's for efficiency in production. With that said, the main objectives concern the comfortability in workers conditions, social welfare and motivation to perform work at highest integrity.

Architectural Objectives

For architecture to have economic and social implications, amongst many, the chapter looks at considering these two main objectives.

1) Special efficiency in how the factory is operated.
- labour and management of the factory needs to be efficient
- Insurance and security for labours and the property needs to be adequate.

2) environmental site considerations
- adequate amenities for the workers need to be provided
- the work space flow needs to be adequate
- Machinery and social space scale needs to be considered to improve perception on workers conditions.

Although not much architectural design development of valuable content in the industrial sector has occurred during the early stages of industrial revolution, early 20th century, extensive studies have taken place in industry building engineering techniques, such as structural and construction.

The technological advancement has led to the use of complex production mechanical equipment's, which has increased the demand for controlled environments for machines, equipment's and products, (Odeleye, 1967) and in some instances, for people also, which has increased environment that are artificially controlled i.e. Factories with no windows. However the introduction of mass production technique techniques which include horizontal handling system and availability of spacious land in the urban areas has evolutionalised the concepts of industry by housing all factory activities in one big mass production building. This "one-roof housing" of activities may appear most efficient for mechanical logic but it leaves disadvantages in most parts of the problems it was looking to resolve. It is therefore the adequate of factory plant buildings is what the chapter wishes to study within the economical and human values through architectural principles. The next section studies a few case studies that touch on these issues.

Chapter II
The Machine

Economical Architectural Design Considerations

The significant in economic implications cannot be easily overlooked because of the nature of industrial buildings. Profitability is still remains strongly affected by the design and construction of the factory building and other strong factors that the architect can be in control of. However these factors may occur way before the decision to build is finalised. To elaborate, profit can be affected by the selection of the site location; the choice appropriate of land on which to build the factory; site transportation system; water resources within the area; local tax rates considerations; the characteristic of the market for product manufactured; technological changes and the question of plant specialisation of flexibility; operational obsolescence and the problem of plant disposal; security to assist from fire hazard. (Odeleye, 1967) once an analysis of all these economic implications is done, then only then can it influence weather the factory can be built or not. If it is built then it is a question of whether the manufacture should own all of it or lease half. That will then influence the architects design approach.

Economic Long Range Planning

Changes within economic system such as; new products; technological adjustments; cycles in which business operates; and changes resulting in competitors actions, present spatial problems that the factory needs to accommodate. (Odeleye, 1967) This means that dynamic economic planning which can accommodate future conditions become an important factor in the architectural spatial approach. This has introduced a “long-range” trend in production planning due to most manufacturing wanting to stay ahead of business. They do so by allowing enough spatial room to introduce new products or automated equipment’s that might profit the company ahead.

Flexibility vs Specialisation

An important question is raised on whether Industrial companies should have flexible or spatialized factory spatial planning or perhaps a shared balance of both can be established. Many businesses have found themselves at serious competitive disadvantages because of highly spatialized spaces (Odeleye, 1967). To counter these problems, industrial companies have to keep up with the pace of technological advancement to avoid

spilling a lot of money of specialising the buildings layouts and if these layout were planned in long-range approach, the company would've saved a lot of expenses. This is not to say that all factories cannot operate successfully on specialised planning.

Cement industrial plants give a good precedent of highly specialised plant because of the characteristics of the industry. This then gives an interesting angle on industrial panning solutions, which is that there might not be a define solution that can group them all in one bracket. The ideal flexibility of one factory is the least ideal situation for another. This means that each problem will have to be individually assessed during the design concept stages, to be well suited for a specific factory plant to allow for long-range flexibility. This highlights the important of understanding and analysing market share within the manufacturing industry. For example, if the product depends on its price, it leaves very tight room for profit margin. In those conditions, where manufacturing companies are pressed on profit margin on their operations, designing flexible facilities is out of the question.

> *The property of plant flexibility, in its fundamental form, requires that the plant facilities, as a system, should be capable of adjusting to satisfy any demands of the process of change. It should be an adaptive system in which various constituent elements or components are free to respond to change individually or collectively without danger or obstruction to one another's existence or proper functioning.*
> *(Odeleye, 1967)*

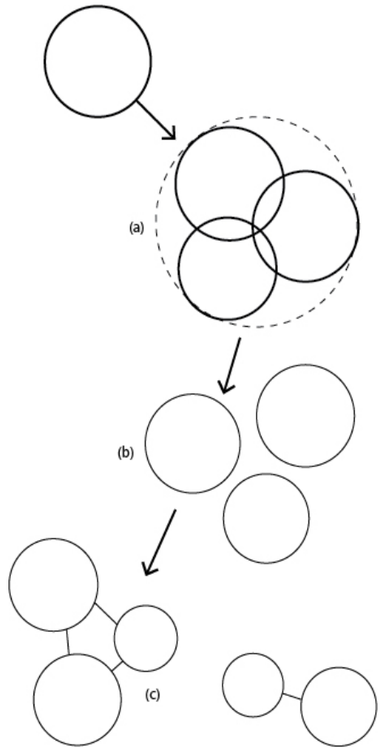


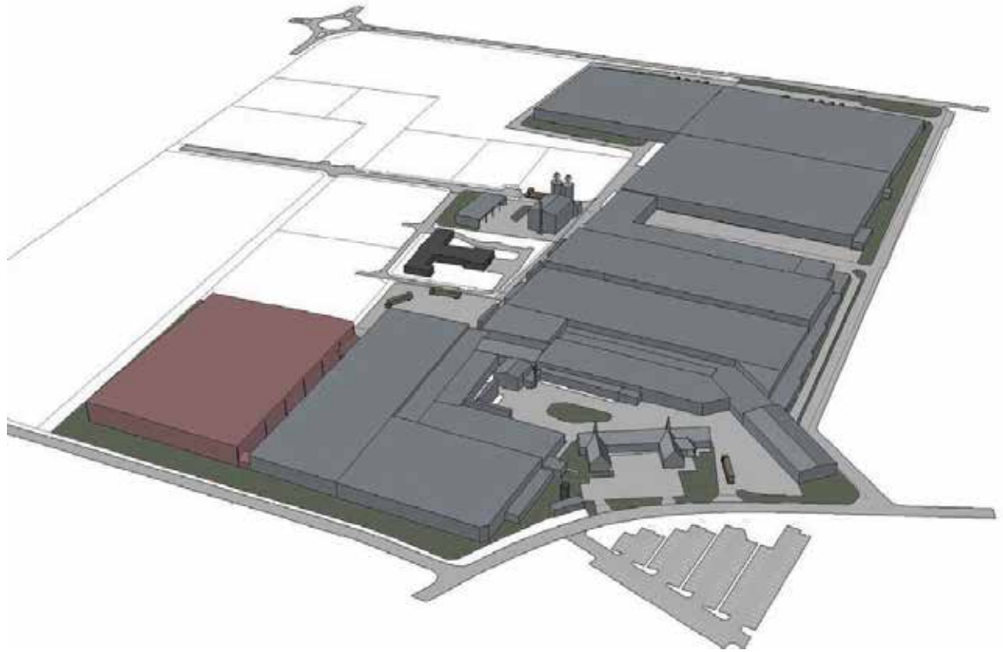
Fig. 3.5: illustration showing design flexibilities consideration within a factory design. Extracted from (Odeleye, 1967) pg. 11

In a case where all facilities of a factory are grouped together, it is safe to assume that at some point, all the facility component will have a place of conflict as illustrated by Odeleye on the Figure 18 within that, there will be some positive relationships of course resulting from cohesive internal activities. On the other hand, if the very same facility components are set out in free space, it heightens possibilities of flexibility advancement, which will take advantage of future expandability on each individual component.

Practical example:

The concept of displacing and free spacing the components within the factory system plant can introduce various flexibilities for long-range planning. The following figures (19 and 20) demonstrate two various variations system that depend on internal activities, functional form and context relationships to influence the design.

Fig 19: Image of Ikea Plant in Babimost, Poland. (Source: http://www.wbpionline.com/features/ikea-to-expand-in-poland-4715364/



This example illustrates the IKEA plant in Babimost (figure 19) as it is before the expansion scheduled. Even though its not at its best potential, the plant arrangement shows flexibility in expanding outwards without causing friction or disturbing the other functioning components of the factory plant. Also from an architectural point of view, it doesn't disturb the visual form of the plant (figure 20).

Fig 20: Image of Ikea Plant in Babimost, Poland. (Source: http://www.wbpionline.com/features/ikea-to-expand-in-poland-4715364/)

Fig 21: Image of Volkswagen Wolfsburg Factory Plant. (Source http://www.autolit.com/Store/1968-volkswagen-wolfsburg-factory-plant-original-factory-photograph.html)

These factory form (Figure 21) is incapable of acting flexible to allow for dynamic change.

This shows that the Industry experiences constant adjustments and changes, which make it hard to predict through design. This means that businesses constantly need to plan ahead to allow themselves flexibility. This also means architects need to consider these factors of fragmenting what would typically be a huge mass plant into component sections that still keep the functioning systems integrity, in order to experience economic advantage of expandability through flexibility.

3.
Case Study

Introduction

Industrial buildings have developed through mechanisation and industrialisation phenomenon. This introduced many changes in industrial buildings, not only through the machines housed on the interior but also through the buildings pragmatism over and over expressing its modern artefacts. These industrial machines started to influence and play a part in the rationale of modern architecture influencing a few architects such as Le Corbusier, where he praised and demonstrated enthusiasm in the machine age. (Caldas, 2008) This age raise a number of questions in relation to the architectural profession that is fueled by creativity and artistry, on whether all that should be reduced to accommodate the technicalities of the machine building. Can a building hold meaning and cultural significant to the society if it is an assemblage of parts on site? This due to the use of pre-fabricated components in most industrial buildings. If that is the case, how can a building hold any artistic value if the parts are already produced before the start of the design. Sparring debates of efficiency vs design or can both co-exist? If so on what terms?

This case study examines industrial buildings, which include, warehouse, factories and manufactures ect. on the techniques and building systems applied on them. This is orientated around a comprehensive understanding of the industrial phenomenon evolution of production buildings, their nature and response to its contexts and site. This includes, buildings dynamics within its methods; buildings processes; and the shape shifting of the aesthetical order, all become the focus in the buildings analysed for this case study.

The Local Furniture Warehouse:
form follows structural system

In this case study, the structural system defines the form. This means that after the structural system has been out in place, the buildings spatial layout, modulation and articulation are established. (Caldas, 2008) The local furniture manufacturing warehouse located in the town of Manguzi, is cited as an example.
This case was selected based on theories by Marco Frascari that every architectural detail is always at a junction – a place where elements/materials join. These are sometimes the connection parts between a column and a roof element. Sometimes it could also be seen as the junction of spaces, such as the link between interior and exterior, defined as a threshold. (Frascari, 1984). He goes on to define the third type of joint, as the negative joint, which is the interval of spaces. These three conceptual joints are what reveals a building from a construction structural system, giving more meaning to spaces since they identify each element.

The warehouse furniture warehouse is a local business that has been running for 15 years by Siyethemba Nxumalo. The warehouse employs 6 individuals who also take a share of the business earning through commission and labour. Mr Nxumalo and his staff of 6 create roughly 15 versatile pieces of furniture all made from wood and timber sourced from local plantations and local warehouse suppliers such as Build-It. The 4 stuff member all have craftsmanship skills on handling wood and they all assist him produce the unique pieces.

Fig 4.1: image of the local Furniture warehouse, Manguzi (authors own, 2018)

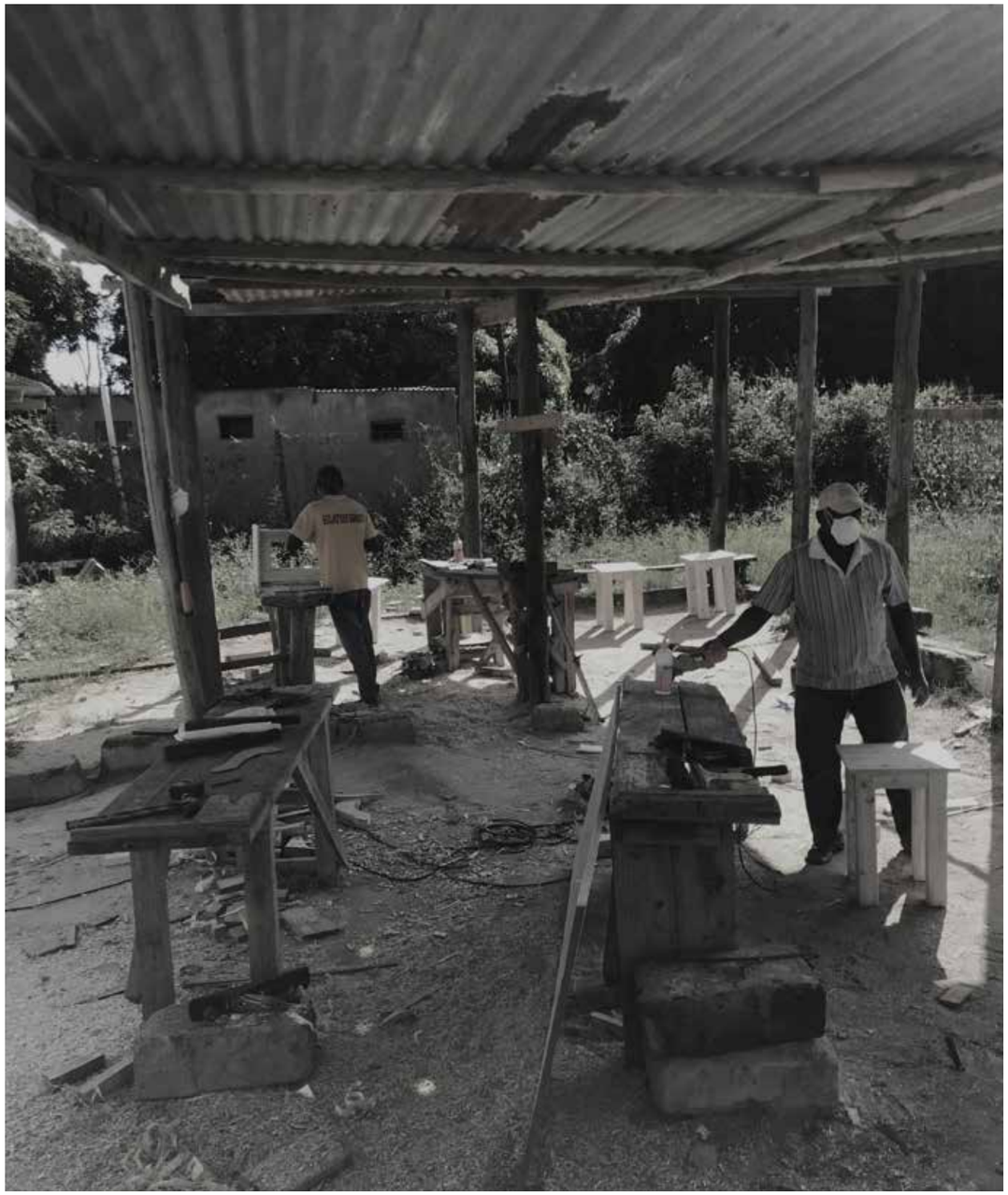
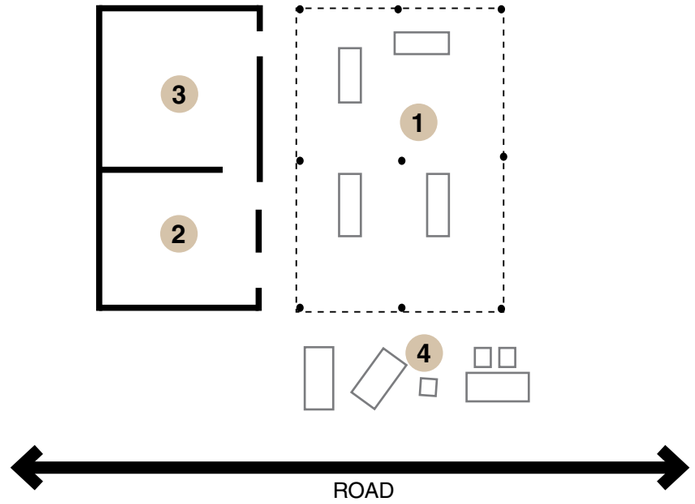


