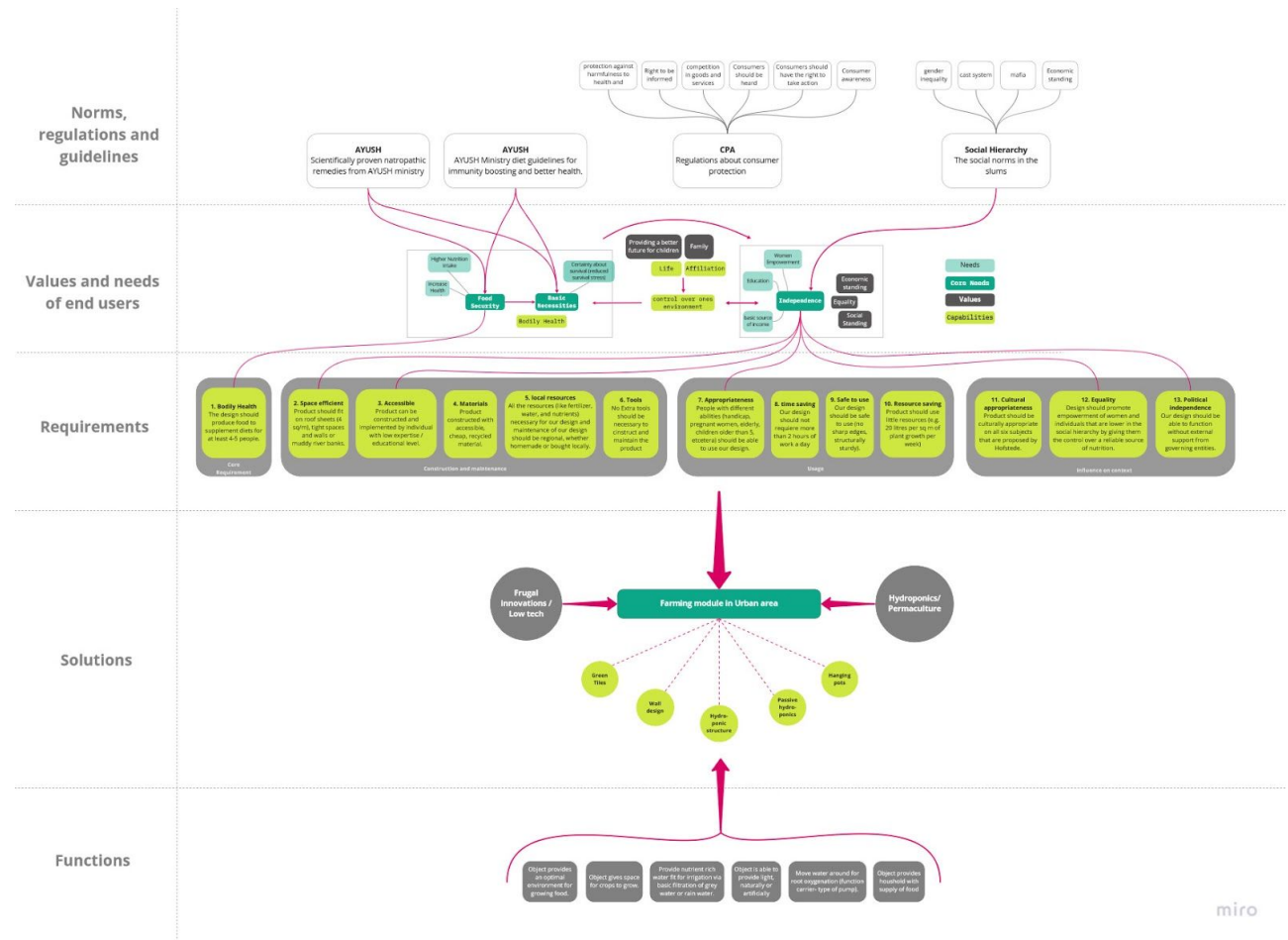


Script of Design

1. Visual

Link to the visual: https://miro.com/app/board/o9J_khANaks/



The visual is divided in four different sections, each of these sections will be explained below.

1.1 Policies, guidelines and norms (section 1)

In the first section of the visual, the found policies, guidelines and norms displayed.

