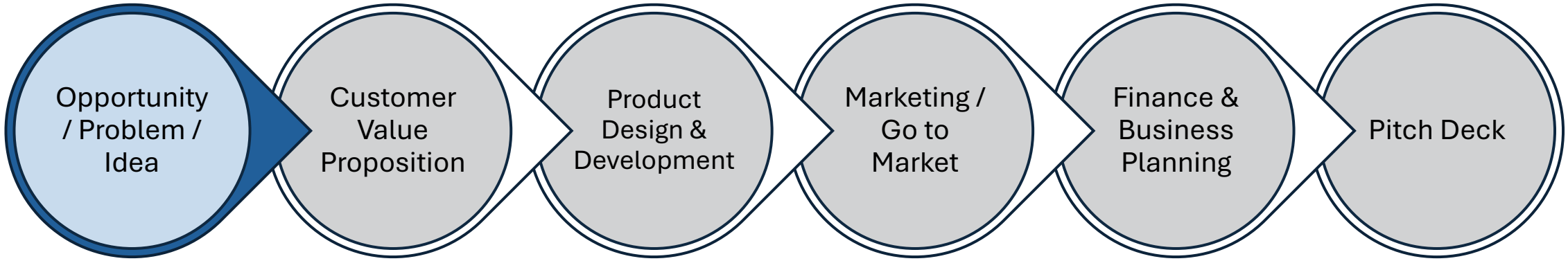
# Product Innovation
# 3rd October 2024

# Process for Start up Creation

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# Opportunity Identification

How many opportunities has your team identified for your project?

How would you determine if the opportunities your team has identified are exceptional?

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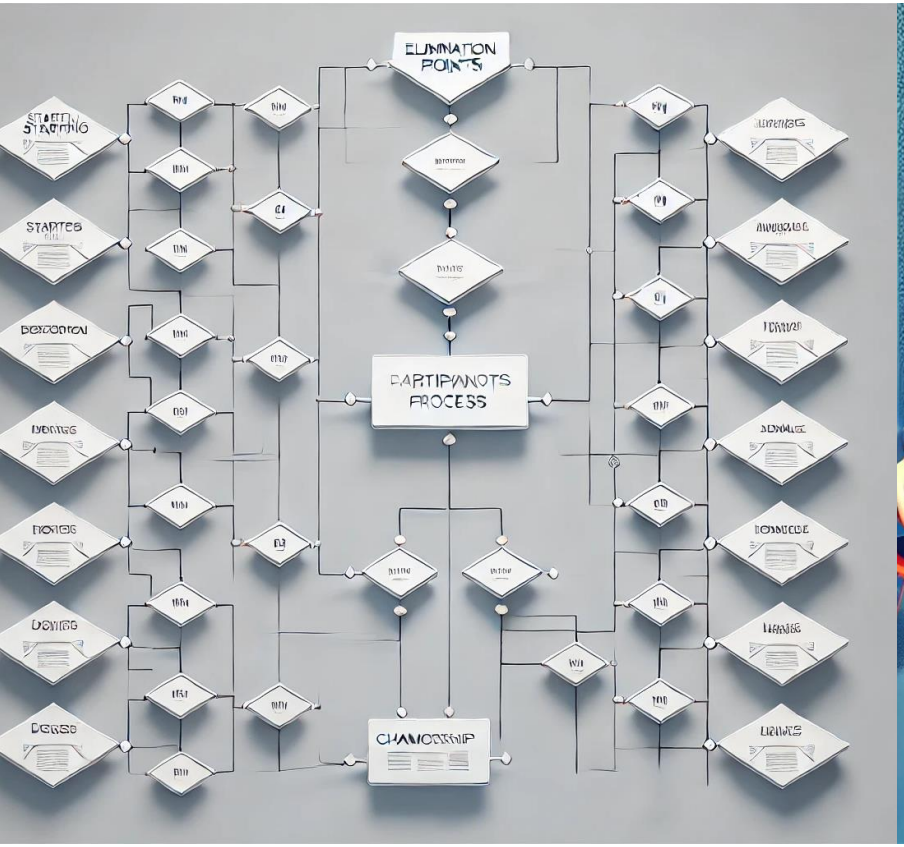
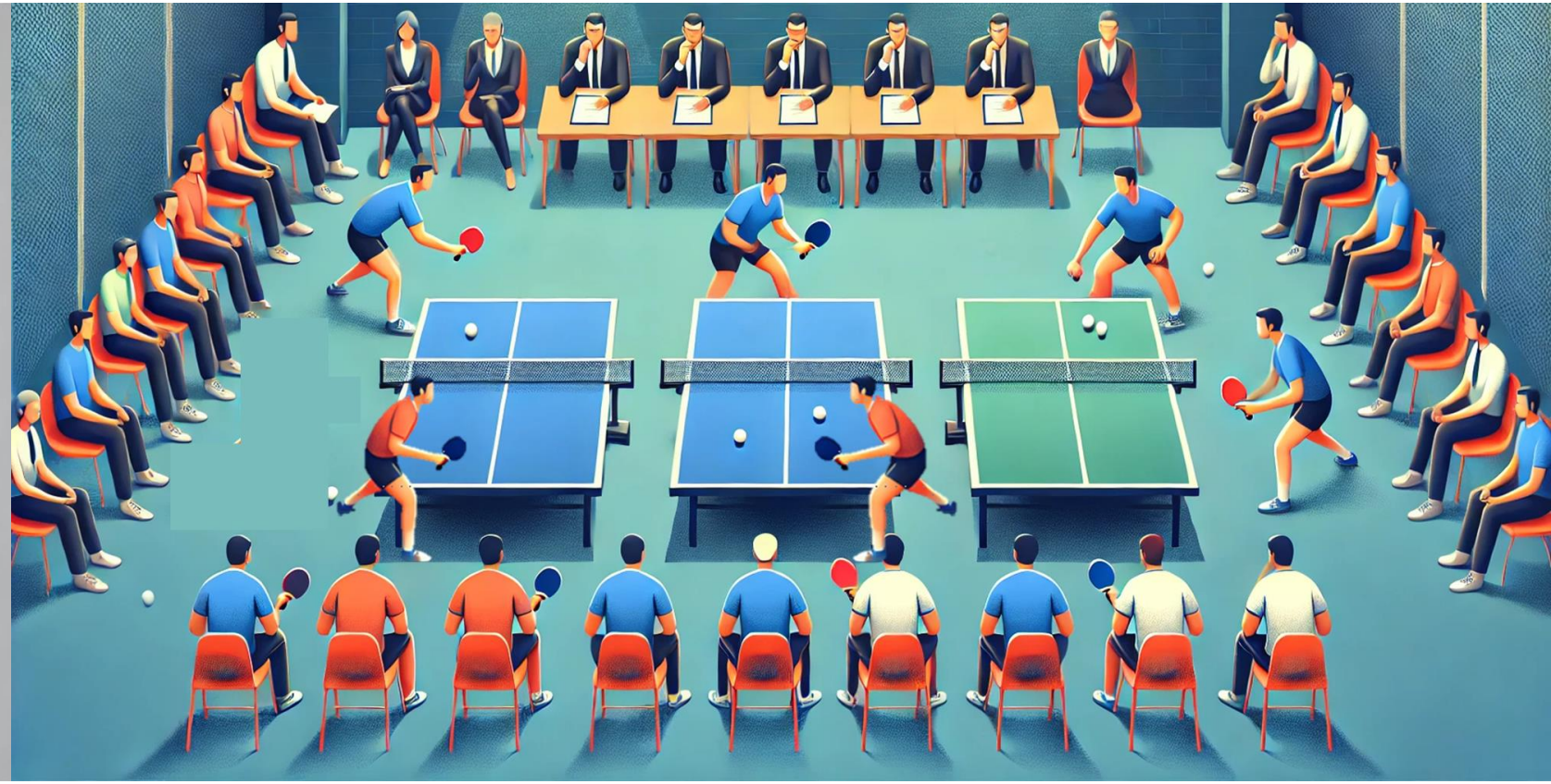
# Opportunity Identification

How would you select the best players from IITB for the national tournament?





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# Opportunity Identification

**Generate many opportunities**

**Step 1: Compile Bug Lists Based on Your Experience**

Recall and note down all frustrations or annoyances you have encountered with your bicycle. Identify as many instances of dissatisfaction as possible related to its use.

**Step 2: Study Customers**

Observe how people use bicycles in real life, noting what they struggle with or avoid. Identify unmet needs or issues that current bicycle designs fail to address.

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# Opportunity Identification

**Generate many opportunities**

## Step 3: Pull Opportunities from Capabilities

List the unique strengths or resources of your team members. Identify areas where these strengths could add value by offering a new product, software, service, or policy related to bicycles.

## Step 4: Consider Implications of Trends

List current trends in technology, the environment, or social norms. Explore how these trends could lead to new innovations or features in bicycle design.

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# Opportunity Identification

**Generate many opportunities**

## Step 5: Innovate at Realization/Service-System/Supply Chain/Business

Think of ways to innovate within the realization, service system, supply chain, or business model while maintaining the core bicycle design.

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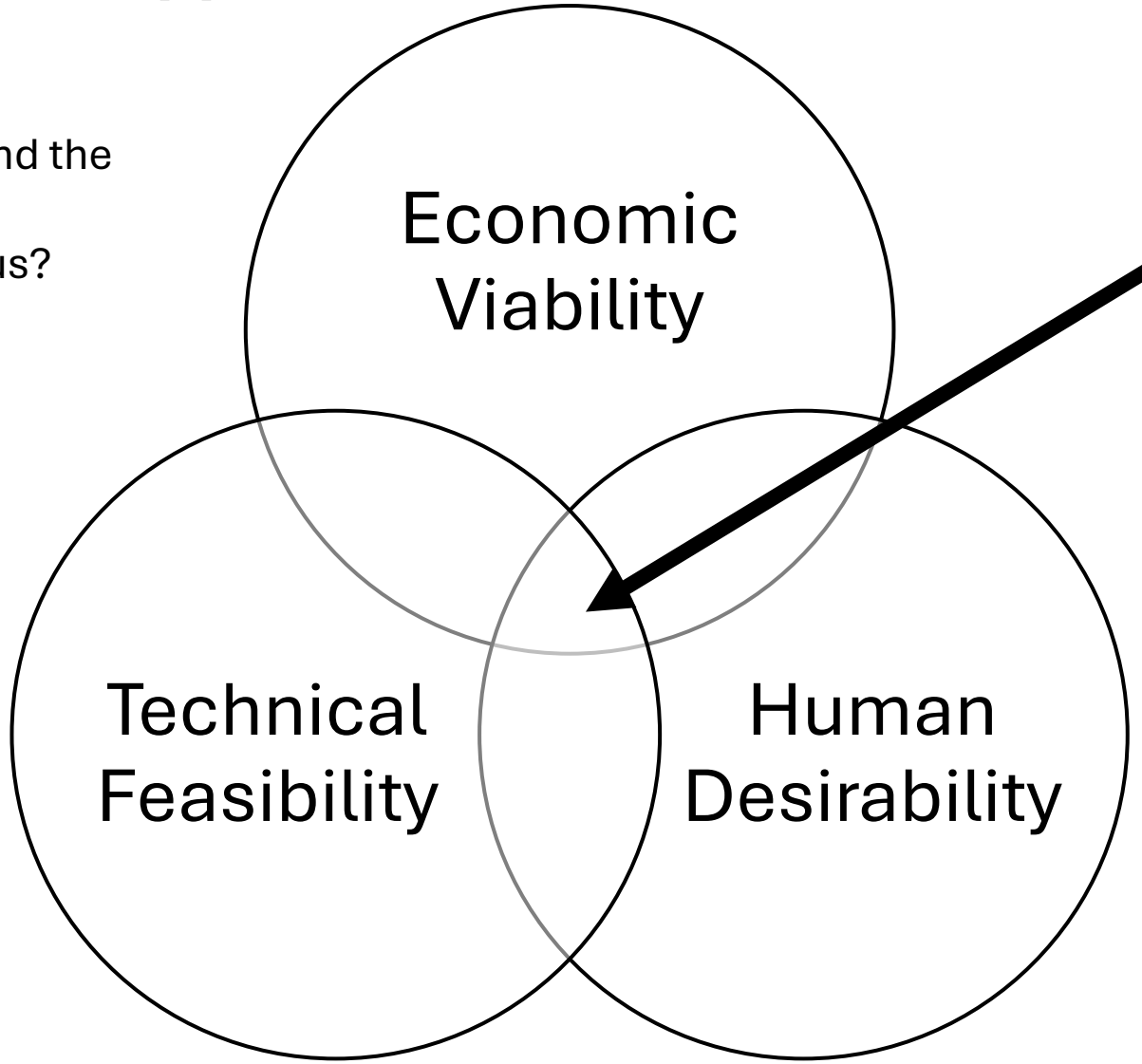
# Opportunity Identification

## Select Exceptional Opportunities

- Will it make money?
- Do we have the resources and the cash to do this?
- Are the risks acceptable to us?
- Can we have a competitive advantage?