Fig 4.2: image of the local Furniture warehouse, Manguzi (authors own, 2018)
Fig 4.3: Diagram illustration spatial layout of the workshop (authors own, 2018)



1. Workspace
2. Admin office
3. Storage
4. Exhibition

Spatial Layout

The warehouse is an open space layout which favours flexibility in the buildings mechanism system. This is informed, within its small scale, by the recurrent requirement for warehouses that need solutions for machinery and production line changes. The space has an enclosed storage room where the business administration operates. The workspace consist of spaces dedicated to woodwork and craftsmanship from cutting, shaping to refinery. Directly in front of the warehouse canopy is the display zone for finished products and that feeds directly to the line of traffic.

Wuyishan Bamboo Raft Factory / TAO:
Design guided by detail

Fig 4.4: image of the local interior space of the bamboo factory (archdaily.com, accessed 2018.07.14)
Fig 4.5: Floor plan illudtrating farmers rest rooms (archdaily.com, accessed 2018.07.14)

In this case study, it focuses on the role of technique in architectural design manufacturing through detailing. In the building analysed, the factories construction detail influenced the choice of building material to give it significant and quality. This building has architectural detailing elements that contain functional aspects associated with aesthetic. The building honours structural integrity but also identifying ethical truth which originated through the technical process.

The building complex is a bamboo raft factory used for storage and manufacturing, located in the rural Xingcun village. The building workshop interior has an open plan layout spanning 14m to allow for flexibility. The architecture of the building a campuses distinct typological and programmatic requirements. Natural light is filtered through by skylights. In addition to the workshop the building has resting, storage and courtyard spaces as well as other additional facilities.

In-stu concrete was used structurally du to principles of localisation and economy, hallow blocks made out of concrete were used for the facade dealing system, with bamboo and wood sun shading system.. The roof was enclosed using cement tiling. For the door, windows and handrails, the choice of material was wood.

By using the basic elements for construction, it allows the architectural logic to shine through the structural and material. The building archived both aesthetic simplicity through detailing and economic means, through the architectural technical resolutions.

4.
Viability Report

A look at the technical practcalities of the project to better understand if the project will be sustainable or not

The Client

The ‘Timber Factory’ will be situated within the timber plantations boundaries of a rural town Manguzi and it is proposed as an extension to the forestry activities in the area. The building being the extension of the forestry activities, mainly the processing of pine wood, and will serve interests of local plantation farmers as well as juristic body that operates paper production industry – Sappi and Umhlabuyalingana municipality are proposed as the client.
Sappi is a global wood fibre company focused on providing dissolving wood pulp, packaging papers, graphic paper and biomaterials.

Users of the building

The main users of the building will involve the Sappi Forestry administrative and managerial staff. Local farmers and labourers under their wing will also occupy the space as they will be working cohesively with Sappi in the supply of wood from the plantations. Local timber/wood orientated businesses will be catered by the building and given a workspace to come and utilise the craftsmanship tools the building offers, to empower their businesses.

Stakeholders

These stakeholders are proposed for their potential interest and benefits from the project:
Primary Stakeholders are due to their interest on the forestry development both agricultural and industrial sectors. With Sappi and private plantation land owners being the client and funder within the factory.
Secondary Stakeholders are those that both fund the project in capital and operating revenue, but also are involved in the production and outcomes of the data and view-points, such as the local plantation owners and Municipal of Umhlabuyalingana as well as the Department of Social Development.
There are various potential stakeholders for the proposed project. These include The Department of Social Development and The Municipality of Umhlabuyalingana. The inclusion of The Municipality of Umhlabuyalingana is because they have interest as part of their development strategy to introduce industrial development in the areas and the proposed project will introduce the first industry in the area. Department of Social Development aims to integrate services and to create a society of conscious and capable local dwellers.

Funding

The government under The Industrial Policy Action Plan (IPAP) overall policy and plans are to address the key challenges of economic and industrial growth and race based poverty, inequality and unemployment. In addition, government funding is a limited means and considerable effort must be employed to raise the level of funding from non-government sources. Therefore a large percentage will be raised by Sappi as they also benefit largely with the Forestry development involving communities. Ngonyama Trust which owns most of the Land under the Umhlabuyalingana Municipality is expected to donate the land. If not, because there is conflict between the Municipality and The Clans concerning land ownership, an application will be forwarded in negotiations with the Induna (Tribal Counsellor) to acquire the land and also donate a small portion to the construction cost for the building (for the good of the people as a negotiation angle)

As the ‘Timber Factory’ is aimed at bringing about industrial shift and starts to become an element of the rural plantation that is more sustainable, it will stimulate job creation and raise the economy of the town through the revenue generated from its production.
Once the construction phase has been completed, the operational costs will be acquired from the profits of the timber materials sold. Any additional cost will be funded by private enterprises and profits from mature equity investments.

Organization Structure

The management structures of the building are as follows

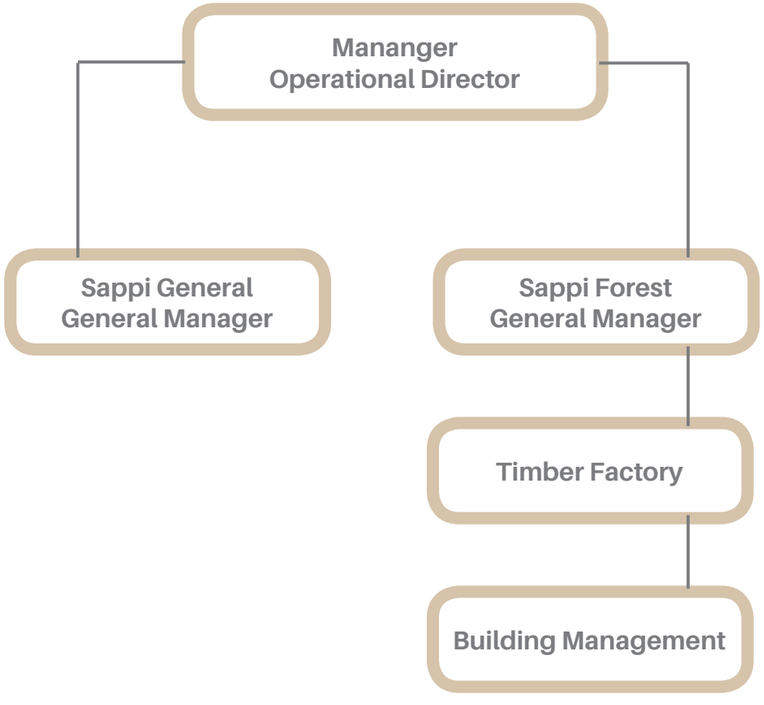


Fig 5.1: Diagram of the management structures of the Timber Factory (Authors own, 2018)

Project initiative

Industrial value chain systems are commonly built on capitalist ideologies. These capitalist structures, as mode of production, make economist the dominant front in the value chain. These structures have since created a long development gap between the harvesting of raw materials in the rural areas and the production of the product in the urban landscape, resulting in unequal developments.

The project objective is to explore the existing industrial value chain in hopes to restructure through re-specialisation from the primary stages of raw material harvesting labour to industrial production stages. By moving industrial activities within the forestry supply chain previously mostly dedicated to and reserved for urban areas closer to rural areas, it not only keeps the supply chain safely intact but improves the context and value found in rural areas. This begins to create an organic platform for ancillary economic movement to start building, in the hopes to improve industrial sustainability found in rural areas.

The proposal of such a project becomes a precedent for future investments into the informal economy. The proposed institution is aligned with vision of Mhlabuyalingana Municipal spatial future developments in introducing industrial activities in the area.

Project Brief

The ‘Timber Factory’ is a new industrial shelter in the rural context that can be transformed to feed into the needs of the farming labour as well as bring economic upliftment. The purpose of the building is to introduce new industrial activity in the rural context of Manguzi which in return bridges the gap between the agricultural and industrial sector by moving industrial activity closer to the primary source. The architecture language looks to welcome back the design principles so often lacking in current industrial buildings - these principles present a great opportunity to effect social change over and above industrial function.

The Factory is of a large scale and must be able to accommodate

all the timber harvestng activities as well as the machinery that comes with it. It is important to note that the factory does not process the timber to its final product but only processes it to lumber and access wood fibre which then gets supplied big industries for further processing. The building will also need to accommodate spaces to cater for farmer's daily labour needs as well as a workspace for local timber/wood small businesses to lend the workspaces and equipment.

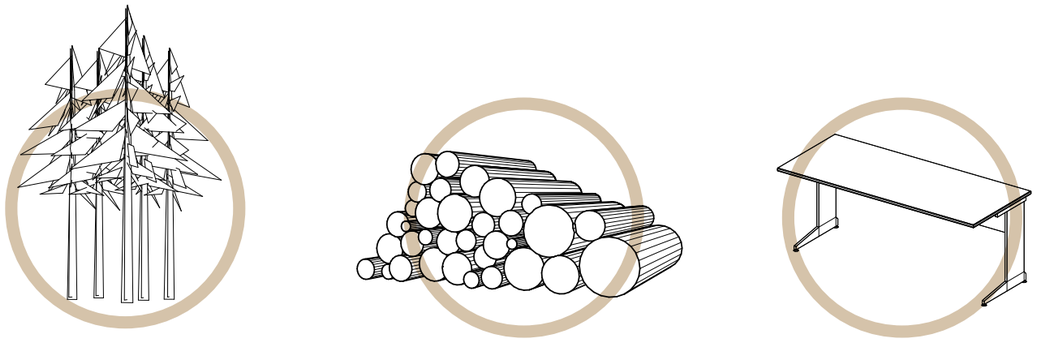


Fig 5.2: Diagram illustrating the flow on one of the main ways the building will be making profit (Authors own, 2018)

Site Selection

The site, as mentioned before, is located within plantations farming activities right on the edges of the small town of Manguzi in the Northern part of KZN. The site was chosen due to being one of the most vibrant forestry activities in the KZN. The project has the potential to grow the forestry activities that already exist by adding value through industrialisation, which in return helps grow the economy and influence cultural transformation. Factors influencing the site are as follows:

1. Forestry activity currently active
2. It sits in line with the Government Development Corridor
3. Open flat land allowing for ease of construction
4. Viability of site with existing networking road links
5. Proximity to the plantations allowing them to feed in
6. Proximity to surrounding settlements for accessing workers
7. Displays potential in agricultural activity and access

The site is currently not zoned therefore new zoning will have to be implemented to accommodate industry.

Sustainable Consideration

Social

The building is set up to promote agricultural sector by empowering local farming activity and farmers through introducing new infrastructure to support large production. The increase in migration from rural areas to urban areas has been due to rural dwellers relying on urban products to counter living standards. Therefor the introduction of an industrial building channels in new job opportunities found in rural areas to counter migration. This will allow for the dwellers to settle in rural areas, introduce new cultural dynamics.

Project site is within the Pine tree plantation. Therefore coordination with the local farmers and building team will be considered to avoid conflicts and delays on either parties' daily procedures

Environmental
Environmental Assessment will need to be considered for the introduction of an industrial building in a plantation site. This is to help better understand the environmental impact the building will have on the natural fabric of the site. If there are settlements around the plantation, this will help understand how the gasses let out by the factory building effect the local dwellers and animals in the surroundings.

There is a huge fire hazard when it comes to forestry, where constant innovative solutions are being introduced to help control fire spreads. In most areas Sappi and Mondi (paper production companies) are working with locals to guard the plantations and give signals where fires are being spotted. In my site I am hoping to use the same methods where locals are appointed to help regulate fire spread on site. Also some trees will have to be chopped off during construction and replanted to blend in with the building at a later stage for sustainability, which will impact the environment temporarily.