The guidelines provided by AYUSH are about health and how one can use spices and crops to boost the immune system. Therefore, these regulations are linked to food security and basic necessities.

The 'Consumers Protection Act (CPA) provides regulation about consumer protection. The different categories of consumer protection can be found in the blocks that are connected to CPA. The CPA regulations are not directly connected to one of the core needs, but are still important for our design. This needs to be taken into account while designing the final solution.

'Gender inequality', 'the caste system', 'mafia' and 'economic standing' are part of social hierarchy. Therefore, these are connected. Social hierarchy sets certain norms that have an impact on the needs and in particular independence. The community feeling in the slums is quite high, resulting in a big importance of this social hierarchy. The people in the slum are in this way dependent on the hierarchy and their place in this system.

An elaboration on AYUSH and CPA can be found in paragraph 5.2

1.2 Needs, Values and Capabilities (section 2)

The second section of the visual identifies and maps out the main stakeholder needs (green-blue), values (grey) and capabilities (light green). These were found through a brainstorming session based on the context study and extra research. This section is a continuation of an earlier visual (appendix 5) in which all the main needs, values and capabilities were displayed. The section is a selection of these in order to formulate the functions and requirements of the design.

It is important to address the values of 'providing a better future for the next generation' and as well as improve the well-being of our families by 'gaining a better control over one's environment'. The capability of Affiliation here is linked to the value of family and Life is linked to improving the next generation's future and their right to live a normal human life and not dying prematurely.

'Control over one's environment' is of course highly interconnected with 'independence'. But 'control over one's environment' also influences basic necessities. Because if people have

control over their environment, they can take care of their necessities better (material control over their environment).

1.3 Requirements (section 3)

Based on the values and needs found, thirteen requirements have been formulated. These requirements are divided into 4 groups; ‘the core requirement’, ‘construction and maintenance’, ‘Usage’ and ‘Influence on context’. A few of them are directly connected to one of the core needs.

Requirements connected to food security

This includes the 1st requirement “The design should produce food to supplement diets for at least 4-5 people.” This is further explored in detail in paragraph 3. These functions and requirements respond to the guidelines published by the AYUSH Ministry in cooperation with the Health Ministry of India. These guidelines describe diets practices and home remedies which can help those infected to cope with the effects of the virus as well as take preventative measures to ensure maximal health and immunity if they are infected. The requirements and functions respond to the guidelines by producing crops, rich in nutrients, to supplement diets, improve health as well as produce the ingredients needed to make the home remedies mentioned in the guidelines.

Requirements linked to Independence

There are five requirements that are directly linked to independence. Independence can arise from multiple levels (e.g., political, education, financial, natural resources etc.) and the requirements are built on these different levels.

For requirement one, the core requirement, the level is ‘independence from natural resources. Because the user has its own crops, the user becomes less dependent on the food market for his intake of nutrients.

Requirements 3 (accessible) and 12 (equality) give independence on a more personal level. To make a design appropriate for everybody and encourage women empowerment you can boost the

self-esteem of parties that before might be dependent on others. We also directly address Independence by specifying that the product should be under full control of the individuals using it. These requirements respond to the social hierarchy norms found in Indian culture of gender inequality, caste system and economic standing through empowerment and equality.

Requirement 13 provides independence on a political level as this requirement is about the design working without reliance on governmental bodies.

Functional requirements

These describe the requirements that need to be taken into consideration in order to let the design function in accordance to the physical and social context in particular: scarcity of space, safety, lack of capital for investment, and shortage of resources and manpower.

The specific requirements and elaboration on them can be found in 5.4 and 5.5.

1.4 Solutions (section 4)

Based on all the requirements that are displayed in section 2, the decision was made to design a farming module for an urban area, or more specifically the slums of Mumbai. Taking frugal innovation/low-tech and hydroponics/permaculture into consideration, five farming modules have been sketched out: ‘hydroponic structure’, ‘Green Tiles’, ‘Hanging pots’, ‘Wall design’ and ‘passive hydroponics’. These five different solutions are further described in chapter 6.

1.5 Functions (section 5)

The solutions also answer a set of functions. In the previous script of design these six functions were identified.

