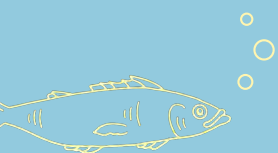
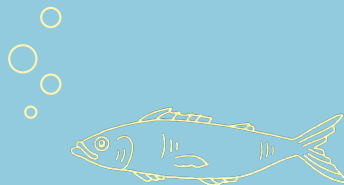
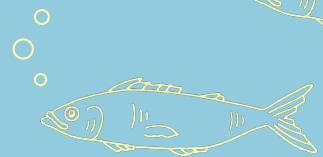


VunaHaraka

A SUSTAINABLE FINGERLING PRODUCTION
THROUGH CO-DESIGN





ABSTRACT

This project was carried out in collaboration with United Destiny Shapers, a community based organisation (CBO) based in Kisumu. The project focused on fingerling production and was developed through a participatory and community-driven design process by four students from Chalmers University of Technology with backgrounds in Architecture and Industrial Design Engineering.

Through interviews, observations, sketching, and collaborative workshops with members of the fingerling team, local knowledge and practical experience was integrated into the design process. The aim of the project was to improve the harvesting procedure by creating a more reliable and predictable source of income for the community.

The final outcome was a full-scale fish net prototype constructed using locally available materials and building techniques. The proposal was designed to reduce physical strain during harvesting, improve efficiency in fingerling collection, and support long-term economic sustainability through adaptable and locally maintainable solutions.

ACKNOWLEDGEMENTS

This project would not have been possible without the support of many wonderful people. We would like to thank the mentors of Reality Studio 2025:

Liane Thuvander, Jessica Lundin, Emiline Elangovan, Lydia Amondi Odhiambo and Joshua Wangafor. Thank you for your knowledge and guidance. We are also grateful to Pauline, Rita, Ladonna, and Stephen for their support, time and kindness throughout the project.



Examiner: Liane Thuvander

Tutors: Emiline Elangovan, Jessica Lundin

This report documents a project developed within the course *Reality Studio* (15 credits, ACE570), offered as part of the Master's Programme in Architecture and Planning Beyond Sustainability at the Department of Architecture and Civil Engineering, Chalmers University of Technology, during 2026.



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INTRODUCTION

COURSE

Reality Studio is an interdisciplinary course within the Architecture and Planning Beyond Sustainability master's program at Chalmers University of Technology. Bringing together students from architecture and industrial design, the course explores sustainable design approaches in developing regions through community engagement and context-sensitive practices. Inspired by the United Nations Sustainable Development (UNSDG) Goals, the studio examines sustainability from social, economic, and environmental perspectives. Students collaborate with local communities, academic institutions and non-governmental organizations (NGO) to foster cultural exchange and mutual learning.

A central aspect of the course is participatory design, where solutions are developed with local stakeholders through workshops, interviews, observations, evaluations, and ongoing dialogue. In this project, students collaborated with stakeholders, mentors, and the United Destiny Shapers (UDS) fingerling team in Kenya to incorporate community needs into the design process, enabling shared learning, knowledge exchange, and locally relevant sustainability solutions.

PROJECT GROUP MEMBERS

The project was conducted by Amogh, Emma, Maja and Josefin, all master students at Chalmers University of Technology. Amogh is an Architecture and Planning Beyond Sustainability student, while Emma, Maja and Josefin are students of Industrial Design Engineering.

AIM

The project aims to contribute to a masterplan for the NGO United Destiny Shapers (UDS) project of fingerling production, by focusing on sustainability in the local low income context. In a broader societal context, the project seeks to support youths by enhancing their well-being, social inclusion, and capacity to balance caregiving responsibilities with economic participation.

The aim is to co-create a life-size prototype in the current pond that allows to evaluate the durability of the construction, efficiency and ease of working conditions, material choices, and to ultimately refine the overall design together with the stakeholders.

In this project the project group aims to learn and apply new aspects to the design process, such as new methods in participatory design and workflows. The project strives to develop solutions which can be implemented for the fingerling production at UDS that will also continue to develop beyond the project timeline.

PROJECT

The project focuses on fingerling production at UDS, with particular attention to the fish harvesting process. The existing work environment is physically demanding, requiring workers to spend long hours standing in water under intense sunlight.



Amogh
Omondi



Emma
Achieng



Maja
Akinyi



Josefin
Anyango



UNITED DESTINY SHAPERS

United Destiny Shapers Community Based Organization (UDS CBO) was founded in 2017 by Peter and Job with the intention to strengthen the local community through initiatives in agriculture, sanitation and waste management, among other. Located in Nyalenda, UDS is a safe meeting place and learning centre for the surrounding community. The organization collaborates with other CBOs, to share knowledge and strengthen community development efforts.

UDS provides mentorship programs for the locals, in the areas of fish harvesting, waste management and urban farming, also holding in educational workshops for community members. These programs focus on social justice, human rights, waste management, sexual and reproductive health. With women making up around 90% of participants.

UNSDG GOALS

3 GOOD HEALTH
AND WELL-BEING



5 GENDER
EQUALITY



8 DECENT WORK AND
ECONOMIC GROWTH



11 SUSTAINABLE CITIES
AND COMMUNITIES



SDG 3

Good Health and Well-being

Improves workplace safety and reduces physical strain for youth involved in fingerling production.

SDG 5

Gender Equality

Ensures youth participation in decision-making through co-creation and participatory design.

SDG 8

Decent Work and Economic Growth

Promotes safer and better-organized working conditions, supporting well-being and productivity.

SDG 11

Sustainable Cities and Communities

Supports inclusive and sustainable community development by integrating local knowledge and stakeholder participation.



BACKGROUND

KISUMU

Kisumu is the third-largest city in Kenya and is located on the northeastern shore of Lake Victoria. The city is an important center for trade, agriculture, fisheries and transportation in western Kenya. Its proximity to Lake Victoria strongly influences local livelihoods, ecosystems, and economic activities, including fisheries and aquaculture (Lake Victoria Basin Commission, n.d.).

NYALENDA

Nyalenda is a large informal settlement in Kisumu that is divided into two sections: Nyalenda A and Nyalenda B. According to the 2009 Kenya population census, Nyalenda had a population of about 32,430 residents living in 8,561 households (Owour et al., 2015). More recent estimates suggest that the population has continued to grow rapidly due to urbanization and population increase in Kenya. The majority of residents depend on small-scale farming and informal businesses, especially the sale of consumer goods, as their main source of income.* Contrasting to the overpopulated neighborhood, UDS is a calm green area.

THE ENVIRONMENT

Kisumu's climate is strongly influenced by lake Victoria and is characterized by warm temperatures throughout the year, typically ranging from 20–30°C (Kenya Meteorological Department, 2026).

The region experiences two rainy seasons: the long rains from March to May and the short rains from October to December. These rainfall patterns are essential for agriculture and fisheries. The rainfalls can also cause flooding and infrastructure disruptions during periods of heavy precipitation (Kenya Meteorological Department, 2026).



THE POND

The fish pond operated by UDS is located approximately 5–10 minutes, by walk, from the organisation's main centre in Nyalenda. The pond is situated on leased land, with an annual lease cost of 35,000 Kenyan shillings (approximately 2,500 SEK). The pond receives its water from a natural spring and is designed with one inlet and one outlet to enable water circulation. Five out of the seven nets placed in the pond are used as breeding areas for the fish. The other two nets are used to hold fingerlings and fry till they are sold. Each breeding net can contain up to six male and 14 female fish and may produce up to 5,000 fry per harvest period, every 2 weeks.*

The pond also faces several challenges according to fingerling mentors. Predators such as lizards, birds, snakes, as well as heavy rain and strong winds, can threaten the fish and the breeding process. To reduce the presence of snakes around the pond, cow dung is used as a deterrent. Despite the ongoing efforts, the fish pond project is currently operating at a financial loss of approximately 70,000 Kenyan shillings from the start of the project in September 2025 to April 2026.*

*Personal communication, Pauline, mentor at UDS, April, 2026



THE FISH

The fish species used at UDS is Tilapia, a species commonly farmed in lakes and also found in the wild across Africa (WWF, n.d.). The fish progress through several growth stages, beginning with fry, fingerling, post-fingerling (also referred to as sardines, or omena in Swahili), post-post fingerling (wiu in Swahili), post-post-post fingerling and finally reaching fish.*

Tilapia reach breeding age after approximately 5–6 months. Following breeding, it takes about 1–2 weeks for the eggs to hatch. The eggs are incubated in the mouth of the female tilapia which later releases the fry once they have developed. Male tilapia are typically red in color, while females are white, and a single breeding cycle can produce up to 500 fry.*



FRY



FINGERLING



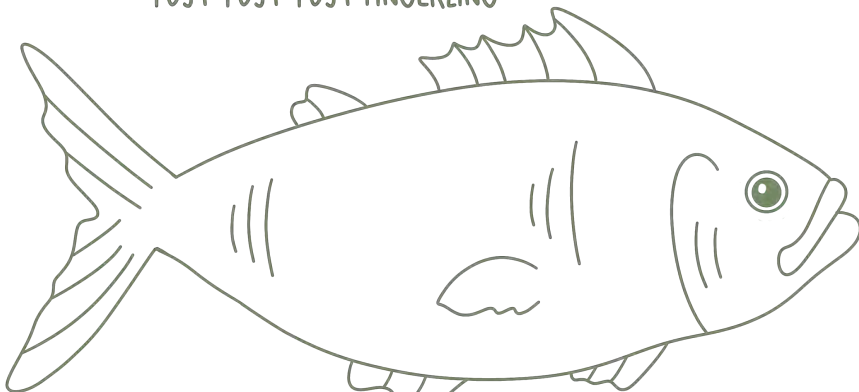
POST FINGERLING (SARDINES/OMENA)



POST-POST FINGERLING (WIU)



POST-POST-POST FINGERLING



FISH

THE ECONOMY

Since February 2025, the group has invested approximately 110,000 KES into the project. Of this amount, around 80,000 KES has been spent on renovations, materials, nets, and labour, while 30,000 KES has covered the lease of the pond.*

The pond has been operational since September 2025. Since then, the group has generated approximately 25,000 KES through fish sales. Their most successful sales session generated around 15,000 KES in January, during which they sold approximately 9,000 fish, including fry, fingerlings, post-fingerlings, and post-post-fingerlings. The selling prices vary depending on the fish size:

- Fry and fingerlings: sold for 2-3 KES/fish
- Post-fingerlings: sold for 3-4 KES/fish.
- Post-post-fingerlings: sold for 5 KES/fish.*

During the January sales session, approximately 10% of the fish were given away due to collateral losses occurring during transportation. The group also sells mature fish, with prices ranging between 200–400 KES depending on the size. Trough fish are sold according to weight and market conditions:

- 1 kg fish: approximately 250–300 KES
- 2 kg fish: approximately 400 KES
- Bucket of fish: approximately 600 KES during the rainy season.*

During the dry season, market prices increase significantly, and a bucket of fish can sell for 700–800 KES. The group explained that fish are harder to catch during the dry season because they move deeper into the pond to avoid sunlight, making this period the peak sales season.*





FINGERLING TEAM

The fingerling team started as an initiative at UDS with the aim of creating income opportunities that could help support the youths' own businesses. UDS began fingerling harvesting in February 2025 and started stocking fish in September 2025. To support this work, Aqua Ban provided a three-month fish farming capacity-building course in June 2025, helping members develop practical skills in sustainable aquaculture.*

The youths who join the harvesting team are mainly young people who have dropped out of school, often due to high school fees or teen pregnancy. Some are orphans or come from low-income households where earning money at a young age is necessary for survival. Mentioned by the local mentors were that some youths of the neighbourhood are so desperate to earn money that they end up stealing or selling sex in order to earn an income.*

All of the youths in the fish harvesting team live in Nyalenda, particularly in the Kasim neighborhood. The group originally started with only female participants, but male youths are now also welcome to join.*

Many of the youths have their own small businesses and most also have children. Because of this, some members are occasionally unable to attend harvesting days, in which case the UDS mentors carry out the harvesting activities.

The youths' businesses mainly involve selling sardines, vegetables, and clothes. The group is supported by some of the UDS employees; Pauline, Rita, Ladonna, Nowel, Joyce, Faith and Erik. During the time that this project took place, Pauline and Rita were frequently recurring participants of harvesting, meetings and workshops.

15 people both from UDS and the youth team are involved in the fish pond project, although they each have different responsibilities and roles within the work. The organization provides small payments to members who work at the pond, mainly as a motivational compensation for the youths to show up. The long-term goal is to increase fish production and generate a higher income that can eventually provide better financial support for the members involved.



MENTORSHIP

The UDS mentorship program includes learning a new skill, in this case fingerling harvesting, and attending *saving and loaning*. *Saving and loaning* is the weekly meeting forum, where the team count their collective savings. To encourage punctuality and active participation, members are required to pay small penalties for late arrival or absence.

**Personal communication, Pauline, mentor at UDS, April, 2026*

Members contribute to the collection of community savings. The funds are divided into two categories: a welfare fund, which supports members during emergencies, and shares, which help finance the group's investments and activities within the mentorship program.



MENTORS

Pauline, 27 years

Worked at UDS for five years and has been involved in the fish pond project for the past two years. She enjoys interacting with people and farming is one of her hobbies. Her favorite sports team is Manchester United F.C.



Joyce, 28 years

Worked at UDS for four years and has been involved in many projects at UDS, including the fish pond project. She has a seven-year-old son and is passionate about building a community that supports food security and gender equality.



Rita, 27 years

Worked at UDS for four years and has been involved in the fish pond project for the past two years. She is also working within the grocery business.



MEMBERS

Steve, 20 years

Has been a member for four months which has helped him to access financial opportunities within his small business. This includes selling sweet potatoes and cassava. He enjoys cooking and is a big fan of Manchester United F.C.



Cynthia, 24 years

She has been a member for one and a half years and has been involved in the fingerling project since joining. In addition to her work in the project, she runs a small business selling slippers and is the mother of a three year old son.



