



Discerned problems
outside personal space

Natural Light reflectors for commercial buildings

The project looks at **energy consumption in commercial spaces**. Closed out concrete structures with no means for natural day light and ventilation leads to more energy consumption at commercial/public spaces for long hours, thus increasing dependency and demands of conventional sources.

Various aspects of a building/complex particularly the **lighting** is worked towards on the lines of **sustainability by using natural methods or renewable energy**.

Reducing the dependency on conventional sources need not necessarily imply just focusing on larger and more visible areas, rather **a small change can help towards expanding the profits achieved to the larger contexts**. Keeping this in mind, the project output is to **enhance the use of natural light** through a product with **simpler forms and functions**.

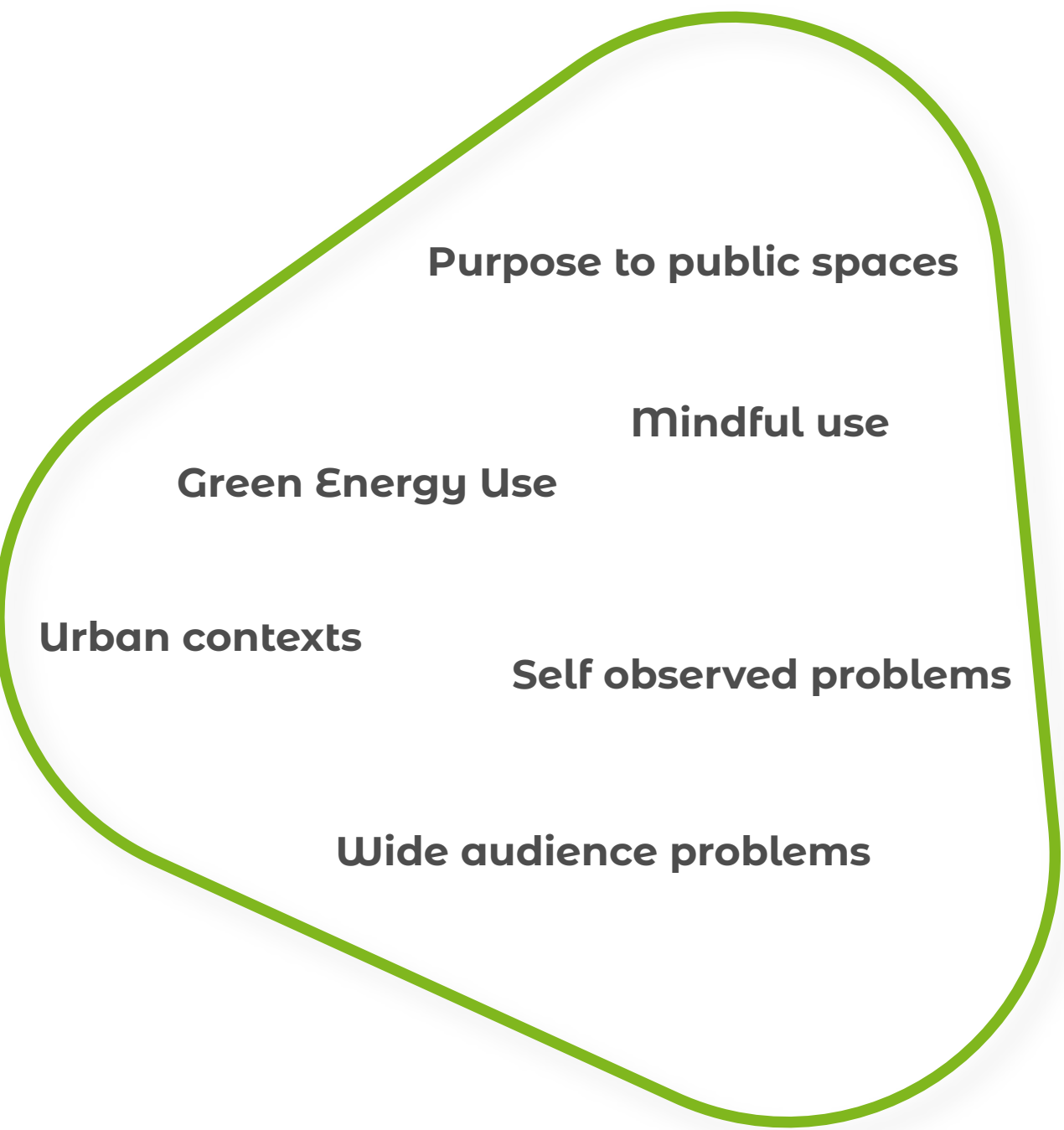


How do we design products and services that aid development?

How can I apply or showcase my personal ideas of development towards a worldly level development?

How can I connect the personal and worldly level ideas of development?

Potential for design to re-imagine and re-shape futures?



Secondary research

insights

Energy consumption growth rate in commercial buildings, as of 2015, is 8% which is more than the residential buildings (5%)

With increase in population the demands for various life style products and services like air-conditioning, heating, refrigerators, TVs, mobile charging, etc are on the rise in order to maintain a standard of living

According to The Bureau of Energy Efficiency, a Government agency, the constructed floor area in India will increase 5 folds by 2030 which will in turn lead to more energy consumption for the larger spaces specifically in terms of lighting and air-conditioning

An assessment by B&E shows that lighting and air-conditioning use almost 80% of energy in a commercial building

Serious doubts regarding the availability of conventional resources as per the projected usage

