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Product Design Intervention: A Study Of Selected Street Food Cart

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Abstract:
Street food is now one of the go-to options for urban people in their hectic schedules. Street foods are cooked and sold by vendors, often in the streets, as ready-to-eat meals. Food vendors on the street are stationary, semi-mobile, or mobile. Customers typically base their decision on food quality, flavour, service hygiene and attractive cart design. Street food vendors customise their carts based on the food they sell and the comprehension of their needs.

The study examined various current street food carts based on ease of operations, hygiene, food safety, aesthetics, and design. The study determined that the existing street food vending cart has a lot of room for improvement, especially in terms of its design, leading to overall better food vending experience. The findings showed a need to standardise the parameters for upgrading the present cart design based on contemporary features, improved aesthetics, increased functionality, and a future-ready solution.

Keywords: *Street food cart design, street food, food safety, regulatory compliance, street food vending, hygiene.*[1]

1. Introduction:

Street food reflects India's cultural variety. Street food's unique taste, presentation, and experience make it popular. "The Food and Agriculture Organization (FAO) and the World Health Organization (WHO, 2017, p.1) define street foods as ready-to-eat foods and beverages prepared and sold by vendors or hawkers, especially in the streets and other similar places". Street food is a global urban, cultural, social, and economic phenomenon. Passivity and less time spent cooking at home are becoming the norm. There are a lot of different kinds of street food, from quick meals to classic dishes. The food is affordable, easy to access and can be vended in small spaces. The term emphasizes 'in the street' vending; therefore, push carts, bicycles, and baskets carried on the head are used to sell and move goods. Due to pavement or other public/private spaces, they may be immobile. Street vendors can be mobile, semi-mobile, or immovable. (WHO, 2017, p.1) State Street food is valued for its convenience and "role in societies' cultural and social heritage." Street food sales support millions of impoverished people. Starting street food vending requires few skills and inexpensive overhead.

"(Sundaram, 2008, p.1) mentions in The National Policy for Urban Street Vendors/Hawkers that street vendors constitute approximately 2% of the population of a metropolis". According to (Fellows et al., 2011, p.2), other estimates put India's street food sellers at around 3 million." Street selling creates self-employment and promotes local culture and tradition. The street food business employs two main groups: the informal

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sector, which has lower educational credentials, and the formal sector, which has chosen it owing to the economy's shrinking and merging (Bhowmik et al., 2005, p.2262).

"(Khairuzzaman et al., 2014, p.1) state that street food vendors lack awareness about safe food handling, the environment, sanitation and hygiene, food display methods, food service, potable water use, etc." Vending carts are not scientifically designed. According to the citation, vendors found unsanitary raw food washing and utensil cleaning facilities. Under the Food Safety and Standards Act, 2006 (FSSA, 2006, p.1), the Food Safety and Standards Authority of India (FSSAI) is responsible for "laying down science-based standards for articles of food and regulating their manufacture, storage, distribution, sale and import, to ensure availability of safe and wholesome food for human consumption and matters connected in addition to that or incidental to it." (FSSAI, reg., 2011) Food Business Operators (FBOs) must follow sanitary and hygiene practices to be licensed and registered under the Food Safety and Standards (Licensing and Registration of Food Businesses) Regulation 2011, notified under the FSSA, 2006. Petty makers, including street food sellers, must be registered and meet Schedule IV Part I (A)'s sanitary and hygienic criteria to ensure food safety.

"(Street et al., 2020, p.1) say the street food industry is huge and unorganized. The FSSAI "Clean Street Food Hub" project strengthens the sector and improves street food safety and hygiene. The lack of basic infrastructure and regulated Food safety Vending Cart models makes street food vending difficult to improve." Compliance with these regulations requires various parties with diverse roles. Intensive training, capacity building, and awareness of street food sellers to improve their hygiene procedures (Choudhury et al., 2011) address hygiene issues. The country needs more effort to develop carts that handle aesthetics, modular components, ergonomics, illumination, food storage, food display, environment protection, waste disposal, cart safety, branding, etc. Therefore, research was done to identify design changes in street food carts using FSSAI's "cart design guidelines" under Clean Street Food Hub (Guidelines et al., 2019).