OTHERS IN FINGERLING TEAM

Ladonna, Nowel and Faith are also mentors, but were unable to participate in the interview. Members who were unable to do an interview includes, Cynthia, Nelly, Morgan, Monica, Mary-Ann, Elijah and Emmanuel.





STAKEHOLDER MAPPING

CORE

PROJECT GROUP

The team involved in the project are four students from Chalmers University of Technology.

UDS YOUTH

The youth group consists of nine members, mostly young mothers. The team is dedicated in fingerling harvesting. UDS offers them a mentorship program, both regarding their own businesses and fingerling harvesting.

UDS EMPLOYEES

There are 20 people that work at UDS, 12 as volunteers and 8 as employees. The workers are responsible to take care of the site and members. They are responsible for different team members and supports workshops.

INVOLVED



UDS MANAGEMENT

Peter and Job founded UDS in 2017 and are one part of the management structure within UDS. The management team also includes Gladys, who is responsible for sending requests for donations for all projects at UDS.

CHALMERS TEACHERS

Jessica and Emily served as project supervisors from Chalmers, guiding the students and supporting the project development on-site during the first two weeks.

DECCTA

Deccta is a team of constructors at Lake Victoria working within the area of industrial fish production at Dunga beach.

STEPHEN

Local contractor and designer, Stephen, working at Zingera.



AFFECTED

Family of fingerling team

Fish

INVOLVED

Community

Customers

Ecosystem

UDS Management

Chalmers Teachers

Funders of UDS

DECCTA

UDS Employees

CORE
Youth of UDS
PROJECT

Project group

Stephen





METHODS

SEMI-STRUCTURED INTERVIEWS

Semi-structured interviews were used as a method to gain information, based on a set of predefined questions with additional follow-up discussion.

WALK AND TALK

Walk and talk was used as an interview method using semi-structured interviews in a more informal setting during other activities.

HARVEST MAPPING

Harvest mapping was used to discuss issues and strengths regarding multiple aspects of harvesting. The participants were given a basis for discussions and their input was gathered to the project scope.

CRITERIA LIST

A criteria list was used to guide the project's scope, stating the projects most important aspects. It also guided decision making throughout the project.

OBSERVATIONS

Observations were used as a tool for gathering information about the context. This includes joining activities while watching and listening without interfering.

BRAINSTORMING

Brainstorming was used as an ideation tool to come up with as many ideas as possible during a set time. It is important during brainstorming to not be judgemental and have an open mind to all ideas presented.

PROTOTYPING

Prototyping was used as a way to physically visualize created concepts by creating physical models.

CO-CREATION

Co-creation was used as a collaborative method of ideation. It focused on gaining ideas together with the fingerling team participants; aiming on making the stakeholders feel ownership of the result.

FRUGAL DESIGN

Using a frugal design approach intends to reduce cost, complexity, and resource footprint while keeping the vital functionality.



PROCESS

Arrival
8th of April



01 OBSERVATION & RESEARCH

First visit to UDS
Dunga beach visit
10th of April
Observation: Feeding at UDS
Meeting: Needs & Wants with UDS
14th of April
Observation: Harvesting at UDS
16th of April



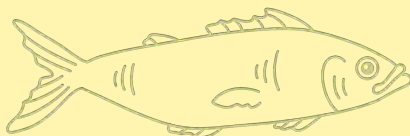
02 PROJECT SCOPE

Workshop: Harvest mapping with UDS
16th of April
Brainstorming: Project group
20th of April



03 CO-CREATION

Workshop: Co-Design with UDS
22nd of April
Observation: *Saving & loaning* at UDS
Meeting: Co-Creation with DECCTA
23rd of April
Brainstorming: Project group
27th of April
Meeting: Co-Creation with Stephen
28th of April



04 BUILDING & RESULTS

Building start
1st of May
Prototype: First evaluation with UDS
5th of May
Prototype: Re-design
6th of May

05 EVALUATION



Departure
10th of May

Prototype: Second evaluation with UDS
7th of May

OBSERVATION & RESEARCH

PROCESS

During the first phase of the research, a field visit was conducted at Dunga Beach, where fish nets in Lake Victoria were observed to gain a better understanding of the local fishing practices and surrounding environment. Initial visits were also carried out at UDS, where the feeding routines in the existing fish ponds were observed and further information about the fingerling production process was gathered.

To define the scope of the project, a needs and wants meeting was held together with the fingerling team. The purpose of the meeting was to identify existing challenges, understand their needs and highlight potential areas for improvement.

OUTCOME

The conducted observations provided valuable insights about the fingerling team schedule and the overall implementation of the fingerling production process. They also contributed to a deeper understanding of the organizational power structures and social dynamics within UDS. Together, the interviews and field observations generated important insights that helped shape the direction and focus of the project.

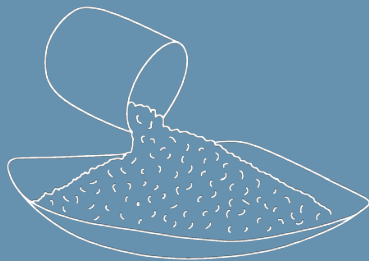
LESSONS LEARNED

Utilizing semi structured interviews turned out to be a good approach to gather information. However, at some points the approach of unstructured interviews turned out to be a better approach, as they allowed participants to speak more freely and comfortably without feeling that their knowledge needed to directly contribute to the project.

Since Kenyan culture believes in hierarchies (The Culture Factor Group, n.d.), we observed that the younger participants may feel less inclined to “teach” or provide information to an international master’s student. This explains why adopting a more conversational approach turned out to be more productive rather than conducting strict structured interviews.

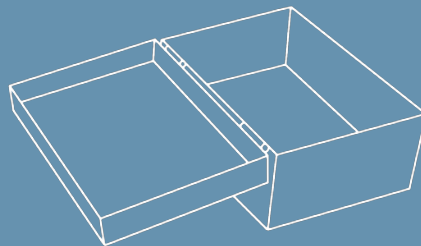


FINGERLING SCHEDULE



Daily

Daily activities at the fish pond include feeding, which takes place twice a day. Once in the morning around 9 a.m. and once in the afternoon around 3 p.m. Another essential routine is monitoring the pH level of the water to ensure it remains at a neutral level of 7.



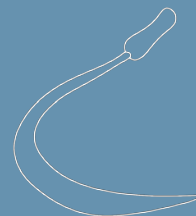
Weekly

Weekly activities include meetings held every Thursday to discuss challenges and other aspects related to the fish pond. During these sessions, members also participate in a “saving and loaning” meeting, where they contribute individual savings to support the development of personal businesses.



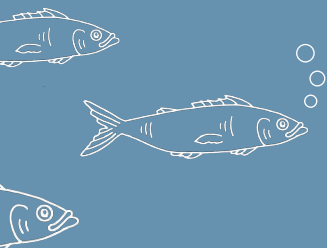
Every two weeks

Harvesting takes place every two weeks and typically requires around five people, lasting up to two hours. The main objective is to collect the fry and transfer them to separate nets to protect them from being eaten by larger fish. During the process, fry may either be moved to another net or sold directly to customers.



Monthly

Maintenance is carried out once a month, or more frequently in response to harsh weather conditions. The process typically takes around four hours and requires up to four people. Tasks include cutting grass, repairing damaged nets, replacing wooden poles, reinforcing anchors, and removing leaves and other debris from the pond.



Every 8 months

Approximately every eight months, the pond is completely emptied by blocking the water inlet. This process takes 2-3 days, during which all fish in the pond are harvested and sold. During this period the group also makes new decisions and improvements for the pond.

OBSERVATION & RESEARCH



PROCESS

We observed both the current feeding and harvesting routines at the pond. We also participated in feeding the fish to better understand the process firsthand. The harvesting procedure was carried out by five UDS participants, including both employees and youth members. In addition, a walk-and-talk session was conducted during the observation to gain deeper insights into the harvesting routine and the challenges associated with it.

LESSONS LEARNED

During the harvesting walk-and-talk, it was challenging to engage in all discussions as the physical distance between the harvesters in the pond and the interviewer limited interaction. It was also challenging to ask more personal questions at this time in the project, which we thought would act as “ice breakers”. As a result, the focus remained mainly on work-related tasks, and most questions were answered by UDS staff due to the hierarchies structures. Some responses were obtained from youth members through direct one-on-one questioning.



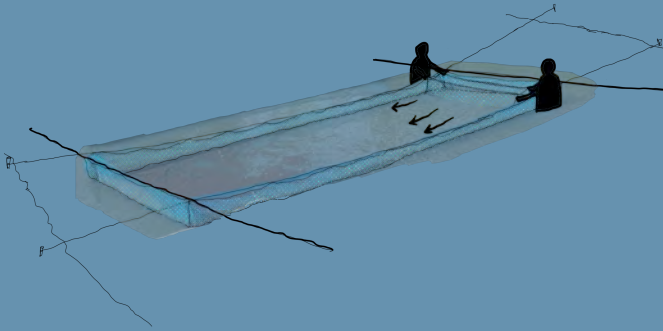
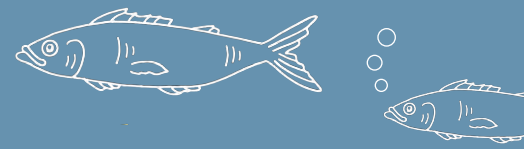
OUTCOME

The harvesting process used by the fingerling team was originally introduced by Aquaban Limited and has remained largely unchanged since November 2025. Its main purpose is to collect fry and fingerlings from mature fish and transfer them either to dedicated nets for further growth or prepare them for sale, depending on their development stage. If the fish are only carrying eggs and no fry have yet developed, harvesting is postponed until the fry are ready to be collected.

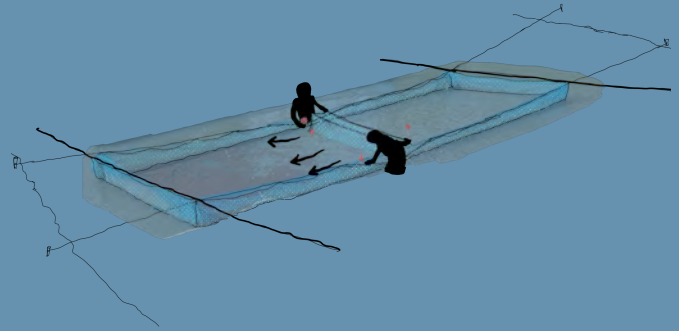
Harvesting is a labour-intensive activity that requires coordination between four to six people. The nets are reinforced with metal wires, which obstruct movement in the pond, and the muddy bottom makes the area slippery and difficult to navigate. The process begins with two people gradually lifting the net from one corner while removing anchors, stones or water bottles, that prevent the net from floating, as they go. As they gradually moves the net as they go leading to cornering the fish in one end of the net. Two people continuously hold the net in place, while two to three others collect the fry by carefully grabbing the adult fish one by one, opening their mouths and rinsing them in the water to release the fry. This step is essential, as adult fish may otherwise spit out or consume the fry. The adult fish are then thrown back to the opposite side of the net to separate them from the collected fry. The fry are then collected using a strainer and put into a bucket. This procedure is repeated for each net in the pond. After collection, the fry are either sold directly or transferred to another net for continued production. When selling, fish are sorted by size and weight before being counted and prepared for sale or redistribution.

Throughout the process, fish are handled carefully to minimize stress and losses. The net is never fully lifted out of the water, as exposure to sunlight can increase stress and aggressive behaviour, making the fish more likely to injure the harvesters. Keeping the fish partially submerged in the water also helps reduce the risk of oxygen loss.

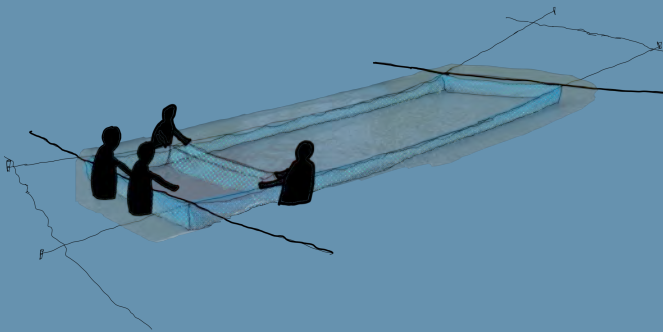
FINGERLING HARVESTING



1. Two people starts lifting the net in on one side, removing anchors as they go.



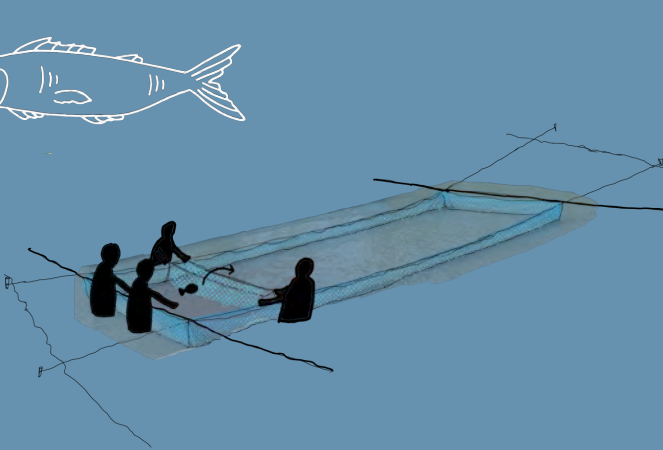
2. They gradually move the net as they go, cornering the fish at one end of the net.



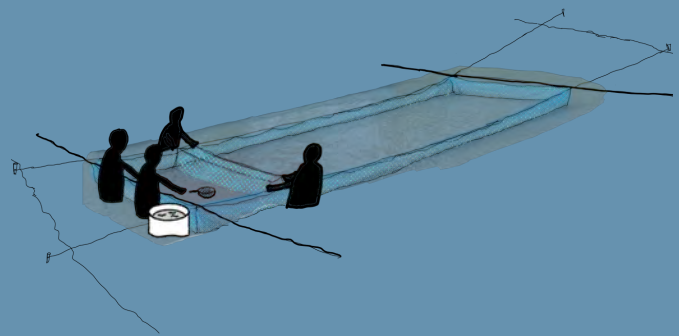
3. Two people are continuously holding the net at the edge.



