Project Proposal for

Design & Optimized Industrial Production of - Value Added, User Friendly, Rural Vegetable Vending 'Smart Cart' by MSMEs

Indian Institute of Technology Bombay
Powai, Mumbai

Project Objective / Concept

“To design improved vegetable cart prototypes that can bring solutions to current problems encountered by lakhs of vendors
such as
storage, health, comfort, usability, muscular-skeletal disorders, lack of technology assistance, value added features and climatic issues
through use of
appropriate technology, optimised manufacturing process, materials and user centric design solutions”

Aspects of Intervention for Design and Production

Vegetable Cart User's Journey

User Profile	Working	Prep	Daily Income	Items Sold
Most cases male middle aged having small families educated with experience of less than 10 years in street vending	start their vending at 7 - 8 AM and continued up to 9 -10 PM minimum 6 hrs maximum 15 hrs per day	cleaning and preparation - half an hour to 2 hours	Rs. 100-300 Rs. 300-500 Rs. 500-1000	vegetables, fruits, fish, meat flowers and readymade garments

source :

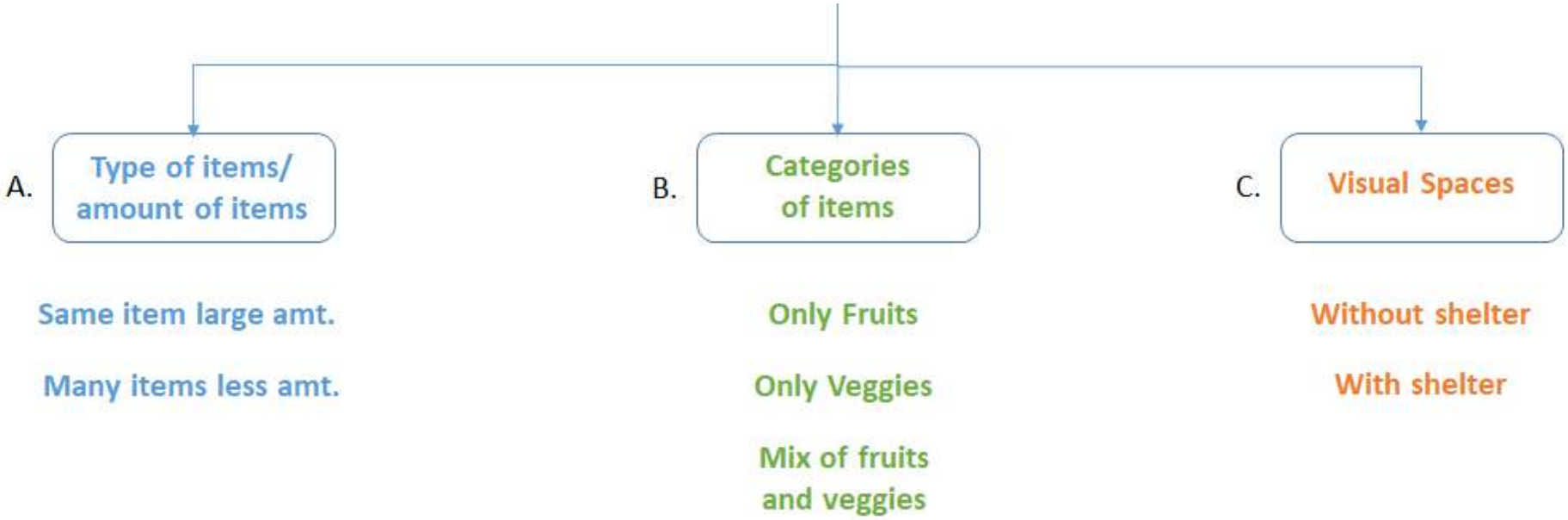
Fruit and Vegetable Street Vendors in Urban Informal Sector in Hyderabad, India

Department of Agricultural Economics, Agricultural College, Warangal, PJTSAU, Telangana, India

Sample size : 60 vendors

https://www.ijcmas.com/8-11-2019/A.%20Samarpitha,%20et%20al.pdf

Cart Inventory & Spaces



A. Types of Items / Amount of items

Same item large amt.

Many items less amt.

B. Categories of Items

Only Fruits

Only Veggies

Mix of fruits and veggies

C. Visual Spaces

Without shades

With shade

Existing Designs of Carts

Existing Cart Designs

- Keeping inclined gives a good way to display/marketing
- New look which might attract customers to buy
- Segregated compartments

- Sectioned parts for different items
- Can last long if maintained properly

Hyderabad

- A solar powered e-cart that can power a light bulb, fan, and charge phones,
- Provides a shelter during rain

Costs of Existing Push and E-Cart Designs

Push cart

6-12 K (OLX Price)

Motorized cart with moped look

1 lac

Battery operated
Battery voltage 60 V,
Motor power 1000 W

Motorized cart

1.45 lacs

Battery operated

Source: IndiaMart

Usability Issues and Observations/Problems being addressed through Design Solutions

Usability Issues and Observations

1. Storage

Hung from the top in nets

Key Insights:

- When there is no space left for more items, they hang the items in the net from the top.

Usability Issues and Observations

1. Storage

Key Insights:

- They have fixed place to sell, and are selling from long time at same place.

Usability Issues and Observations

1. Storage

Key Insights:

- No proper storage facility for storing the leftover fruits and vegetables
- Spillage of goods occurs from the sides.
- Goods get crushed if vendor is not careful
- **Improper storage leads to damage and wastage of commodity**

Usability Issues and Observations

1. Storage

Key Insights:

- Keep their vegetables on or within wet gunny bags
- Repeatedly sprinkle water on the vegetables on hot days.
- Store in a small room of a nearby retailer by paying monthly rent. Some vendors reported that they would sell the leftover stock of the day to small retailers

Usability Issues and Observations

2. Health

Key Insights:

- Musculoskeletal disorders arise which affect arms, shoulders and neck.
- Pushing the cart on inclines is a tough task
- Most stay within 4-5 km of the vending place and they would travel by walk or bike or bus or auto from their residence to work place
- Headaches because of head loading and joint pains because of continuous roaming.