Green building examples in India

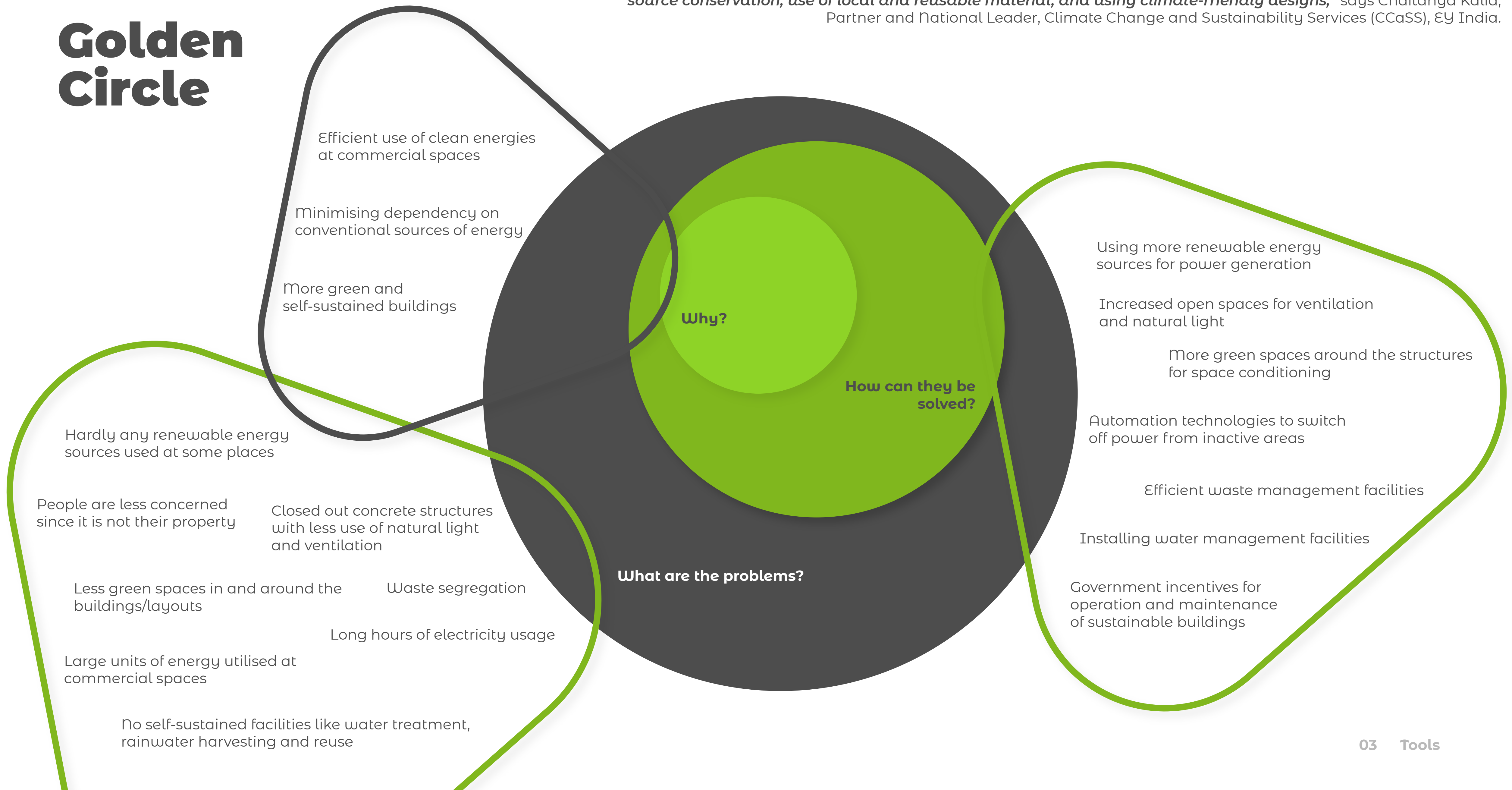


CII-Sohrabji Godrej Green Business Centre, Hyderabad
The complex, built on a flat ground, uses thick vegetation for cooling and reducing pollution, two air cooling towers that cool the air upto 8 degrees, a terrace garden covering 55% of the roof, solar panels that provide 20% of the required energy. All construction material where certified by the green building council and almost 96% of the construction waste has been recycled.

Microsoft’s newest Noida office is LEED certified and meets the indoor air quality standards of ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), ISHRAE (Indian Society of Heating, Refrigerating and Air Conditioning Engineers) and OSHA (Occupational Safety and Health Administration)

🌟 *“Sustainable architecture is not only about improving energy efficiency of the building; it is also about natural resource conservation, use of local and reusable material, and using climate-friendly designs,”* says Chaitanya Kalia, Partner and National Leader, Climate Change and Sustainability Services (CCaSS), EY India.

Golden Circle



Why?

How can they be solved?

What are the problems?

Efficient use of clean energies at commercial spaces

Minimising dependency on conventional sources of energy

More green and self-sustained buildings

Using more renewable energy sources for power generation

Increased open spaces for ventilation and natural light

More green spaces around the structures for space conditioning

Automation technologies to switch off power from inactive areas

Efficient waste management facilities

Installing water management facilities

Government incentives for operation and maintenance of sustainable buildings

Hardly any renewable energy sources used at some places

People are less concerned since it is not their property

Less green spaces in and around the buildings/layouts

Large units of energy utilised at commercial spaces

No self-sustained facilities like water treatment, rainwater harvesting and reuse

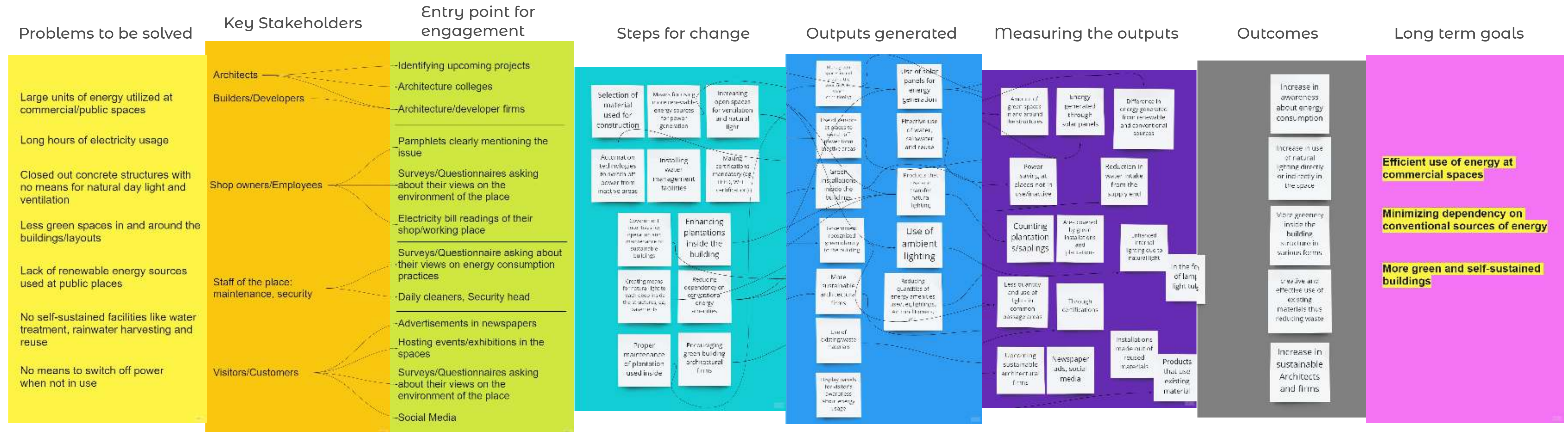
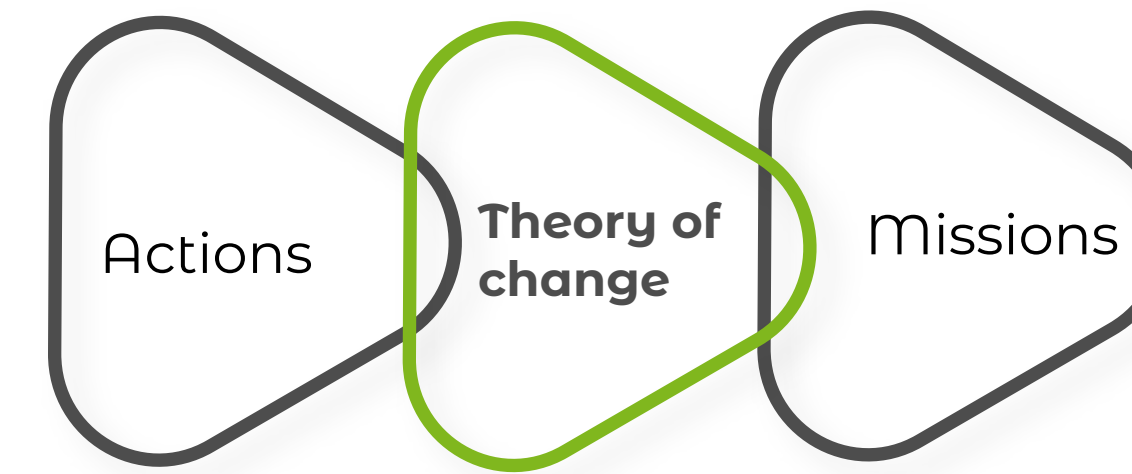
Closed out concrete structures with less use of natural light and ventilation