Economy
The increase in highly developed products and quality requirements linked with international retailers often overlooks the small scaled farmers who have little resources, access to infrastructure and financial capital to produce at a product high demanded standard. In relation, the building program adds value to the raw materials found in rural landscapes by processing them further and selling them at a high value then previous, sharing the profit percentage with the farmers. In the long run the building hopes to make more profit with the supplies sold than the running of the factory, creating a sustainable industrial cycle.

Income Sources

Conclusion

In conclusion the development sees a sustainable industrial building that seeks to empower the rural areas through raw material value addition. The project is sustainable in its operational projections and maximises profit to benefit the farmers and increase revenue generated by plantations in the rural context.
The project proves to be a good investment that will financially serve the interests of the client for many years to come.

Project Projected Cost

Program	Quantity	Area m2	Total Area m^2	Cost per m^2	Total Cost R
Administration					
Open plan offices	1	100	100	8 600	860 000
Manager offices	3	20	60	7 500	450 000
Board room	1	25	25	7 000	175 500
Staff breakroom	1	50	50	6 800	340 000
Security Office	1	20	20	6 800	136 000
Total			**255m^2**		**R 1 961 000**
Production					
Sawmill	1	1 500	1 500	4 200	6 300 000
Receiving Zone	1	250	250	5 300	1 325 000
Assembly	1	200	200	4 200	840 000
Storage	2	100	200	3 600	720 000
Total			**2150m^2**		**R 8 345 840**
Public Amenities					
Entrance foyer	1	60	60	8 600	516 000
Information office	1	40	40	6 800	272 000
Sales office	1	20	20	7 500	150 000
Total			**120m^2**		**R 938 000**
Workshop					
Kitchen	1	40	40	6 800	272 000
Storage	1	60	60	3 600	216 000
Workspace	1	250	250	4 200	1 050 000
Showroom	1	60	60	4 200	252 000
Change rooms	1	30	30	6 800	204 000
Rest rooms	3	30	30	7 800	234 000
Total			**470m^2**		**R 2 227 000**
Services Amenities					
Bathrooms	3	30	120	6 800	816 000
Service Plant (HT & LT)	1	150	150	6 800	1 020 000
Fire services	1	40	40	6 800	272 000
Parking	1	500	500	600	300 000
Total			**810m^2**		**R 2 408 000**
Total Building Cost					**R 15 879 840**
Total area			**3 805 m2**		

The Cost excluded from total building cost
Land Cost
Land development and servicing cost
Landscaping
Professional Fees

Operational Cost

Salaries Staff

Projected Operation Costs PHASE 1				
Staff Salaries				
	Quantity	Salary p/m	Salary p/p p/a	Collective p/a
Directors				
Chief Financial Officer	1	60 000	720 000	720 000
Chief Operations Officer	1	60 000	720 000	720 000
Chief Executive Officer	1	75 000	900 000	900 000
Chief Technical Officer	1	55 000	660 000	660 000
		250 000		**3 000 000**
Administration				
Admin Clerk	3	15 000	180 000	540 000
Secretary	1	7500	90 000	90 000
Auditor	1	35 000	420 000	420 000
Security Guard	4	5 000	60 000	240 000
Head of Security	1	6500	78 000	78 000
Accountant	1	25 000	300 000	300 000
		94 000		**2 118 000**
Production				
General Worker	8	7 500	90 000	720 000
General Manager	1	25 000	300 000	300 000
Technical crew	4	10 000	12 000	000
Industrial Engineer	1	35 000	420 000	420 000
		77 000		**540 000**
Service Amenities				
Cleaners	4	4500	54 000	216 000
In-house IT Technician	2	25 000	300 000	600 000
Maintenance Personnel	2	5500	66 000	198 000
		35 000		**1 014 000**
Total Salary Cost Per Month		**456 000**	**Per Annum**	**6 676 000**

Administration Costs

Administration Cost	Per Month	Per Annum	Cumulative Total Per Annum
Utilities (electricity, water, ect)	200 343	2 404 116	
Raw materials	100 000	1 200 000	
Marketing		846 360	
Insurance	30 473	365 676	
Repairs and Maintenance	167 770	2 013 240	
Printing and Stationery	16 294	195 528	
Other expenses	28 400	340 800	
		Total Administration Cost Per Annum	**7 365 774**

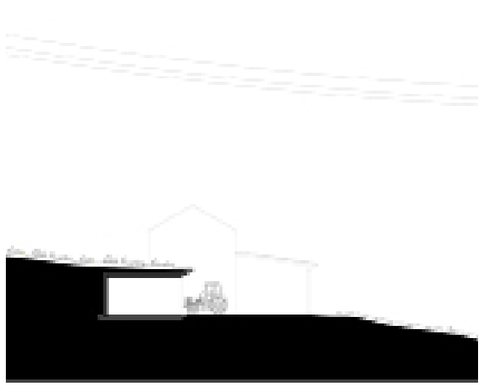
Projected Cash Flow

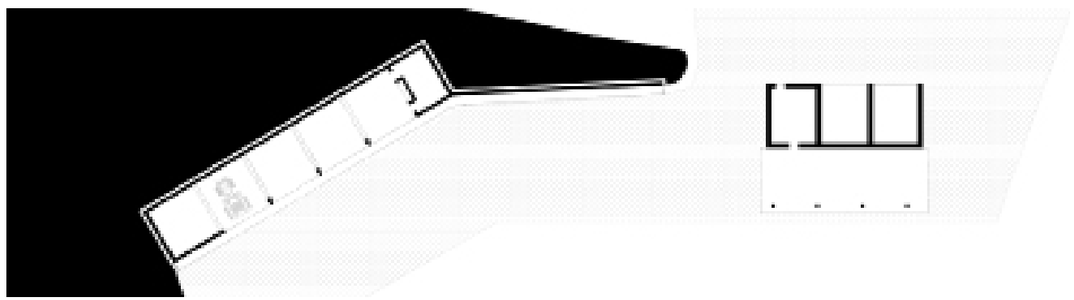
	Operational Income	Operational Expenditure		
year	**Increase at 15% per annum**	**Increase at 10% per annum**	**Total capital**	**Net cash flow**
0			15 879 840	15 879 840
1	20 120 000	8 033 374		(3 793 214)
2	23 138 000	8 756 377		(1 498 217)
3	26 608 700	9 544 450		(1 184 410)
4	30 600 005	10 403 451		4 316 714
5	35 190 005	11 339 763		7 970 402
			Net Cash flow total over 5 years	**7 970 402**

4.
Precedents

Agricultural Machinery Depot
Deamicisarchitetti

Gavi AL, Italy
2017





Project Description

The farm “La Raria” Introduces interesting dynamics because of program where agricultural activity meets the foundation which aims at protecting territories by interventions concerning art and culture.

The architecture of the new agricultural Machinery Depot ignored the typical approach of object being laid on the ground, but rather utilised the landscape slops as the modeling of the building, blending it into the hill.

The concrete slabs whch define the architecture within its structure, is very clear and was archieved through low budget.

The careful detail paid attention of the joinery, texture of the burnt wood are the elements communicated very well within the building to disect the art in architecture.

Analysis

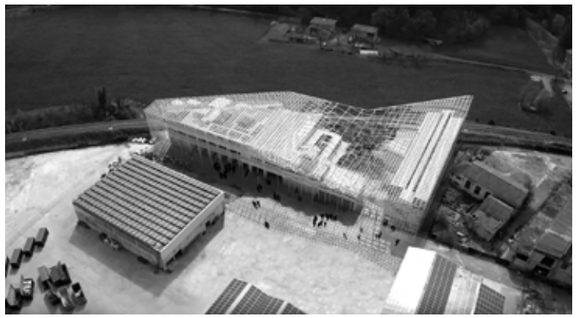
The building is very succesful in blurring the lines between architecture and landscape. This language not only blends succesfully into the environment, but it also speaks on how architecture can tick boxes of easthetically pleasing while being functional.

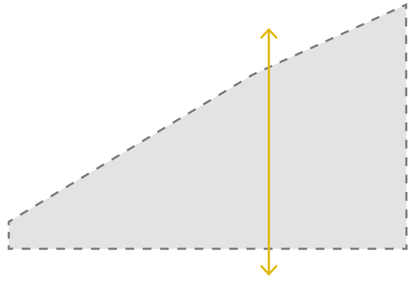
Left to Right
Fig 5.3.1: Photograph of the agricultural depot in its natural habitat
Fig 5.3.2: Section through the landscape and building
Fig 5.3.3: Photograph of the parking bays giving context.
Fig 5.3.4: Floor plan drawing of the building

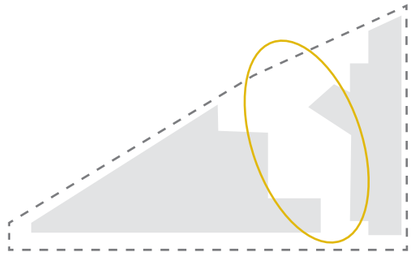
Cite: “Eco-Cocoon - Green Academy Renewal of a former paper factory in Marzabotto, Bologna, Italy” 2016. Sparch.gr. Accessed 29 June 2018. http://www.sparch.gr/en/projects-7/eco-cocoon-green-academy-159

Eco-Cocoon, Green Academy
Papanikolaou Architects Architects

Marzabotto, Bologna, Italy
2016







Project Description

The building is a “recycled building” of what used to be a paper factory and is now turned into an “Eco-cocoon” of old and new nature.

Ground floor, the factory is transformed into a spaces of start-ups. On upper floors the spaces transform into Eco-science museum, laboratories, research and exhibition spaces.

The architectural language evokes sentimental memory of what used to be while introducing new program, through untreated, rough finishes within the certain spaces.

Analysis

The buildings floor plan is divided into two sections, the light gray being mostly general public spaces (such as museum) and dark gray introducing spaces that are mostly private (such as research spaces)

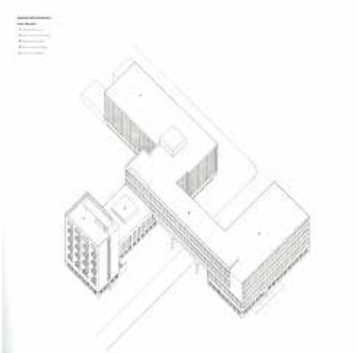
The devision of spaces creates a central courtyard that acts as a break-away attracting social activity

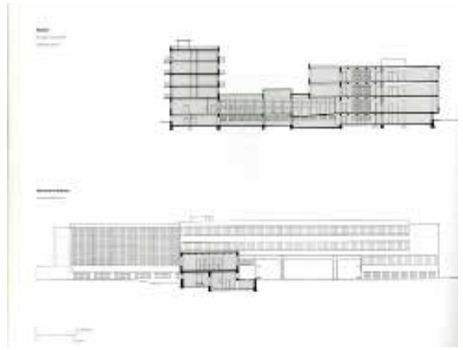
Left to Right
Fig 5.4.1: Photograph of the eco-cocoon green academy showing facade structure
Fig 5.4.2: Diagram of floor plan illustration line of spatial division
Fig 5.4.3: Photograph of the academy giving context.
Fig 5.4.4: Floor plan diagram illustrating courtyard social space.

Cite: “Agricultural Machinery Depot / deamicisarchitetti” 29 Nov 2017. ArchDaily. Accessed 22 June 2018. <https://www.archdaily.com/884504/agricultural-machinery-depot-deamicisarchitetti/> ISSN 0719-8884

AD Classics: Dessau Bauhaus
Walter Gropius

Dessau, Germany
1926





Project Description

The designs functions is an intersection between art, architecture, industry and design, by defining a style of architecture that will stand the test of time.

The facilities found within the school include spaces for teaching, accomodation for students, and auditorium and teaching spaces. The school and the workshop are tied together by the bridge which transforms itself as the roof for the administration block.

Analysis

The building fundings is that a large part of the function involves teaching and because of that, spaces were a lot smaller with office spaces not far from the the lecture rooms.

the building works very well in tying a knot between teaching, housing and workshops through its architectural planning and language.

Left to Right
Fig 5.5.1: Photograph of Bauhaus showing context of scale
Fig 5.5.2: Diagram of the buildings massing exo
Fig 5.5.3: Photograph of the main entrance
Fig 5.5.4: Section exploration

Cite: Megan Sveiven. “AD Classics: Dessau Bauhaus / Walter Gropius” 10 Nov 2010. ArchDaily. Accessed 30 June 2018. <https://www.archdaily.com/87728/ad-classics-dessau-bauhaus-walter-gropius/> ISSN 0719-8884

5.
Design Principles

RURAL

URBAN

A: CURRENT VALUE CHAIN

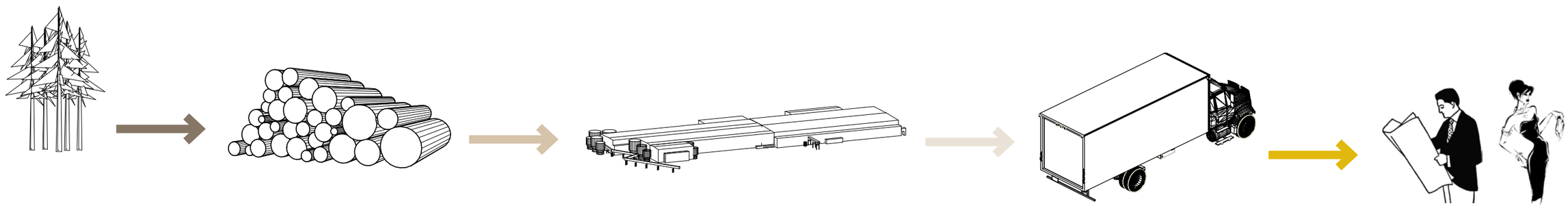
Farming + Harvesting

Post-Harvesting Handling

Processing + Warehouse

Retailers + Distributors

Consumers



RURAL

URBAN

B: PROPOSED STRUCTURE

Farming + Harvesting

RURAL: TIMBER FACTORY

Consumers

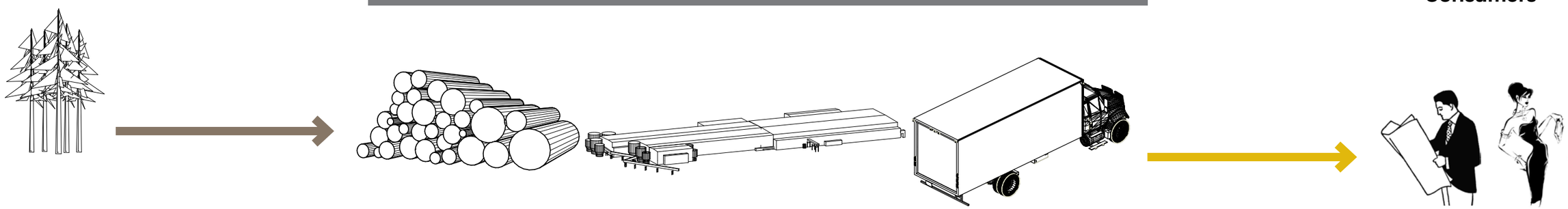


Fig 6.2: Diagram Illustrating the value chain (Authors own, 2018)