- Is the product feasible?
- Can it be made?
- Is the technology available?
- Does it satisfy the needs?

- Is there a need?
- Can/ will the customer buy?
- Is there a relative advantage to other products?

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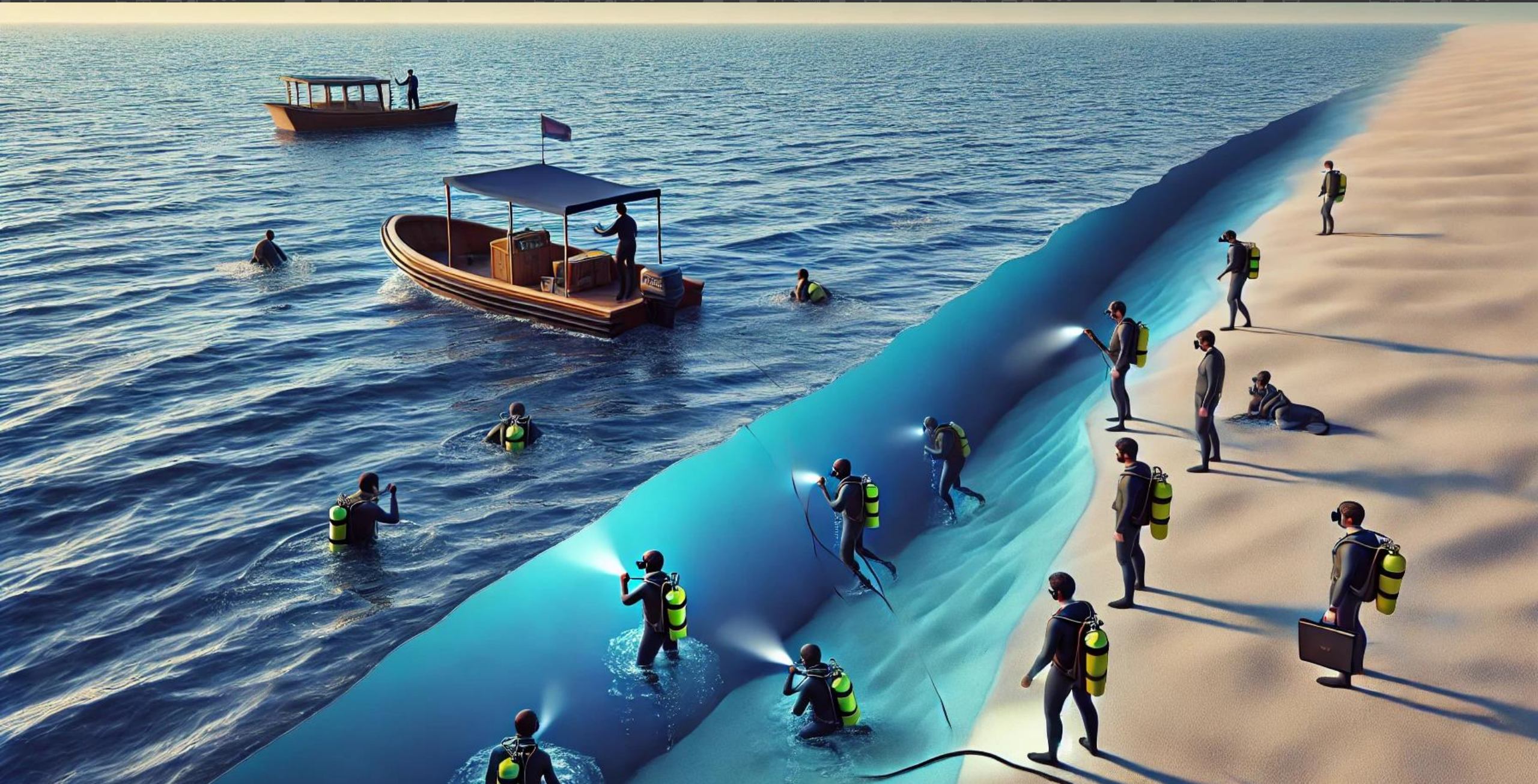
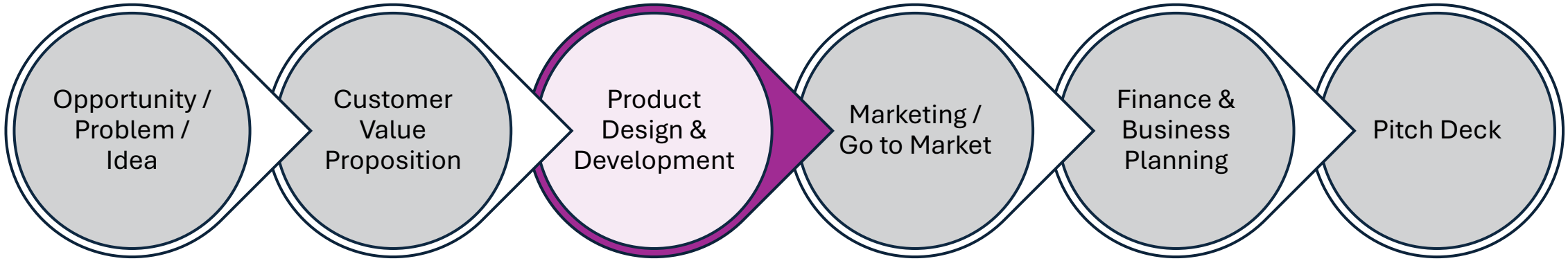
# Opportunity Identification



# Process for Start up Creation

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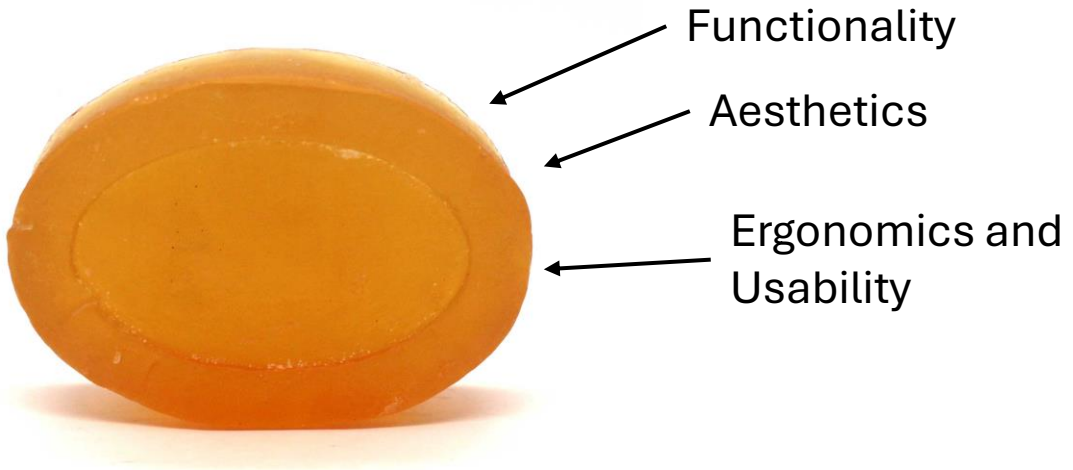
# What is Design? (Noun)

**Artificial:**

“produced by the art rather than by nature, not genuine or natural ; affected; not pertaining to essence of matter.” [1]

**Products:**

“Products are artifacts conceived, produced, transacted and used by people because of their properties and functions they may perform” [2]




*[1] Simon, H.A., 1996. The sciences of the artificial. MIT press.*
*[2] Roozenburg, N.F. and Eekels, J., 1995. Product design: fundamentals and methods (Vol. 2). John Wiley & Sons Inc.*

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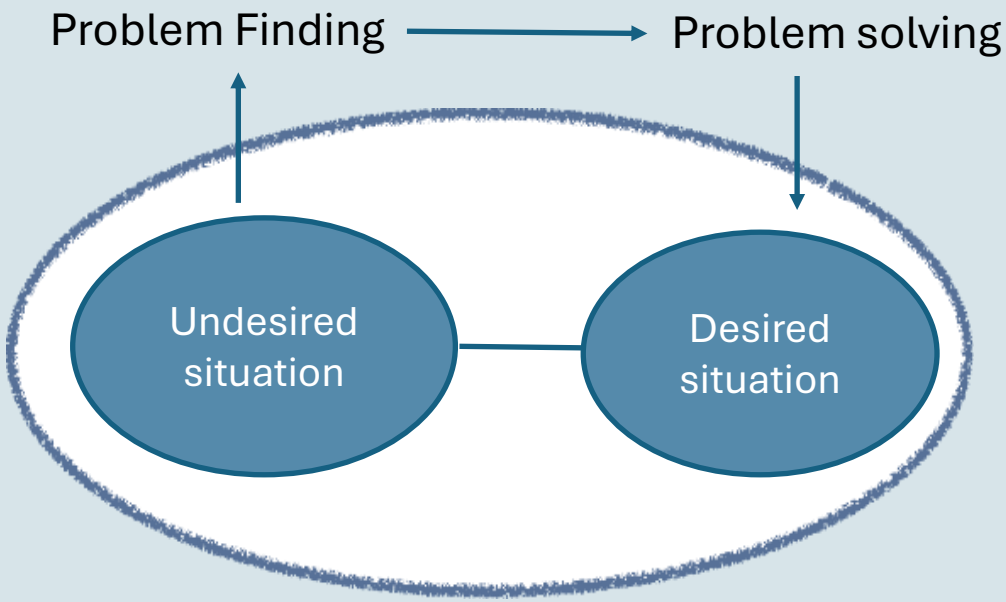
# What is Design? (Verb)




***Design** as a 'verb' :the process of design [1]*

**Product Design**

"Designing a product is a goal directed thinking process by which problems are analyzed, objectives are defined and adjusted, proposals for solutions are developed and the quality of those solutions is assessed." [2]

Systematic product design approach:
Prescriptive Models:

- French
- Pahl & beitz
- Roozenburg & Eckels
- Nigel Cross
- Ulrich & Eppinger

*[1] Simon, H.A., 1996. The sciences of the artificial. MIT press.*
*[2] Roozenburg, N.F. and Eekels, J., 1995. Product design: fundamentals and methods (Vol. 2). John Wiley & Sons Inc.*