2. Regulations

2.1 AYUSH Guidelines

AYUSH is a government ministry which is responsible for the education, research and propagation of indigenous alternative medicine systems in India. In times of Covid, they issued guidelines for preventative measures for corona, as well as measures to help individuals cope with the symptoms of corona (AYUSH, 2020). Some of these remedies and guidelines, which are relevant for this challenge, are listed below.

1. Spices like Haldi (Turmeric), Jeera (Cumin), Dhaniya (Coriander) and Lahsun (Garlic) are recommended in cooking.
2. Sore throat, Hoarseness of voice: Hot saline water gargle. Gargling with neem water decoction with honey. Coriander and turmeric Kashayam with black pepper.
3. Expectorant Cough: Chewing ginger (*Zingiber officinale*). It is rich in 1,8 cineole which is an anti-inflammatory, antispasmodic, antitussive and expectorant.
4. Dry Cough: Ginger Kashayam with honey, cloves, cinnamon, turmeric and pepper for dry cough in milk.
5. Malaise and Fatigue: Nutrition rich in Plant proteins, Natural Vitamin C, glucose and Vitamin D Lemon water with honey to boost immunity.

These guidelines are in line with what could be produced using our product. We have further Identified two culturally and regionally adapted crops that could be used to effectively supplement diets.

Amaranthus Spinosus (Spiny Amaranth) is a leafy vegetable that is an integral part of a number of regional cuisines and is commonly used as an energy snack called 'Chulai', by roasting the seeds palm sugar.

Amaranth is known as a superfood, because a serving of 100 grams contains the following portion of daily value (how much of each nutrient is required per day in one's diet): Vitamin A (58%), Vitamin C (48%), Vitamin K (950%). It is also a good source of minerals such as Iron, calcium potassium and manganese providing 38% of DV (daily value) for minerals.

Palak is the Hindi word for spinach. In this case we would select Desi Palak (or local spinach) which can be found commonly as it grows wild, seeds are also found as it is distributed in

various seed stations around the country. This variety (*Beta vulgaris* var *bengalensis*) is adapted to the local environment and requires few resources to grow. Spinach is widely used in the Indian cuisine, for example in the world-famous dish “palak paneer”.

Palak also has a very high nutritional value, a serving of 100 grams contains; Vitamin A (188%), Vitamin C (31%), Vitamin K (402 %) as well mineral such as Potassium (12%), Iron (15%), Magnesium (20%) and Manganese (39%) of DV (daily value)

These two crops are good contenders to answer the dietary needs deemed important by the AYUSH ministry.

2.2 Regulations on product implementation

When designing a product, the safety of the consumers, should be kept in mind. In India this is regulated by law, just as in Europe. In law this falls under the term product liability, in the CPA 2019 defined as ‘responsibility of a product manufacturer or product seller, of any product or service, to compensate for any harm caused to a consumer by such defective product manufactured or sold or by deficiency in services relating thereto’.

In India there are two main regulators when it comes to product safety: pan-industry regulators and industry-specific regulators. In the first category, pan-industry regulators, the most significant agency checking product safety and quality is the Bureau of Indian Standards (BIS), which was formed when the BIS Act was established. This act allowed the central government to demand certain standards, by making goods, articles, processes, systems or services or any essential requirements for such goods, articles, etc. mandatory comply to a certain set of rules. The goods, articles, processes, systems and services will most likely be notified of these rules when they are necessary for:

- Public interest
- Protection of human, animal or plant health
- Safety of environment
- Prevention of unfair trade practices
- National security

Since our design is not directly related to any of these things, we won't have to look at the BIS Act to gain a better understanding of regulations that need to be followed.

2.3 Consumers protection Act

The Consumer Protection Act 2019 (CPA) made the Central Consumer Protection Authority possible (CCPA). The CCPA can promote, protect and enforce the rights of consumers.

Currently 'cause of action' is not defined in the Indian statutes, but in general this means the consequences of a breach in the rules, whether that will result in a court case, fine, or otherwise. CPA 2019 makes it possible for the consumer to take action against the producer if any harm is caused by a defect product.

We are of course not involved in the whole process of bringing a product to the market, so we don't have to think about all the rules of return policies and policies when something breaks down, since the end-users will probably repair the designs themselves or get new ones from third parties, who can be useful for implementation of the design (see context study). Therefore, not the whole CPA applies to the context of slums in Mumbai, but some parts do.