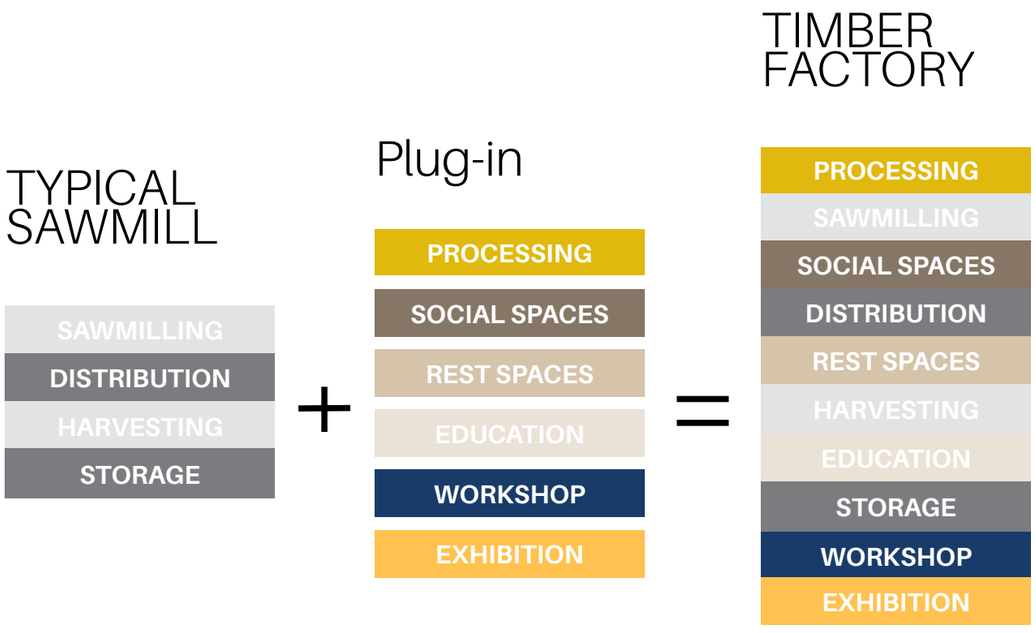


Fig 6.3: Diagram Illustrating the how the program works (Authors own, 2018)

The Program

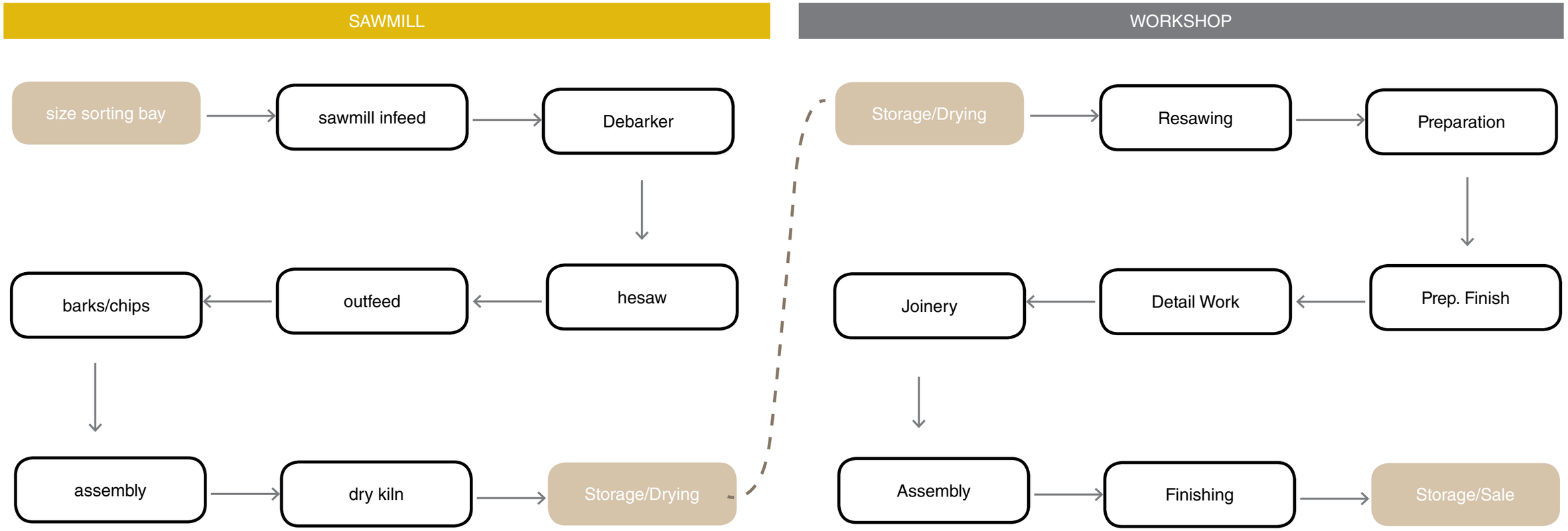
Defining function and form

The first question on the design approach is “what do i wih to archieve?” and “how can i archieve that?”. With that in mind, the design has four desired outcomes: the local plantations, the local economy, the people (local farmers and settlers) and sparking knowledge (based on plantations and handling timber). With this, the buildings outline is defined which hopes to influence economical uplifment, social shift and industrial transformation.

The program needs to address:

- Harvesting pine trees and processing the timber (Sawmill)
- Timber Tools and Machinery handling training
- Pause areas for farmers and workers
- Creating income from sales and training throough workshops, showrooms and the distribution of the production

The diversity of the program reflects a full sawmill factory as well as a plug-in public spaces where producers and consumers share spaces. This adds a civic value to what will be typically a sawmill plant, which then serves the peoples needs in hopes to power and sustain.



The Sawmill

The sawmill will look at important design consideration factors such as:

- allowing for a linear production process line
- Machinery defines the space
- And comfortable room height

The sawmill goes against capitalist mode of production and inverts it to the local people directly. It will process and produce lumber from the timber found in the plantation and feed it directly to the workshop for people to use and produce their own final product.

Fig 6.4: Diagram Illustrating the production flow of the program
(Authors own, 2018)

The Workshop

The common factors in the workshop and sawmill design typology are:

- The handling of wood and timber requires large storage spaces
- Noise and Dust levels are high
- And a clear production line flow needs to defined

I decided to limit the timber sections to no larger than 8 meters and this is informed by the plantation pine tree sizes found on site, which vary from 6-12 meters in length, depending on maturity.
For the noise levels, insulated wall panels will be considered and within the floor planning, rest areas will be separated away from the sawmill. Sufficient ventilation will also be considered to try reduce the dust and encourage a healthy working environment.

Rest Rooms

The pause areas will look at important design consideration factors such as:

- Shared spaces for lunch breaks
- Sleeping bunkers
- And shared communial kitchen and cafeteria

With the harsh working conditions workers find themselves in the plantations, the rest spaces aim at accommodating and solving everyday workers needs.

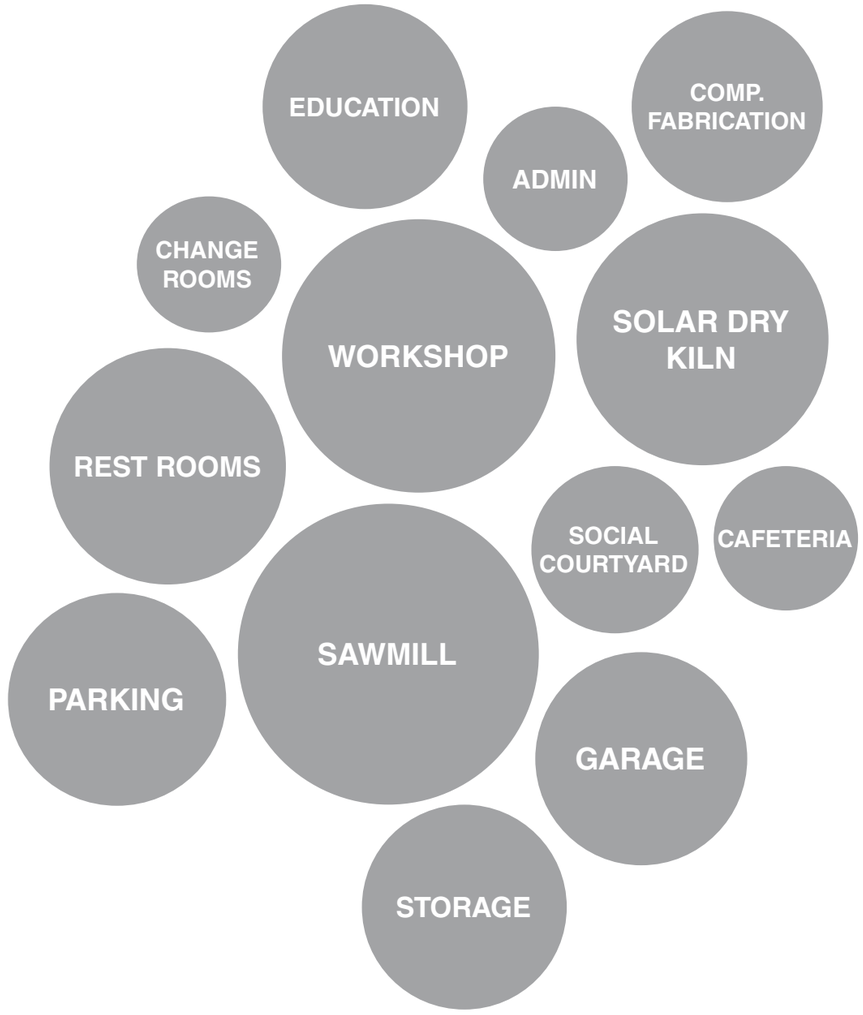
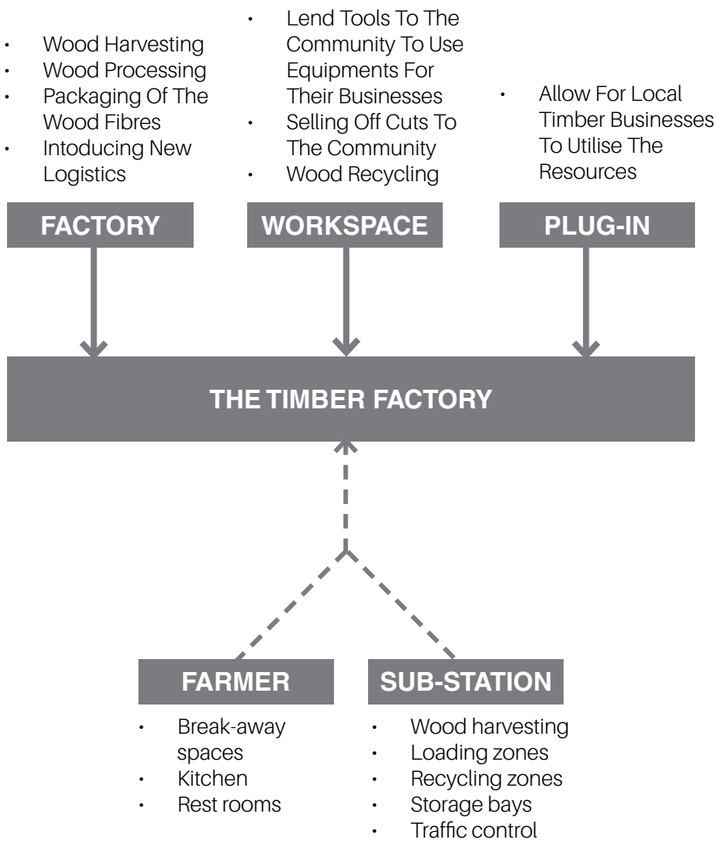