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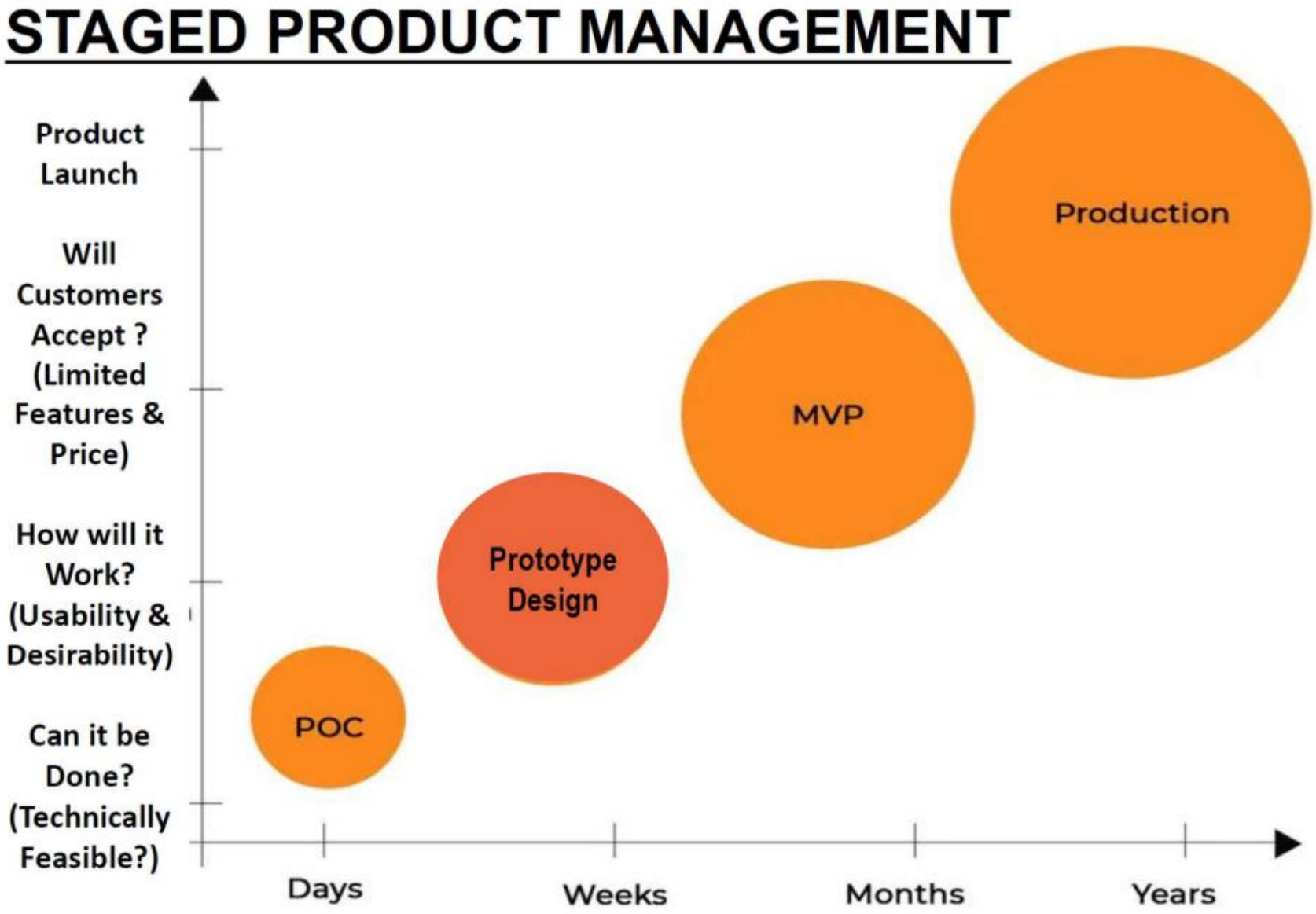
# Product Development Process: Outcome view

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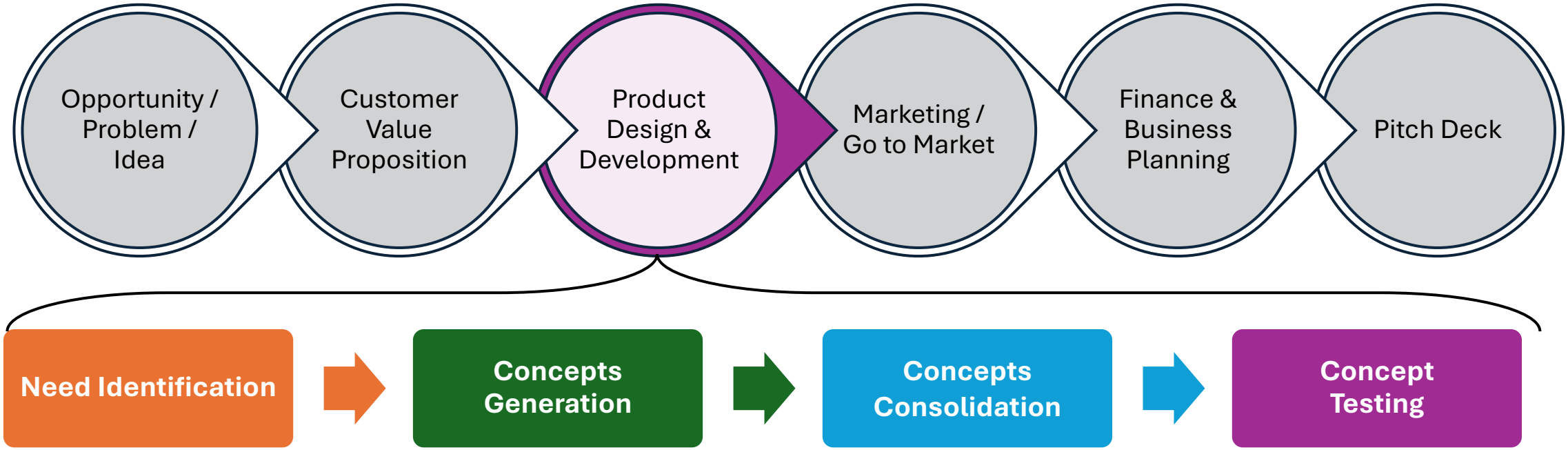
# Product Design Process: Outcome view




**Need Identification**

- Users
- Problems
- Needs
- Requirements

**Concepts Generation**

- Functions
- Ideas
- Concepts

**Concepts Consolidation**

- Sketches
- Mockups
- **PoCs**
- **Prototypes**

**Concept Testing**

- **Prototypes**
- **MVP**

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# InsuFlo: An Affordable Insulin Pump: A Case Study

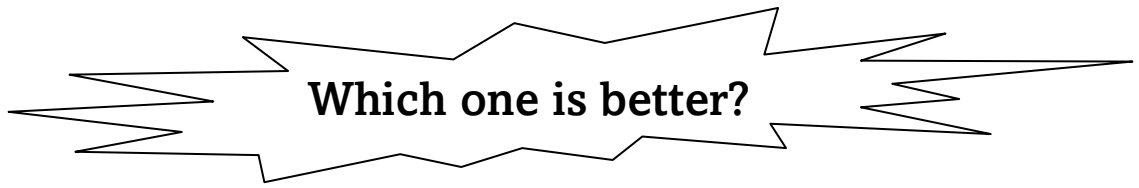
## Diabetes in India

**Type 1 diabetes (T1DM)**
8.1 Lakhs people [1]

**By 2040**
Almost double [1]

**Solution**
- Multiple Daily Injections (MDI)
- Continuous Subcutaneous Insulin Infusion (CSII)




*[1] The Lancet Diabetes and Endocrinology, 2021*

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# InsuFlo: An Affordable Insulin Pump: A Case Study

## Markets in in the United States, Europe and Australia


Tandem


Insulet's Omnipod,


Accu Check

## Markets in in India


Medtronic

**Cost**

Baseline pump: ₹3.6 lakhs, Flagship: ₹5.5 lakhs

- Lead screw/nut
- Precision micro-motor

*"An affordable insulin pump for people with diabetes"*

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# InsuFlo: An Affordable Insulin Pump: A Case Study

Mr Deval Karia
M.Des, Batch 2018,
CPDM, IISc

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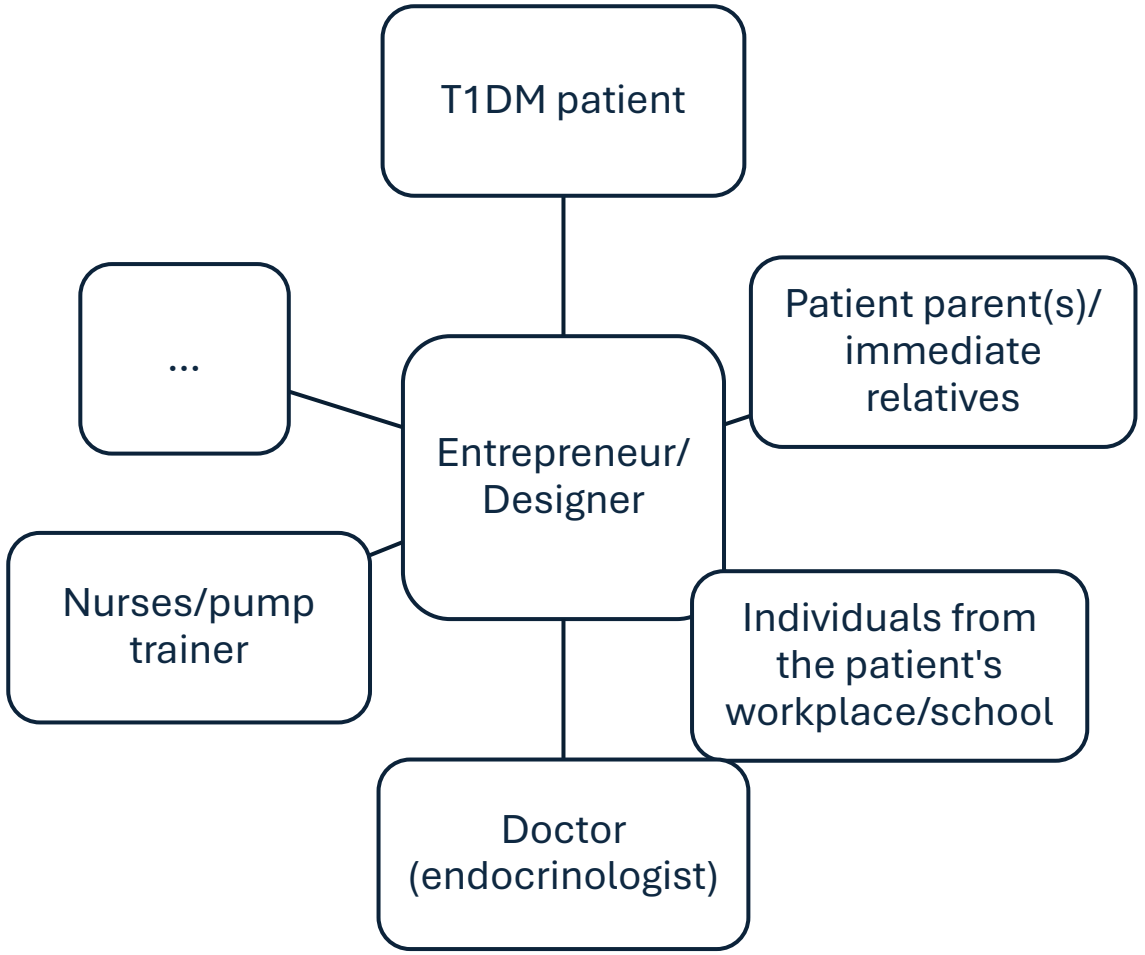
# Stage 1: Need Identification

## List of stakeholders




**User segments**

- Age
- Lifestyle
- Gender

- **Pain points (Examples)**
- Women tend to hide the pump under clothing to prevent discovery
- Make use of a washroom every time they need to administer a bolus dosage or monitor delivery
- ...