Ahmedabad, Gujarat, has a booming street food business. India's first heritage city has great tourism potential, and street food helps promote it. (Sundaram, 2008, p.1) states that there are "more than one lakh street vendors in Ahmedabad" and that the law has dramatically increased the city's daily population. According to observation, the seller fails to provide hygienic meals. (Deore et al., 2019) that customers of all socioeconomic levels, like Ahmedabad Street food, are sceptical about sanitation. The famous street foods in the city are Sevpuri, Pani Puri, Maggie & Pasta, Momos, Frankie, Sandwich, Puff, Muska Bun, Dal Vada, Chole Kulche, Pav bhaji, Fancy Dosa, Fafada, Paratha, Puri Shak, Vadapav, Dabeli, etc.

Interviews with street food sellers were employed for concentrated case-study research. The study is limited to Ahmedabad's major street food hotspots. Case-study studies and surveys cover various aspects of street food vending. However, this study shows how street food merchants currently use carts. It also addresses how to enhance street food cart design to solve street food vending difficulties.

This paper outlines new directions for designing street food vending carts. New designs can boost existing vendors' profits and attract new street food businesses.

1. Methodology

One definition of design is problem-solving. Designers start design problems with incomplete and imprecise perceptions of design goals. Several paths may solve the issue. Determining the design problem is the first and most important step. This stage is crucial to understanding street food vending carts today. Understanding is vital because it affects future research and processes. The product acceptance model analysed food vending cart

challenges, including practical, socio-cultural, legal, and environmental factors. Functional design emphasizes product adoption's usefulness, usability, and user experience. (Kotwal et al., 2019, p.273) states, "The design's utilitarian qualities include functions, durability, and versatility. The design's usability features include ease of use, efficiency, and effectiveness. The user experience of the design solution considers aspects like arousal, semantics, trust and loyalty, identity issues of the product with the user, etc."

(Kalita et al., 2017, p.93) suggested "Visual ethnographic narratives, observations, and interview" methodologies are used to document forty street food vendors. Based on (Chakravarty, 2020) questions about the vendor's activities at the cart, various concerns about ergonomics and usability, safety, storage, garbage disposal, and food display were inquired. The cart's hygiene, product standards, and aesthetics were all observed. Photographs, videos, and interview methods were among the information acquired.

This exploratory study helped create a thorough questionnaire to learn about street food vendors difficulties and perspectives. According to (Kotwal et al., 2019), knowing the street cart user's work environment, tasks, and behaviours was crucial. User research methods included "ecosystem analysis, DILO analysis, and task analysis."

In July–October 2021, 100 Ahmedabad Street food sellers were surveyed for "An empirical study of design elements of semi-permanent food vending setup and its implications for street food vendors." The poll includes mobile street food vendors serving prepared cuisine. A questionnaire was given to assess the "owner's socioeconomic status, technical knowledge and skills, existing facilities at the vending site, relationship with the cart, awareness of legal compliances, assessment of training requirements, assessment of adequate food safety, hygiene needs, aesthetics" and cart appeal (Kotwal et al., 2019, p.266). A 30-point observation list supplemented the 100-question questionnaire. Unbeknownst to the street food seller, the cart's location, vending practices, and vendor cleanliness were observed. The study only included pushcart vendors offering prepared meals, not fruit juices, ice cream, water, or other drinks. The sample size was determined based on food availability, street selling position, and market size.

The study selected 10 khau galis (street food lanes) in Ahmedabad's West, South, North West, and Central Zones. Manek Chowk, Vastrapur Lake, CEPT & HL Lane, SG Highway (Rajpath Club), Sindhu Bhavan Road, Gujarat College, Kankaria Lake, Municipal Market, and Bhatiyar Gali. The areas were selected due to frequent flow of students, labourers, residents, and office workers.

This study recommends design features for cart aesthetics, functionality, ergonomics, usability, and consumer satisfaction.