4. They grab one fish at a time, opening the mouths of the fish to remove fry.

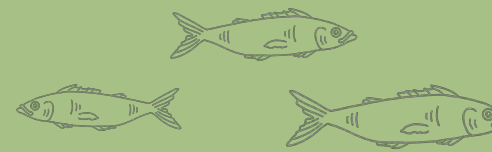


5. The adult fish is then thrown back to the other side of the net.



6. The fry is then removed with a strainer and put into the bucket.

PROJECT SCOPE



PROCESS

A harvest mapping workshop was conducted with the aim of encouraging participants to freely sketch and communicate their ideas, experiences, and opinions regarding the current pond area using pens and paper.

To define the project scope, the data gathered from observations and research was structured into potential project directions. At the same time, a criteria list was developed to create a clearer understanding of what the project should include and prioritize, see Appendix 1.

The criteria list was used as a tool to guide decision-making and identify the aspects most important to the project.

The findings from the observation and research phase were then compiled into categories based on the needs and desires expressed by UDS, as well as issues identified during the feeding and harvesting observations, Appendix 2.



OUTCOME

The selected criteria reflected the needs and demands expressed by the fingerling team, the project scope, available resources, and potential future outcomes. Each criterion was weighted on a scale from 1 to 5, where 5 represented the highest level of importance.

Fish escaping from the nets was identified as the largest concern and one of the main causes of economic loss. As a result, the project scope focused on improving the fish nets and was divided into four key problem areas: sinkers, loosened nets, sinking nets, and fry removal.

The group aimed at focusing on solutions that would keep a higher percentage of fish inside the nets, and thereby increase income from the fingerling production. To address these challenges, the project focused on reducing physical effort, increasing accessibility, improving resource efficiency, minimizing time-consuming maintenance, lowering maintenance costs compared to the current use of wires and wooden poles, and enhancing safety for harvesters by reducing risks such as tripping on wires.

LESSONS LEARNED

The harvest mapping exercise did not produce the expected outcomes, as neither the youth nor the mentors contributed sketches or actively engaged with the map provided. Although a local mentor for the course was present to translate and bridge communication, participants still appeared uncertain about the purpose of the activity and the session instead evolved into a general group interview about their harvesting experiences. Clearer instructions would have been needed. It also became clear that starting with overly broad or open-ended questions reduced participants' willingness to share ideas.

Similarly, early attempts at collecting data on materials were limited, as the fingerling team showed little interest in discussing material choices without a clearly defined concept. These discussions only became relevant once a specific concept had been introduced.





SINKERS

Current net sinkers are heavy, impractical, and time consuming to find. Some of the current sinkers are rocks with sharp edges which also damage the nets and contribute to further losses.



LOOSENETED NET

The wires often loosen during harvesting and due to environmental exposure, requiring frequent and time-consuming maintenance. Additionally, the poles supporting the wires can deteriorate or break over time, particularly because of termite damage.



SINKING NETS

Heavy water floodings and while harvesting, hence the fish are escaping.



REMOVING FRY

Holding nets is a two person activity in the harvesting process that is both heavy and time consuming.

CO-CREATION

PROCESS

The four identified problem areas within the project scope were explored to better understand the range of possible solutions, see Appendix 3. The project group conducted an individual brainstorming session focused on generating concepts with varying levels of implementation, ranging from low to high. High-level implementation referred to concepts that introduced entirely new systems or significantly changed the existing net structure. Medium-level implementation involved introducing new elements while still retaining parts of the current pond design and harvesting procedure. Low-level implementation focused on minimal changes, such as utilizing the existing wires, maintaining the current harvesting process, or applying a frugal design approach, see Appendix 4.

Following the brainstorming session, a workshop was held together with the fingerling team and the youth involved in harvesting. During the workshop, the project group firstly intended to brainstorm together with the participants. Secondly, sketched concepts were presented and participants were encouraged to openly discuss and provide feedback on each idea. In total, nine concepts were presented, of which four were considered practical and relevant by the fingerling team, while others were discarded due to implementation difficulties or limited usefulness. The participants also rated the four winning concepts on a scale from 1 to 10 based on their perceived value, which helped the group identify the most promising concepts for further development.

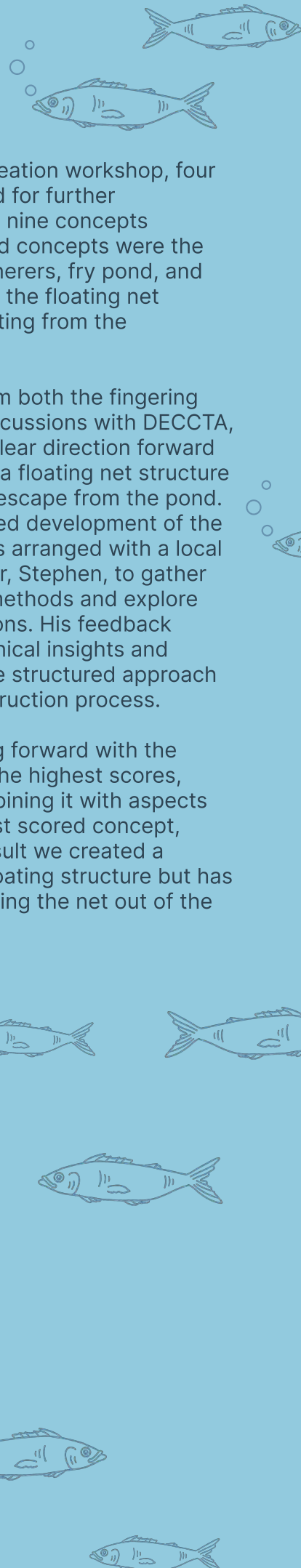
As part of the ideation phase, an co-creation session was also conducted with the DECCTA team to gain local knowledge regarding construction methods and material choices. The discussion covered both existing harvesting nets in Lake Victoria and the concepts developed for the fingerling team. DECCTA shared insights into their current fish pond systems and contributed valuable information regarding net construction, suitable materials, and associated costs, which supported the continued concept development process.

OUTCOME

As a result of the co-creation workshop, four concepts were selected for further development out of the nine concepts presented. The selected concepts were the floating net, raised cornerers, fry pond, and fish trap. Among these, the floating net received the highest rating from the participants.

Based on feedback from both the fingerling team workshop and discussions with DECCTA, the group identified a clear direction forward focused on developing a floating net structure aimed at reducing fish escape from the pond. To support the continued development of the concept, a meeting was arranged with a local contractor and designer, Stephen, to gather input on construction methods and explore possible design directions. His feedback provided valuable technical insights and helped establish a more structured approach for the prototype construction process.

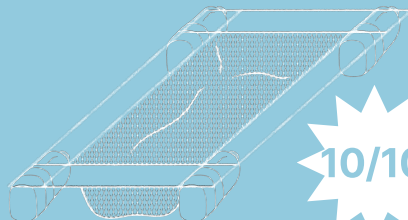
This resulted in working forward with the solution that received the highest scores, floating net, while combining it with aspects from the second highest scored concept, raised corners. As a result we created a concept which has a floating structure but has additional poles for raising the net out of the water.



RATED CONCEPTS

FLOATING NET

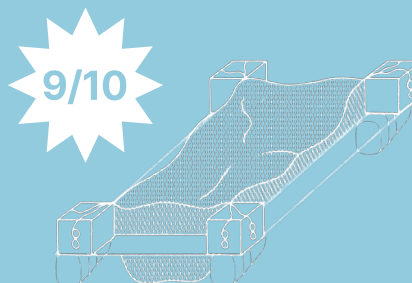
The floating net is constructed using a frame combined with water bottles. The frame provides stability, while the water bottles makes it float. Additional water bottles filled with sand or soil are used as anchors to keep the net securely in place.



10/10

RAISED CORNERS

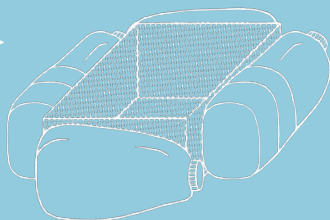
A floating net with an integrated tension rope that can be tightened to corner the fish during harvesting. The frame has raised corners for extra flood protection and support. This design makes the harvesting process more efficient and requires fewer people.



9/10

FRY POND

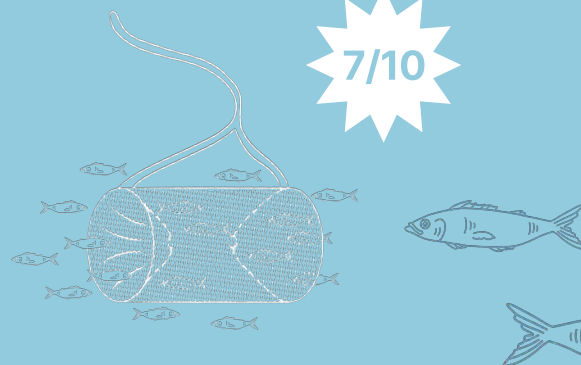
The fry pond is a small net used for holding fry or fingerlings during harvesting, designed to attach to the larger nets. By incorporating water bottles for flotation, the structure remains above the water, allowing the fry to be easily and safely transported from one net to another.



8/10

FISH TRAP

The fish trap is a low implementation, that the UDS group did not know about. This solution could easily be implemented to reduce the amount of fish that have escaped their nets and are not surrounded in the pond.



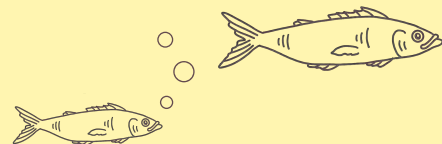
7/10

LESSONS LEARNED

During the co-creation process, unexpected participation barriers emerged, as the participants were less inclined to actively create concepts together than initially anticipated. This highlighted the importance of preparing alternative workshop approaches, such as having pre-developed concepts available and being flexible enough to adapt the workshop structure spontaneously when needed.

Presenting sketched concept ideas created by the students proved to be the most effective way of facilitating co-creation with the fingerling team, as participants appeared more comfortable giving feedback on existing ideas than generating their own through drawing or other creative exercises. This approach encouraged open discussions and resulted in valuable feedback and reflections from the participants.

Another important insight was that allowing participants to first discuss the concepts in their native language created a more open and relaxed conversation, where they expressed their thoughts more freely. A group member could then summarize and present the main ideas or comments in english for the rest of the meeting participants.



BUILDING & RESULTS

PROCESS

The construction materials were purchased by the project group with assistance from members of fingerling team. The prototype was then built together with a local constructor, Stephen, from the organization Zingira, who supported the construction process during one of four days. The fish net was sewed two times, once as the existing nets and once to add the rope to create the raised wall. Members from the fingerling team also participated during the prototype building.

The construction took place at the UDS compound and began with assembling the wooden frame using screws. Water bottles were then attached underneath the frame structure to provide flotation, and finally the fish net was sewn into the frame. Once completed, the finished construction was carried to the pond.

LESSONS LEARNED

The intended knowledge transfer was less successful than expected, partly because several of the fingerling members were absent due to overlapping activities or limited motivation among those present. If it would have been strongly highlighted to the fingerling group about their long-term gain of attending the workshop, the attendance might have been increased. Including a constructor permanently working at UDS would also have been a way of securing the construction knowledge within the fingerling team.

To address the knowledge transfer and ensure that the construction methods could still be reused in the future, instructional videos were recorded demonstrating how to secure the bottles with rope and attach them to the wooden frame. These videos were later used to form part of the handover instruction manual.

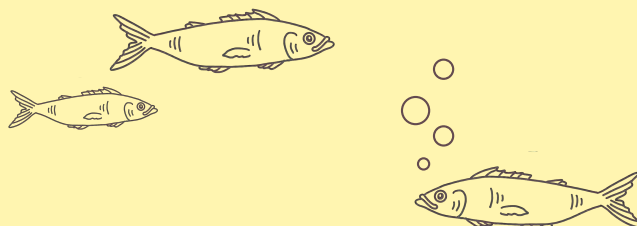
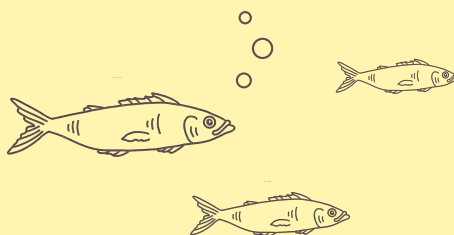
The limited participation and engagement may also reflect cultural factors, as similar patterns were observed throughout multiple co-creation activities during the project.

OUTCOME

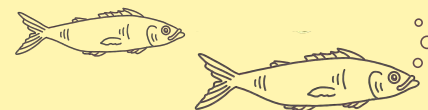
Attaching the net to the frame and the rope for the raised wall into the fish net proved to be challenging. The net had to be sewn twice since the group was unfamiliar with the net material and had to switch techniques to ensure to not break the net.

The initial construction did not provide the desired height of flotation, leading the group to rebuild the floating system by replacing the water bottles with cooking oil jerry cans. This modification proved successful, as the new floating mechanism raised the net structure higher above the water level, achieving the intended result.

The co-creation aspect of the prototype construction was only partly successful. Stephen was compensated for his work on the frame construction, as well as for sharing construction knowledge and providing access to tools. While the members expressed an interest in participating in the building process, engagement varied, with some members present during the building but not actively involved in the building process.