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# Stage 1: Need Identification

## List of stakeholder needs

| Rank | List of Stakeholder Requirements |
|---|---|
| 1 | **Extremely precise insulin delivery** as dictated by medical requirements |
| 2 | **Malfunctioning of the device** in extreme environments must be **informed to the user** |
| 3 | **Adequate alarms/response** to Hypo-glycaemic and Hyper-glycaemic episodes |
| 4 | Device **performance** should be reasonably **independent of external environmental conditions** |
| 5 | Provision to **vary the Basal delivery rate** across the day |
| 6 | The **initial investment** on the pump **and recurring costs** must be **affordable** to a majority of the Total Addressable Market (TAM) |
| … | … |

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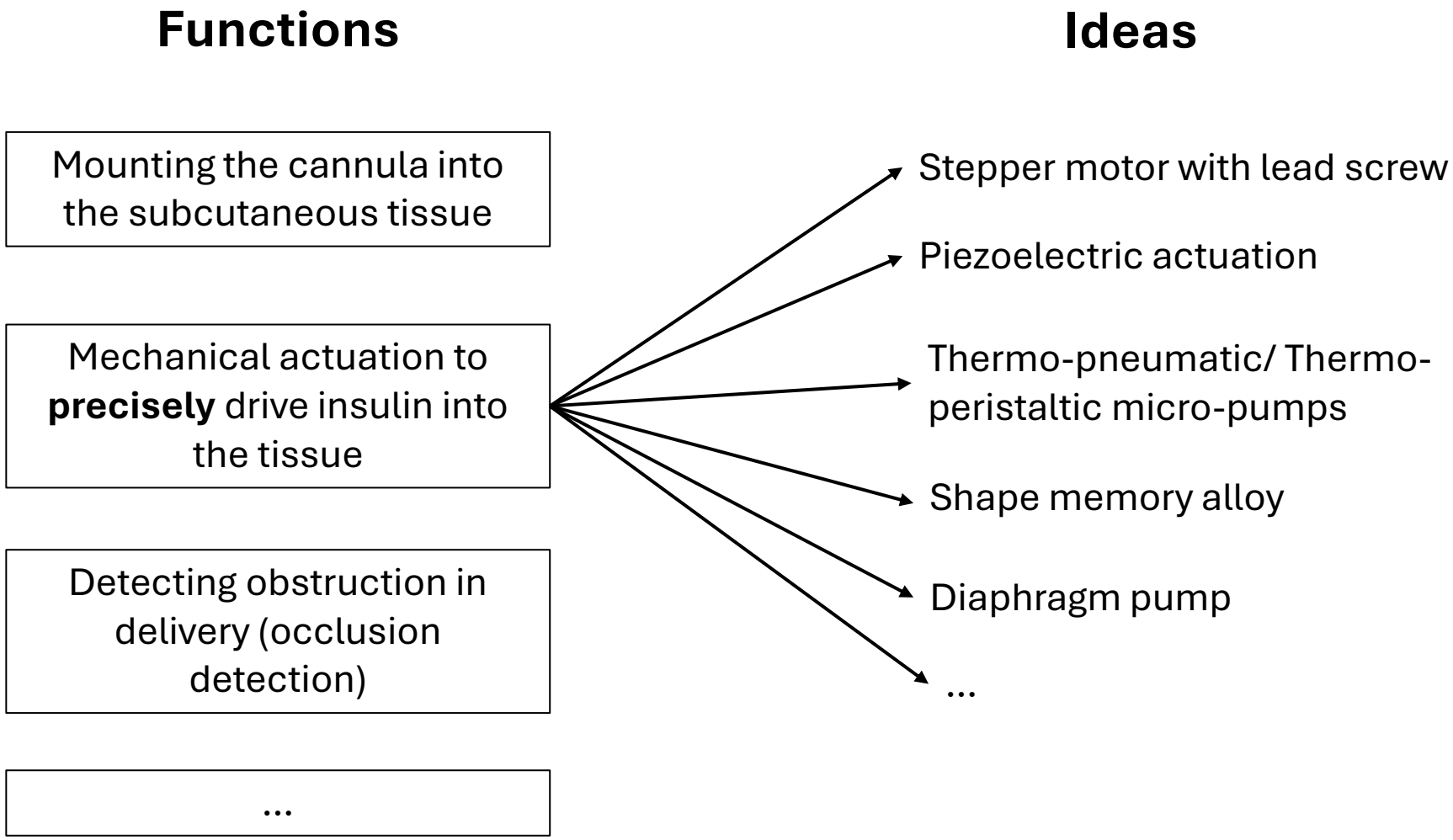
# Stage 2: Concept Generation

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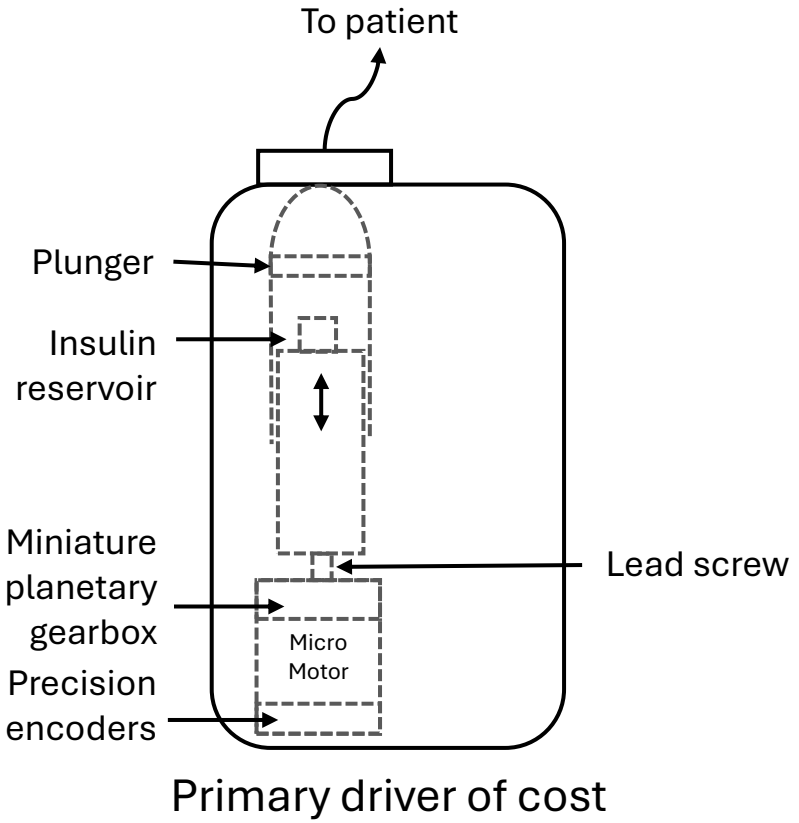
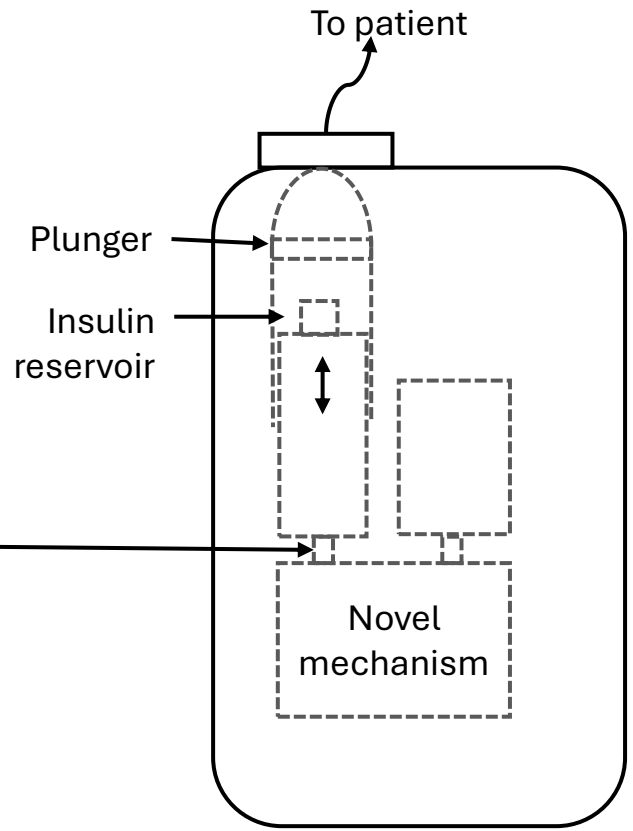
# Stage 2: Concept Generation

## Commercially available pumps




Primary driver of cost

## New design

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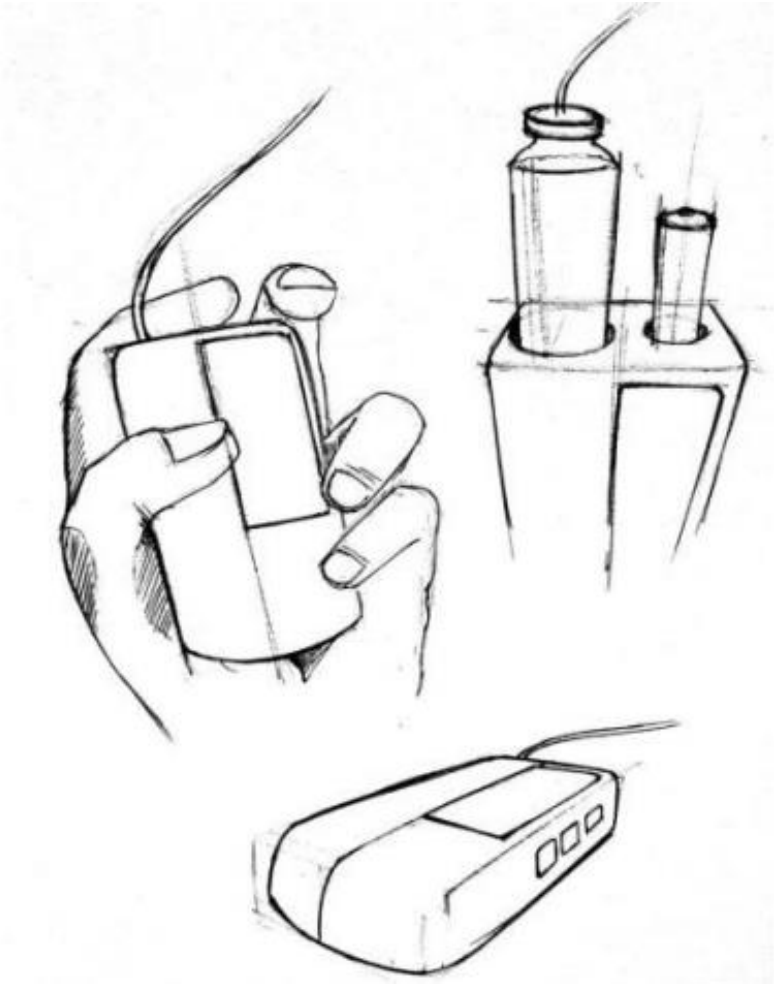
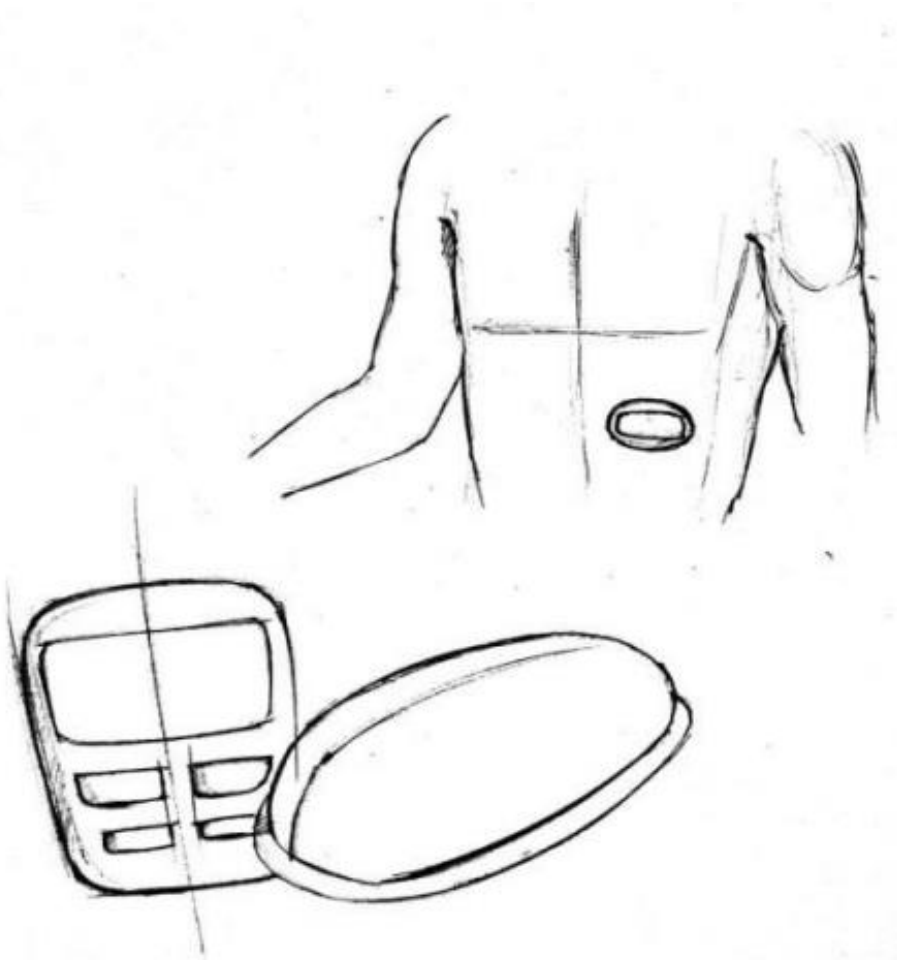
# Stage 3: Concept Consolidation