Waste segregation

Long hours of electricity usage

Theory Of Change

! Tool to articulate change. Outlines the steps by which one achieves the goals.



Miro board link:
https://miro.com/app/board/o9J_lubKrxI=?invite_link_id=904864609995

Design Thinking Process

Empathize

- Observe
- Engage
- Immerse

Observe

Self observing problem spaces 🌟

RMZ Galleria Mall



Openings for natural light



Constant electricity use in basement parkings



Less opening for natural light

At unused spots

Translucent roofs for natural light

Orion Mall



Difference between spaces with natural light and artificial lights

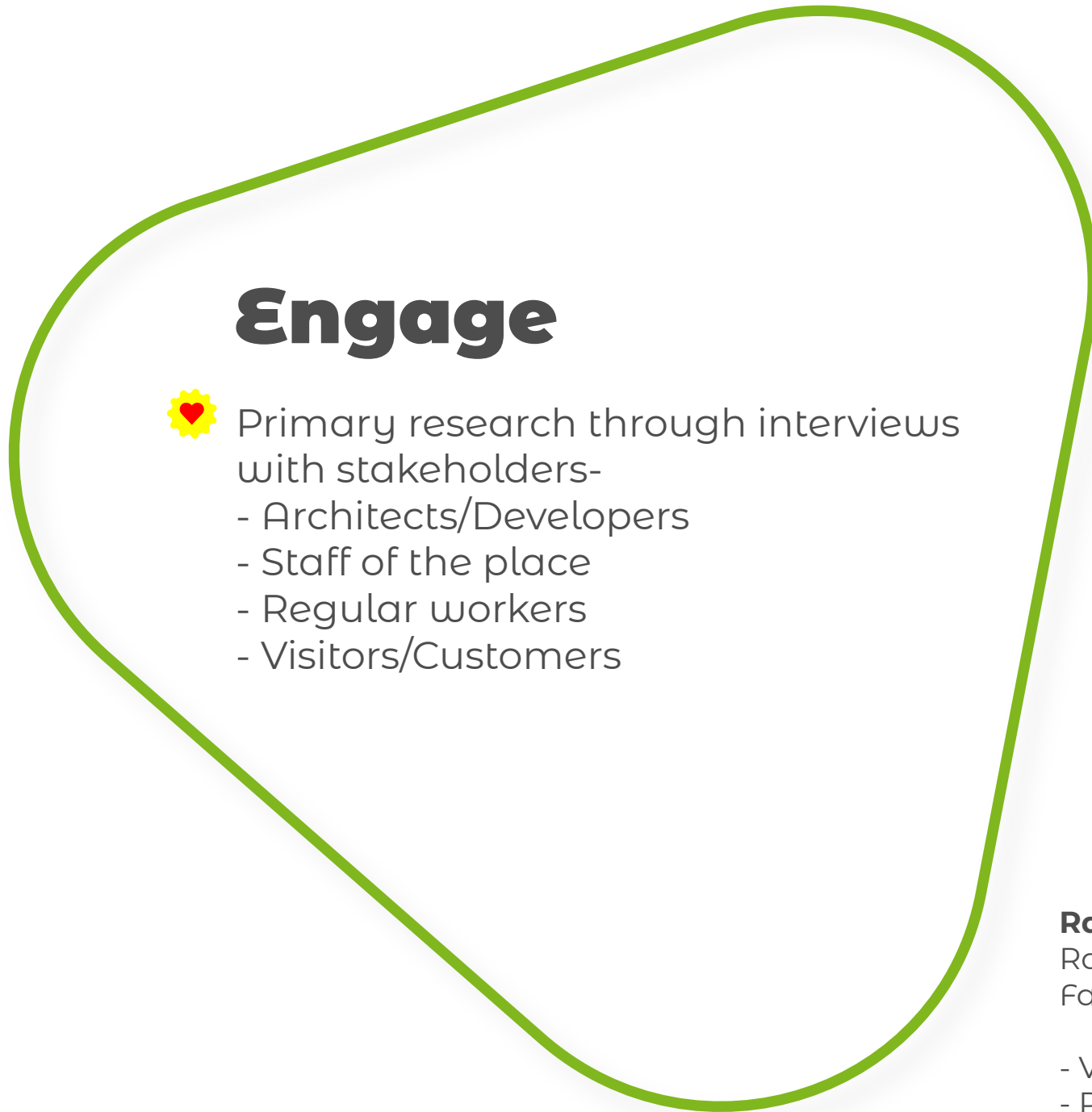
Yeshwanthpur Metro Station



More openings for natural light and ventilation

Difference between spaces with natural light and artificial lights





Stakeholder Interviews

Mukesh Sir
Security head for the Ground floor, RMZ Galleria Mall
One to one interview recorded in written

- Arrives to duty at 9:30am. Mall timings 10am-10pm
- Lights/ACs remain on all the day
- ACs don't reach certain places
- Weekends attract more crowd, around 10-12k, than weekdays, around 5k.
- Evenings see more crowd on weekdays. Almost after 4-5pm.
- Basement lights of level B1 stay on all day while lights of levels B2 and B3 are mostly operational on weekends.
- Lights aren't centralized. Control available for different sections of the floor. Each floor has a separate light/AC control panel.
- He isn't bothered much about natural light. "2nd floor receives some natural light" on asking about amount of natural light at the place.
- Will feel good if natural day light can be accessed (on asking for preference).
- Power cuts last merely "Do second ke liye (snaps fingers)" as they have generators.