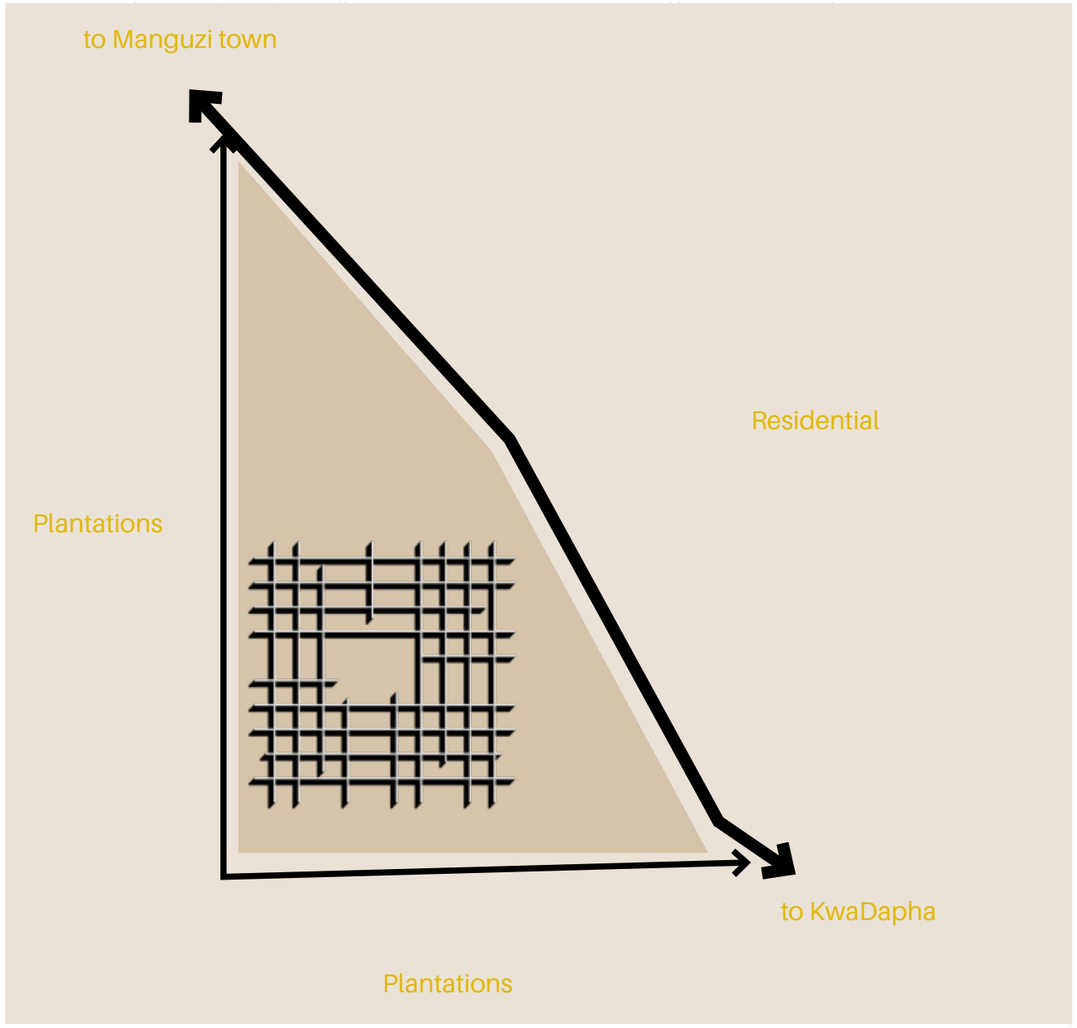
Fig 6.5: Diagram illustrating the buildings program based on how much each space occupies (Authors own, 2018)

Noise Levels

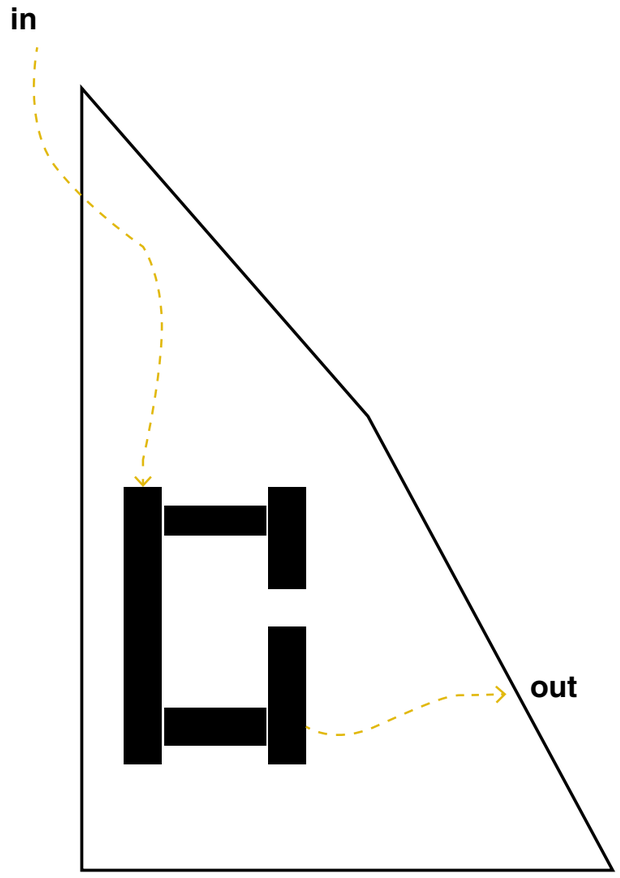
The noise level is an important factor in the buildings design consideration. Therefore understanding the relationships between various programs on how noise can effect the function of the spaces. Spaces like the Sawmill and workshop produce the most amount of noise

Fig 6.1: Diagram illustrating the buildings program based on how much space occupied (Authors own, 2018)



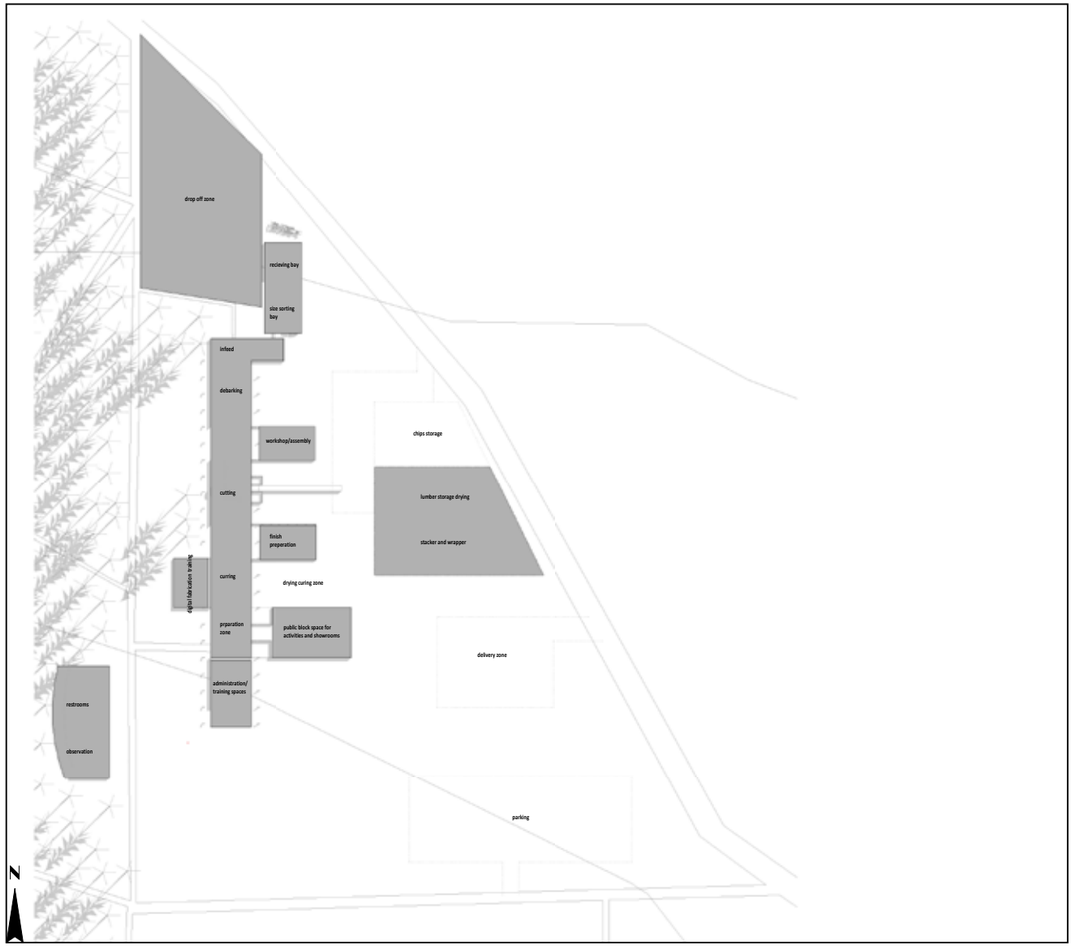


Site



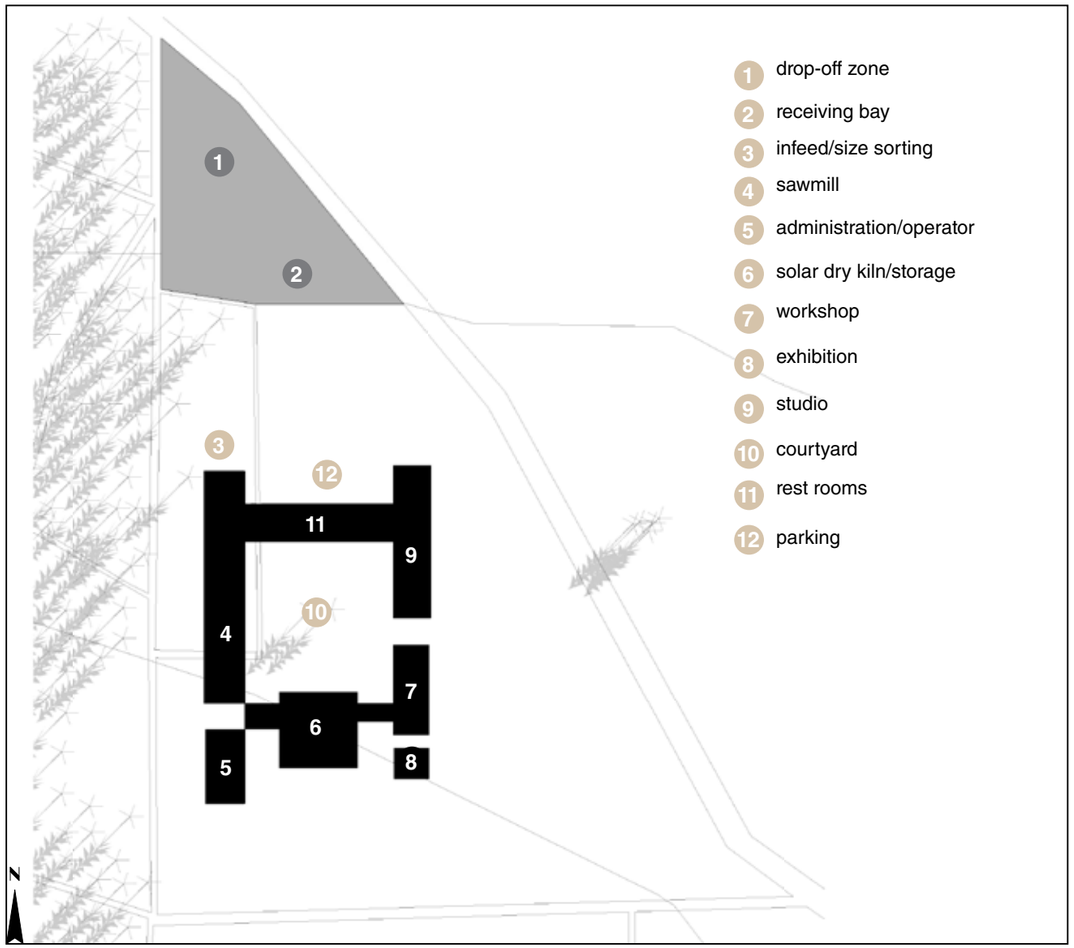
Site and program

The diagram above is shwoing the site and program in context conceptually. It also illustrates the flow of production from a point of entry to the point of exit in relation to site and program.



Site and program (initial layout)

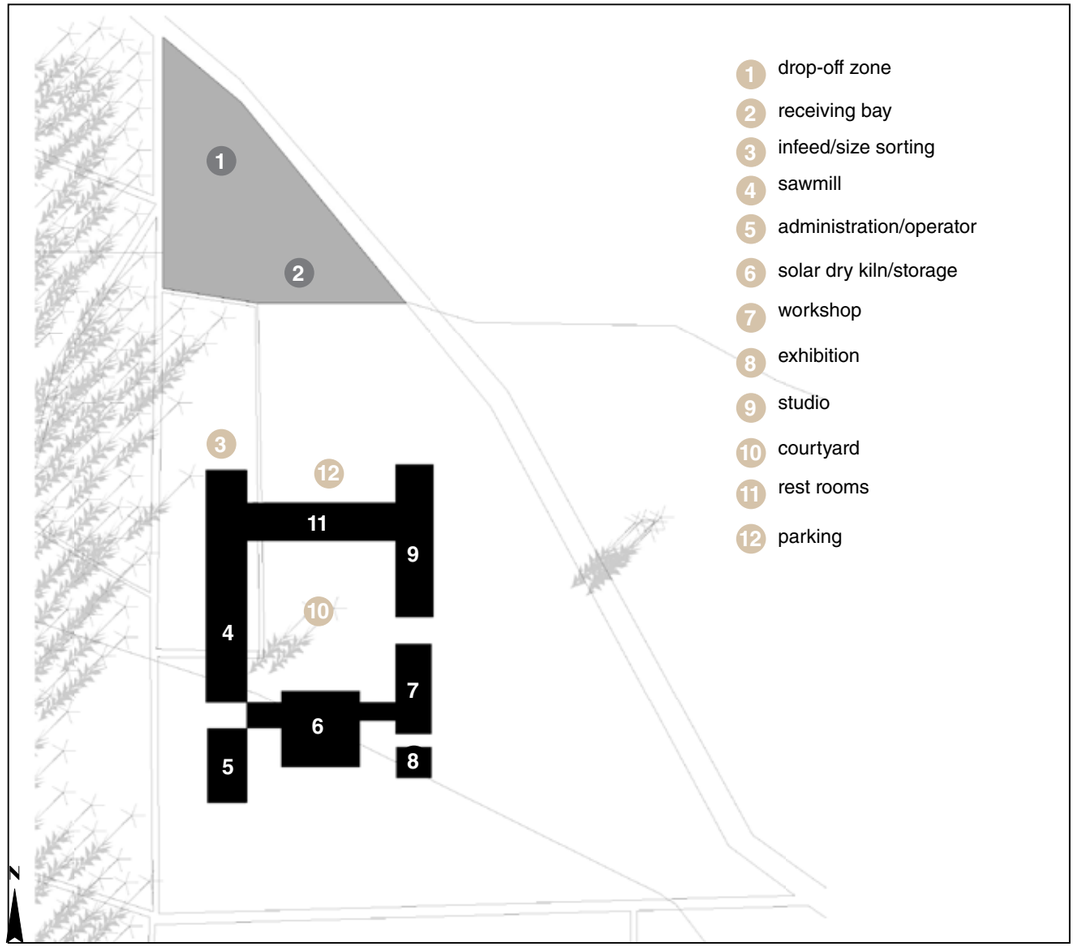
The initial program layout was influenced by the production flow of a typical sawmill. The linear setting ensured that the production line is afficient. The only problem was the lack of consideration for the public spaces in attaching them to the main sawmill factory to allow for a cohesive program.