2. Results & Findings

2.1. Results of Preliminary Study

The study of design, functionality, and usability was the basis for Visual Documentation. The information gathered was divided into the following categories: demographic study, preparation study, utility study, storage analysis with accessible storage mapping, storage mapping and water storage mapping, reachability analysis, pain and discomfort analysis, and other features study.

2.1.1. The following are the details of one preliminary study case study of street vendors.

2.1.1.1. Demographics details:

Figure 1: Photo of the vendor

Street food vendor Kanhaiyalal Kumavat, 26, is from Bhilwara, Rajasthan. His family of four lives in Memnagar, Ahmedabad. At CEPT University Khau Galli, he sells Maggi, Pasta, Momos, and Frankie from 8 a.m. to 10 p.m. on a pushcart. His customers include nearby college students, daily wagers, auto rickshaws and cab drivers, and passersby. His daily earnings are 1500–2000 rupees. Before Covid, he earned 2000–2500 rupees daily. He used savings and borrowed money from his family to pay around 35000/- rupees. His height is 5'7". He has pain in different body parts while working on the cart. He's unaware of changing cart design and technology. In the interview, he said he would upgrade his cart if it improved storage, manoeuvrability, and aesthetics and helped him grow his business.

2.1.1.2. Preparation Study:

For preparation study, the process of preparing Frankie was studied. It took 10 minutes for the vendor to serve the dish. It requires moderate-level cooking skills to prepare it. The dish can serve one person.

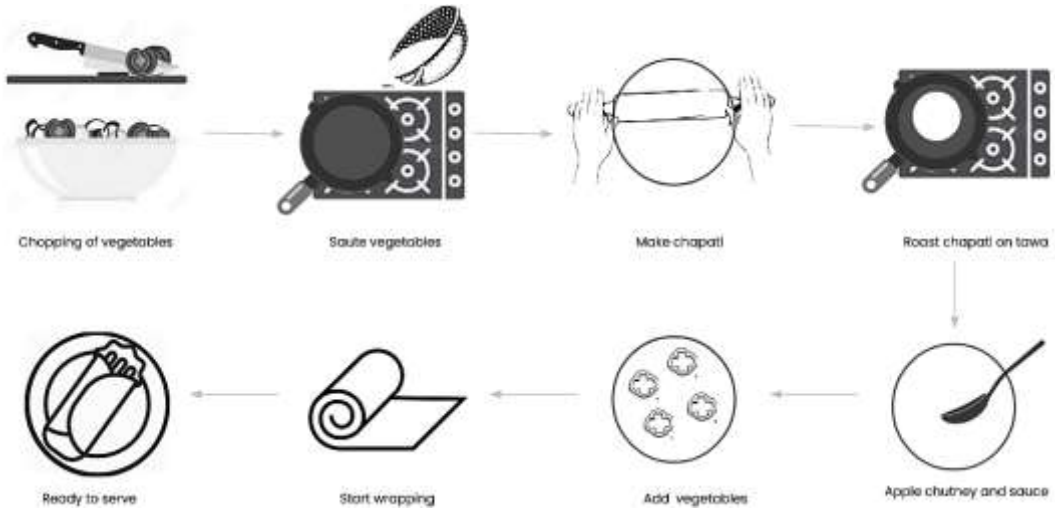

Figure 2: Illustrative representation for process of making Frankie

After setting up the cart, the seller cuts vegetables and makes chutney and sauces. The action is repeated throughout the day as needed. The diagram above shows how the street food seller makes Frankie. Only sautéing veggies and chapati roasting is done in real time before assembling and serving the Frankie.

2.1.1.3. Storage and Placement Study:

Figure 3: Front and Back view of the cart

Figure 3 depicts the cart's front and back views. The observation concluded that the cart includes storage above the working area and on the top of the cart, which is not visible from the front view due to the enclosure displaying the cart's branding.

Figure 4: Storage above working area, on the working area and below the working area

Figure 5: Storage of cutlery, water and momos steamer

For easy access, frequently used objects are kept near the cooking apparatus (Figure 4). Figures 4 and 5 show the additional storage above the cart for cutlery, raw materials, and hooks for hanging tools. Figure 4 displays a food item in the working area for vendor convenience and extra storage space below the cart, where he keeps supplies and a stool. Water is stored in a steel drum behind the cooking unit in Figure 5. Figure 5 shows the cart's roof-mounted Momos cooker removed. The vendor stores vessels, raw vegetables, plates, cutting boards, all chutneys and sauces, Maggi packets, and water according to use. The gas pipe to the cylinder is limited and must be placed in a particular location, so the cooking apparatus cannot be fixed.