Raghu
Random Visitor at Orion Mall
Face to face interview recorded in audio

- Visits the mall once in 15 days probably.
- Previously one could see only higher income level visitors due to luxurious brands but now all classes of people can be seen here.
- Apart from the shops likes to visit the lake in the open area of the mall.
- Natural light here is good than other malls
- AC, ventilation is good. Mall is quite spacious.
- Can't expect much greenery inside the malls since it is a commercial place, but still it might be good.

Pallavi

Works at Dyson, Orion Mall ground floor
Face to face interview recorded in audio

- Mall timings 10am-10pm
- Arrives at 9:45am
- Lights are on all the time, but the ACs are on only on the weekends
- Usually visits food courts, lake in the open area of the mall and some shops during free time.
- The amount of natural light available is comfortable and feels open
- Internal greenery/plantation will definitely be a good thing but maintaining it would be a task. One will need to water them in a certain way. Plantations outside have created a mess so need to be careful about internal plantations.
- The power source is the same but bills are generated individually.
- It's not as indoor as it gets in any backend organization and so it does not feel inconvenient staying indoors all the time.
- But means for any natural light will definitely feel good.
- Overall experience in a mall is fun since they get to see different kinds of people.
- Usually more rush during the day on weekends other than that same rush on all days.

Megha Gupta

Works at RSP design consultants
On call interview recorded in written

- Yes, indoor commercial spaces lead to more energy consumption due to lack of natural light.
- Natural lighting depends on architecture of the space, openings, sun direction.
- Natural lighting can be in the form of hollow spaces, atriums, etc.
- Glass panels are not a good practice since it radiates heat. Concrete, cement also consume heat. Structures with holes can be a good option.
- Certifications like the LEED, WELL certificates should be made mandatory and brought into practice. Eg, Microsoft, CISCO, Mercedes Benz buildings are LEED certified.
- Using automation technology to reduce energy wastage.
- Green building awareness is improving.
- Architectural terms can be changed internally.
- The HVAC of the building needs to be looked into carefully.
- Natural ventilation isn't possible at bigger spaces but possible at smaller places.
- Internal plantations improves the look and the feel of the place.
- External plantations can't be expected much due to maintenance
- Various plantations help in keeping the building cool, pollution out and reduce noise pollution.

- Gain points
- Pain points
- Insight points

Immerse

Secondary research around the problem + **research for design** 💡

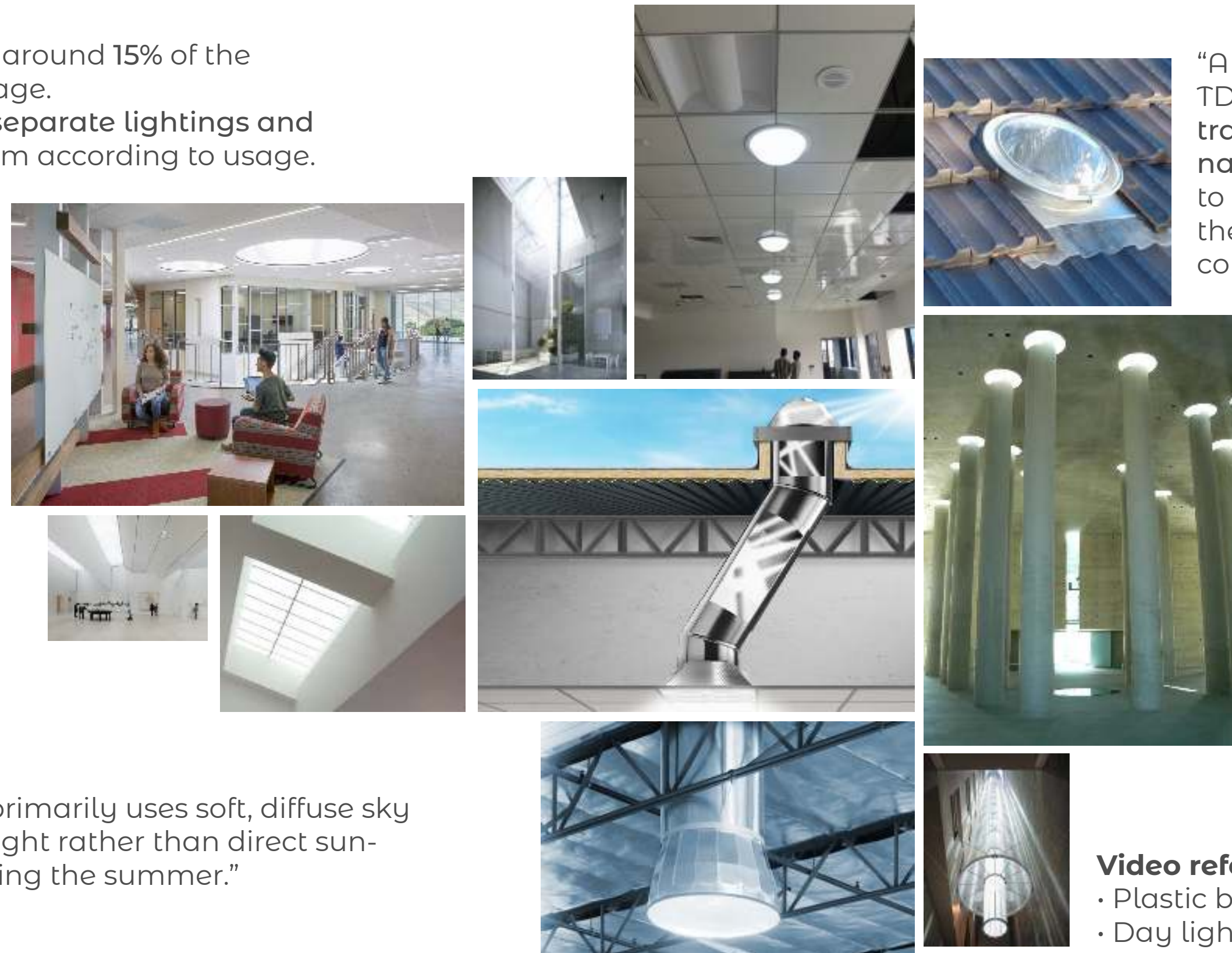
Natural lighting 💡

Artificial lighting can consume around 15% of the building's annual electricity usage. Different sections should have **separate lightings and control** to help users switch them according to usage.