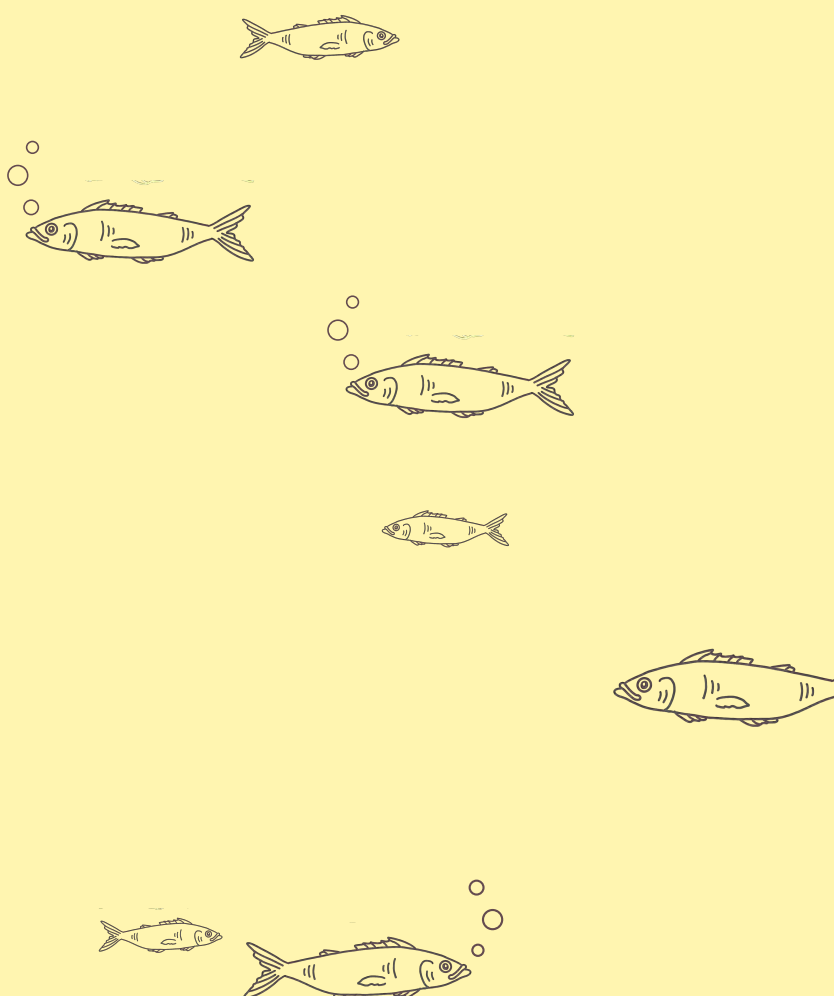


VUNAHARAKA

The prototype was named VunaHaraka (*Swahili for Harvest Faster*). VunaHaraka is a flood-resistant fish harvesting system developed together with United Destiny Shapers. Its design improves harvesting efficiency, reduces fish escaping, and supports sustainable youth-led aquaculture using locally available materials.

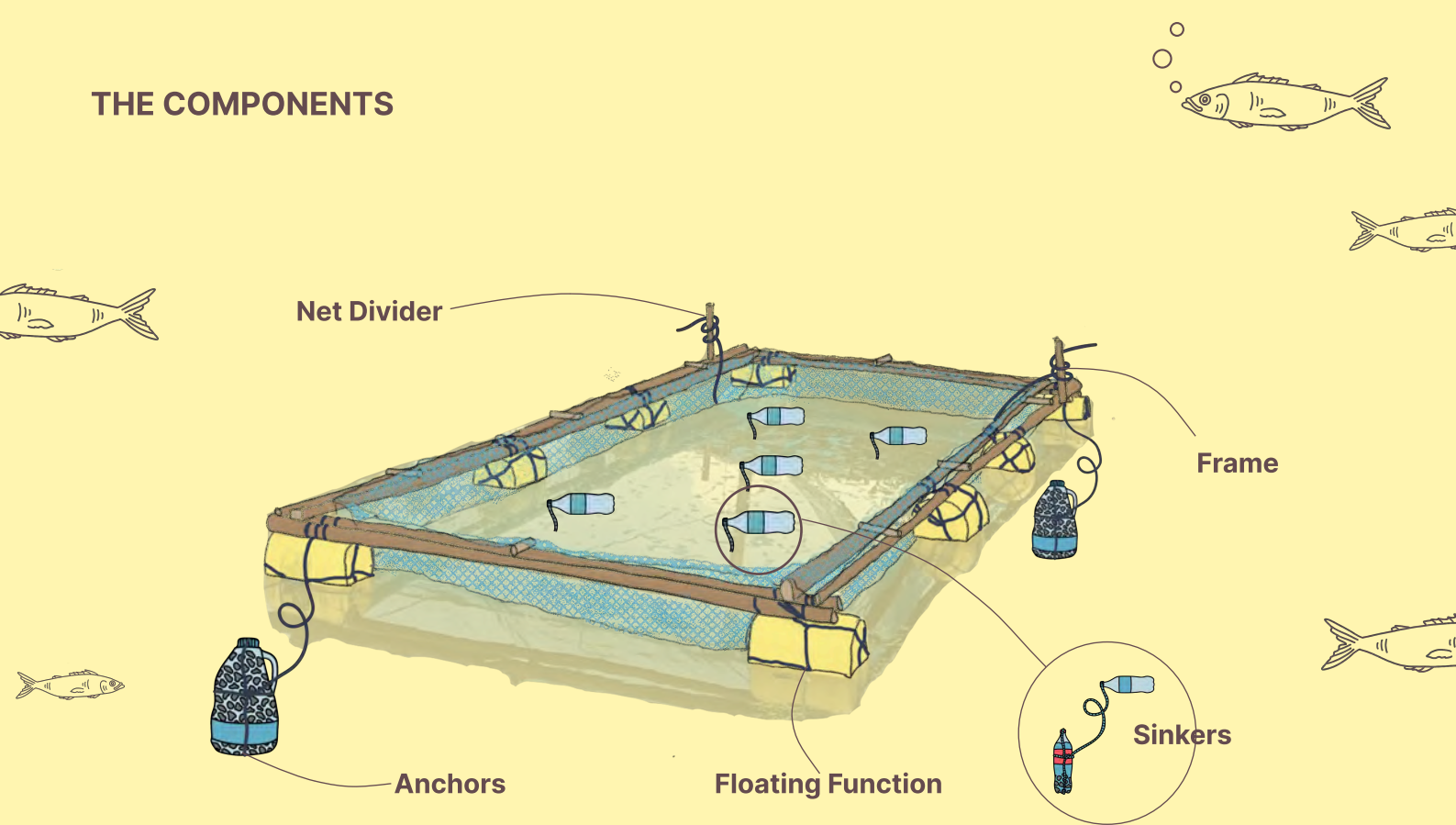
Sustainability is at the centre of this innovation. The construction is built frugally, using locally available and recycled materials; it transforms waste into functional infrastructure while reducing the environmental footprint.

The design enables a stronger and more durable harvesting structure compared to existing solution, preventing fish from escaping while making harvesting faster, safer, and more efficient. If fully implemented across the pond, the new system will reduce harvesting time by up to 50%, lowering labor demands while generating stable revenue.





THE COMPONENTS



FLOATING FUNCTION

The floating function of the prototype improves both usability and harvesting efficiency. By allowing the structure to float, the design prevents fish from escaping during periods of heavy rain and rising water levels. It also improves working conditions for the harvesters, as they no longer need to bend underneath the wires that support the existing net construction above the water surface.

ANCHORS (OUTSIDE THE NET)

The anchors are positioned with two anchors at each corner of the structure. The anchor ropes are intentionally kept slightly loose rather than tightly secured to the frame. This prevents the structure from drifting around the pond while also allowing it to rise and float naturally with changing water levels. As a result, the anchors stabilize the construction without pulling it downward during floating conditions.

SINKERS (INSIDE THE NET)

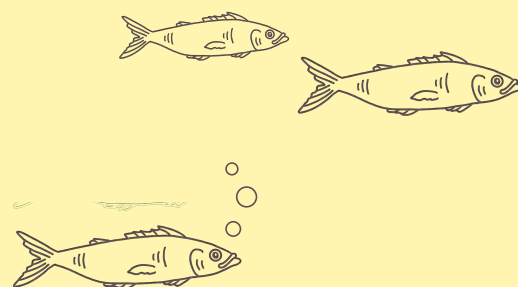
The sinkers keep the net submerged and properly positioned in the water. Each sinker is connected to a floating bottle attached at the end of the rope, making the sinkers visible to the harvesters. This visibility is important during harvesting, as it helps workers locate, remove, and reposition the sinkers efficiently while cornering the fish.

FRAME

The frame is constructed using locally available eucalyptus poles, chosen for their low cost, accessibility, and suitability for the local environment. The use of budget-friendly materials makes the design affordable and easier to replicate and maintain within the community.

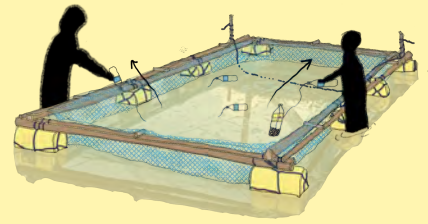
NET DIVIDER

The net divider supports the fish-cornering process during harvesting. The poles provide stable attachment points for securing the harvesting wall, making it easier to gather the fish into one area. In the previous design, two people were required to hold the net wall up throughout the harvesting process. With the new design, the net can instead be tied directly to the poles, reducing physical strain and minimizing the need for additional labor.

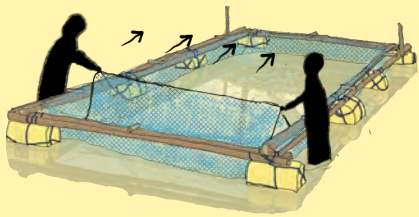


NEW PROCESS OF HARVESTING

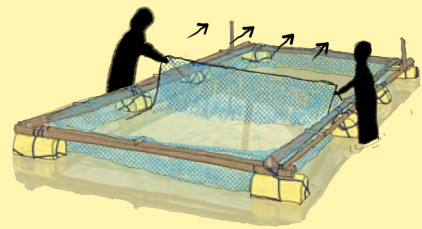
The upgraded harvesting process is illustrated in seven steps. The solution allows two people to complete harvesting, compared to previous solution that requires a minimum of four people as two people are required for only holding up the net while the others do the rest of the harvesting.



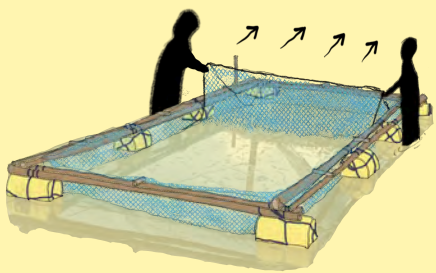
1. The sinkers are moved outside the net.



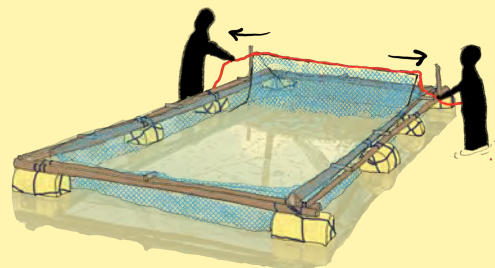
2. Two person start lifting the short side of the net



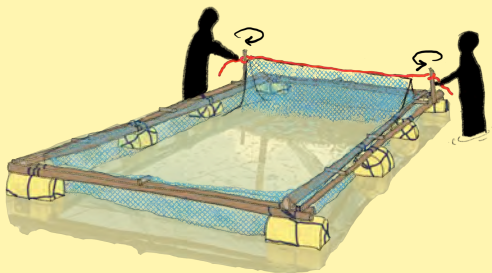
3. They gradually move the net from one side to the other.



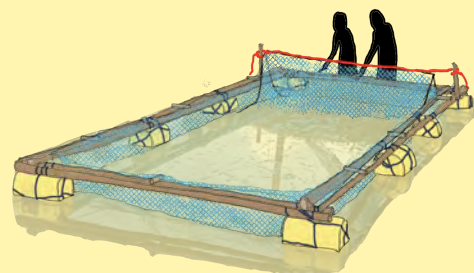
4. When reaching the other side, they have cornered the fish.



5. They lift up the rope that is inserted in the net, and pull it so that the net gets tight.



6. They tighten the rope onto the two side poles.



7. Now, they can let go of the net and start harvesting.





EVALUATION

To evaluate the final concept, a testing session was conducted. During testing, two persons from the fingerling team, a mentor and a member, got into the water with the prototype and tried out the harvesting process. No fish was placed in the net for this.

Along observing the testing, the team did a walk and talk to better understand the experience of the updated design. This resulted in positive feedback; all steps were easier managed compared to the previous solution according to the testers.

They immediately treated it as their own; one of the harvesters started leaning his whole weight on the construction and the other one started moving it around without first removing the anchors. Some instructions were therefore given for increased longevity of it.

When trying to find a suitable placement of it, they wanted to place it under the wires of the other nets constructions. This mismatched the intention of eliminating ducking under wires. However, it turned out the reason was to prevent it to get stolen, which was not something previously discovered.

For further evaluation, they mentioned that it would be easier to know critical improvement aspects when harvesting was done with the fish actually in the pond. This was outside of our time scope.

A concern raised by the project group, was that their way of tying the rope made it a bit lower than when a different technique was used, which we tried to teach during the session, and consciousness was raised whether the height would be enough to prevent fish from jumping over. Therefore, some possible future improvements were discussed with them.