For example, the consumer right, and thus the rights that have to be respected and taken into consideration, in India, as defined by the CPA, are as following:

- Consumers need to be protected against the marketing of goods and services that are harmful for their health and possessions.
- Consumers have the right to be informed about the quality, quantity, potency, purity, standard and price of goods and services in order to protect the consumer against unfair trades.
- There need to be competition in goods and services, to ensure variety and competitive prices.
- Consumers should be heard and feel like their interests will be considered
- The right to take action against unfair practices, restrictive trades or exploitation of consumers
- The right to consumer awareness

The CPA defines ‘defect’, which describes if a product is good enough to go on the market and is therefore an appropriate design, following the regulations set by the Indian government, something our design should be, as:

Any fault, imperfection or shortcoming in the quality, quantity, potency, purity or standard which is required to be maintained by or under any law for the time being in force or under any contract, express or implied or as is claimed by the trader in any manner whatsoever in relation to any goods or product and the expression "defective" shall be construed accordingly. (CPA, 2019)

They define harm, which is something a product should of course avoid to cause, otherwise measures against it can be taken, as:

"harm", in relation to a product liability, includes—

(i) damage to any property, other than the product itself;

(ii) personal injury, illness or death;

(iii) mental agony or emotional distress attendant to personal injury or illness or damage to property; or

(iv) any loss of consortium or services or other loss resulting from a harm referred to in sub-clause (i) or sub-clause (ii) or sub-clause (iii),

but shall not include any harm caused to a product itself or any damage to the property on account of breach of warranty conditions or any commercial or economic loss, including any direct, incidental or consequential loss relating thereto; (CPA, 2019)

This is a very extensive and complicated explanation of the CPA and its regulations, but in short, we need to make sure our design doesn’t cause harm to the consumer in any way, physical or psychological, and transparency should be maintained.

3. Values, Needs and Capabilities

3.1. Values and needs

Through the context study we identified the main values as; 'Economic Standing', 'Social Standing', 'Family', 'Equality', and 'Providing a better future for the next generation'. By contacting individual stakeholders in India and asking them, we found out these values were accurate.

It was found that most values identified were linked to the group of needs under Independence, further highlighting its importance in our problem and solution.

The main issue identified during the covid-19 lockdown, was that poor people were depending on external organisations, like the government and NGOs, to provide for their basic necessities. However, this did not suffice. Giving people control over the provision of basic necessities reduces the pressure on external organisations as well as allow for greater certainty in fulfilling basic necessities. This identifies independence as the most important need which is heavily linked to basic necessities and food security.

3.2 Capabilities

In the context study and the design concept poster, the capabilities of 'Life', 'Bodily Health', 'Affiliation' and 'Control Over One's Environment', were identified through studying Martha Nussbaum's work on the capability approach (Nussbaum, 1999).

Here "Control Over One's Environment" seems to play an important role as it is the main capability that we will act through to improve food security, basic necessities and independence, this further improving the capabilities of Life and Bodily health. We intend to give control over one's basic necessities, and more specifically, food security. This will give the certainty of living which was lacking during the covid-19 lockdown in India due to lack of nutrition, due to loss of employment and lack of provision by external bodies (Government and NGOs, as recalled from previous milestones and the context study). Furthermore, control over one's health and nutritional intake increases one's independence which was Identified above as one of the most important needs to design for. Here we have the values of economic and social standing which are major values for most Indian citizens and are linked to independence.

Furthermore, the capability Affiliation also plays an important role as life in slums is very closely related to communal living style. This style of living, where the benefit of the whole community is considered, is very important for the community in order to gain their independence and has been demonstrated through the extreme entrepreneurial spirit in these slums and the building of many micro businesses and factories.

‘Bodily Health’ is quite straightforward as provision in basic necessities, like food security, which has a positive impact on bodily health.

4. List of Functions and Requirements

4.1. Functions

- Object provides an optimal environment for growing food: light, water, nutrients.
- Object gives space for crops to grow.
- Provide nutrient-rich water fit for irrigation via basic filtration of grey water (kitchen and bathroom waste water) or rain water
- Object is able to provide light, naturally or artificially.
- Move water around for root oxygenation (function carrier- basic pump)
- Object provides a household with a supply of food.