In bigger common areas like foyers, corridors **skylighting can be used in place of artificial lightings** as one doesn't has to worry about long hours of electricity use.

Natural light can be used to **keep the indoors warm** during winters.

"Good daylighting primarily uses soft, diffuse sky light and reflected light rather than direct sun-light, especially during the summer."



Light Tubes 💡

"A light tube (also known as a tubular daylighting device or TDD) is a tube lined with a **highly reflective material that transmits light either from a point on the roof or an external wall, all the way through a building**. A diffuser is used to spread light into the space. A solar collector — which is in the shape of a dome — is placed on the external surface to collect and direct light into the solar tube"

Efficiency of light tubes can also be increased by using sun tracking devices like Heliostats.

Light tube efficiency is more when **pipes are short and straight**.

Video references

- Plastic bottles go solar: <https://youtu.be/hPXjzsXJ1Y0>
- Day lighting strategies: <https://youtu.be/sWjoaaP84C4>

Define

- Analysis
- How might we?
- Problem definition

Analysis

Analysing data gathered from primary and secondary research

How might we?

Questions that focus on problem at hand and possible directions of intervention,

Problem Definition

Designing products or installations that enhance the amount of natural light entering any recreational indoor public spaces like malls and complexes.

Since lighting consumes major energy in a building, the inquiry outcome will focus on using natural day light to reduce the energy consumption.

Products and installations at spaces that have atleast some level of openings in the structures for the means **using natural light** will be in focus going ahead. Various spaces like IT firms, commercial buildings require closed environment to avoid space heating for servers and computer units. Considering the fact, the target space will be **recreational public spaces** like malls and complexes.



How can we minimize power consumption at indoor public spaces?

How might we minimizing use and dependency on conventional sources of energy?

How might we make use of natural lighting for commercial spaces?

How can we design products that use natural light?

How can we infuse natural lighting applications with plantations into public spaces?

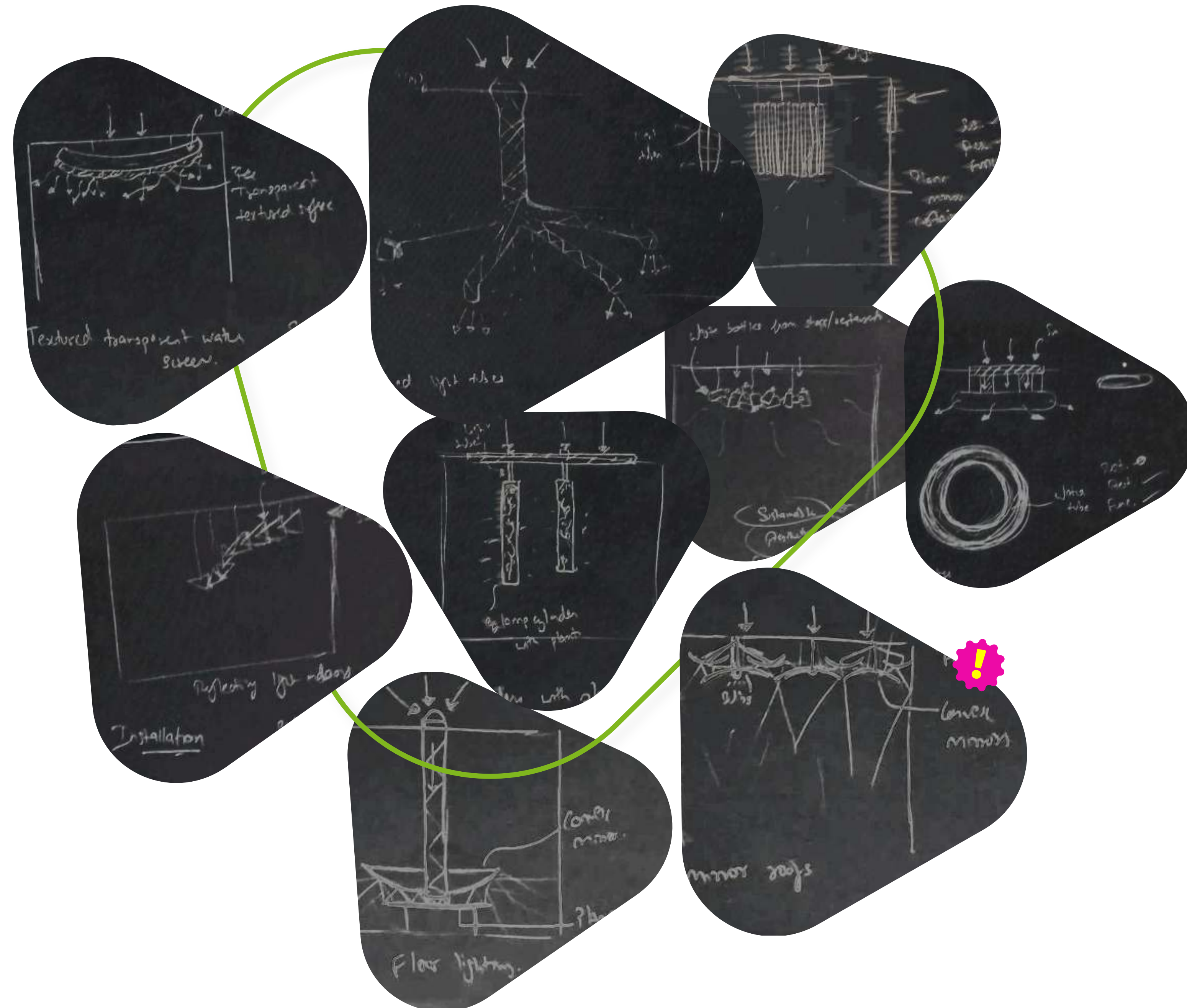
How might we use renewable/sustainable to provide natural lighting inside the spaces?

How might we use sustainable material for products that use natural light?

What can be the ways for natural light to reach deep inside the structures?

How can we absorb power from natural sources and use it for the space?