Usability Issues and Observations

2. Health

Bringing a stool to sit

Key Insights:

- Long hours of Standing
- No place to sit on.

Usability Issues and Observations

2. Health

Key Insights:

- Sitting on the cart itself to avoid standing.

Usability Issues and Observations

3. Climatic Issues

Key Insights:

- Come up with makeshift shades to protect from rain and heat

Usability Issues and Observations

3. Climatic Issues

Key Insights:

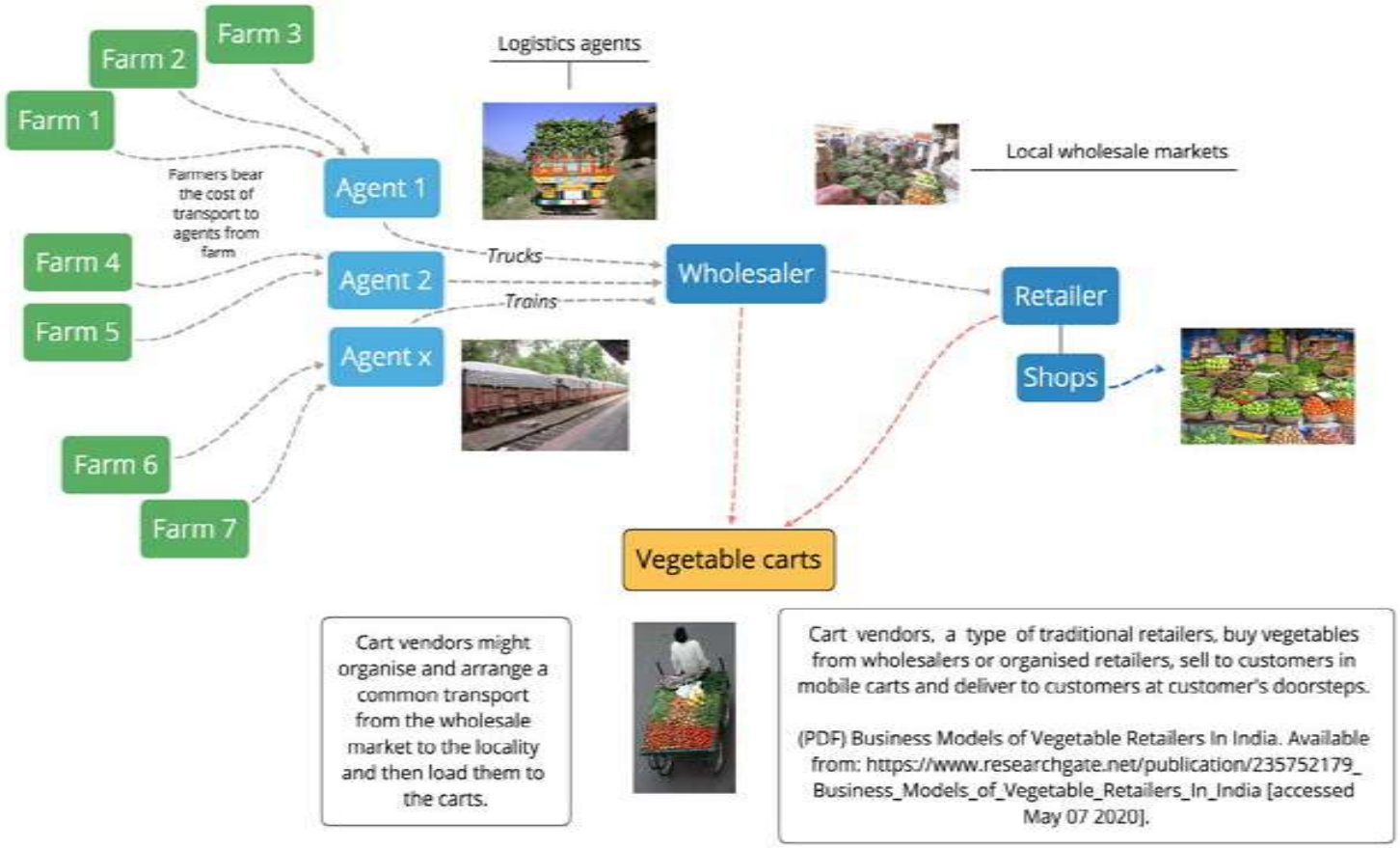
- Dragging the cart in muddy waters

4. Other Issues

- Territorial competition from other street vendors
- Lack of toilet facilities, they have to use open toilet system especially women
- Fear of eviction by municipality officials
- Street vendors are usually associated with encroachment of public spaces, causes traffic congestion, inadequate hygiene, and poor waste disposal

Visual Layout of the Supply Chain

Urban Vegetable Supply Chain



Rural Vegetable Supply Chain - Tamil Nadu

Close proximity

The farmers themselves sell their produces directly to the end consumers in local markets, regulated and unregulated 'farmer markets', or they sell to intermediaries—agents and organised retailers.

Local markets

Farms

Vegetable carts

Traditional Retailer

Agents

Shops

The rural sales mostly depends on unorganised traditional retailers

Farmers market

Direct sales from farmers to customers (organised by Government of Tamil nadu)

104 Markets in Tamil nadu

% amount of wastage of vegetables and fruits at different stages

Commodity	Agricultural	Post harvest	Processing and Packaging	Distribution	consumption
	Production	handling and storage			
Fruits and Vegetables	15%	9%	25%	10%	7%

Source: Global Food Losses and Food Waste: Extent, Causes and Prevention, FAO, 2011

Management of Perishable and non-perishable items

- Keep checking if the items are good or not,
- Spraying the water, to have good humidity level, to keep it cool
- The items are provided by the local agents
- Try to sell at lower price if it is not in good condition
- At last, they throw it!