4.2. Requirements

Core requirement

- The design should produce food to supplement diets for at least 4-5 people (since there are 4.7 people per household in 2011), by reducing deficiencies and improving immunity and health.

Construction and maintenance of the product

- The design should be space-efficient to fit in the tight space the slums offer (walls, rooftops etc.)
- The design can be constructed and implemented by an individual with little expertise and education.
- The design should be frugal and made of accessible, cheap waste material.
- All the resources (like fertilizer, water, and nutrients) necessary for the design and maintenance of the design should be regional, whether homemade or bought locally.
- No extra tools should be necessary to construct and maintain the design.

Using the product

- People with different abilities (handicap, pregnant women, elderly, children older than 5, etcetera) should be able to use the design.
- The design should not require more than 2 hours of work a day.
- The design should be safe to use (no sharp edges, structurally sturdy) since children and elderly will also be working with it.
- The design should use water sparingly (e.g. 20 liters per square meter of plant growth per week).

Influence of product on context

- The design should be culturally appropriate on all six subjects that are proposed by Hofstede (Uncertainty avoidance, individualism, masculinity, indulgence, long term orientation, power distance). See appendix 8.
- The design should promote the empowerment of women by giving them control over a reliable source of nutrition.
- The design should be able to function without external support from governing entities and the food market.

5.5. Requirements elaboration

- **The design should produce food to supplement diets for at least 4-5 people (since there are 4.7 people per household in 2011), by reducing deficiencies and improving immunity and health.**

This is the main requirement we intend to design for, as it addresses the food security problem directly and has a big link with the pandemic problem, as it focuses on increasing nutritional intake to improve health. It also answers to the guidelines drawn by the Health Ministry of India in cooperation with the AYUSH ministry (see under regulations, paragraph 5.2). We also define the functions the design must have to be able to provide for this requirement, namely a correct environment for growth of food supplements.

In this challenge, providing a quantity of food, enough for a whole household is way too hard. Therefore, this design will focus on supply of certain supplement diets, to battle malnutrition in the slums, as this is a great problem in the slums (see context study).

- **The design should be space-efficient to fit on the roof (1.8 * 2.4m roof sheets) or other tight spaces like outer walls or riverbanks.**

Since there is not much space in the slums in Mumbai, it is hard to tell where the design will be implemented and how people will use it. We can design it one way, but people might use it in another way than we intended it to be used. Therefore, we decided to make the design small enough to fit on roofs. Since we are not sure how people will use the design yet, we don't have any other measures we can take into account. That's why we decided to make a design that is relatively small, so it fits in tight spaces and can be placed almost everywhere.

- **The design can be constructed and implemented by an individual with little expertise and education.**

The instructions should be clear for people who do not have any experience with building a product or farming. Firstly, there needs to be made sure that the level of language isn't too high, so people with lower levels of English and a lower level of education are also able to follow the instructions. Secondly, there should not be put complicated mathematics in the design. There should be a use of simple visuals.

- **The design should be frugal and made of accessible, cheap waste material.**

Since we will probably try to implement a complicated, expensive method of farming in a poor area, we really have to reduce the costs while maintaining the functions and quality. Therefore, we have to take into consideration the materials that are available to the target group. This will probably mostly be waste.

- **All the resources (like fertilizer, water, and nutrients) necessary for the design and maintenance of the design should be regional, whether homemade or bought locally.**

Transport of resources costs extra money and therefore, considering the economic profiles of the people in the slums, resources should be locally. This is also more sustainable and efficient.

- **No extra tools should be necessary to construct and maintain the design.**

Considering the economic profiles of the people in the slums, the design should not make use of extra tools as this will increase the cost.

- **People with different abilities (handicap, pregnant women, elderly, children older than 5) should be able to use the design.**

In the slums there are no social services, meaning everyone has to either work or depend on someone else to get basic necessities. Even people who are struggling with illness or a handicap often keep on working because they have little choice. Kids have to do chores from a young age as well; therefore, making sure everyone can work with the product is of the utmost importance.