## Embodiment 1: Infusion set



## Embodiment 2: Patch based



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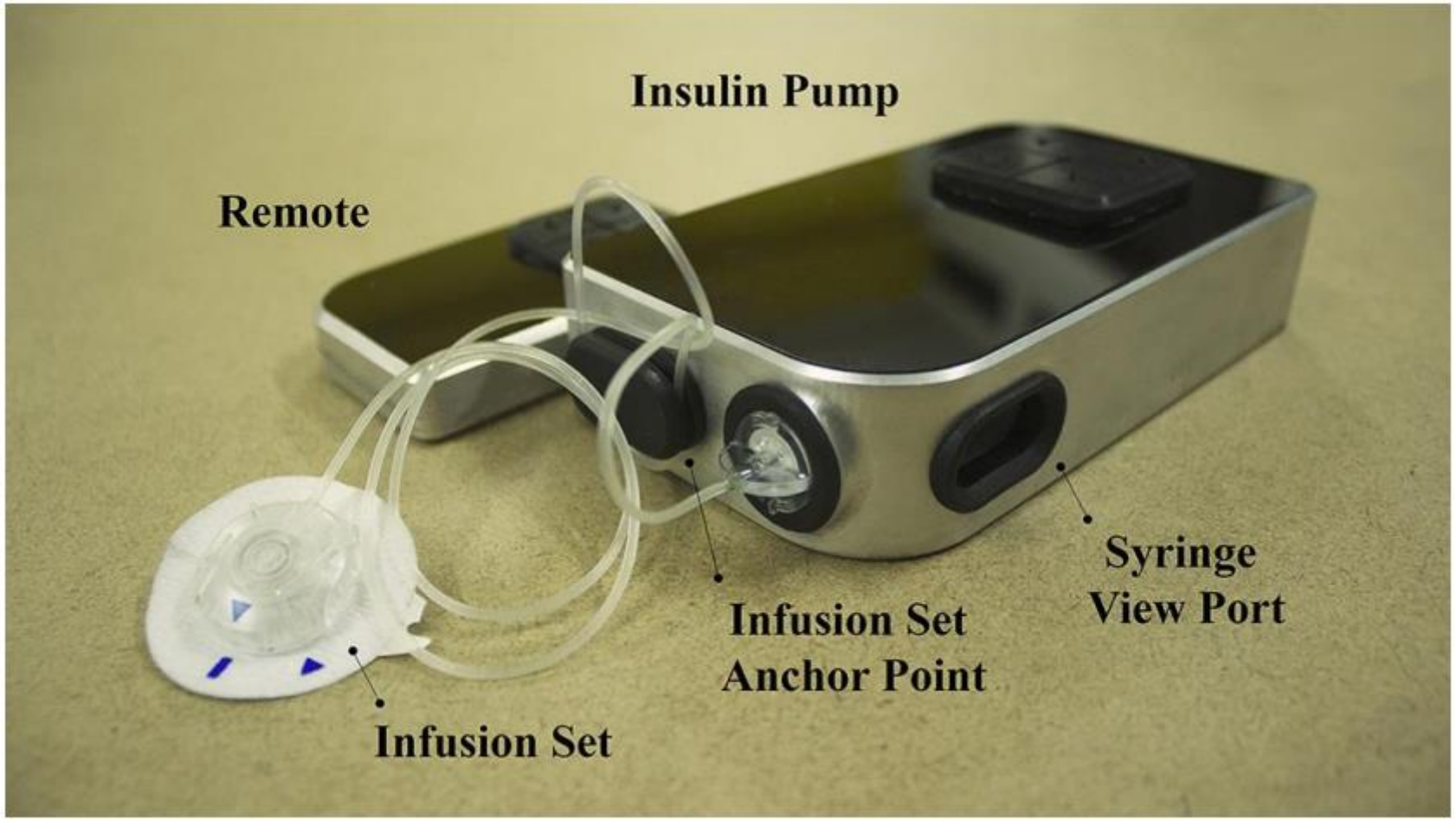
Credit : Deval Karia, IISc

# Stage 3: Concept Consolidation




**Prototype insulin pump and remote**

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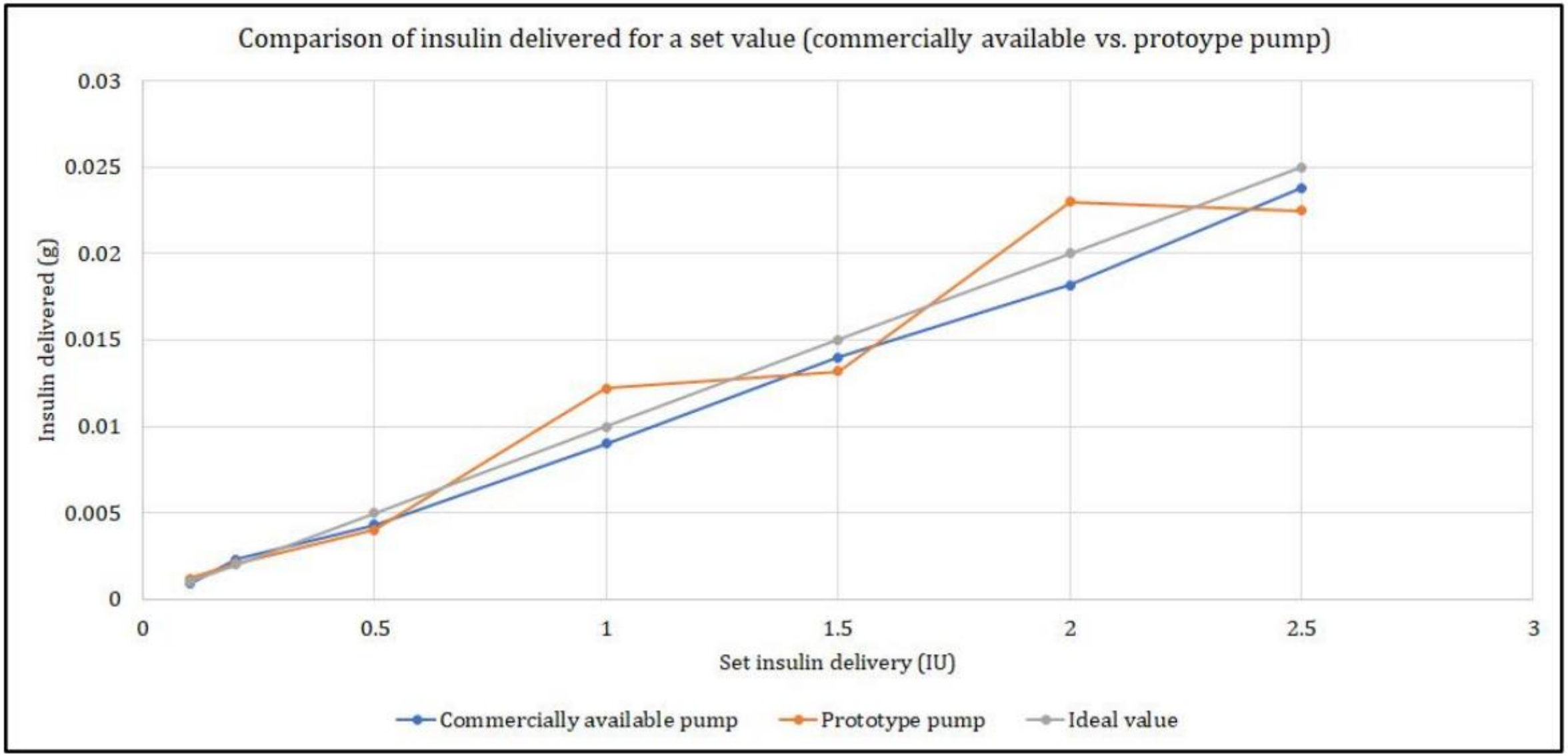
Credit : Deval Karia, IISc

# Stage 4: Concept Testing

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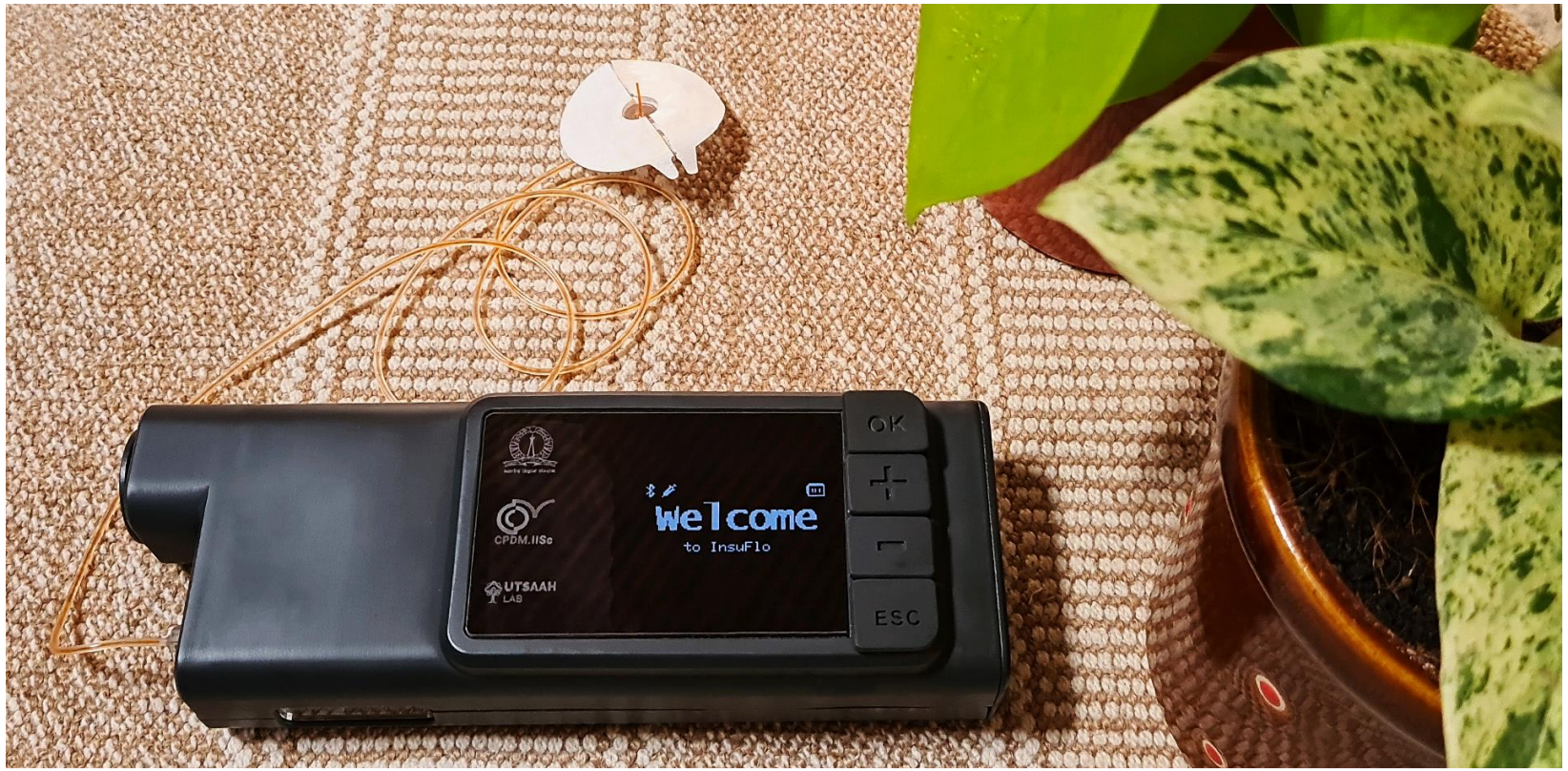
Credit : Deval Karia, IISc