Ideation



Prototype

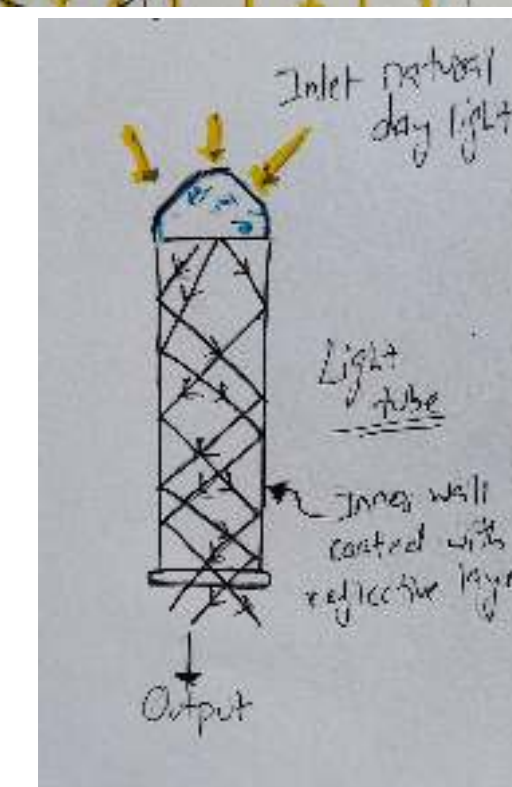
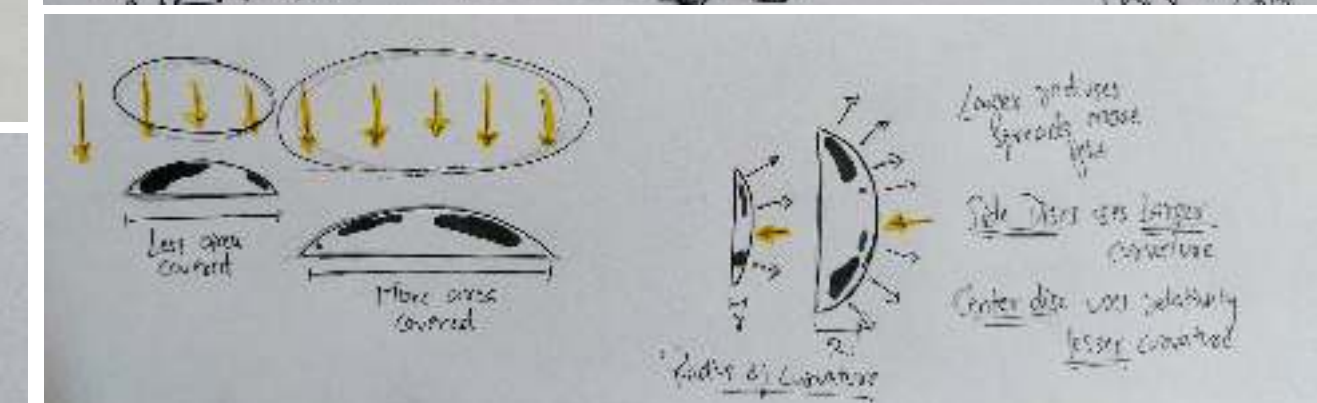
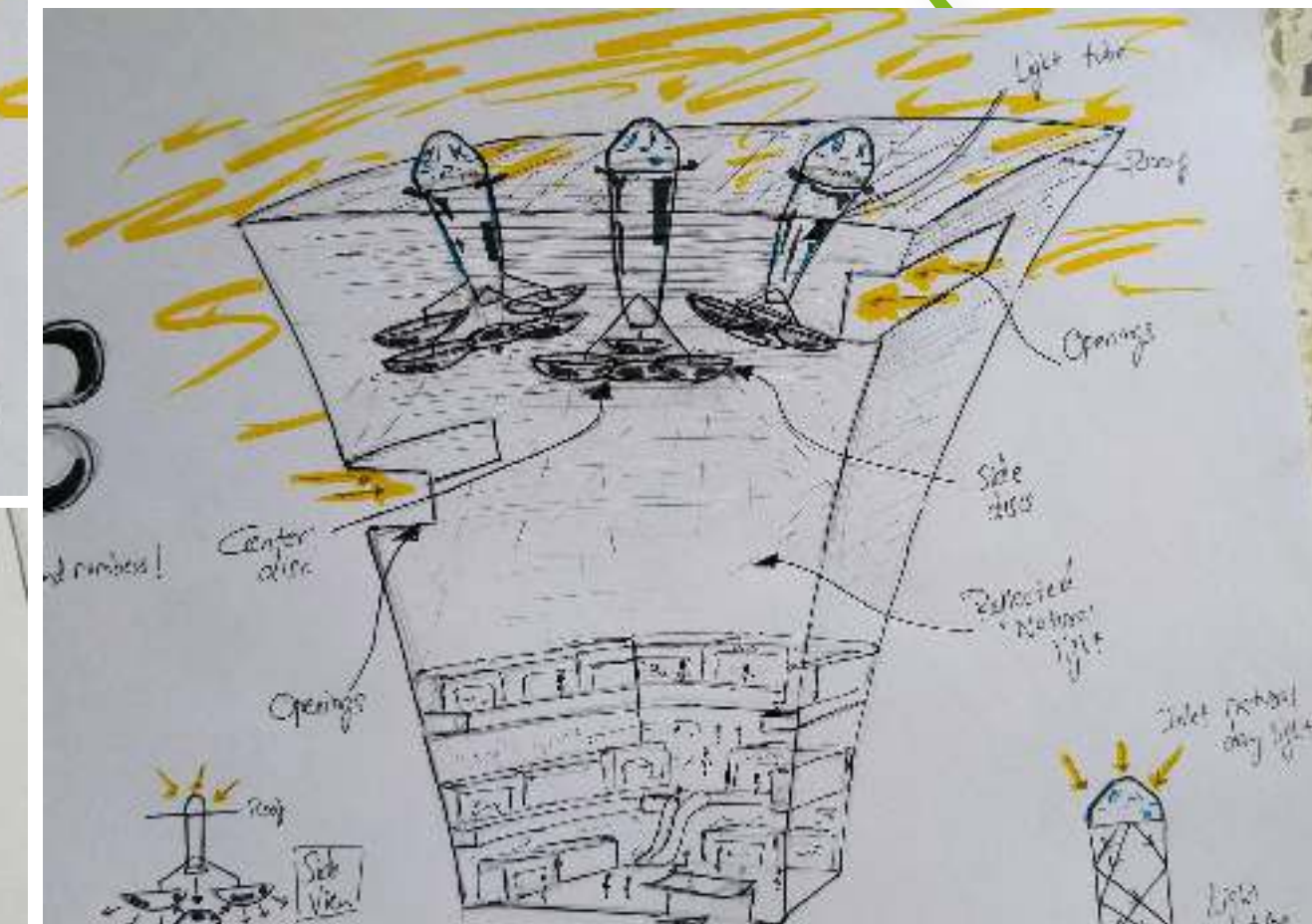
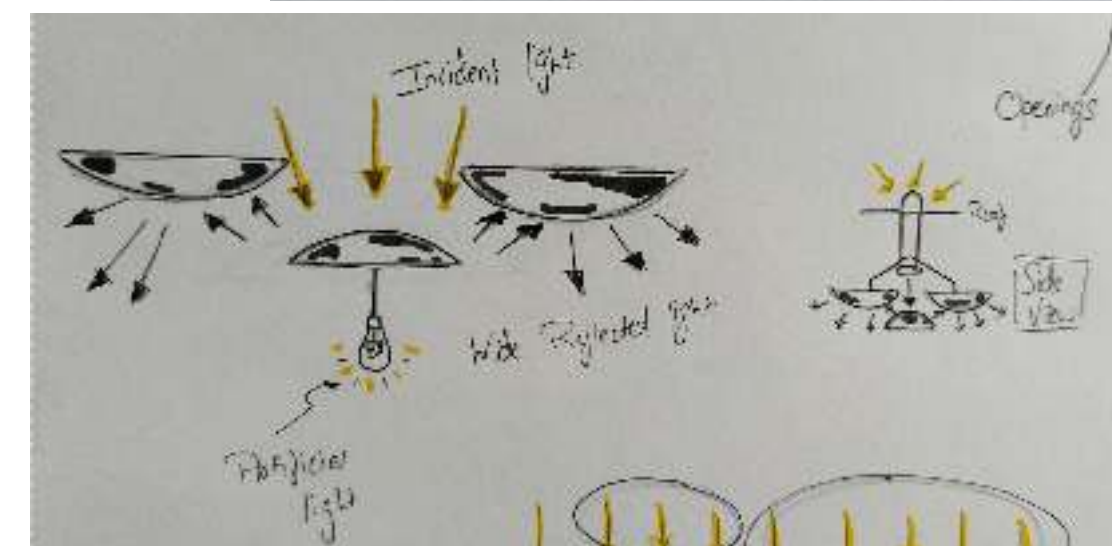