Figure 6: List of major items available on the street food cart

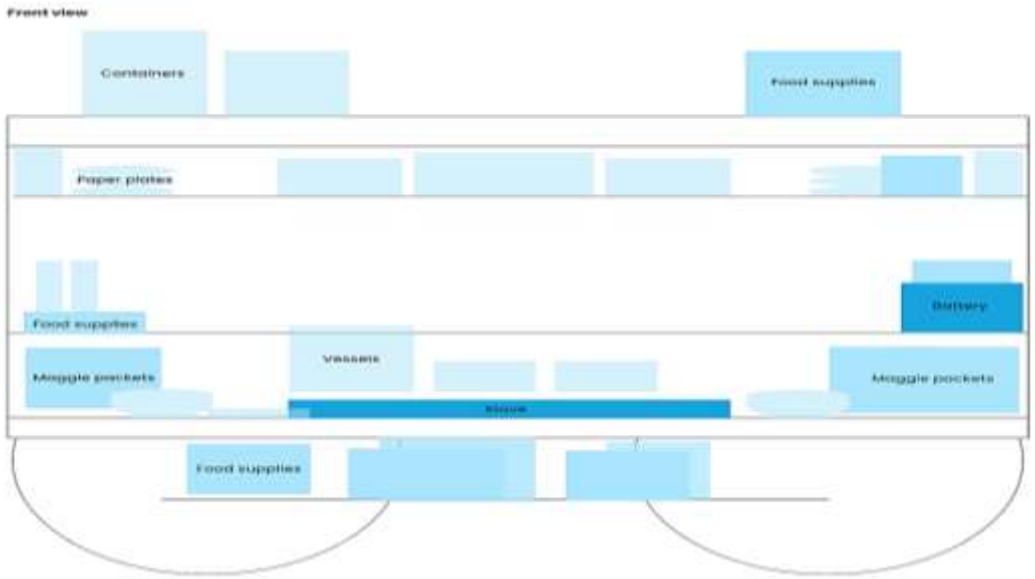

Figure 6: List of major items available on the street food cart

Figure 6 shows a visual list of items in the cart. Figure 7 depicts how the various items are arranged and positioned on the cart.

2.1.1.4. Activity Study:

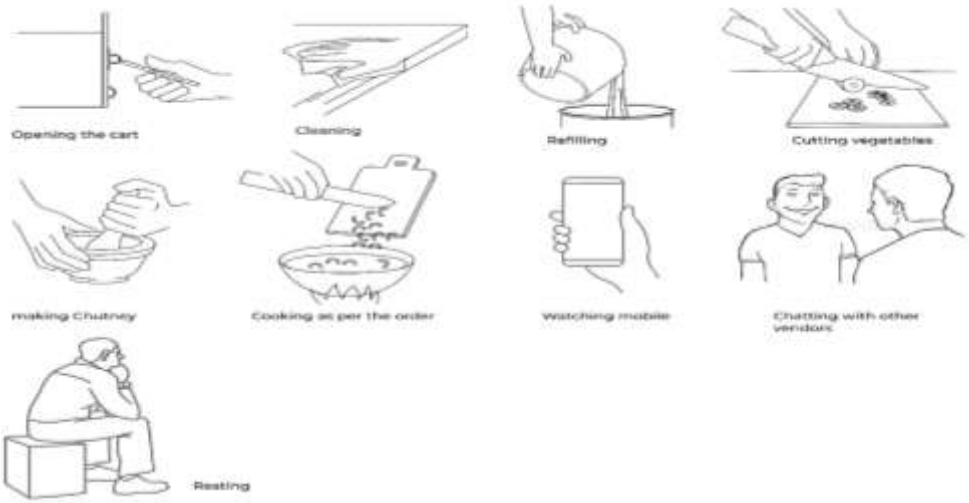

Figure 8: Activity study

The section depicts the vendor's daily working, idle, and leisure activities. His job involves setting up the cart, preparing food, and cooking on the cart. His idle activities include cleaning the cart, preparing and replenishing his supplies, and resting. During pastimes, the vendor talks to his fellow vendors and watches his phone.