1. drop-off zone
2. receiving bay
3. infeed/size sorting
4. sawmill
5. administration/operator
6. solar dry kiln/storage
7. workshop
8. exhibition
9. studio
10. courtyard
11. rest rooms
12. parking

Site and program (current layout)

The success of this program layout was based on the fact that linear production flow was considered through x and y axis, which in returned allowed for a courtyard space that can be utiilse a social break-away spaces and little pockets in between for circulation flow. The program reads as one design instead of multiple staggered programs



Site and program (current layout)

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FACTORY

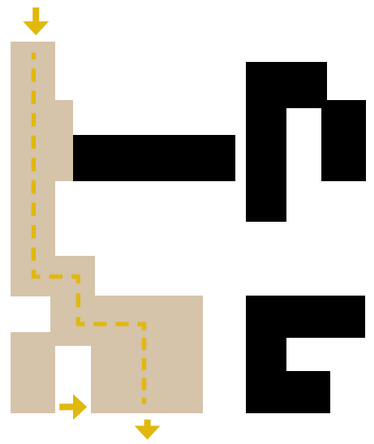
HOUSING

WORKSHOP

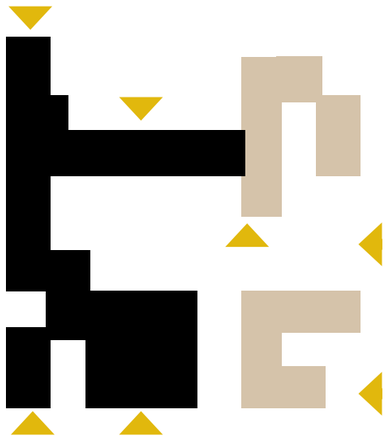
Building Typology

Each building mass is defined by its typology. This was influenced by a study of typical Industry, Residential and Workshop typologies in the case studies and precedents.

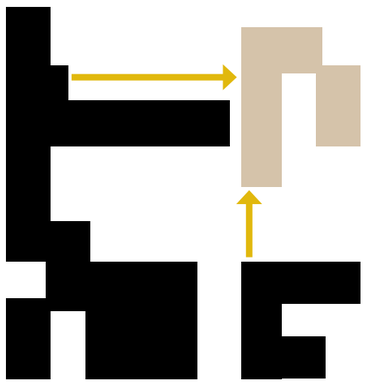
WORKERS REST ROOMS



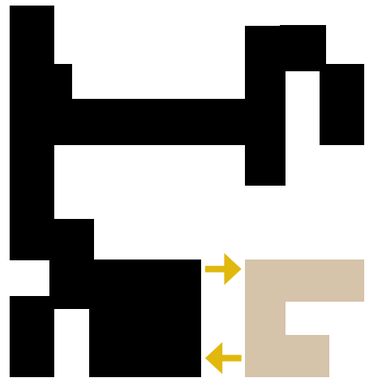
SAWMILL/STORAGE



ENTRANCE
PUBLIC VS PRIVATE

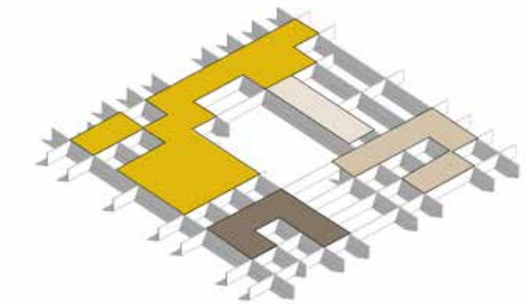


WORKSHOP STUDIO

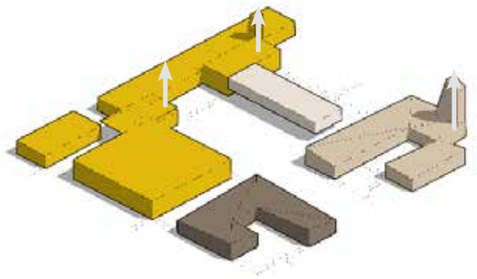


ADMINISTATION/OPERATOR

Massing Development

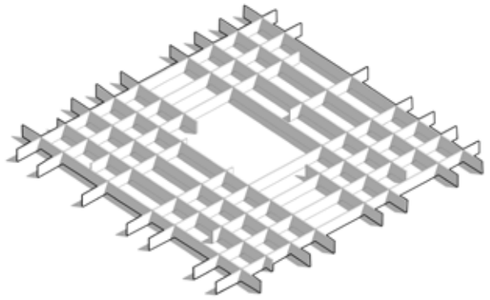


C The spatial layout derived from the grid

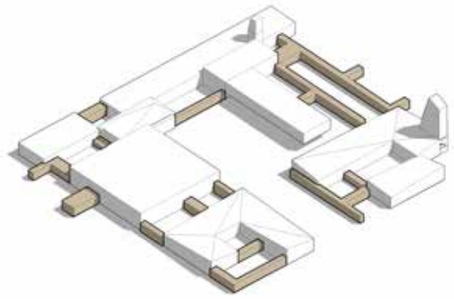


D The mass resulting from the grid, shapping the building.

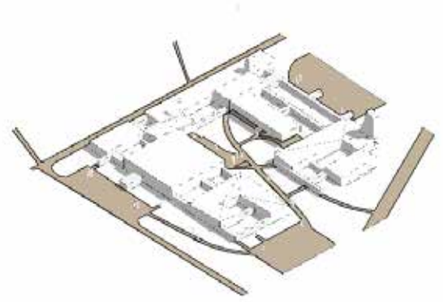
A Site showing plantation grids



B abstract grid derived from the plantations incoporating a formal grid used in buildings

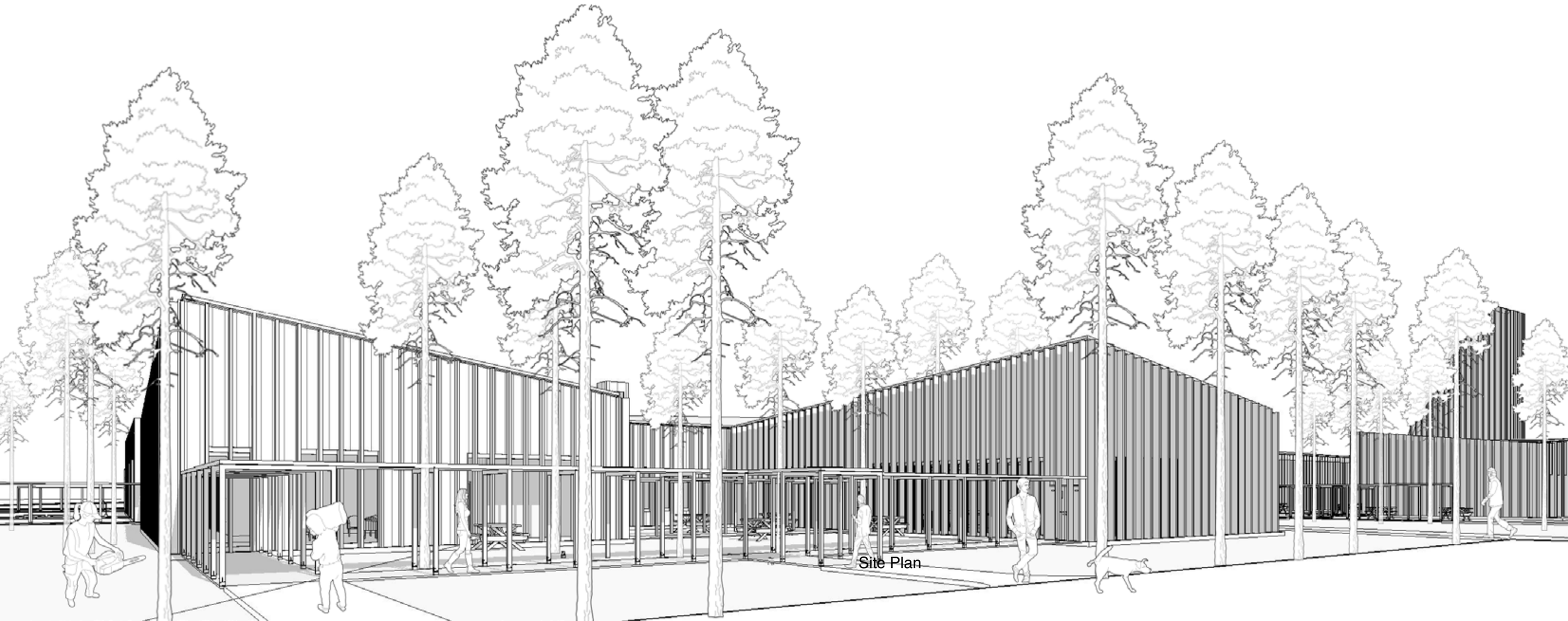


E Connecting links pathways connecting the building blocks



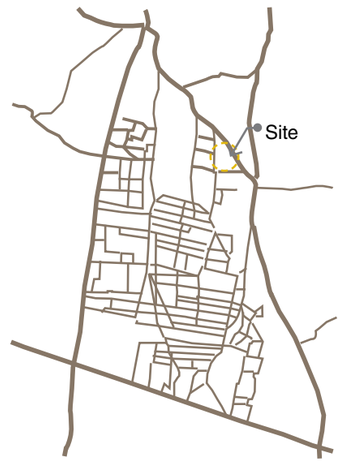
F Site road links in relation to the building