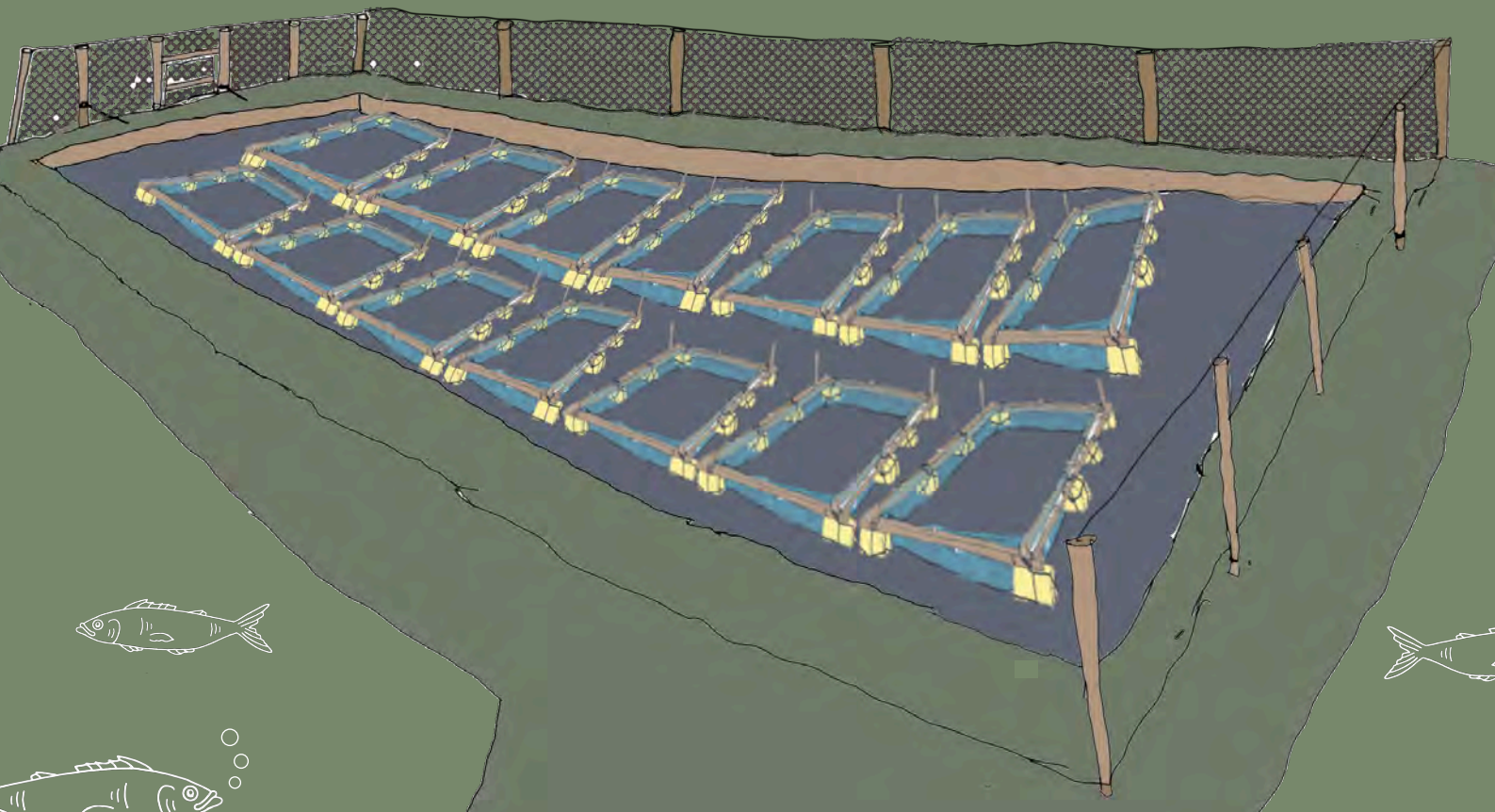


MASTERPLAN



A masterplan was created to align with the fingerling team's future plans and visions. With frugality, accessibility and sustainability in its core, all components consist of local materials that are low in cost, in comparison to materials commonly used in the aquaculture industry. Hence the prototype ensures a sustainable future as it also unifies with UDS's goal of having 15 harvesting nets by the end of 2026. This will not only increase revenue, it will ensure better working conditions for the harvesters.

The projection for the masterplan is to implement the prototype construction to the entire pond - whether it is the existing pond, a new leased pond or bought one - as VunaHaraka is designed for easy scalability, portability and repairability. For the new net construction UDS can both reuse the existing fish nets, but also receive funding for additional ones.

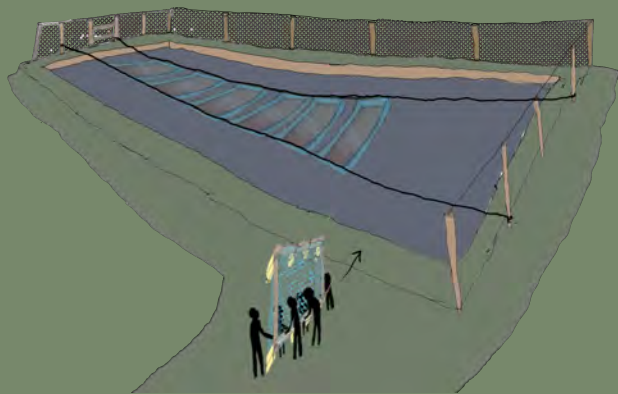
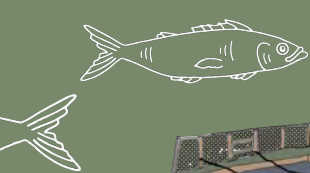


REPAIRABILITY

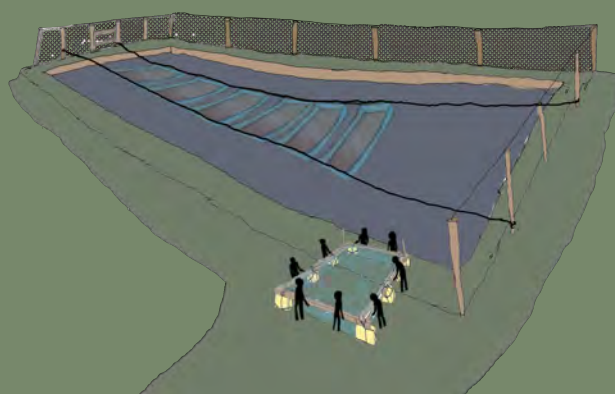
As the pond is cleared out every 8 months for maintenance, the durability and resistance of the materials chosen were done with the timeline as the main focus. All of the materials used are said to last over one year under normal operating conditions. However, in the case of an unforeseen incident, the prototype can be raised out of the water and each part of it can be replaced individually without affecting the rest of the construction. Ideally, we suggest that the nets, floaters, sinkers and anchors are checked for holes or leaks during each maintenance period and replaced if parts appear damaged.

PORTABILITY

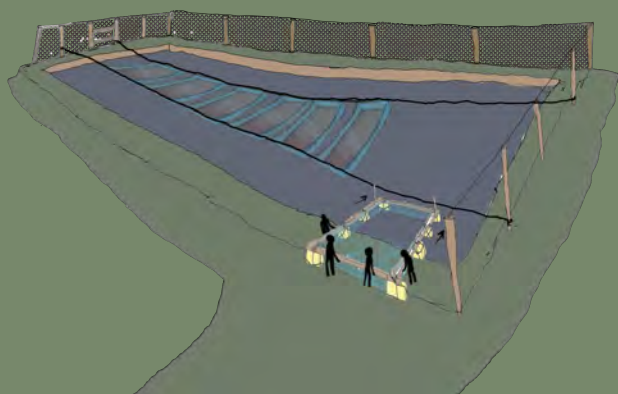
The prototype was built with keeping mobility in mind. VunaHaraka can be assembled at a suitable location, such as the UDS compound, and then transported to the leased pond for installation and use. If in the future UDS decides to shift their operations to a new location the construction can be removed from the existing pond and carried over with around 5-6 people holding the net up vertically. During our construction process the same method of transportation of the net was used.



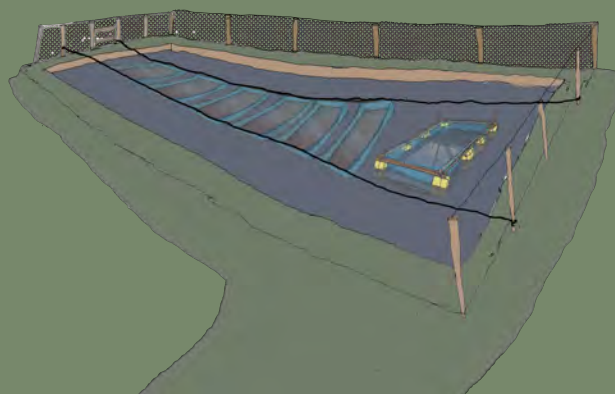
Moving the pre-assembled net to the pond



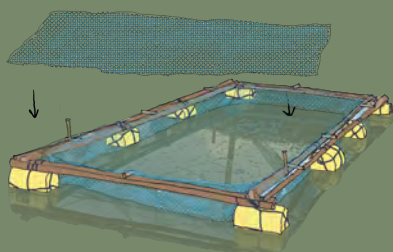
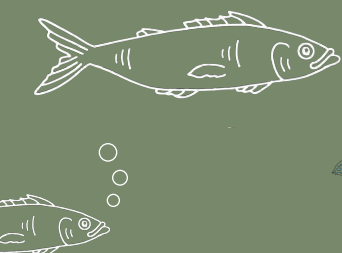
Turning the net to prepare it for lowering



Lowering the net into the pond



Moving the net into the desired place



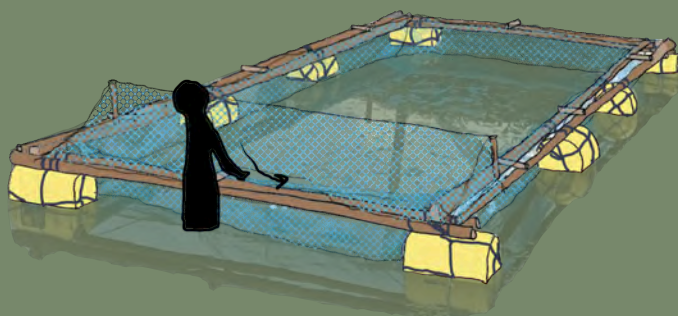
NET COVER

As an addition to the existing structure, the remaining net material from the rest of the project can be used to aid in the harvesting process as an extra layer of preventing fish escaping. As the fish get agitated when being cornered for harvesting, it risks them jumping over the net and into the surrounding water.

In order to solve this potential issue the net can be used as a cover that is laid over the two poles and extending towards the harvest side, with a small opening left in it to allow the harvesters to reach in and pull out the fish. With this implemented into the final prototype the team can ensure that the fish, even with the jumping will land back inside the net, preventing economic loss for UDS in the long term.



The solution was inspired by suggestions from our local contractor, Stephen, based on his previous fish pond experience, to have a full-size net on top of the entire construction. This would secure the fish on a higher level, but this would be a costly implementation and goes beyond the observed problems. Therefore the project group recommend to start using the scrap net cover solution. Covering the whole construction is considered to be a long-term implementation.





REFLECTIONS



THE IMPACT

The prototype directly affects the harvesting income and contributes to a more sustainable work. The income is affected in two ways. Firstly, preventing fish from escaping the nets and secondly lowering the numbering of people needed in the harvesting process.

It can be argued that the reduction of people in the harvesting process is not good for the locals if it risks leading to unemployment. However, in this context the harvesting process is an activity that occurs once every two weeks, where member absence is common since members have other business, children or unexpected activities hindering them from attending. If the harvesting cannot be completed the result will be non-existent income that day. If this can be prevented by a lower participants needed, then the outcome is a more stable revenue shared by the members of the whole harvesting team. On those days where all participants show up, the work load can be distributed between all members which would make the process more motivating and efficient.

Harvesting is a time and energy consuming activity, particularly in ponds like this that rely on basic methods and simple net set ups. The prototype introduces more intuitive and easy use of the nets, which improves the efficiency of the harvesting process. If all nets are replaced and upgraded to the new design, the harvesting time could potentially be reduced by half, while still using the same number of people.



LOCAL VOICES

Throughout the project a desire-based framework was used, inspired by Tuck (2009). We were conscious of not viewing differences as vulnerabilities, as this could have a damage-centred effect. To manage this we focused on fulfilling desires through local resources and interdependence of the collective.

Incorporating local voices in the design process, such as speaking to the DECCTA team, observing people's multi-use of jerry oil cans, and talking with Stephen about his previous experience of fish ponds were all important small steps that led the project in the right direction. An interconnected knowledge network was created along the way.

By incorporating several local stakeholders into the project, we highlighted their value in the process. Asking Stephen to lead the construction building was one example of successfully incorporating local knowledge, and the result would not have been nearly the same without his help.





THE FUTURE

The goal of the VunaHaraka project was to improve the identified problem areas within fingerling production by developing a solution that enhances both the economic conditions and the working environment during harvesting. The current prototype is intended to function as a showcase for future investors and funders, demonstrating how low-cost and locally adapted solutions can improve fish farming practices in natural ponds.

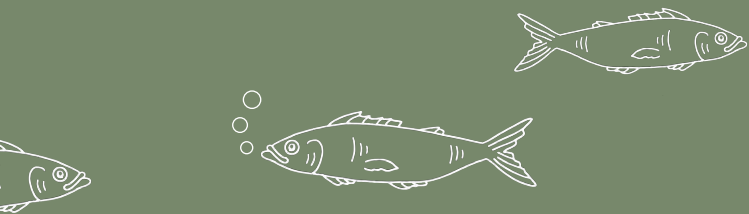
UDS has been provided with a strategy describing the prototype, its functionality, and the improvements it creates for the harvesters and the pond system. This approach is intended to support future funding opportunities, donations, and partnerships for continued development and expansion.

The fingerling group is currently focused on building a long-term and sustainable fish farming system while seeking external funding or investing to support future upgrades and expansion. Investment decisions within the group are made collectively, and they are currently in the process of building two new nets from funding they received after our site visit.

The current investment of approximately 110,000 KES has already enabled the construction and operation of seven nets while covering labour, renovations, and pond leasing costs. UDS's goal of expanding from seven to fifteen nets by the end of 2026 further demonstrates that the system can be scaled within the existing financial structure.

In addition, the pond has already generated income through fish sales, indicating early economic potential despite challenges related to flooding, fish escape, and the initial learning process. Overall, the financial discussions with UDS suggest that VunaHaraka is a scalable, low-cost, and sustainable prototype with strong potential for future implementation in small-scale fingerling production.