Storage of Items

- They have a storage space at their house
- They try to keep items wet, to maintain the humidity level

Role of agent

- He partners up with more number of local vendors to supply them the goods
- He takes care of the supply, mode of transport to avail the vendors vegetables,
- He sets the prices to sell

Key Issues

The vendors struggle with many issues in their day to day life, mainly but not limited to storage, weather conditions, proper maintenance of goods.

The key issues are:

- Spoilage of goods due to long hours of exposure to heat and other weather conditions.
- They constantly sprinkle water on goods to prevent them from drying out.
- Long hours of Standing.
- No place to sit on, sometimes they sit on the cart itself to avoid it.
- Lack of proper shade in the cart, which is very much needed in the times of rainy season or summers.
- Lack of categorised storage or compartments for different types of goods often leading to goods being piled up.
- Navigating the roads with the cart requires heavy physical effort, especially on inclines.

Project Objective

“To design:
improved vegetable cart prototypes that can bring solutions to current problems and address issues encountered by lakhs of rural vendors such as storage, health, comfort, usability, muscular-skeletal disorders, lack of technology assistance, value added features and climatic issues

through use of:
appropriate technology, optimised manufacturing process, materials and user centric design solutions

incorporating modern features like:
modularity, facility for storage of goods, shelter, seating facility, human comfort and safety, seller and buyer usability, road maneuverability, lighting, water spray facility, etc”

Deliverables

1. Design Prototypes of 2 -types of vegetable carts: Retrofit Value Added Model and New Modern Model.
2. Comprehensive field study, product audit, usability and ergonomic study, road safety and full project documentation.
3. Proof of Concept/ Test Rig/Test Prototype
4. Technical detailing, drawing and 3D Models of above 2 vegetable carts for commercial production.
5. Legal and Road Safety positioning, Market testing, Vendor Identification, Production and assembly plan and MSME assessment for production.
6. Video material for dissemination of work, promotion, production and assembly modules. Documentation, promotion and branding.
7. Video documentation, product and process dissemination, Production & assembly modules
8. Assessment of financial linkage with schemes and bank assistance programmes
9. Prototype testing and refinement, Technology refinement, Product and Feature Testing, Production optimization, detailed part and assembly design and production plan.
10. Market Testing: Market trials, Vendor Interface sessions, Vendor Workshop, MSME production Workshop, production and assembly assessment.
11. Market Test based Refinement and Final Models, Promotion and Branding

Work plan and Methodology:

Phase I: 06 Months - Preliminary Study and Proof of Concept (PoC) / Rig

- Field study and analysis of current cart uses and types in different parts of the country, challenges for manufacturing carts and its maintenance, availability of raw materials, cost factors and other challenges; Usability, Ergonomics, Maneuverability etc.
- Design Brief Formulation, Ideation, Conceptualization, Study Model development
- Road Safety Regulations and Guidelines, MVA, Industrial Production, Legal inputs
- Video material for process documentation and module content.
- Assessment of Material and manufacturing processes / MSME/Vendor/ Industrial units and equipment manufacturers
- Prototype Development (Proof of Concept/Rig/Test Prototypes)

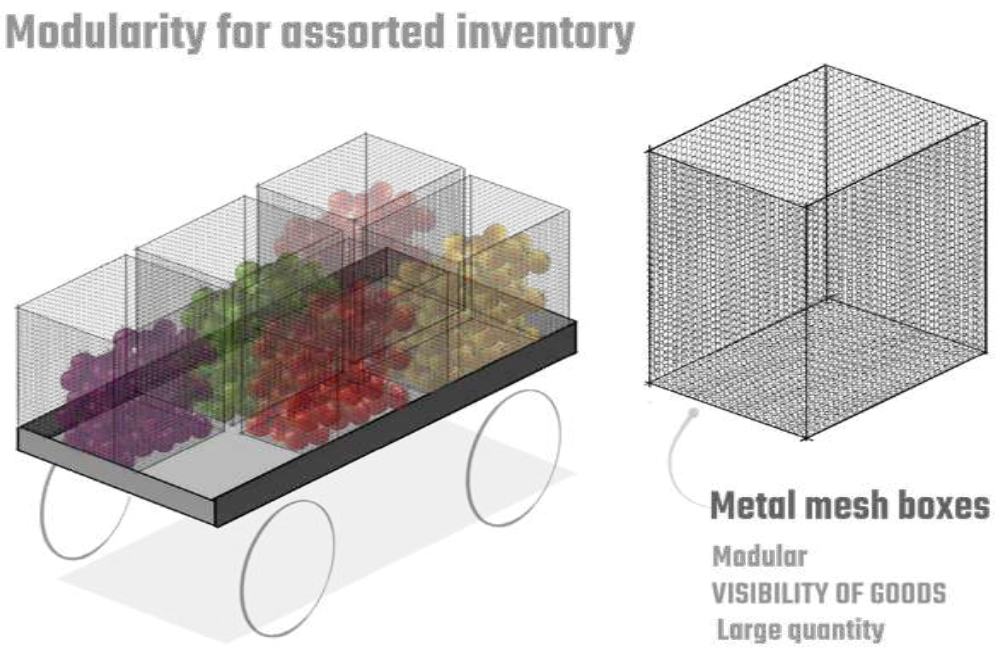
Work plan and Methodology:

Phase II: 06 Months - Market test, Final Prototype and Vendor Interface

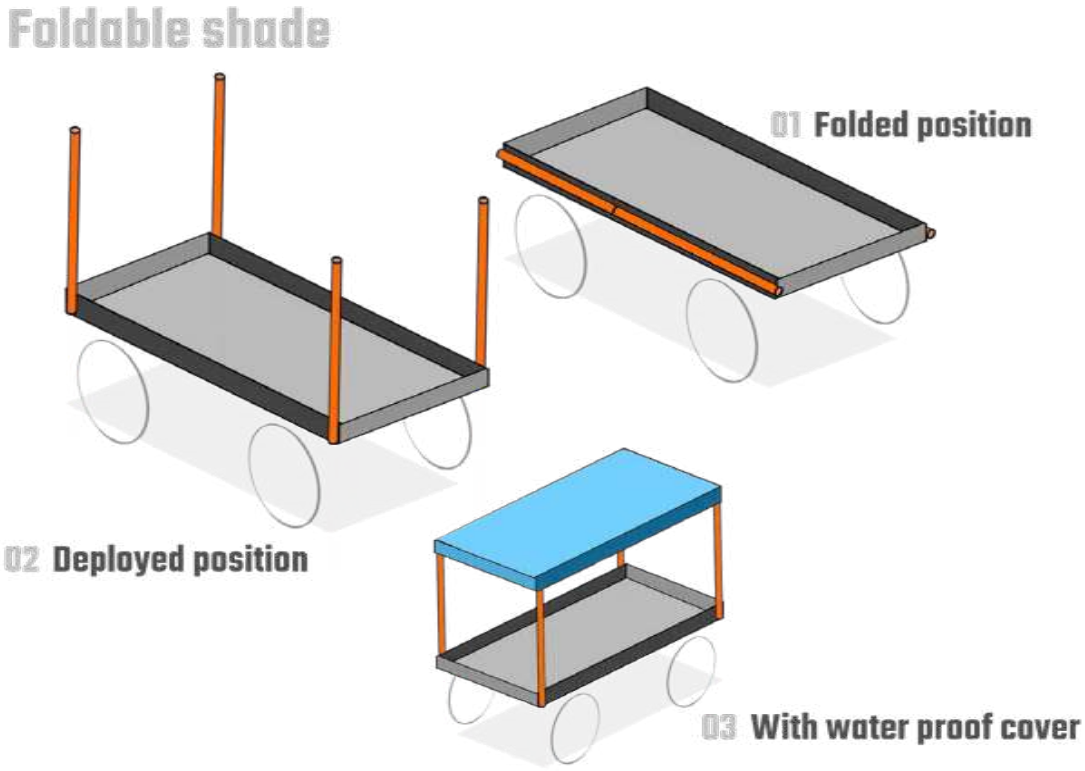
- Prototype testing and refinement, Technology refinement, Product and Feature
- Testing
- Production optimization, detailed part and assembly design and production plan.
- Market Testing, MSME interface, Refinement and Final Models
- Promotion and Branding
- Video material for dissemination of work, promotion, production and assembly modules
- Assessment of financial linkage with schemes and bank assistance

