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
- Most cases male
- Middle aged having small families
- Educated with experience of less than 10 years in street vending

## Working
- Start their vending at 7 - 8 AM and continued up to 9 - 10 PM
- Minimum 6 hrs, maximum 15 hrs per day

## Prep
- Cleaning and preparation - half an hour to 2 hours

## Daily Income
- Rs. 100-300
- Rs. 300-500
- Rs. 500-1000

## Items Sold
- Vegetables, fruits, fish, meat
- Flowers and readymade garments

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**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

Cart Inventory & Spaces

A. Type 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 shelter
   - With shelter
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
- 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

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.

Baskets below

Puncture tyres, bad in conditions
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

Key Insights:

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

Bringing a stool to sit
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
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

Farm 1
Farm 2
Farm 3
Farm 4
Farm 5
Farm 6
Farm 7

Agent 1
Agent 2
Agent x

Logistics agents

Trucks
Trains

Wholesaler

Retailer
Shops

Local wholesale markets

Cart vendors, a type of traditional retailers, buy vegetables from wholesalers or organised retailers, sell to customers in mobile carts and deliver to customers at customer’s doorsteps.

Cart vendors might organise and arrange a common transport from the wholesale market to the locality and then load them to the carts.

Rural Vegetable Supply Chain - Tamil Nadu

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

The rural sales mostly depend on unorganised traditional retailers.

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

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Agricultural Production</th>
<th>Post harvest</th>
<th>Processing and Packaging</th>
<th>Distribution handling and storage</th>
<th>Consumption</th>
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</thead>
<tbody>
<tr>
<td>Fruits and Vegetables</td>
<td>15%</td>
<td>9%</td>
<td>25%</td>
<td>10%</td>
<td>7%</td>
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</table>

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.
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

Modularity for assorted inventory

Metal mesh boxes
- Modular
- VISIBILITY OF GOODS
- Large quantity
Preliminary Ideation

Foldable shade

01 Folded position

02 Deployed position

03 With water proof cover
Preliminary Ideation

Cart with shade and seating facility

01 Retracted position

Handle for pushing

02 Extended position

Shade for sun & rain

Water tank
1. Lighting in the interior for use at night

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

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

4. To ease movement

5. Shutters that extend as platforms where weighing scale and other objects can be placed
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
6. Customisable dividers to adjust as per quantity of items
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
4. Vendor just need to cross across the sit to access goods,
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
Preliminary Ideation

1. **Arrangement of goods (idea 2)**

   - Basket kept inclined
   - Wooden frame (better cooling)

Key features:
- Foldable parts: Can be fully packed inside for safety of goods
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

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<th>Particulars</th>
<th>Unit Cost</th>
<th>No of Units</th>
<th>Month(s)/Time Total Costs</th>
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<td><strong>A. Recurring Expenses</strong></td>
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2.2 Cost of Raw Material, 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.

Sub-Total: 400000

500000

150000

150000

100000

1750000

300000

2050000

410000

2460000
# Budget for Phase-II: 6 Months - Market test, Production Ready Final Prototype & Vendor Interface

## A. Recurring Expenses

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## B. Prototype Refinement and Development (Final Prototypes)

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## 3. Documentation, Promotion and Branding

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## 4. Promotion of new Vegetables Carts among Vendors, Manufacturers and MSME assessment & system integration for production.

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## C. IITB Overhead Charges

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## TOTAL BUDGET FOR PHASE-2

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Budget for both phases

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


http://www.fao.org/3/s8620e/S8620E0a.htm
https://www.researchgate.net/publication/235752179
https://en.wikipedia.org/wiki/Tamil_Nadu_State_Agricultural_MarketingBoard
http://agritech.tnau.ac.in/agricultural_marketing/agrimark_List%20of%20uzhavar%20shandai.html
Thank you

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