# Stage 4: Concept Testing




| Pump | Programmed Bolus Value (U) | Delivery Error Mean (%) |
|---|---|---|
| Insuflo | 1 (0.01 ml) | 2.62 ± 0.066 |
| M722G | | -0.26 ± 0.019 |

©DSSE

Credit : Deval Karia, IISc

# Stage 4: Concept Testing

Pre-clinical animal investigation at a GLP-certified facility

Delivery accuracy comparable to competitor device

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# Go to Market


An **affordable** insulin pump for people with diabetes

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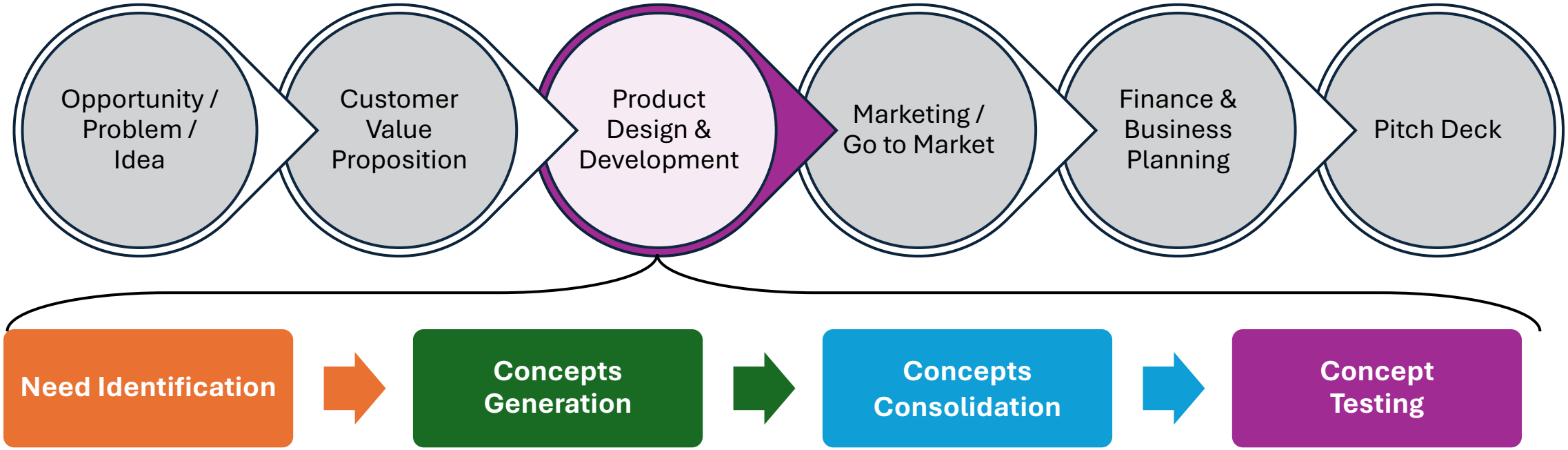
# Product Design Process: Activity view




- Observation
- Interaction
- Experience

- Ideation
- Inspiration
- Syntheses

- Sketching
- Prototyping

- Analysis
- Evaluation
- Selection

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# Stage 1: Need Identification

## Interaction with Users

- Interaction with multiple users
- Interaction with multiple segments of the users

## Types of user statement

- Problem
- Desire
- Likings
- Disliking
- Improvement

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# Stage 1: Need Identification

## Interaction with Users

- **When and why do you use the bicycle?**

"I use my bicycle mostly for commuting to class every day."
"I ride it to visit Padmavati temple because it is faster than walking."
"I use it for exercise on the weekends."
"It is my main mode of transport for short trips around the Powai.“

- **Walk me through a typical journey with the bicycle you have.**

"I unlock it, hop on, and ride to the Lecture Complex. Then I lock it there."
"I usually ride through some shortcuts, so the ride becomes uncomfortable."
"I have to carry it up and down stairs at my hostel since it is very costly"
"When I arrive, finding a safe spot to park it can be a hassle.“

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# Stage 1: Need Identification

## Interaction with Users

•**What do you like and dislike about your bicycle?**

"I like how lightweight it is, but it doesn’t feel sturdy."
"I love the speed, but I hate that the seat is uncomfortable."
"It is easy to manoeuvre, but it doesn’t have enough gears for hillside areas."
"It is a simple design, but the tyres get flat too often.“

•**What improvements would you make to your bicycle?**

"I wish it had a better lock, so I don’t worry about theft while I am in the hostel/ classrooms/ labs."
"It needs more comfortable handlebars for longer rides."
"It would be great if it could fold up for easier storage."
"I would add a basket for carrying groceries or small items."

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# Stage 1: Need Identification

## Converting Problem Statement into Need Statement

| User statement | Need/ Desired condition |
| --- | --- |
| I unlock it, hop on, and ride to the Lecture Complex. Then I lock it there. | The bicycle should be easy to secure at public locations. |
| I usually ride through some shortcuts, so the ride becomes uncomfortable | The bicycle should offer a smooth and comfortable ride on uneven surfaces. |
| I wish it had a better lock, so I don't worry about theft while I am in the hostel/ classrooms/ labs. | ✗ The bicycle should incorporate a better lock.<br>✓ The bicycle should incorporate security against theft. |
| It would be great if it could fold up for easier storage. | ✗ The bicycle should have a folding mechanism.<br>✓ The bicycle should be easy to store in small or compact spaces. |

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# Stage 1: Need Identification

## Converting Need Statement into Specifications

| Need/ Desired condition | Specifications |
| --- | --- |
| The bicycle should offer a smooth and comfortable ride on uneven surfaces. | Suspension: front suspension fork to absorb shocks on bumpy roads.<br>Tire width: wider tires (e.g., 2.0-2.5 inches) for added cushioning.<br>Tire type: durable, puncture-resistant tires for outdoor use. |
| The bicycle should provide a comfortable seating experience. | Seat: ergonomic, padded seat with adjustable height.<br>Seat design: shock-absorbing seat post for extra comfort. |
| The bicycle should incorporate security against theft. | |

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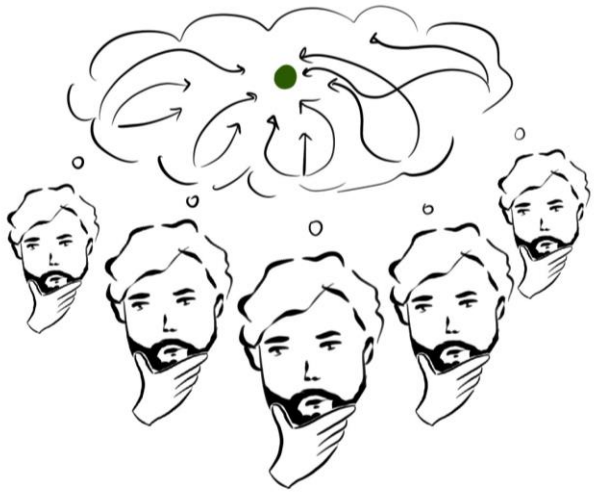
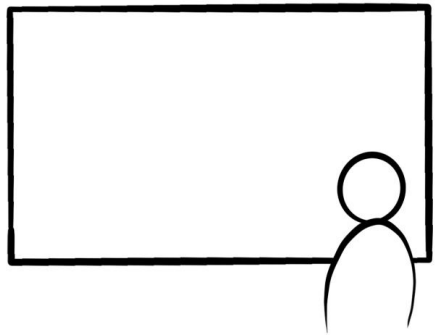
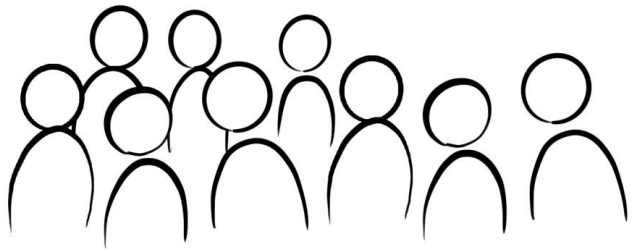
# Stage 2: Concept Generation

## Idea Generation: Brainstorming





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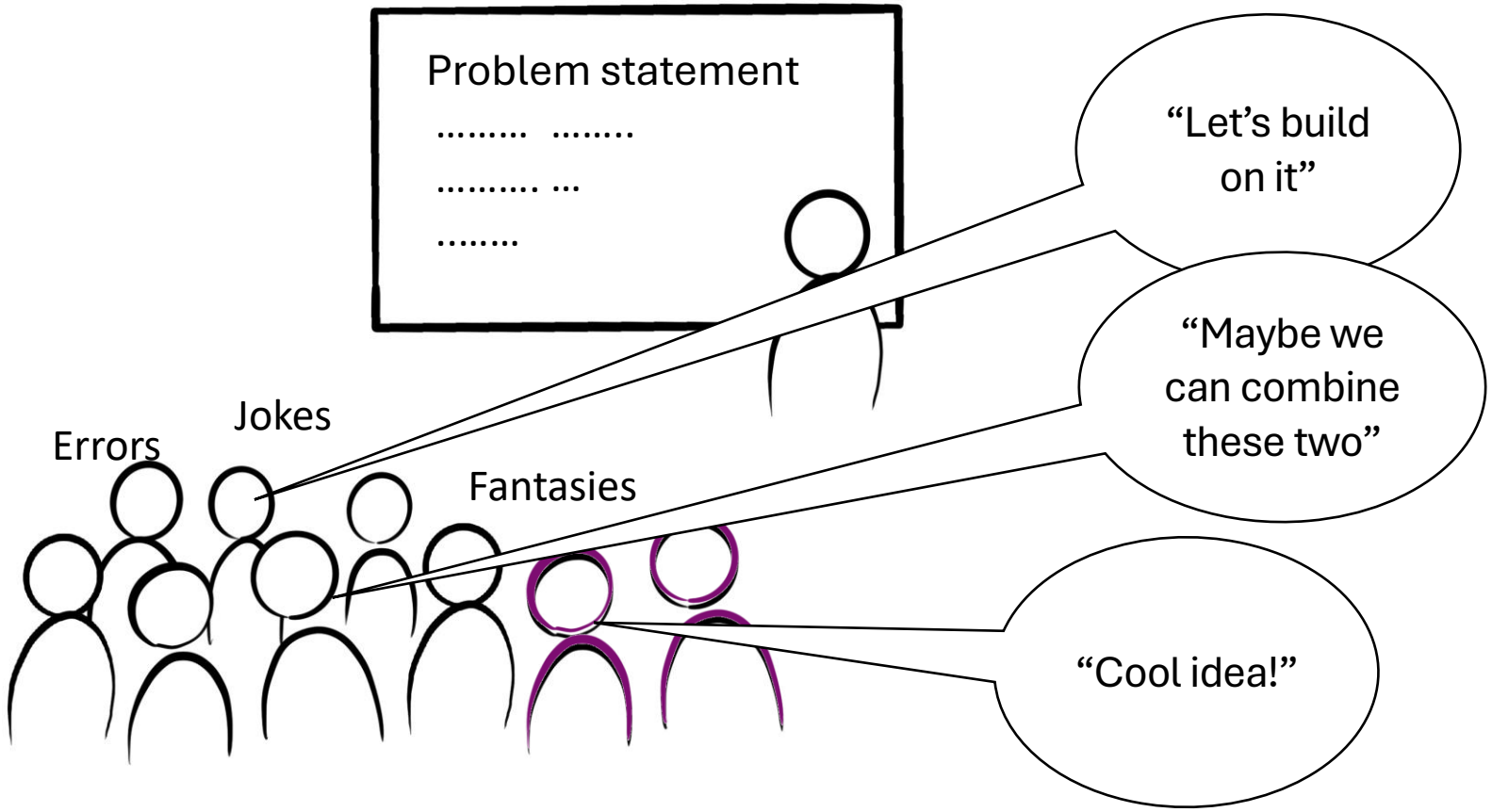
# Stage 2: Concept Generation