Preliminary Pre-Proposal
Ideations & Sketches
for
Potential Visualisation

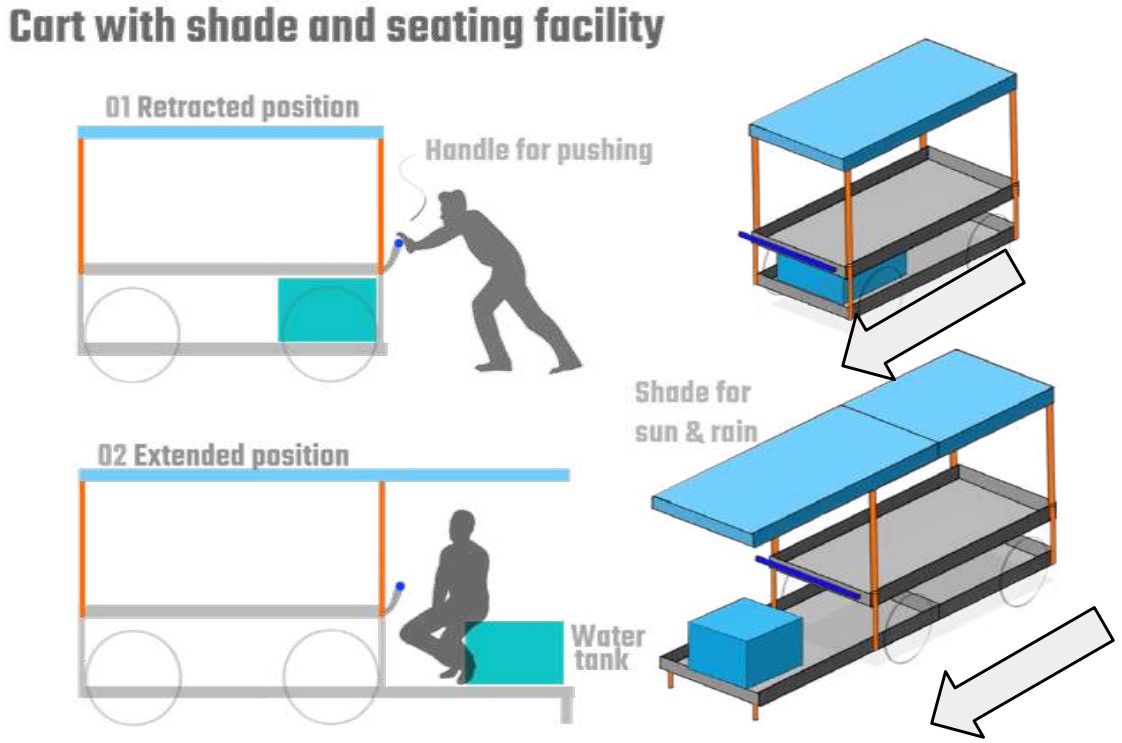
Preliminary Ideation



Preliminary Ideation

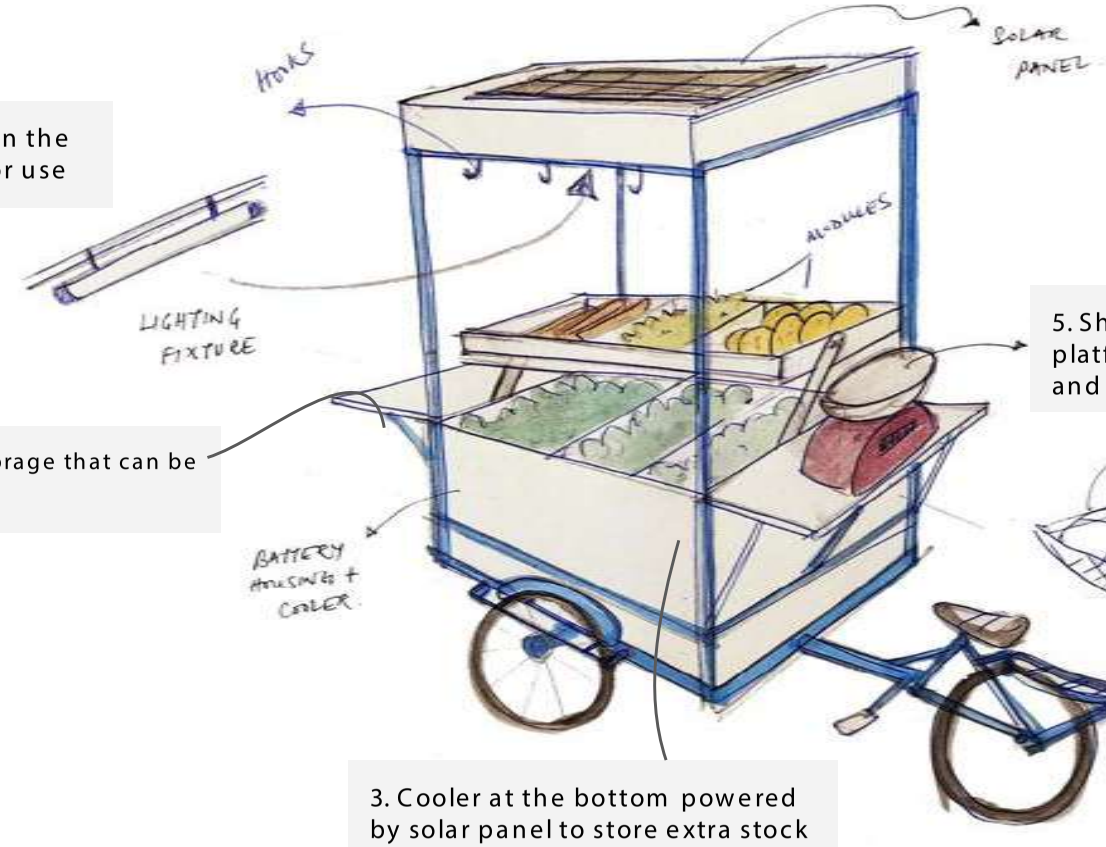


Preliminary Ideation



Preliminary Ideation

1. Lighting in the interior for use at night



2. To create more storage that can be packed up and shut

5. Shutters that extend as platforms where weighing scale and other objects can be placed

4. To ease movement

3. Cooler at the bottom powered by solar panel to store extra stock