The project group, together with UDS, has developed a business pitch aimed at potential investors regarding future investments, highlighting the prototype's sustainability, durability, and long-term impact on both the harvesters and the pond environment, see Appendix 5. Based on the on-going scaling and the financial meeting with UDS, the VunaHaraka project demonstrates strong potential for future scaling and long-term sustainability.

The budget shows that the prototype can be constructed and maintained using affordable and locally available materials, while addressing key challenges in pond fingerling production and making it a financially accessible solution for small-scale production. Through UDS's collaborations with organizations across Kenya, VunaHaraka may also contribute to knowledge sharing and inspire similar solutions in other communities and fish farming initiatives.

The prototype aligns with Hamdi's principle of acting through small changes to emerge real development (2004). Instead of trying to copy and paste a financially heavy solution from a planner's perspective, we focused on using local resources to take small steps that would emerge to something bigger.

The total cost of constructing one VunaHaraka prototype is approximately 9,800 KES, demonstrating that the design is realistic to reproduce in similar pond environments. The use of low-cost and reusable materials, such as eucalyptus poles, reused plastic bottles, and locally sourced nets, further reduces investment barriers and supports future expansion.





THE PROJECT

At the beginning of the project, UDS had high expectations regarding both the time commitment and the involvement of the Chalmers group in activities outside the project scope. This initially created uncertainty within the group about balancing relationship-building and project progress.

The experience highlighted that trust cannot be created instantly but develops gradually throughout the project process. Over time, communication and collaboration between UDS and the Chalmers group became stronger, demonstrating the importance of mutual understanding and intercultural cooperation in collaborative projects.

The goal of the project was to apply participatory design methods by engaging local stakeholders in the development of the prototype. However, the design process developed differently than initially expected. The local stakeholders often did not provide direct design proposals or sketches, as the group had anticipated.

Instead, many participants preferred that the Chalmers group take responsibility for developing and presenting design concepts. As one local member expressed during week two, “we are not designers” (Rita, personal communication, 22 April, 2025).

This highlighted cultural differences in how participation and expertise are viewed. According to the Cultural Compass framework, Kenya and Sweden differ in their perspectives on hierarchy and participation. Kenyan culture generally places greater trust in hierarchical structures and specialized expertise, while Swedish culture often emphasizes equality, direct communication, and collaborative participation (The Culture Factor Group, n.d.).





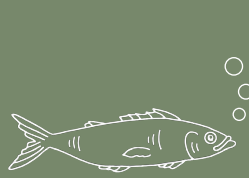
With this understanding, the co-creation process was adapted throughout the project. The approach of emergent design was crucial in this moment, which AFS also argues for (2022). We realised that meaningful outcomes were not possible with rigid tools; we needed flexibility to allow for unexpected findings. Although the participatory design process did not unfold as originally expected, the project still achieved co-creation through continuous dialogue, feedback, and collaboration with the local stakeholders.

The local input became an important part of the iterative design process and directly influenced the development of the final prototype. The intention of co-creation was to connect a local ownership to the project, and from observing the interaction with the prototype in the pond, this was still seen as successful.

Since we had the approach of collecting cultural knowledge and resources through-out the process, our roles can be seen as “enablers” rather than “providers” in the project (AFS, 2022). This allowed us to create a bottom-up solution rather than a prone-to-fail top-down solution. Through this we enabled a design process that was responsive to the context while also initiating the local ownership.



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APPENDIX 1

Criteria list

Criteria - The criteria are defined to guide the project's scope.

Weight - A scale from 1-5, where 5 is the high rank and 1 is low rank.

Ranked Weight - The criteria used to evaluate this outcome are ranked relative to one another, based on their importance.

Concepts - Each concept could either solve the criteria as follows:

- Better than the defined criteria = +
- As good as the defined criteria = 0
- Worse than the defined criteria = -

Scoring

- The scores resolve themselves into ranking them out of each other.

Criteria	Explanation	Ranked Weight (1-5)
Portable prototype solution	The prototype must be portable due to local resource, the tendency of lending a hand is bigger than buying.	4
Real-life solution	The prototype should solve or relieve the intended problem and perform reliably under real-life conditions.	5
Local income budget	The aim is to create a realistic prototype that the local community can re-create with their knowledge, efforts and resources, to create a solution that they see ownership over. (low income, min. 5000-2000 shilling?)	5
Decrease the escaping of fish from the nets	The prototype should help eliminate escaping during the harvesting and flooding.	5
Repairability	The prototype should be easy to repair and maintain using locally available tools and skills.	5
Durable materials	Long lasting or easy exchangeable materials in the local context.	5

Time to Build	The prototype should be feasible to build within a reasonable time (2 weeks) using available resources.	5
Ease of Use	The prototype should be simple to understand and operate without requiring advanced skills or training.	5
Scalability	The solution should be easy to reproduce and scale within the community or in similar contexts.	4
Enjoyment: Awareness and including the community in all stages	The prototype should be a result of co-creation so the local community feels ownership of the prototype.	4
Climate conditions	The prototype should function well under local environmental conditions (e.g., heat, rain, heavy wind)	4
Safety and health	The prototype should not cause more danger for the humans than the current solutions.	5
Fish and human relationship	Fish get aggressive when cornered or see the sun.	3
Environmental footprint	The project should minimize its impact on the environment and avoid increasing pollution, resource consumption, or ecological damage.	3

APPENDIX 2

Issues Identified

Needs and desires

Categories from interview and observations, who included

- UDS 1: First meeting with UDS
- Harvesting observation: first observation of the harvesting
- Observation of feeding: first observation of the feeding action.

Adjusting the nets (pulling and keeping the net above water)

- Holding nets requires technique and two or more people (UDS 1)
- Nets are sinking from water (UDS 1)
- Anchor problem (heavy nets, impractical anchors): (Harvesting observation)
 - Big problem was taking stones and water bottles. time consuming and heavy to shift the weights. (Harvesting observation)
 - Stones might crush the fish. might tear the nets (Harvesting observation and UDS)
- Fish are escaping during harvesting, jump over the net-holders attempt to hold the net. (Harvesting observation)
- Observation: difficult to maintain the nets, above the water level and tightening the nets and poles while harvesting. (Harvesting observation)
- Fish are escaping due to floodings/sinking of the net (Harvesting observation)

Feeding distribution

- Hard to reach while distributing food (observation of feeding)
 - Hard to know if all of the fish have gotten enough feed (UDS 1)

Durability due to weather conditions and maintenance

- Construction breaks (UDS 1)
 - Net break due to hard weather conditions (UDS 1)
 - Termites eating the wood poles (UDS 1)

Physically demanding

- Accessibility:
 - Getting in and out of the water (slippery mud + no stairway etc.) (UDS 1 & Harvesting observation)
 - Moving fry's into another net, have to "dive" under the wire and keep bucket from tilting (Harvesting observation)
 - The ground of the pond is very slippery during the harvesting act (Harvesting observation).
 - Fish getting more aggressive when they see the sun (Harvesting observation)
- Exhaustion:
 - Physical demanding to harvest in the water for two hours with high precision (UDS 1)
 - Nets seemed heavy - with dirt and growth on it (observation & interviews)
 - Harvesting responsible commenting that the nets aren't that heavy (Workshop)

Harvesting process: Sorting the fish

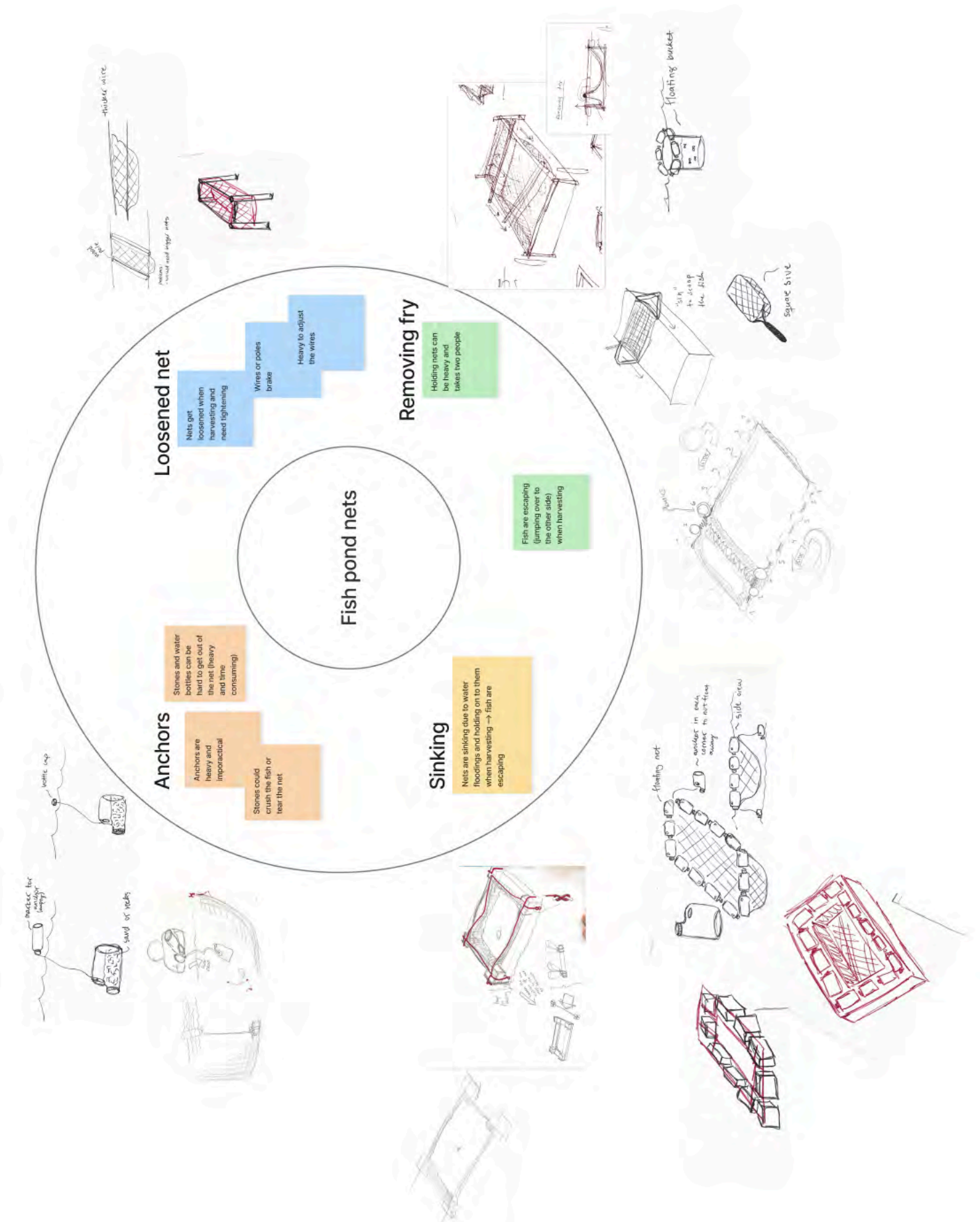
- Fish spatial logic (UDS 1)
- Time consuming: moving fish from one place to another (UDS 1)
- Separating harvesting and fingerling production (UDS 1)
- Lot of loss of fingerling with the leaves being thrown out of the net with the breeders (Harvesting observation)
- The process of attempt to maintain the pond is difficult/no system to count the fish and fingerling (Harvesting observation)

Other:

- Longer pants are preferable for harvesting (UDS 1)
- Fish fins are "poking" the harvesters fingers or other body parts (Harvesting observation)

APPENDIX 3

Brainstorming



APPENDIX 5

Handbook for VunaHaraka

Business pitch

In Nyalenda, Kisumu, fingerling harvesting is physically demanding, inefficient, and vulnerable to flooding. Damaged nets often lead to fish escape, production losses.

At United Destiny Shapers, we are changing this reality. Together with youth fingerling producers and Master's students from Chalmers University of Technology, we have developed a new flood-resistant net system designed specifically for local fish farming conditions. The upgraded design creates a stronger and more durable harvesting structure that reduces fish escape during floods while making harvesting faster, safer, and more efficient. If fully implemented across all ponds, the new system will reduce harvesting time by up to 50%, lowering labor demands and reducing harvesters' exposure to ammonia-contaminated water.

Sustainability is at the center of this innovation. The nets are built using locally available materials and recycled plastic bottles for flotation support, transforming waste into functional infrastructure and reducing environmental pollution.

This project is also creating opportunities for youth. UDS currently supports 15 young members who are building financial resilience, practical skills, and community through collaboration and shared investment. New construction cost 9 800 KES; that's a value of 12 big fishes. By reducing fish losses and improving efficiency, the upgraded system will increase the saving of the project, strengthen collective savings and support compensation for harvesters.

Our goal for 2026 is to scale this innovation to 15 upgraded nets, creating a more climate-resilient and sustainable aquaculture system for local communities. This is more than a technical upgrade, it is a youth-driven, community-based solution that combines sustainability, innovation, and economic empowerment.

With your support, we can expand sustainable aquaculture, reduce environmental waste, and create lasting opportunities for young people in Kenya.

Thank you for...