## Idea Generation: Brainstorming

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# Stage 2: Concept Generation

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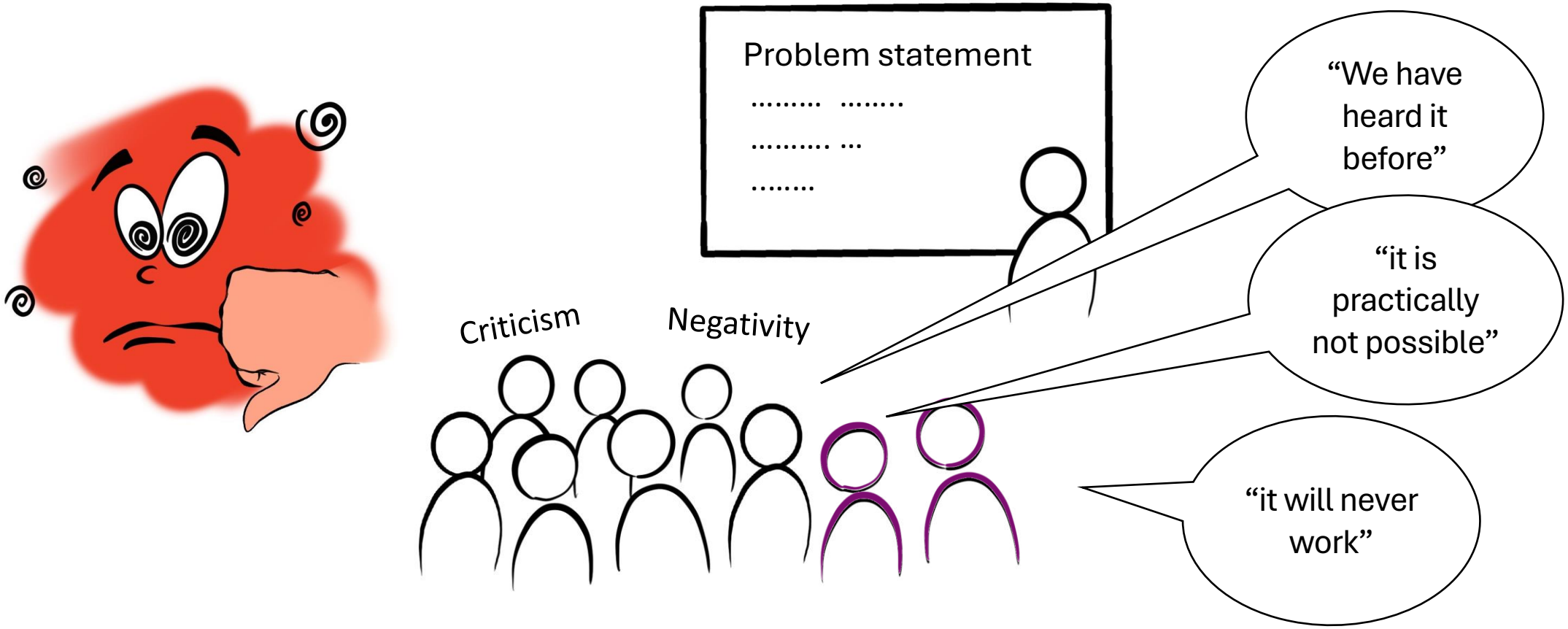


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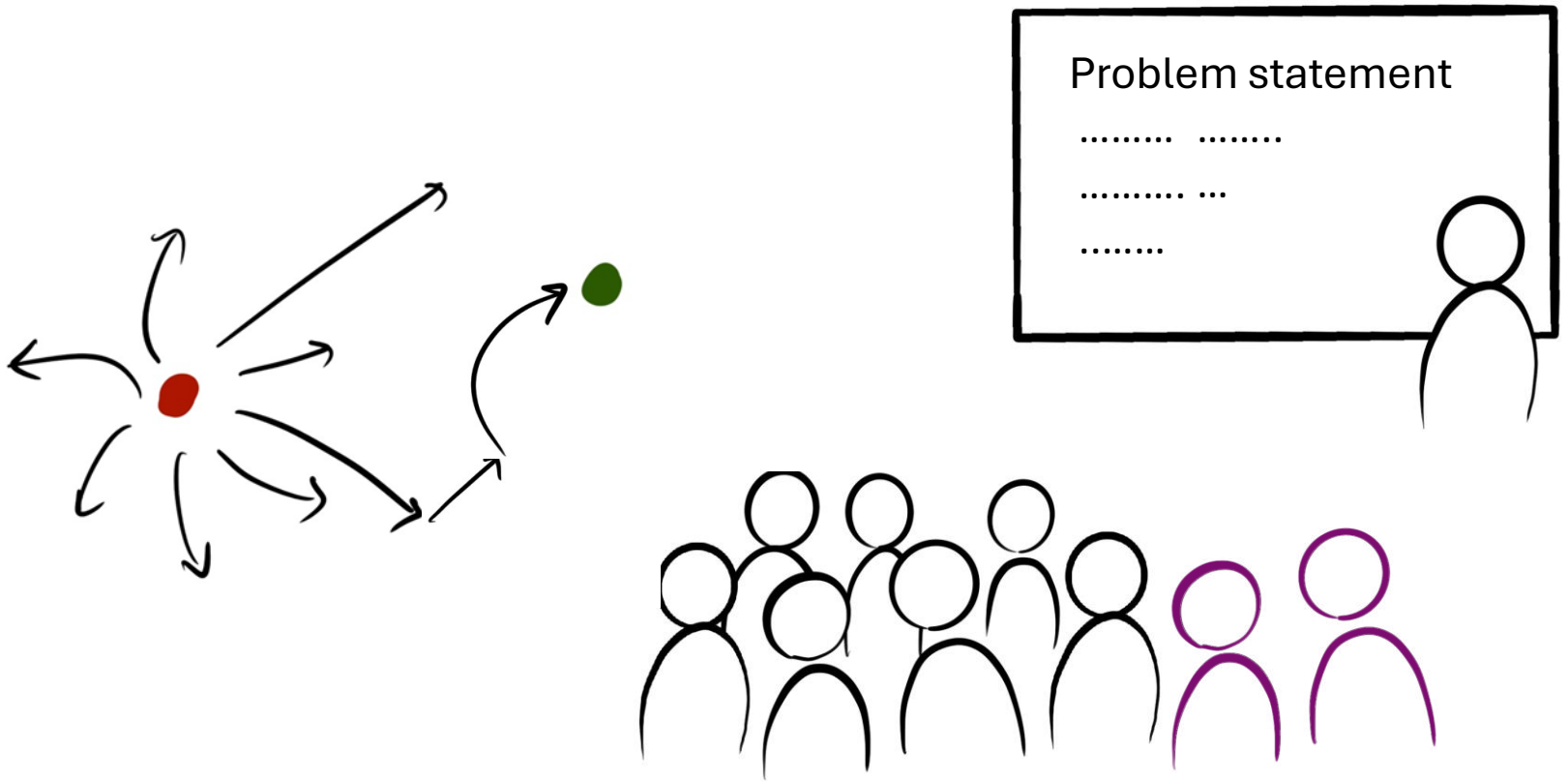
# Stage 2: Concept Generation

## Idea Generation: Brainstorming

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# Stage 2: Concept Generation

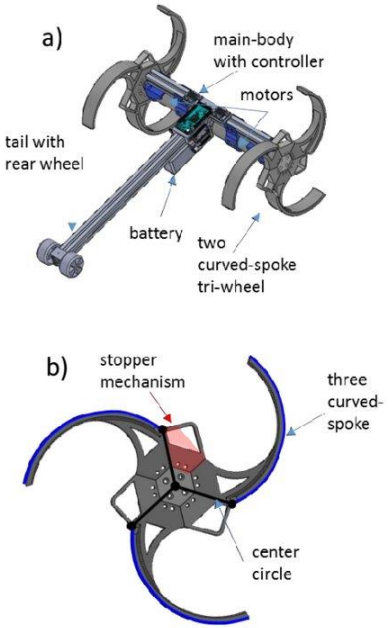
## Idea Generation: From function to form

### Making wheelchairs navigate patients across stairs

“Navigating stairs (ascend and descend) for patients, regardless of the staircase's configuration”

Track based Mechanism

Tri-Wheel Mechanism




Curved-Spoke Tri-Wheel Mechanism

Stair lift

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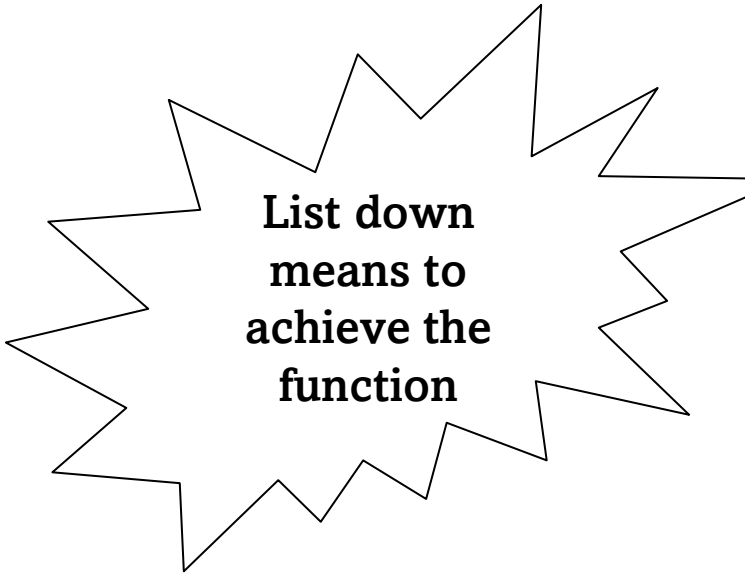
# Stage 2: Concept Generation

## Idea Generation: From function to form

"How might we prevent bicycle theft when left unattended for bicycle owners in a way that ensures convenience (doesn't compromise convenience)?”