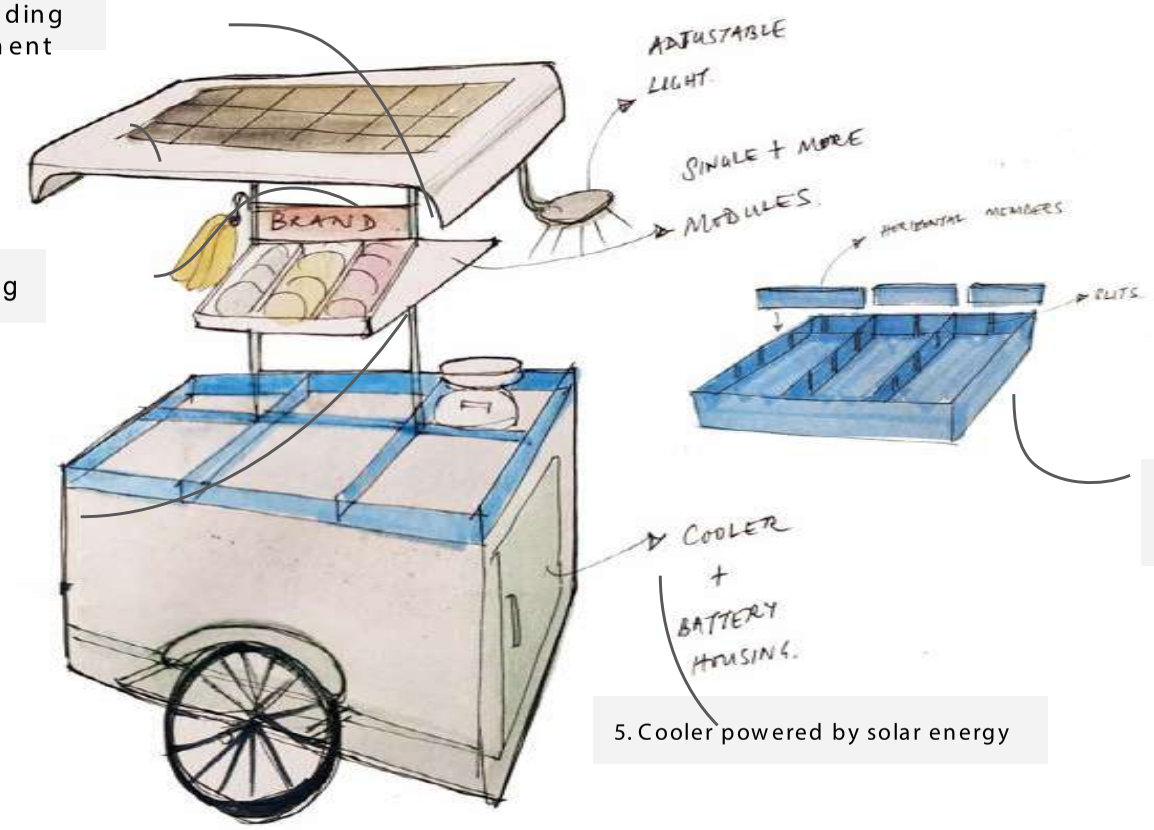
Preliminary Ideation

1. Branding Element

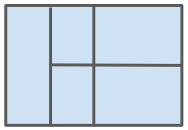
2. Rounded edge for softer look

3. Hook for hanging

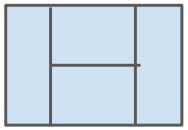
4. Storage supported by frame



5. Cooler powered by solar energy



Tray Arrangement 1

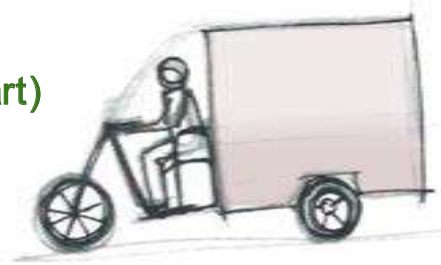


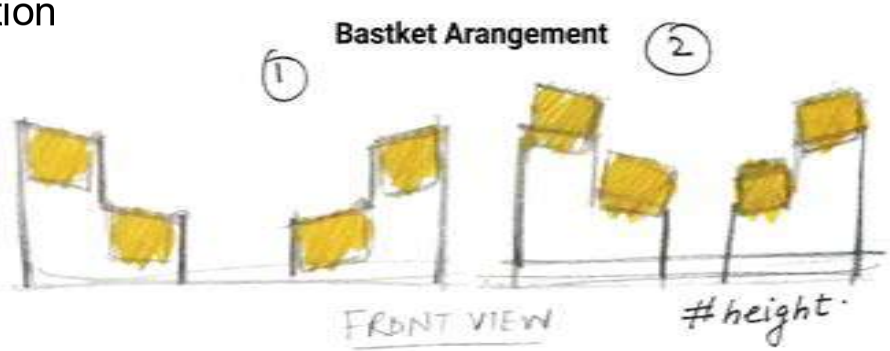
Tray Arrangement 2

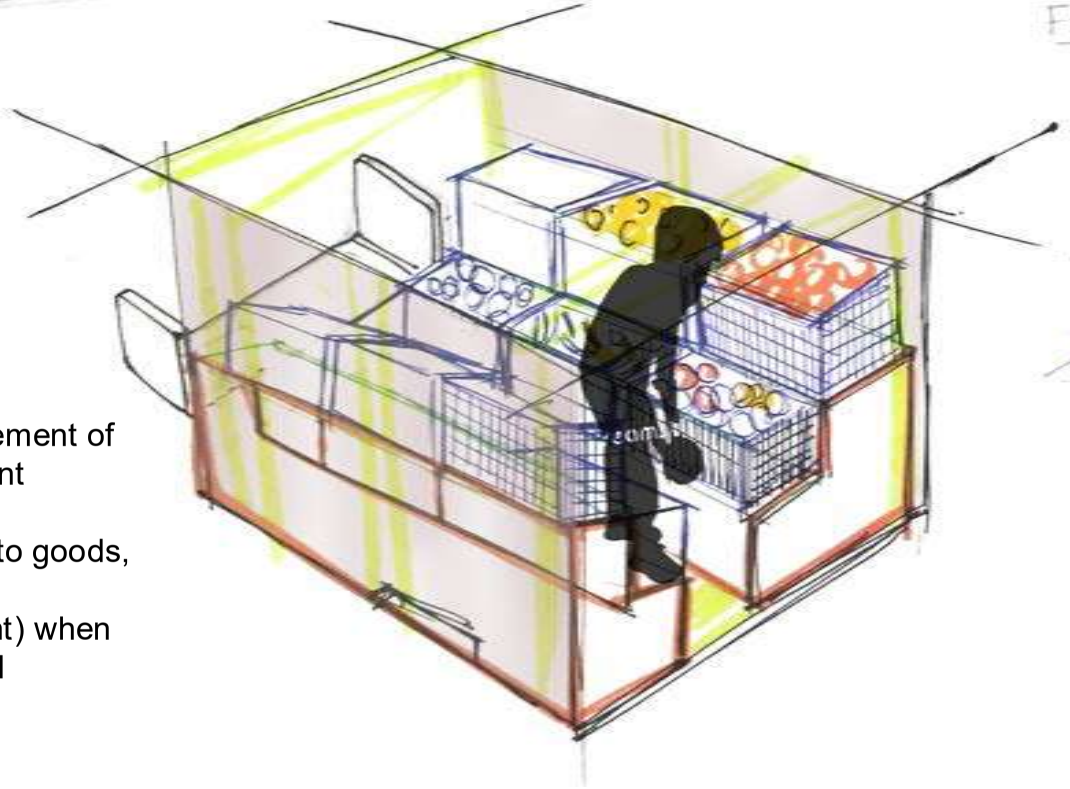
6. Customisable dividers to adjust as per quantity of items