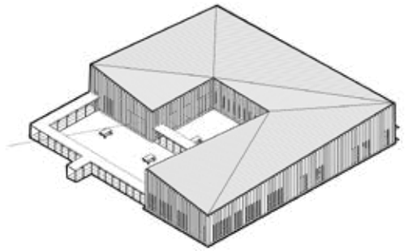
6.
Design Drawings



Site Plan

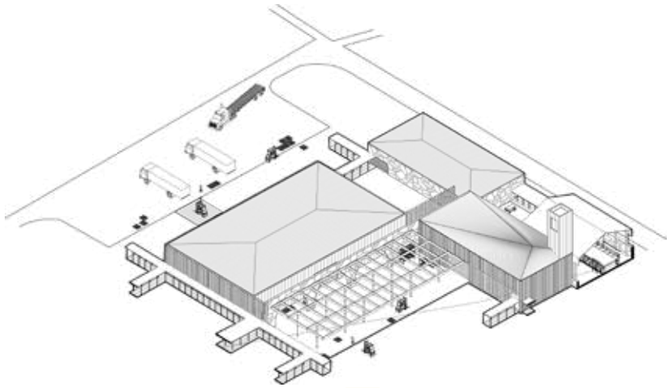
Site Plan





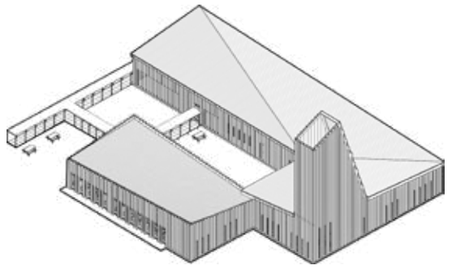
1

Administration block



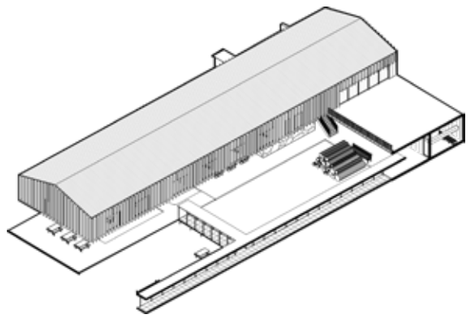
2

Production & Storage block



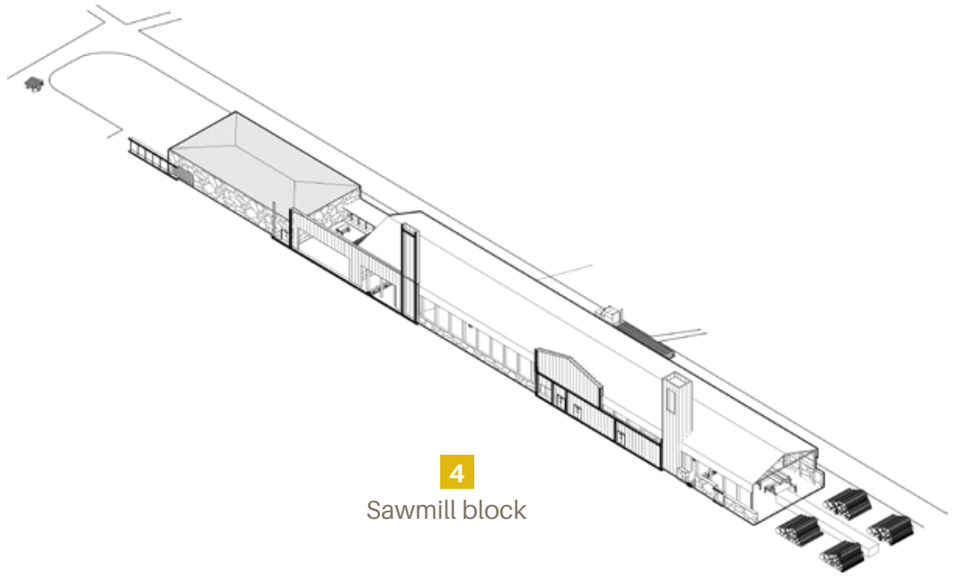
3

Public Interface block



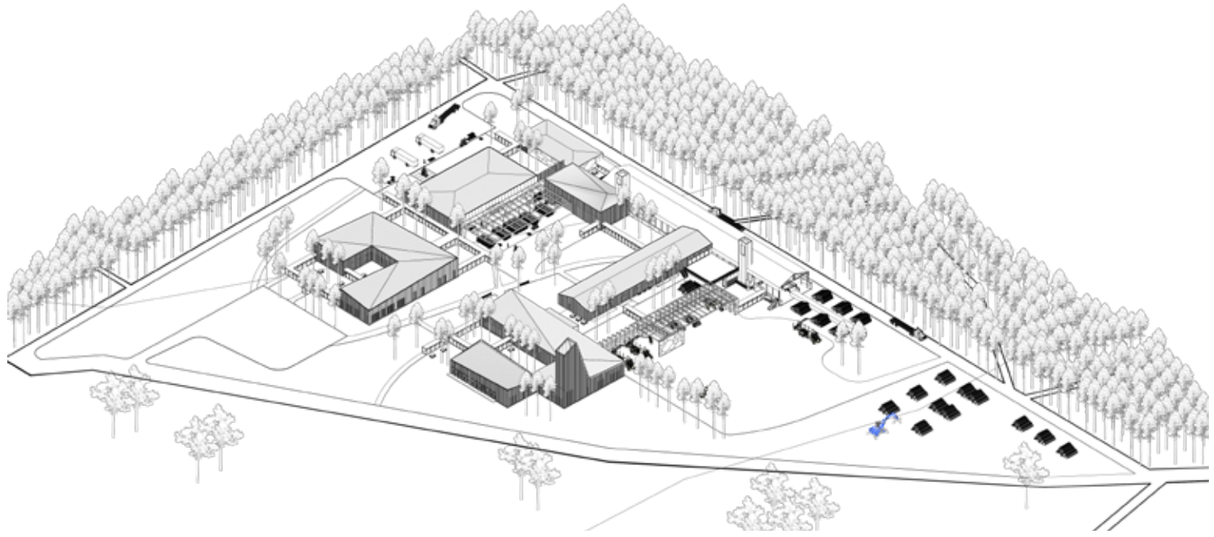
4

Rest Room block

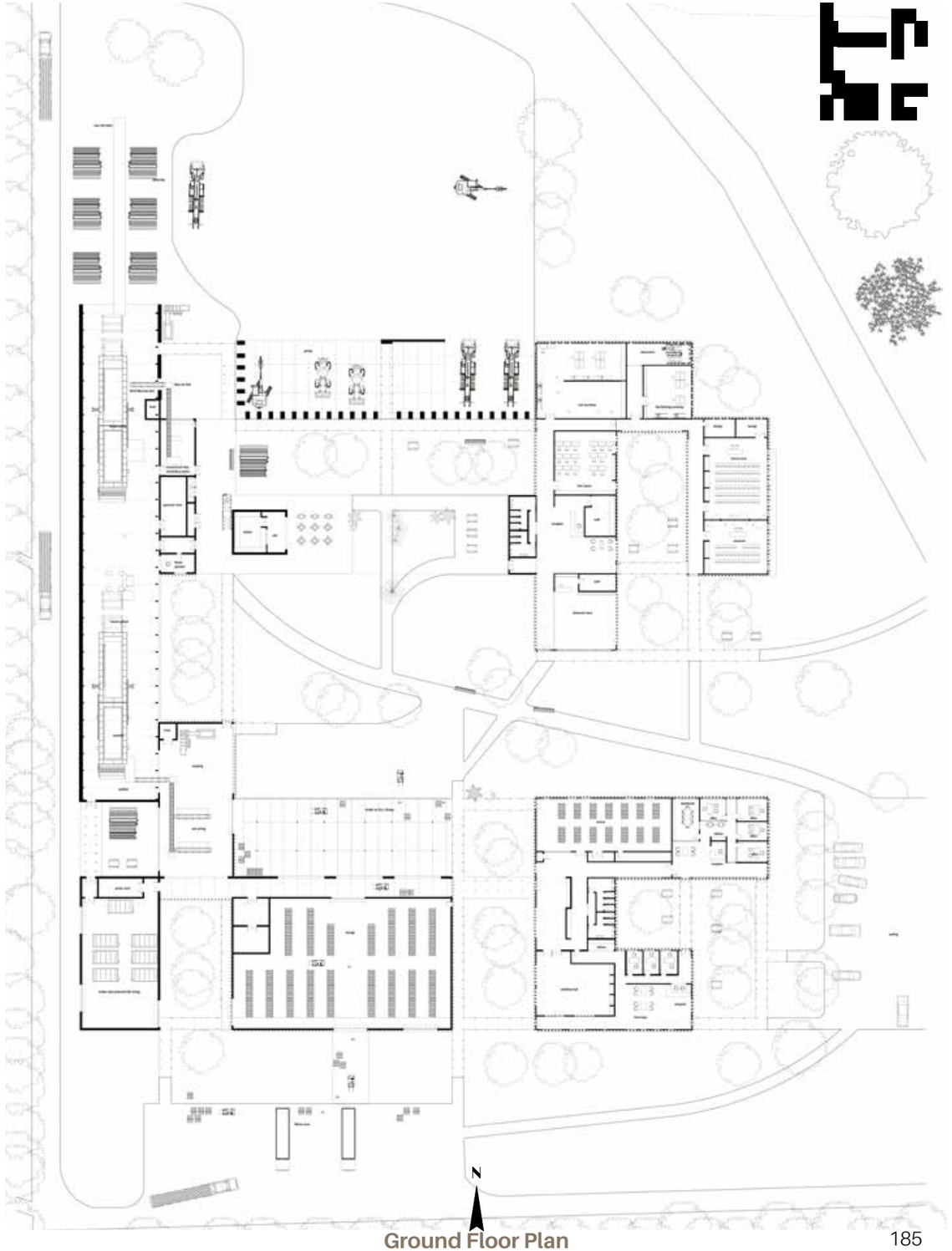


4

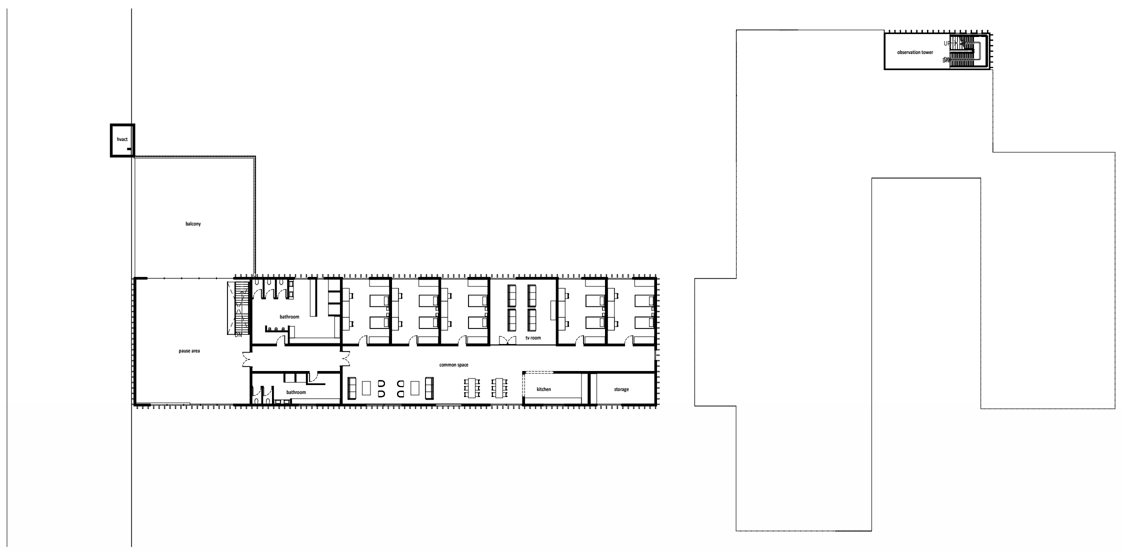
Sawmill block



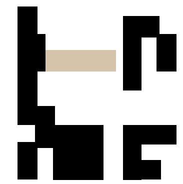
Site Plan

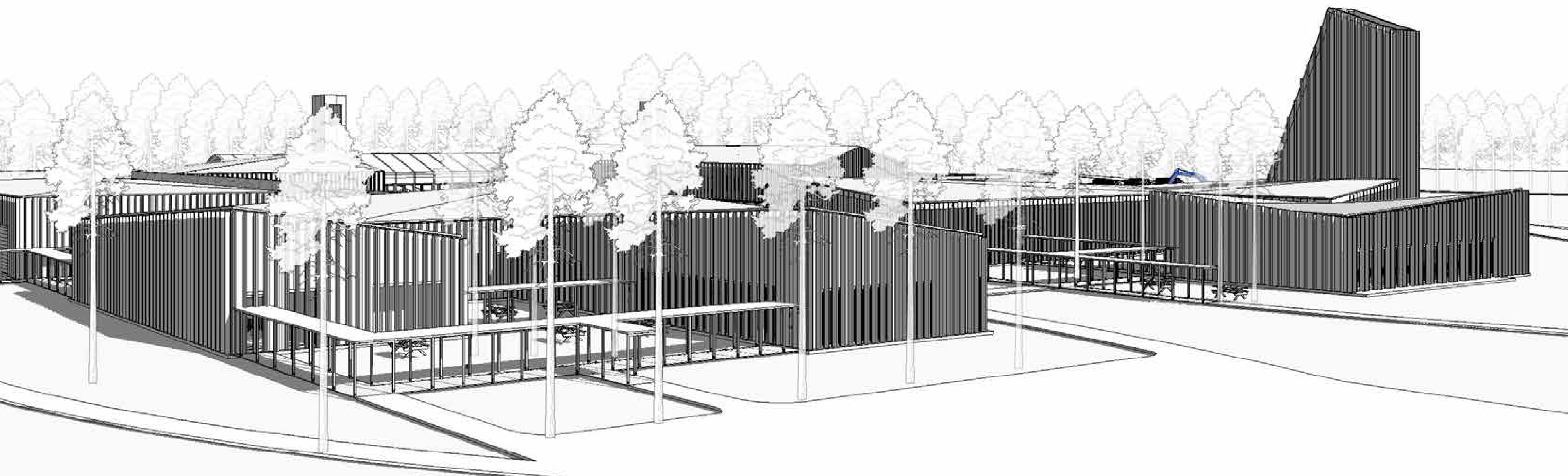


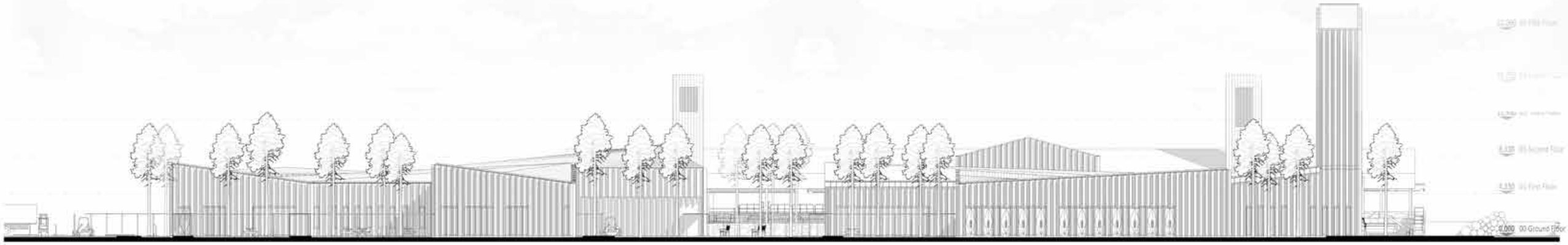
Ground Floor Plan



First Floor Plan

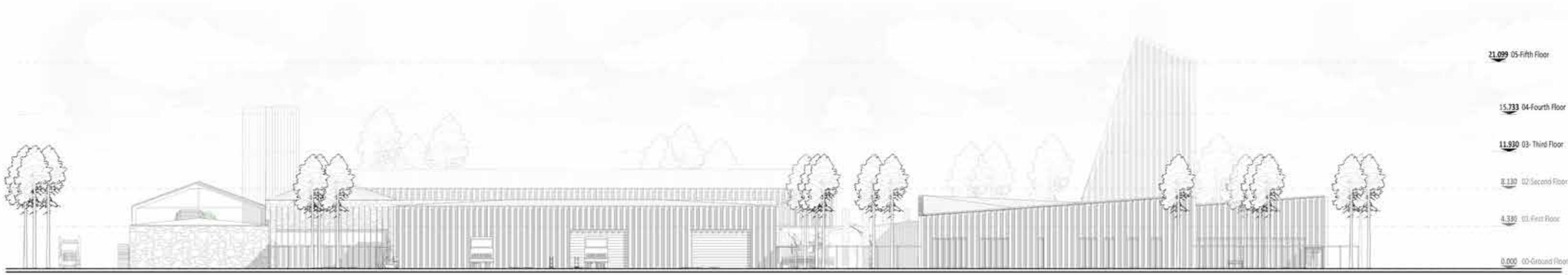