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# Stage 2: Concept Generation

## Idea modification

- Feasibility
- Utility
- User-friendliness
- Safety
- Environmental aspects
- Economic aspects
- Simplicity

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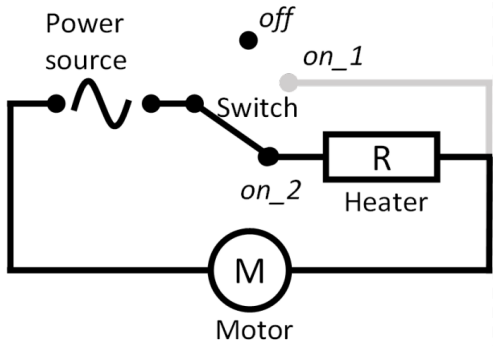
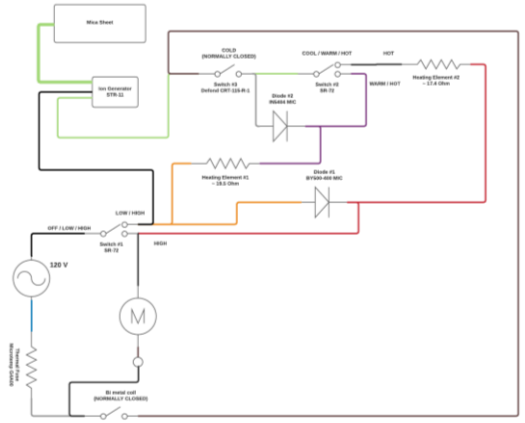
# Stage 3: Concept Consolidation

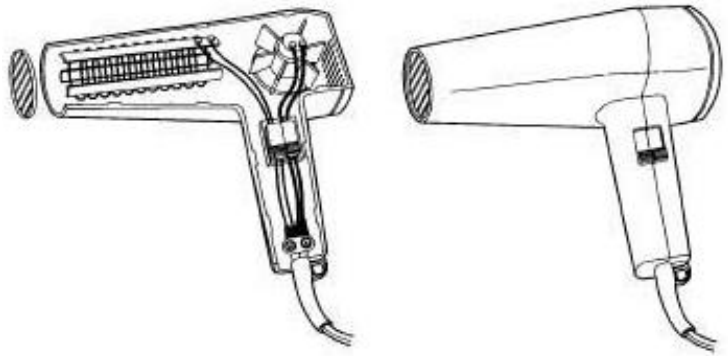
## Languages of design




Structure diagram



Network diagram



Functional prototype

Sketch

3D model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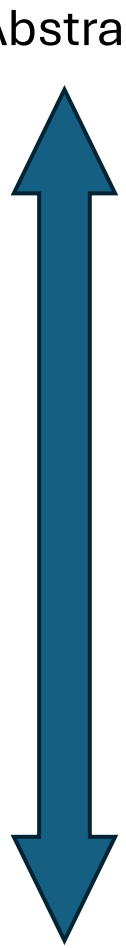
# Stage 3: Concept Consolidation

## Languages of design




| | | |
|---|---|---|
| Text | → | Description and explanation |
| Chart/ Diagram | → | Structure, flow, or networks |
| Sketches | → | Shape, form, layout |
| Drawings | → | Dimensions, annotations, technical specifications |
| CAD Models | → | Geometry, proportions, and form |
| Mockups | → | Colours, materials, and finishes |
| Prototypes and PoC | → | Functionality, user interaction, and performance |

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# Stage 3: Concept Consolidation

## Concept prototypes

"A preliminary version of a final product and it can represent both aesthetic and functional features."

"an approximation of the product along one or more dimensions of interest"

## Purpose

- Learning
- Communication
- Demonstration
- Decision-making

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# Stage 3: Concept Consolidation

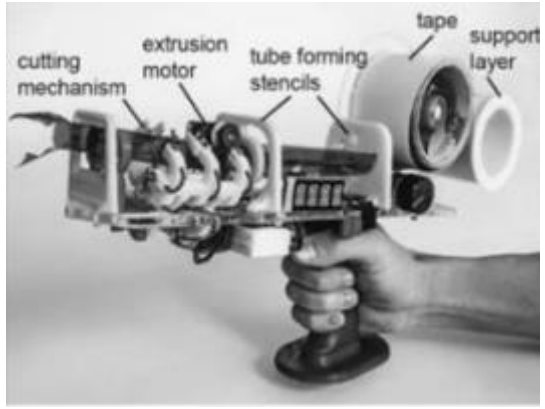
## Concept prototypes


Paper

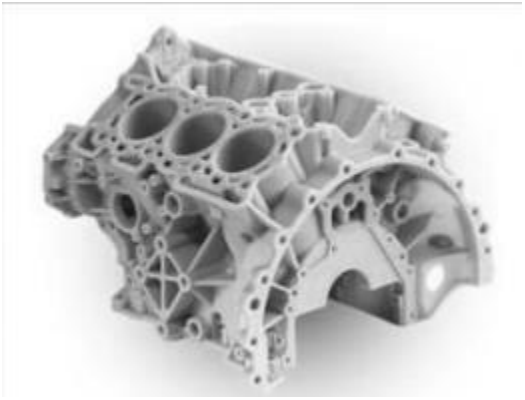
Foam

Cardboard

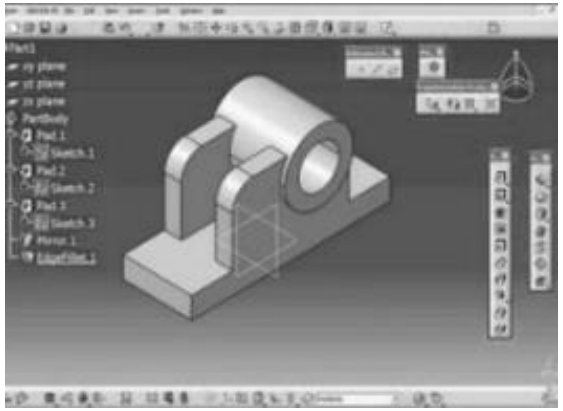
Scaled down




Functional



3D printed



CAD

Augmented reality

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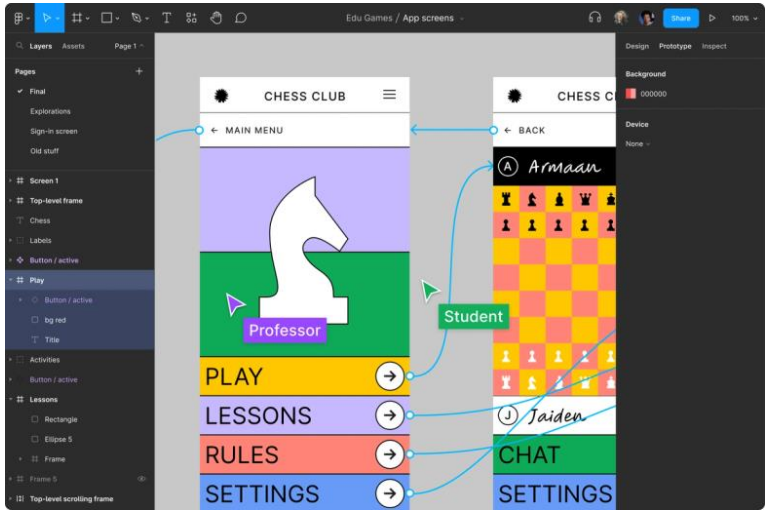
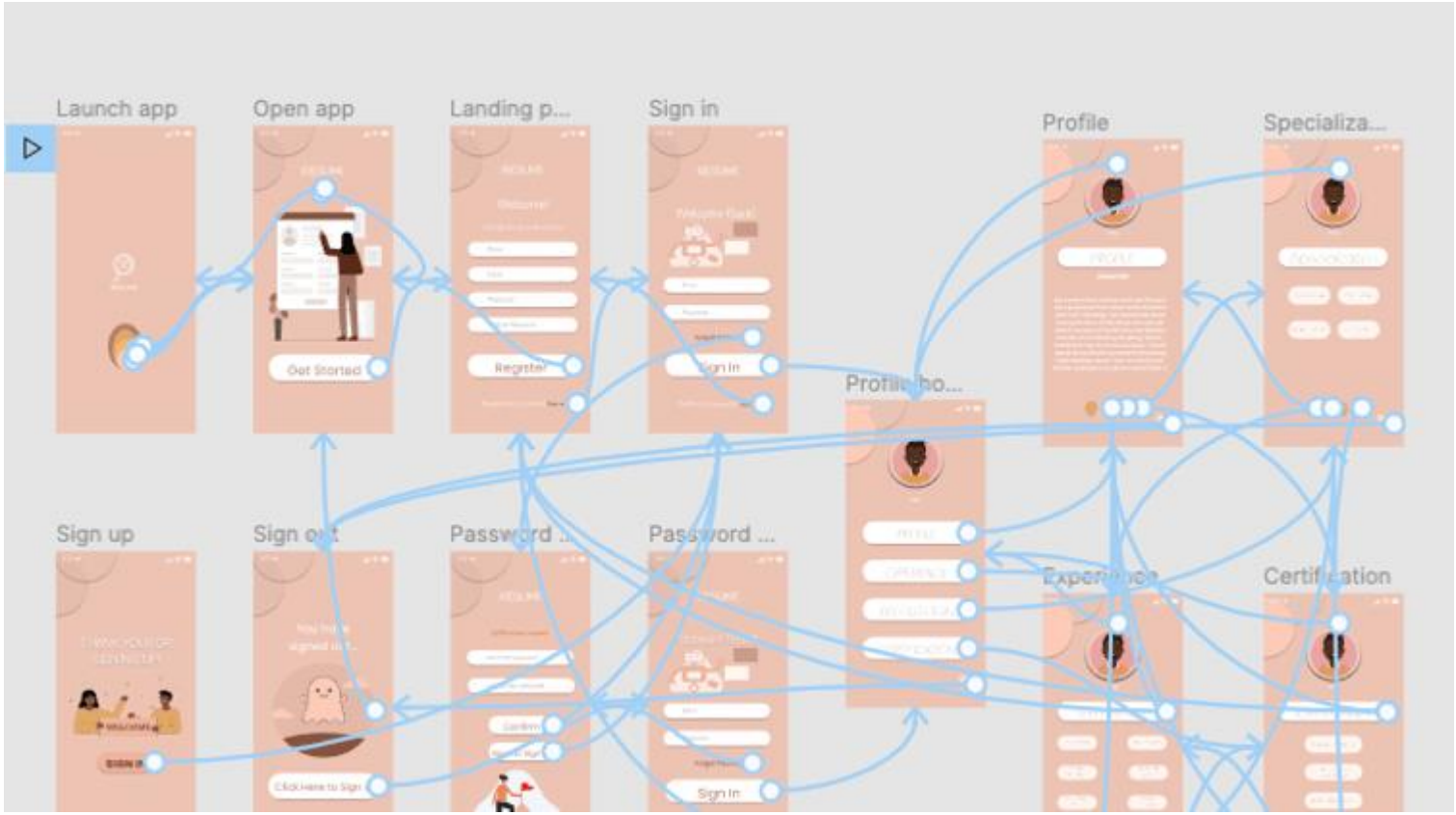
# Stage 3: Concept Consolidation

## Concept prototypes

Figma

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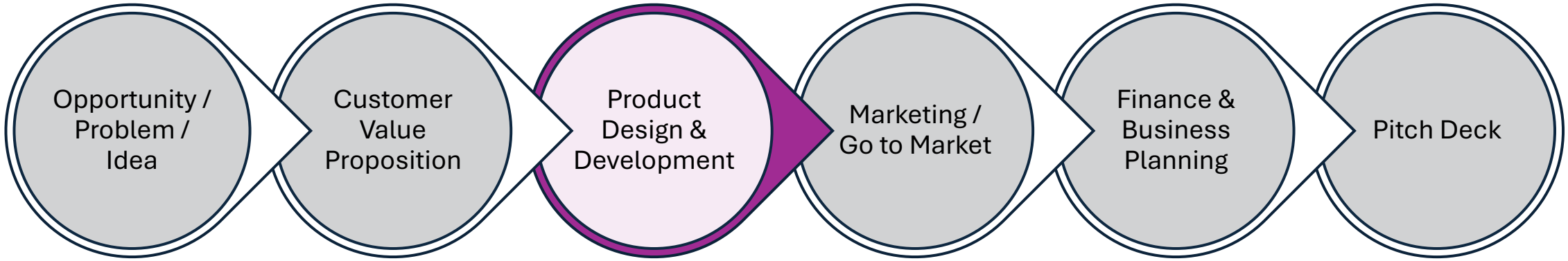
# Product Design Process: Activity view




**Need Identification**

- Observation
- Interaction
- Experience

**Concepts Generation**

- Ideation
- Inspiration
- Syntheses

**Concepts Consolidation**

- Sketching
- Prototyping

**Concept Testing**

- Analysis
- Evaluation
- Selection

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