Preliminary Ideation

1. E- kart (electrical cart)







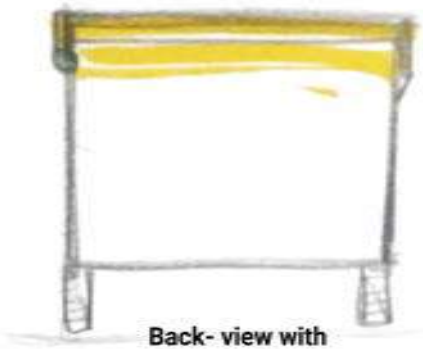
Key features

1.For ease of arrangement of goods, in large amount

2. Ease accessibility to goods,

3. Place to sit (in front) when no customers around

Preliminary Ideation



Back- view with
closed roof

Back side
foldable cover

Key features

4. Vendor just need to cross across the sit to access goods,

Preliminary Ideation

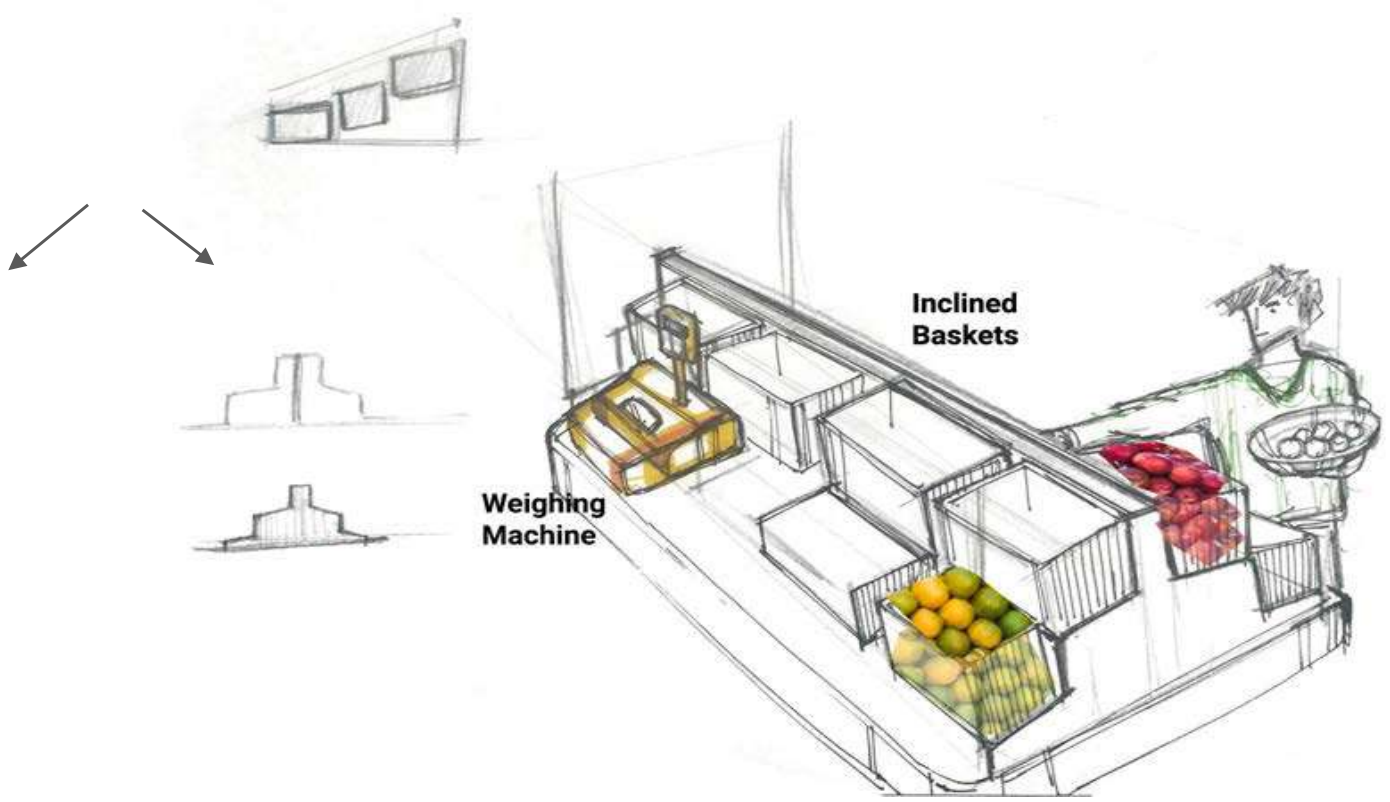
Arrangement of goods (idea)

Key features

1. Goods are kept inclined in 2 levels for ease visibility,

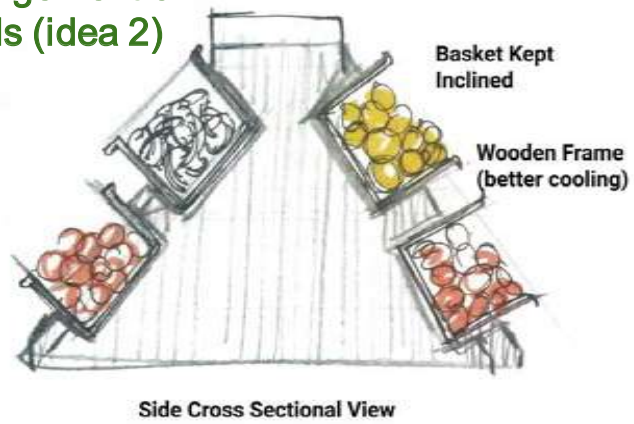
2. Easy to access goods

3. Different baskets for variety of goods

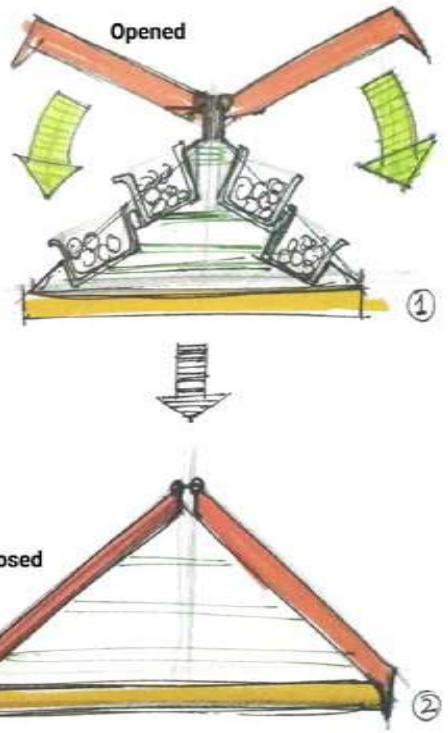


Preliminary Ideation

1. Arrangement of goods (idea 2)



Side Cross Sectional View



Key features

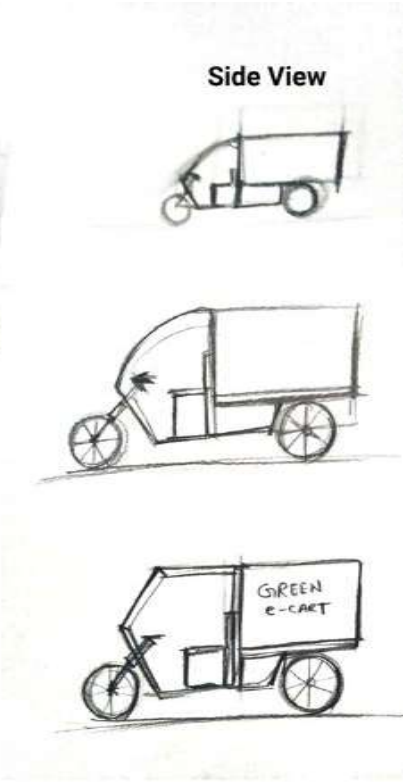
4. Foldable parts: Can be fully packed inside for safety of goods