1. Placing the five sinkers as illustrated
2. Always tightening the harvesting rope
3. Not putting your weight or sitting on the frame
4. Removing the sinkers and anchors before moving the net

Prototype budget

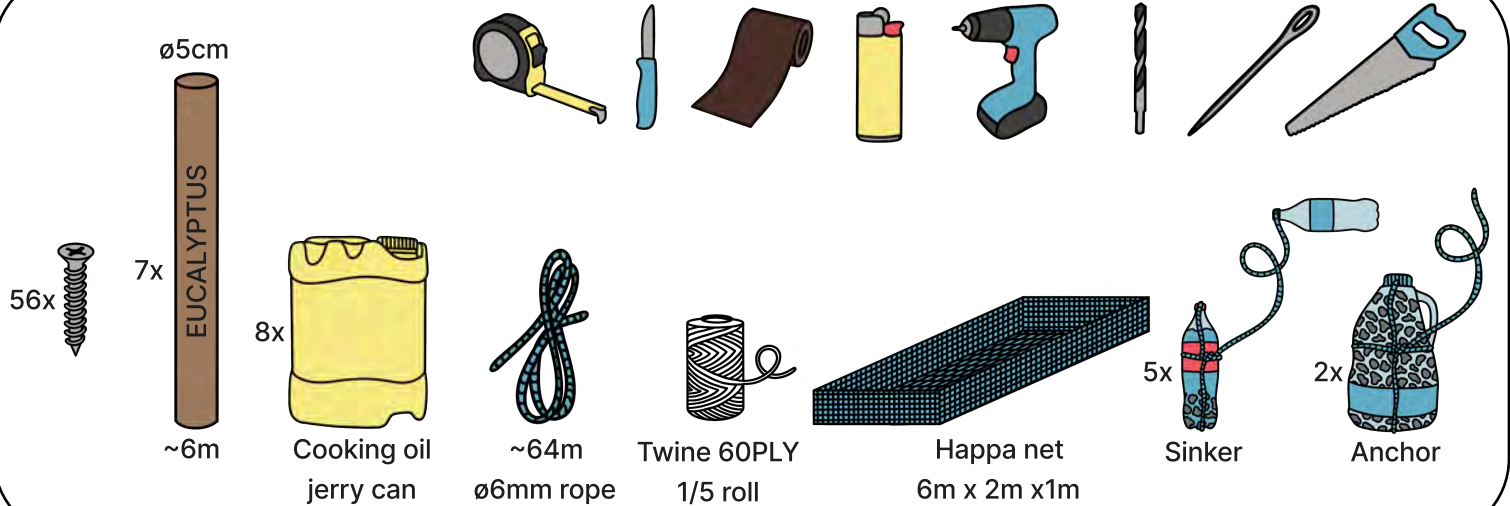
VunaHaraka

Material	Amount	Price per amount	Total price
Net	1	4000	4000
Sewing of net		1500	1500
Eucalyptus wood	6,5m	168/ 6m	1092
Rope 6mm	88m	1850/ 200m	814
Nylon thread	1/5 roll	300 per roll	60
screws	56	800/ 200 pieces	224
lighter	1/2	100	50
sand paper	0,5m	50/ 1m	25
Jerry oil cans	8 pieces	150 per piece	1200
Labour	1/2 day	1500 per 1 day	750
TOTAL			9715 kes

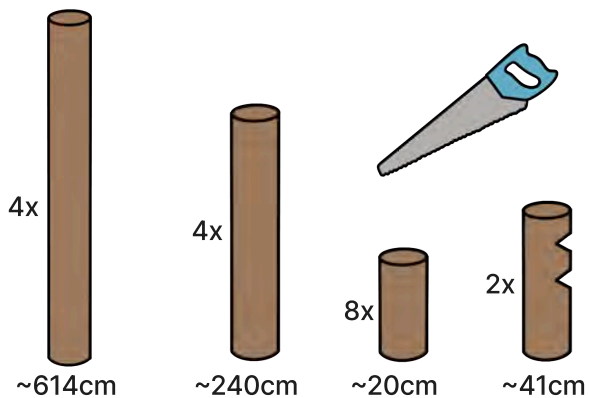
VunaHaraka

Materials needed:

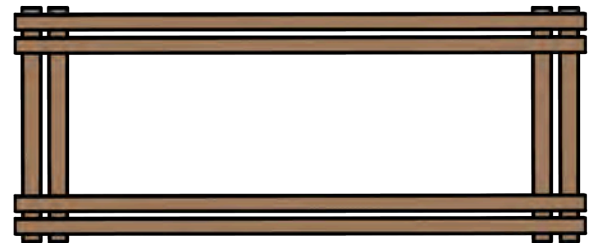
Tools needed:



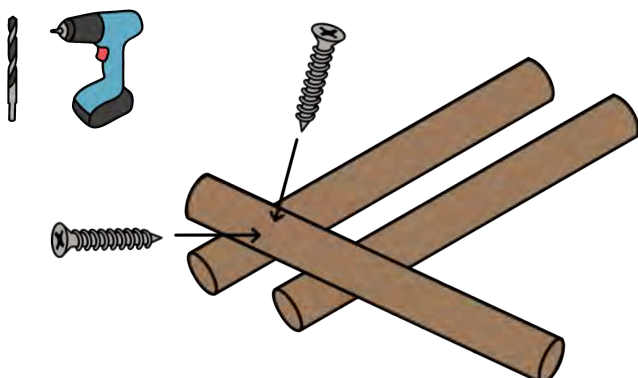
1. Measure and mark all lengths of the eucalyptus poles and cut with the saw.



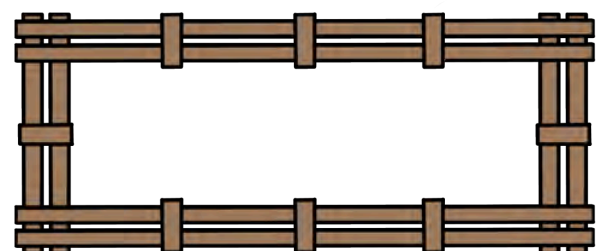
2. Assemble all eucalyptus round poles into the frame structure.



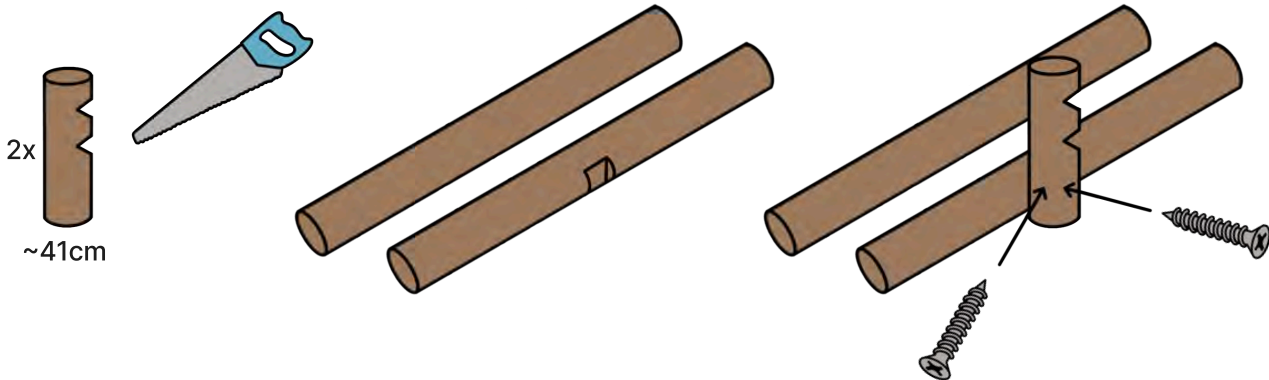
3. Drill holes at all connection points and screw together with two screws.



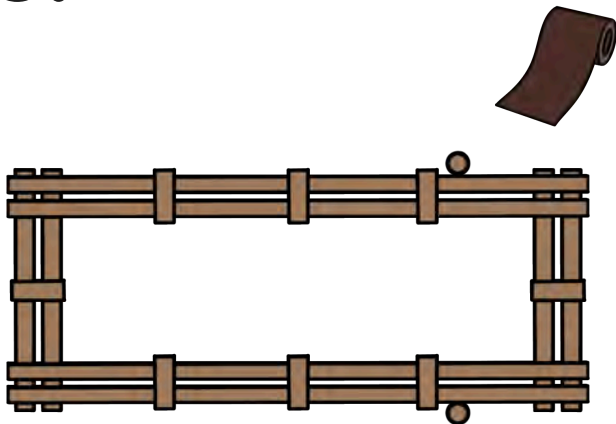
4. Place the connection poles on the frame structure and screw into place



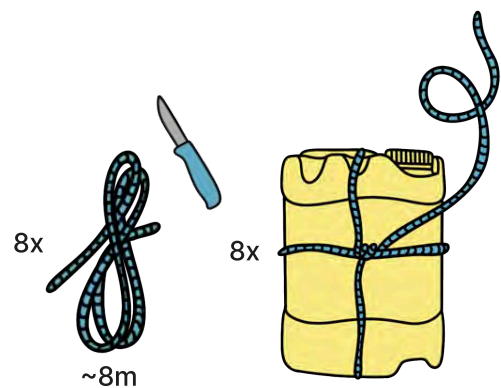
- 5.** Cut out the indentation on the 41cm long pole and cut out a indentation at the attachment point at 145cm from the edge. Attach with two screws.



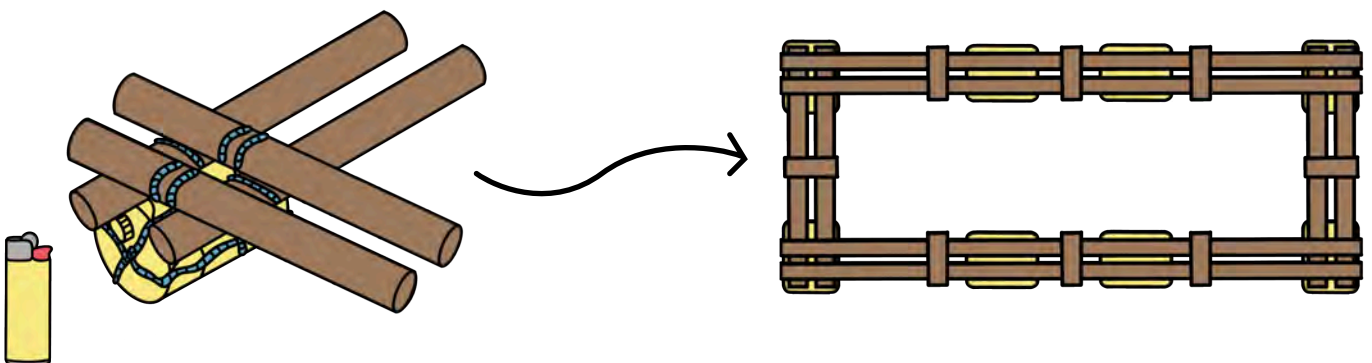
- 6.** Sandpaper all rough edges.



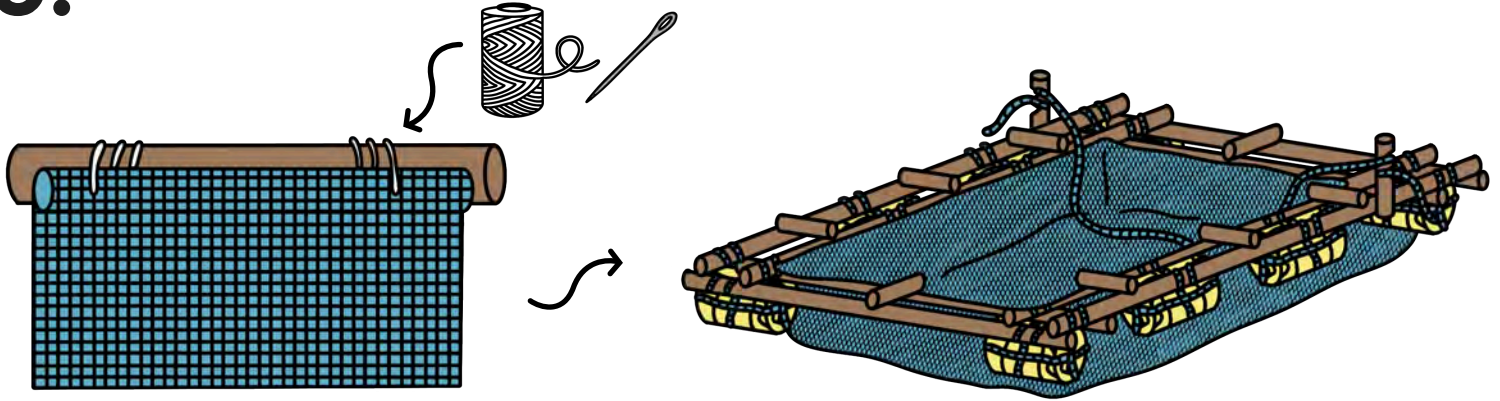
- 7.** Grab your jerry can and start tying around it with a 8m long rope.



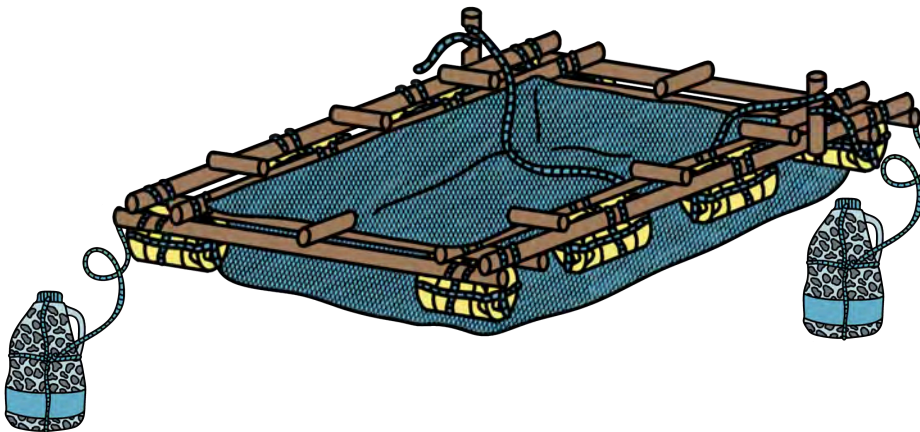
- 8.** Attach the jerry can underneath the frame by attaching it with the rope. Tie all 8 jerry cans as illustrated to the right. Burn all edges of the rope with the lighter



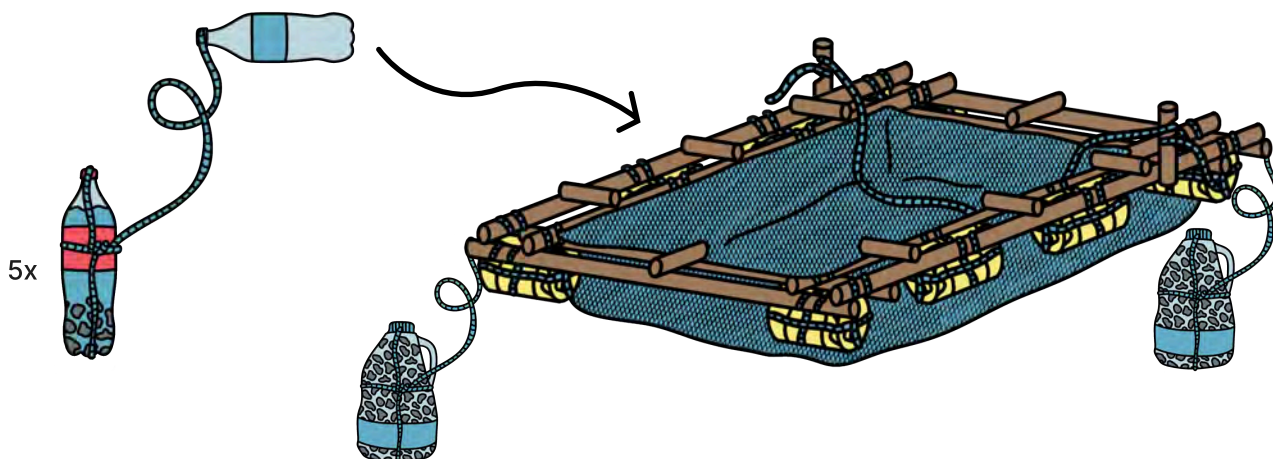
- 9.** Loop the twine into the border loop of the happa net and attach to the frame.