- **The design should not require more than 2 hours of work a day**

The plants will need some maintenance; likely, the users will have to water, plant, fertilize and harvest them. Like we will discuss in number 9, the product can empower women. For an optimal empowerment effect, we suggest that the maintenance time is between 1 and 2 hours. If the maintenance would be less, the effort and results might not be attributed as much to the women. But if the maintenance was higher, it would be too much work to take on next to the other daily chores.

- **The design should be safe to use (no sharp edged, structurally sturdy), since children and elderly will also be working with it.**

Building upon the fifth requirement 'People with different abilities (handicap, pregnant women, elderly, children older than 5) should be able to use the design', we need to make sure it is safe to use and can't be easily damaged. Because children are always playful and might bump into the design it should be steady enough to withstand those bumps. Furthermore, it should avoid sharp edges in order to guarantee the safety of children interacting with the design or playing around it. Preferably, the design should be a sturdy, smooth box which can withstand a lot and can't harm any people working with it.

- **The design should use water and other resources sparingly (e.g. 20 litres of water per square meter of plant growth per week)**

In order for the design to stay effective and usable for the stakeholders, their living circumstances need to be considered. The people in the slums live in poor conditions and don't have access to a lot of resources. Therefore, the design needs to be economical with resources and water.

- **The design should be culturally appropriate on all six subjects that are proposed by Hofstede (Uncertainty avoidance, individualism, masculinity, indulgence, long term orientation, power distance).**

See appendix 8; the cultural values are worked out in there.

- **The design should promote the empowerment of women by giving them control over a reliable source of nutrition.**

In the design ethics part of Deliverable A, there is an elaboration on how the design can empower women. According to the interview conducted with experienced developmental workers and other initiatives (IFAD, 2019) (SM Sehgal Foundation, 2018), vegetable gardens can empower women. In India, men are the primary income earner, providing for their families; there is a lot of gender inequality (Seguino, 2011). However, when women get their own source of income, it will have an influence on their social status. What the developmental workers saw was that women started behaving more confident and freer. The design should help them with this. Look in the context study (Chapter 2) for more information.

- **The design should be able to function without external support from governing entities and the food market.**

Something that has been discovered during the context studies, is that the main problems of the target group are related to their dependence on the food market (See context study). As a result of the pandemic, many daily wage workers lost their job and did not have any money to buy food. The government helped a tiny bit by handing out some food, but that was not sufficient. In

the current and in future pandemic situations, we can make people in the slums more resilient by providing them with the means to grow their own food.

6. Interactions between stakeholders, context and functions/requirements.

6.1. Intended interactions

- In exchange for a small amount of work the design provides a basic food supply (*stakeholders & function: object should provide a household with a supply of food*)
- The design will be implemented in the stakeholders housing (*context & stakeholder & requirement: The design is required to be space efficient to fit either inside the house (8 sq m/resident in 2016) or on the roof (1.8 * 2.4m roof sheets)*)
- The design will make the stakeholders more independent, relying less on an outer source to provide them with basic necessities (*stakeholders & context*)
- The stakeholders will be provided with fresh crops to improve their bodily health (*stakeholders & function: Object should provide a household with a supply of food*)
- By providing the stakeholder with a basic supply of food, their survival stress will be lessened and their mental wellbeing will be improved. (*stakeholders & context & requirement: Object should provide a household with a supply of food*)

6.2. Unintended interactions

- The design may be used by mafia or people higher in the hierarchy to control the poor people by owning their food supply (*context & requirement: Design should not exclude anybody with a handicap, like people in a wheelchair or one-armed people, etc.*)
- The design could be used to farm crops, sell them and buy alcohol or drugs instead of basic necessities (*stakeholders & function: Object should provide a household with a supply of food*)
- The female stakeholders could be burdened by the extra task in the household, causing more inequality (*stakeholders & context & requirement: The design should promote the empowerment of women by giving them control over a reliable source of nutrition.*)
- The design, when placed in optimal conditions and producing the maximum output, could give the users more than they need and therefore provide them with a basic source of income (*stakeholders & function: Object should provide a household with a supply of food*)

- The stakeholders may gain basic knowledge about farming methods and long-term planning. *(stakeholders & context)*
- The design, if communally applied, could connect people through collaboration *(stakeholders & context & requirement: Up to four people should be able to use the product communally)*