Preliminary Ideation

1. E- cart : Frame design ideas

Key features

1. Place to sit comfortably
2. More space to keep goods
3. Easy to arrange goods separated,
4. Freedom to move around for more business



Project Budget

Budget for Phase-I : 6 Months - Preliminary Study and Proof of Concept (PoC) / Test Rig

	Particulars	Unit Cost	No of Units	Months/Times	Total Costs
A.	Recuring Expenses				
1	Salary of Staff/Expert Fees				
1.1	Project Director/PI Services	0	1	6	0
1.2	Product Designer	50000	1	6	300000
1.3	Mechanical Engineer	40000	1	6	240000
1.4	ITI Trained/Diploma, Mechanical	25000	1	6	150000
1.5	Honorarium: Technical/Industry inputs/Design inputs/Content creation/Rural FGD content and plan/interns	100000	2	1	200000
1.6	Road Safety regulations, Motor Vehicle Act, Industrial Production, Legal inputs	100000	0.5	1	50000
1.7	CPTS/Support staff for Studio Tasks	10000	1	6	60000
	Sub-Total				1000000
2	Prototype Development (Proof of Concept/Rig/Test Prototypes)				
2.1	TA/Study of various cart types, material uses, manufacturing processes/ MSME/Vendor/Industrial units and equipment manufacturers				100000
2.2	Cost of Raw Matarial, Facility use, Machine Use, material & equipment procurement, transportation, and Labour Charges, Technology sample for trial and testing, Multiple Rig development and testing, Ergonomic, Testing, Muscular Skeletal testing, Occupational Fatigue Assessment.				400000
	Sub-Total				500000
3	Documentation, Promotion and Branding				
3.1	Video documentation of process and product development	75000	2	1	150000
	Sub-Total				150000
4	Contigency, Cost Escalation and Misc. Expenses	0	0	0	100000
	Total Recurring				1750000
B	Non-Recurring Exp				0
5	Equipment etc.				
	Computer Systems with Graphics, 3D modeling, Technical Analysis, and accessories.	75000	4	1	300000
	Total Project Cost [A+B]- Ph-1				2050000
C	IITB Overhead Charges				
6	Towards R&D Facilities, Space, and other Facilities used, Administration, Accounts, Audit etc.	20%	1	1	410000
	TOTAL BUDGET FOR PHASE-1				**2460000**

Budget for Phase-II : 6 Months - Market test, Production Ready Final Prototype & Vendor Interface

	Particulars	Unit Cost	No of Units	Months/Times	Total Costs
A.	Recuring Expenses				
1	Salary of Staff/Expert Fees				
1.1	Project Director/PI Services	0	1	6	0
1.2	Product Designer	50000	1	6	300000
1.3	Mechanical Engineer	40000	1	6	240000
1.4	ITI Trained/Diploma, Mechanical	25000	1	6	150000
1.5	Honorarium: Market/Technical/Industry inputs/Design inputs/Content creation/ Market FGD content and plan/interns	100000	1	1	100000
1.6	Road Safety Guidelines &regulations, Motor Vehicle Act, Use Capacity, Industrial Production, Legal inputs	100000	0.5	1	50000
1.7	CPTS/Support staff for Studio Tasks	10000	1	6	60000
	Sub-Total				900000
2	Prototype Refinement and Development (Final Prototypes)				
2.1	TA/Study Cart Production/ material uses, manufacturing processess/ MSME/Vendor/Insustrial units and equipment manufacturers				50000
2.2	Cost of Raw Matarials, Facility use, Machine Use, material & equipment procurement, transportation, and Labour Charges, Technology sample for trial and testing, Multiple Rig development and testing, Ergonomic, Testing, Muscular Skeletal testing, Occupational Fatigue Assessment.	200000	1	1	200000
2.3	Market Testing: Market trials, Vendor Interface sessions, Vendor Workshop, MSME production worksop, production and assembly assessment.	200000	1	1	200000
	Sub-Total				450000
3	Documentation, Promotion and Branding				
3.1	Video documentation, product and process disemination, Poduction & assessembly modules	0	0	0	0
3.2	Promotion of new Vegetables Carts among Vendors, Manufacturers and MSME assessment & system integration for production.	200000	1	1	200000
	Sub-Total				200000
4	Contigency, Cost Escalation and Misc. Expenses	100000	1	1	100000
	Total				1650000
B	Non-Recurring Exp				0
5	Equipment etc.				
	Computer Systems with Graphics, 3D modeling, Technical Analysis, and accessories.	0	0	0	0
	Total Project Budget[A+B]- Ph-2				1650000
C	IITB Overhead Charges				
6	Towards R&D Facilities, Space, and other Facilities used, Administration, Accounts, Audit etc.	20%	1	1	330000
	TOTAL BUDGET FOR PHASE-2				**1980000**

Budget for both phases

TOTAL PROJECT BUDGET				
Phase-1				2460000
Phase-2				1980000
GRAND TOTAL				4440000

Includes IIT Bombay overheads.
No Consultancy Costs are charged to this project.
Taxes applicable as per norms.

References

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Thank you

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