- 10.** Attach two anchors to two opposite sides of the frame structure.



- 11.** Insert the sinkers into the net

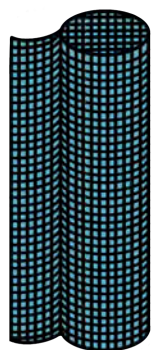




VunaHaraka - Happa net

Materials needed:

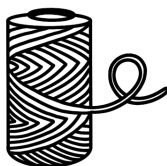
Tools needed:



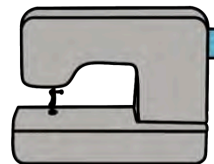
Happa net



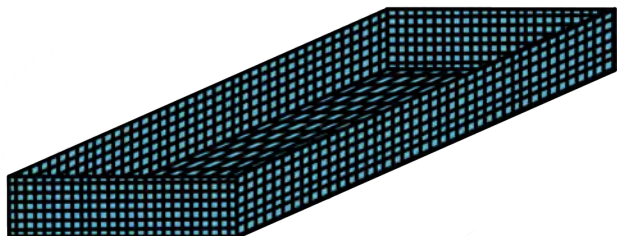
~6m
ø6mm rope



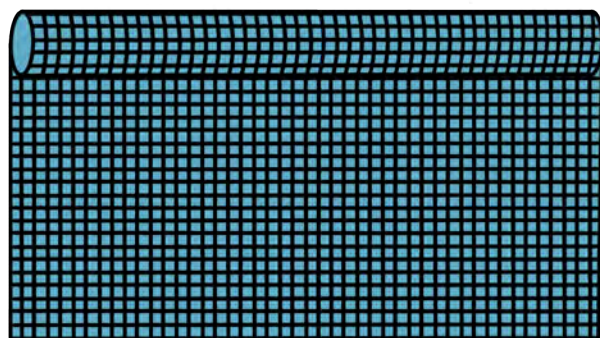
Twine 60PLY



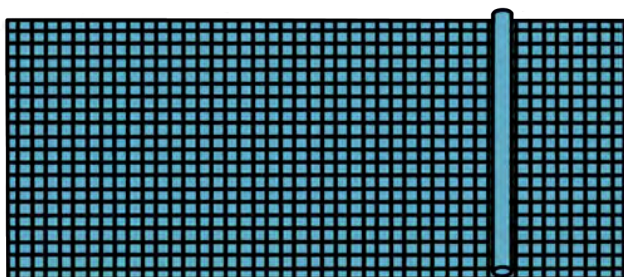
1. Sew the happa net into a 6m x 2m x 1m structure.



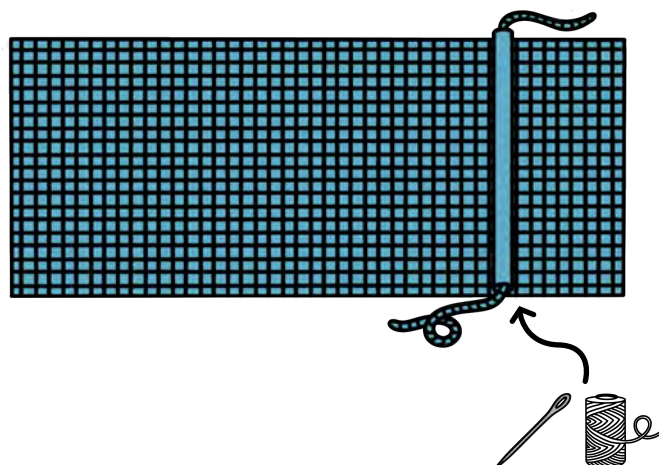
2. Sew a 2cm border loop around the net structure.



3. Sew a loop 145cm from one bottom edge of the net structure.



4. Insert a 6 m piece of rope into the loop along the bottom and sew at the edge.

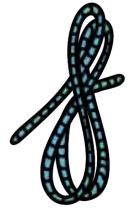




VunaHaraka - Anchors

Materials needed:

Tools needed:



~1,15m
ø6mm rope

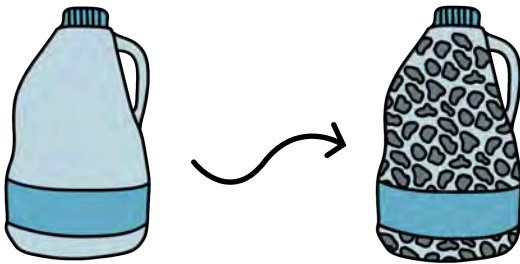
2x



5 liter bottle



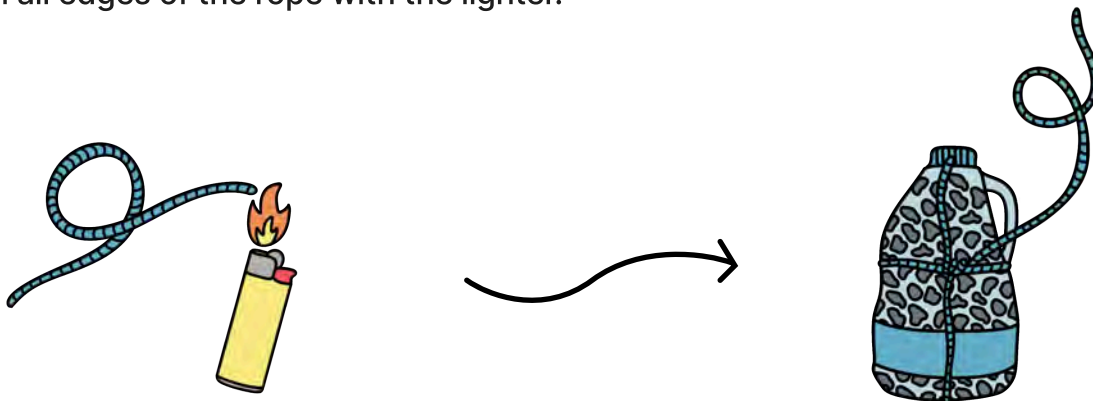
1. Fill the bottle with small stones until it is fully filled.



2. Cut 570cm rope per anchor and tie around the large water bottle.



3. Burn all edges of the rope with the lighter.

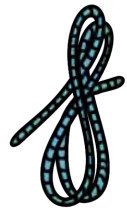




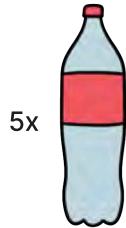
VunaHaraka - Sinkers

Materials needed:

Tools needed:



~1,25m
ø6mm rope



5x

2 liter bottle

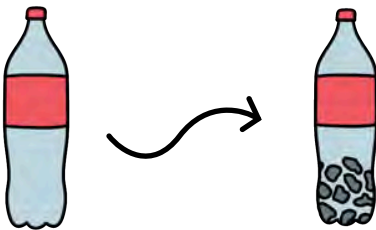


5x

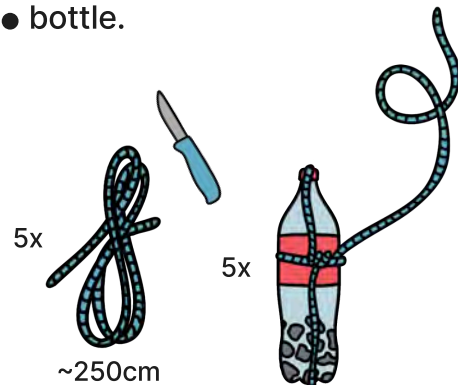
1 liter bottle



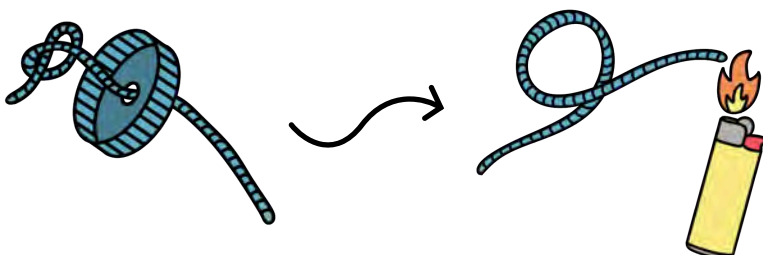
1. Fill the 2 liter bottles with small stones up to around 1/4 of the bottle.



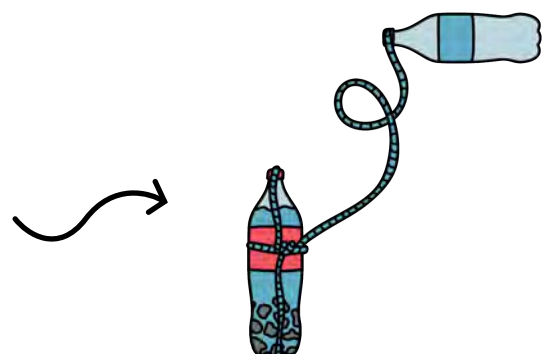
2. Cut x cm rope tie around the 2 liter bottle.



3. Cut a small hole on the cap of the 1 liter bottle. Insert the rope and tie a knot to secure.



4. Fill the rest of the bottle with water. Assemble and burn all edges of the rope.



APPENDIX 6

Project cost breakdown

Prototype build

When	What	Amogh	Emma	Jose fin	Maja	Comment
28/4	Stephen	1000				2h of consultation
29/4	Tape measure	1000				
30/4	Happa net	4000				1m x 30m
30/4	6mm rope	1850				200m
30/4	twine 500g	300				
30/4	needle	0				Got for free
30/4	Screws, bit, glue	3650				Turned out to be useless for the prototype
1/5	5×75mm screw	800				200 screws
1/5	Eucalyptus wood	1350				8 pieces, around 6m
1/5	Carrying wood	150				
1/5	Stephen	1500				1 days work
1/5	Net stitching	2500				Could be done for 1000 kes if not for the time crunch
4/5	Snacks, drinks etc.				1529	
4/5	Net stitching for rope	200				
5/5	Sand paper P80		50			50cm
6/5	Rope 6 mm roll 2	1850				
6/5	Oil cans	1200				8 bottles
6/5	Knife	100				
Total:		30222	210	6120	2057	

Project costs

When	What	Amogh	Emma	Josefin	Maja
10/4	Tuktuk → Sooper	450			
10/4	Pens and papers			375	
14/4	Tuktuk	400			
16/4	Groceries for lunch			3750	
16/4	Tuk Tuk	400			
20/4	Silver tape			295	
22/4	Paper		210		
22/4	Tuk Tuk	500			
23/4	Tuk Tuk	600			
28/4	Tuk Tuk	350			
1/5	Soda for workshop				328
1/5	Tuktuk				200
30/4	Tuk Tuk	400			
1/5	Tuk Tuk			250	
1/5	Boda boda	550			
4/5	Tuk Tuk			400	
4/5	Boda Boda	550			
5/5	Tuk tuk	400			
6/5	Tuk Tuk	550			
6/5	UDS snacks			1050	
7/5	Tuk tuk	400			
8/5	Tuk Tuk	200			
8/5	UDS lunch	3022			

APPENDIX 7

Logical Framework Matrix

	Project Description	Performance Indicators	Monitoring	Assumptions
Overall Objective	Improve the working conditions of youths engaged in the fingerling project while strengthening collaboration between the youths and UDS	Improved safety and well-being Increased perceived quality of life Strengthened social collaboration	Communication with stakeholders Evaluations with UDS	Continued support from community stakeholders at UDS; willingness of participants to engage
Project Purpose	To understand stakeholder relationships and co-create solutions that improve working conditions for youths	Good communication between stakeholders Level of stakeholder participation Level of co-creation engagement Identified needs and challenges	Participation video records Field study notes Prototype to hand over Better + more efficient workflow Used local materials & craftsmanship	Active participation from youths and workplace actors; access to stakeholders Cultural differences

Results	Development of a new or improved work method, service, or physical solution that enhances safety and quality of life for both the youths and fingerlings. Community likes the result and will uses it Booklet as an manual, something to hand over	Usability of solution Adoption or acceptance by stakeholders Stakeholder satisfaction	Prototype testing, responds from harvesting team	Proposed solutions are feasible within local constraints and are shaped to last (resources, time, skills) Don't want to share their opinions, needs, ...
Activities	Context analysis (harvest mapping, walk-and-talk), stakeholder engagement, co-creation workshops (games, ideation by drawing/modelling), concept development, prototyping, evaluation	Completion of planned activities Number of participants engaged Iterations of concepts developed Trust	Weekly progress tracking Documentation (photos, notes) Prototype outputs	Openness Willingness to teach us Availability of time (5 weeks), materials and stakeholder motivation