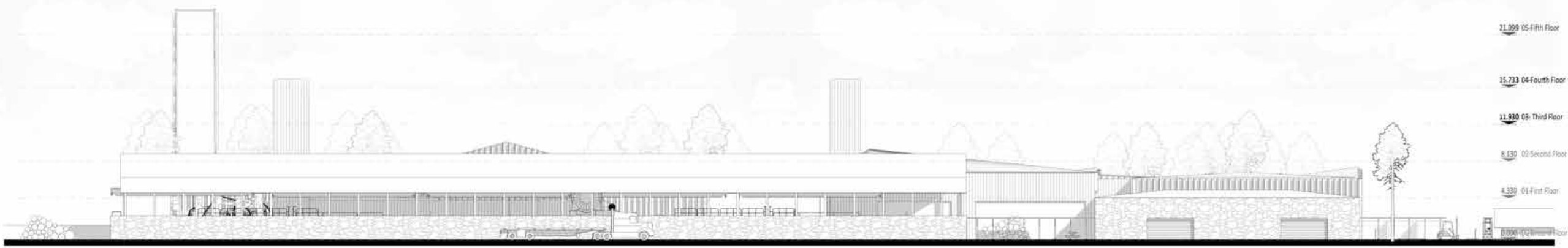


East Elevation

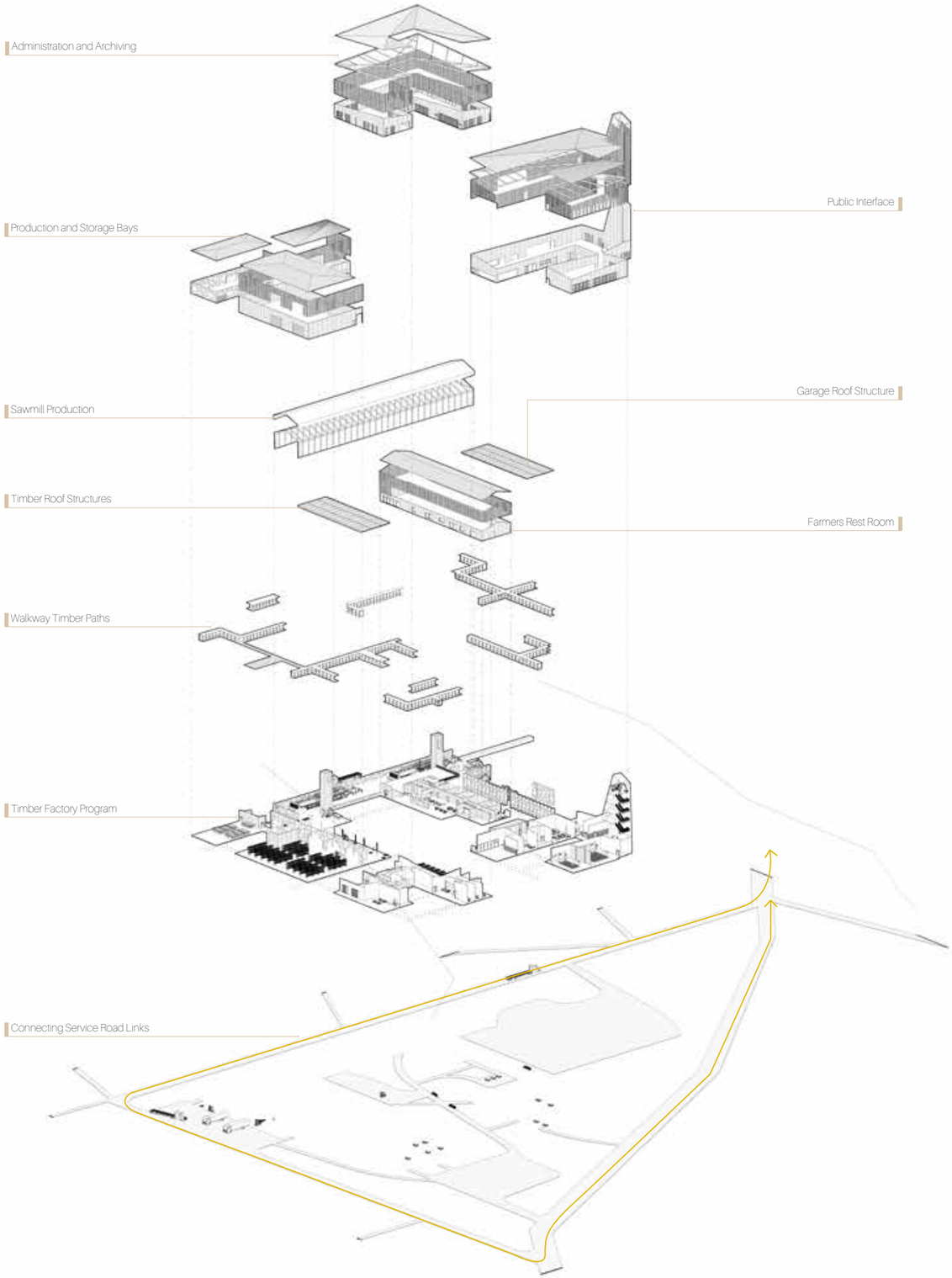
North Elevation

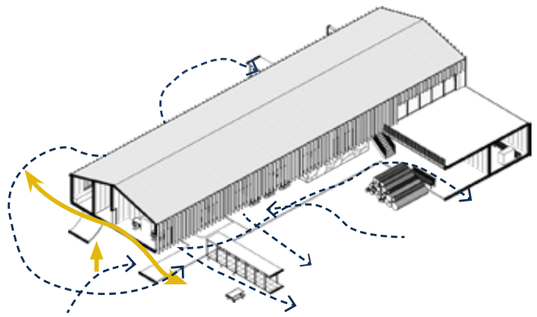


South Elevation

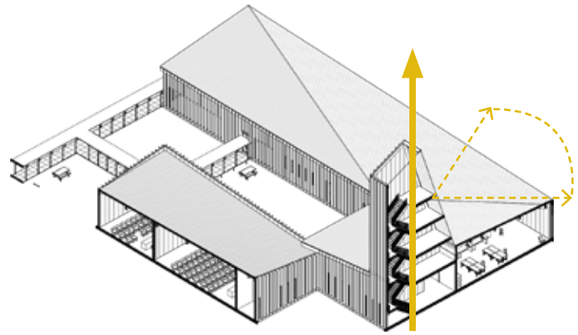


West Elevation

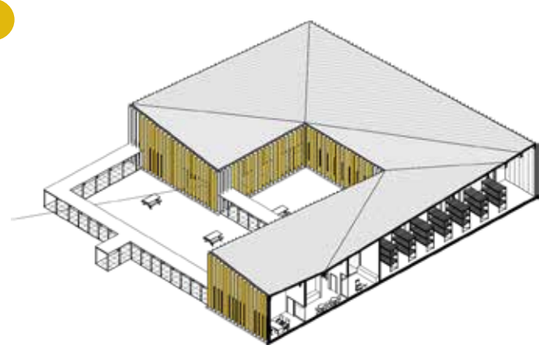




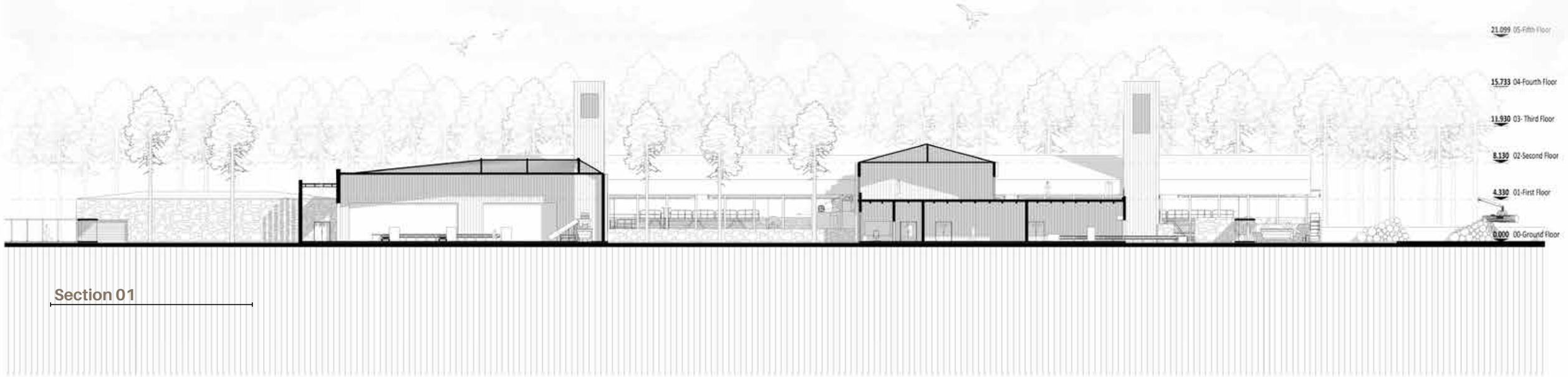
Free Space



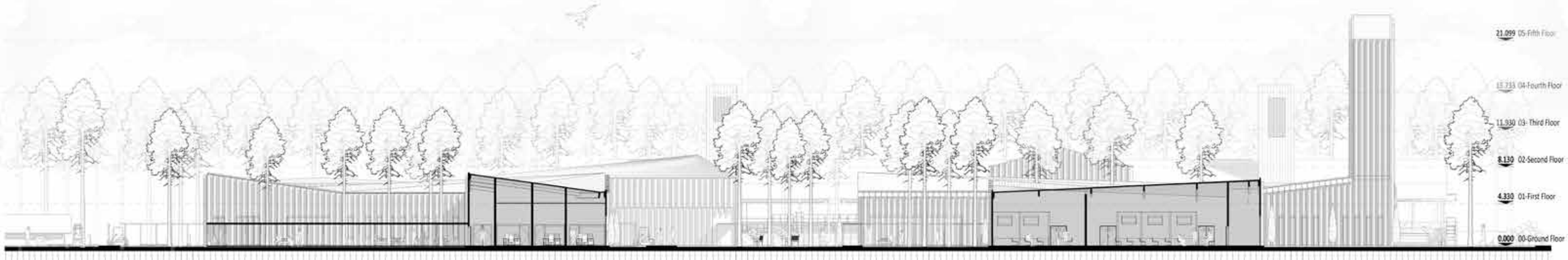
Observation Tower



Louver Facade System



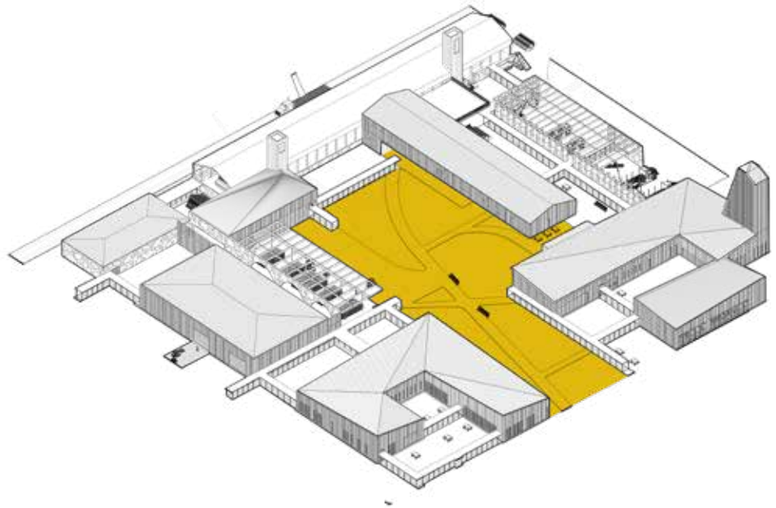
Section 01



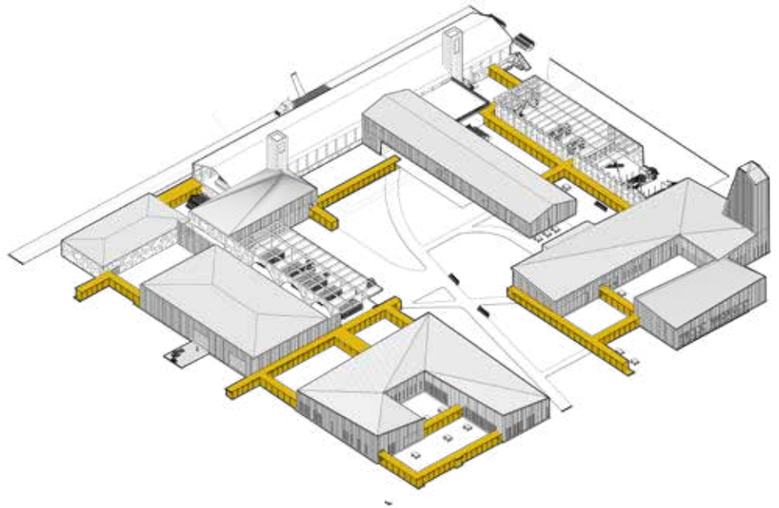
Section 02

Section 03

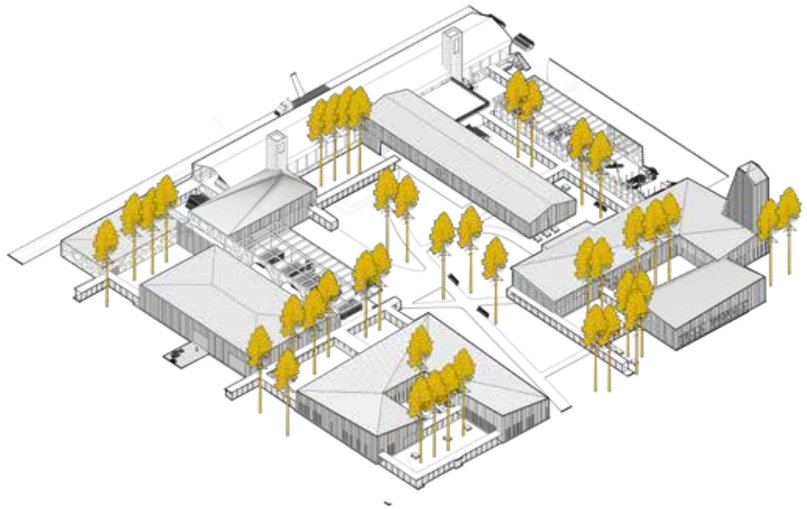
Section 04



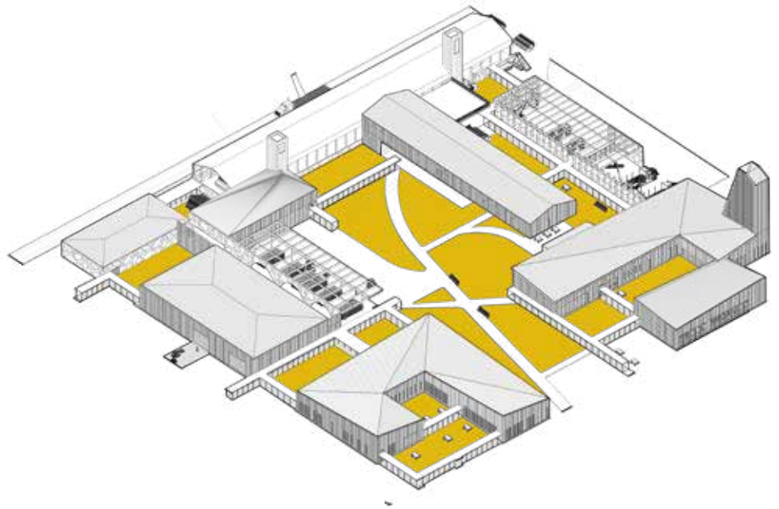
The Square



Circulation Links



re-Plantation



Green Spaces

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