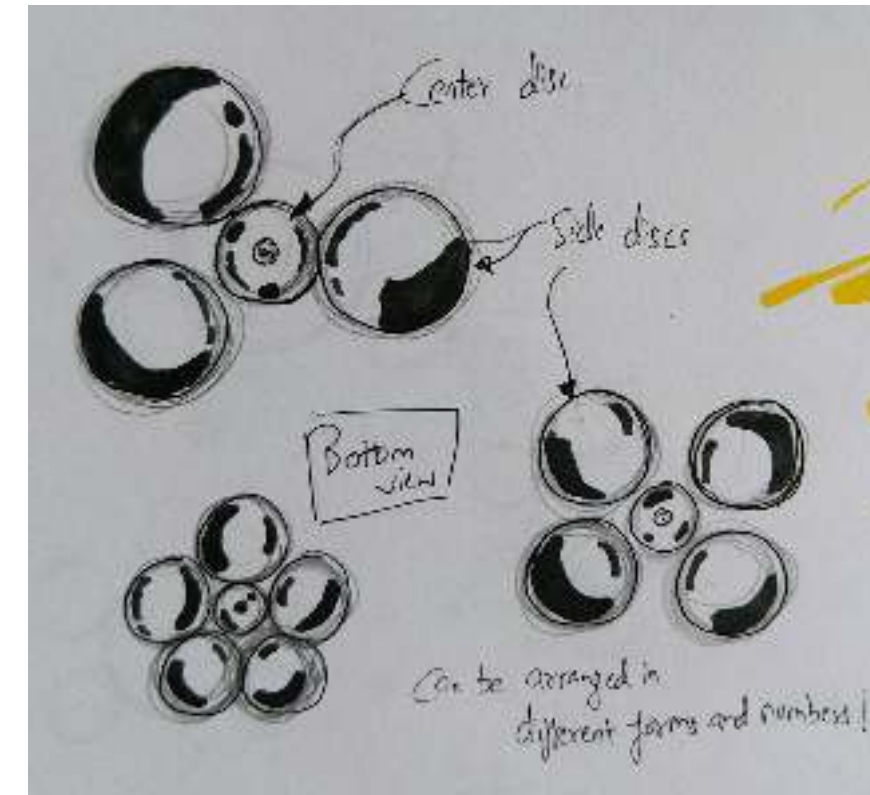
The end product of the inquiry takes the shape of a product or an installation at the public space. The prototype includes:

Product sketches

Preliminary model - non functional

Final prototype model - digital renders

Concept Sketches



Concept-

The concept of the product is derived from using the basics of reflection of light on different types of surfaces. Adding this to the existing light tubes that are available today can help in increasing the spread of natural light indoors.



Convex surfaces, as we all know, reflects incident light over a wider field area, this principle of **reflection of light over convex surfaces** is being used here to spread the incident daylight from the light tubes to a more wider space such as a mall or a complex.

Preliminary model

Non functional

Using the available resources and materials, a rough preliminary model is made which depicts the product. The model is made using materials:

- Cardboard boxes
- Chart paper
- Aluminium foil
- Broom sticks

The model is a scaled down one and is non functional since its aim is to physically show the first iteration/draft of the concept.

Light tubes

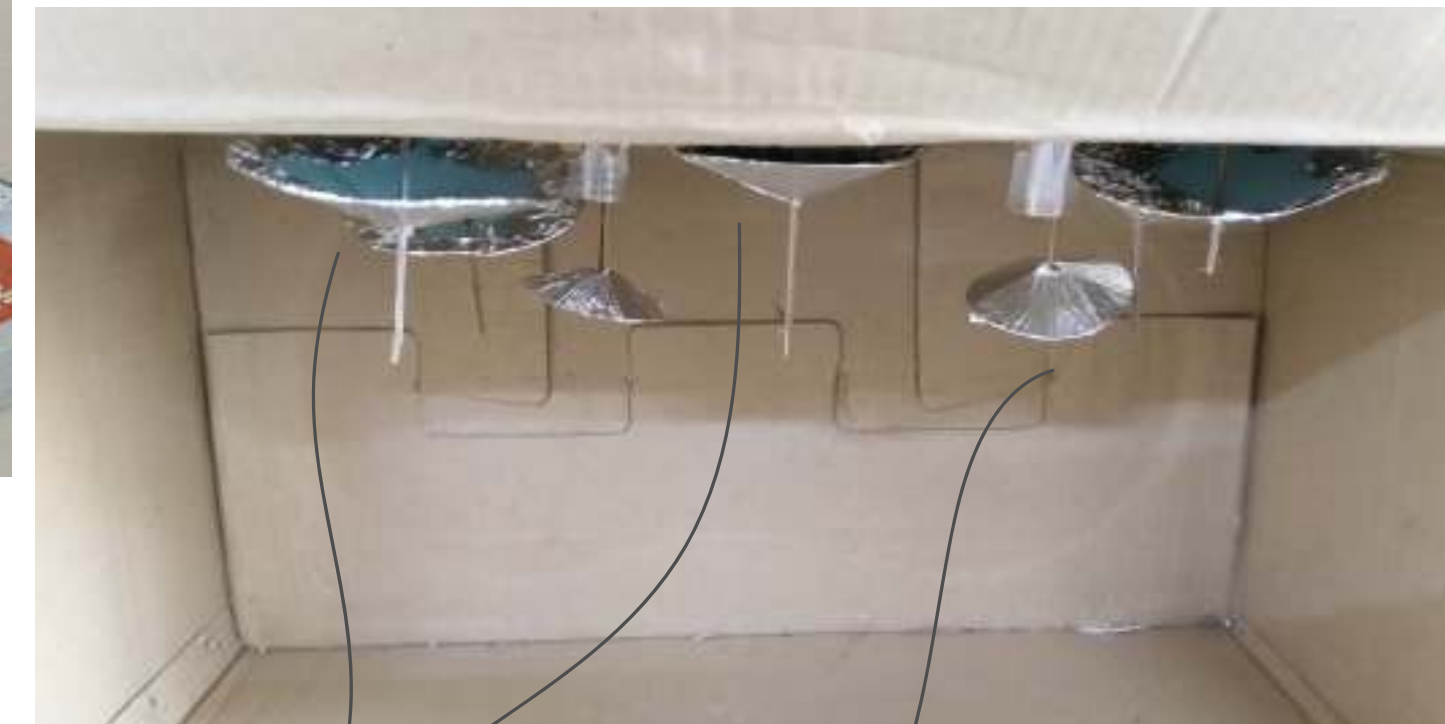


Foil covered chart paper surfaces



Side discs

Center disc



Natural Light reflectors

for commercial buildings

**Final prototype
model**
Digital renders





Convex discs in various orientations and numbers



Artificial lights can be applied at the inner curvatures of the discs.



Light collector

Clear dome shape allows collection of light from all directions

Carbon fibre texture



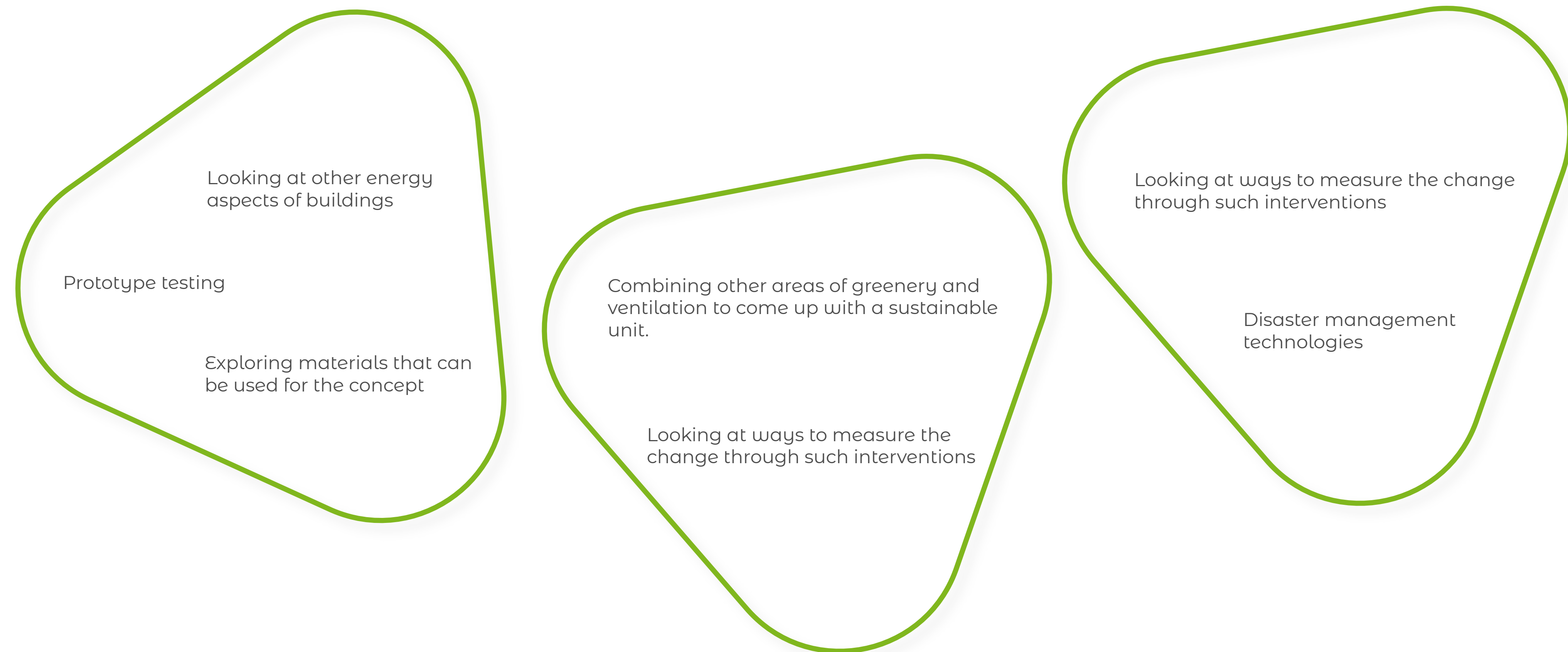


Concept testing in a closed structure with no artificial lights and dark walls



Further Scopes

The concept has been developed at preliminary and digital platforms as of now. Possible next steps could be



Reflection

The inquiry has not only helped me expand my desires to work towards tangible product design but also keeping environment under the lens. It gave an opportunity to look at potential for design to re-imagine and re-shape futures, as was the central theme of the studio. Looking at our own scopes and indicators of development not only led to selection of the inquiry but also the areas and themes to work towards in future inquiries. Learning and applying tools of golden circle and theory of change catalyzed the progress of the inquiry. The tools also helped in concentrating more on the process of how to reach the big why's rather than just the outcome that I had for my inquiry. Primary research pushed me out of my comfort zone to conduct user interviews and specifically common public in my inquiry. Being mixed in terms of outputs the process was insightful and at the same time testing and at times giving no relevant data. All these steps fitting into the sequence provided with a practical approach to a true design thinking process.

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