2.1.1.5. Ergonomics Study:

This section depicts the vendor's interaction with the cart while preparing the meal.

Figure 7: Placement diagram of major items

Figure 8: Activity study

Figure 9: Utility Storage

Figure 9 shows that the position of items is determined by the availability of storage and preparation space, as well as the frequency with which they are used. Dedicated preparation and storage area is not allocated. Frequently used items like chutneys, sauces, cheese, cutting boards, and others can be reached by moving a small distance right. Less-used larger vessels are stored on the cart's roof, which are difficult to access. The vendor uses the icebox for support because he has no seating arrangement.

Figure 10 shows a body proportion analysis of the vendor's cart reach. It indicates that the cart has a congested space layout, and the vendor has to go above and beyond to access critical storage spaces for food preparation. Better space planning is needed to

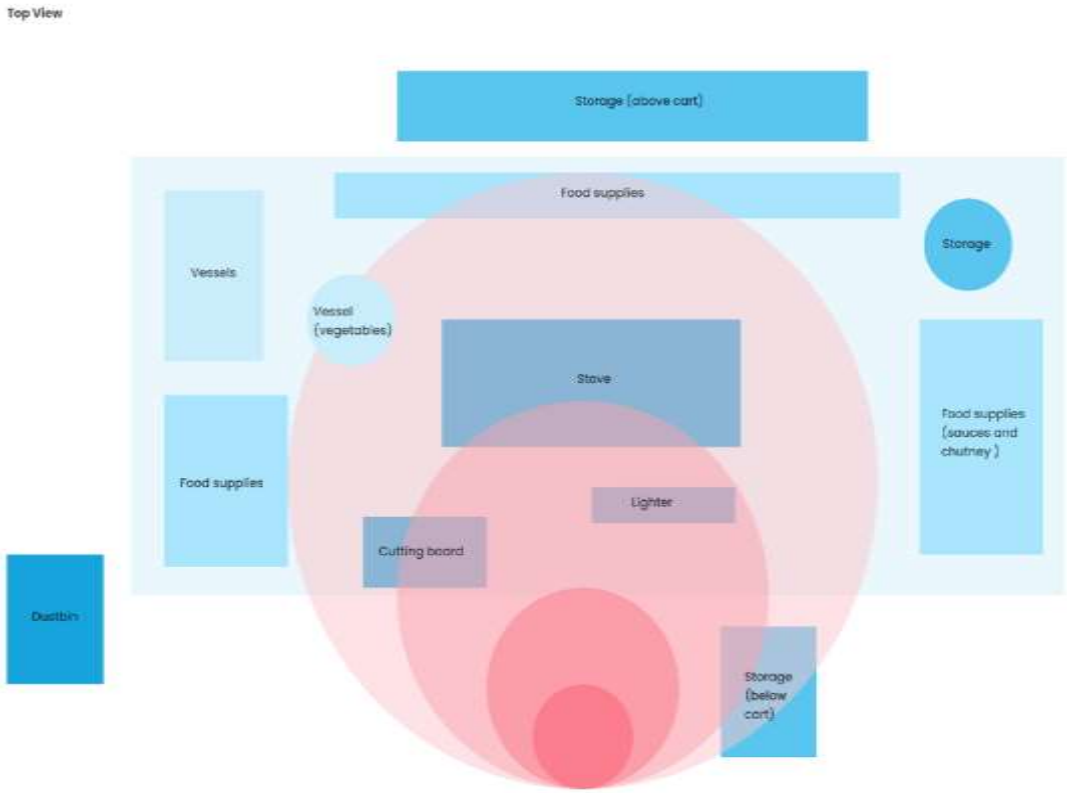

Figure 10: Vendor reachability analysis diagram

keep essential equipment and ingredients accessible to the vendor.

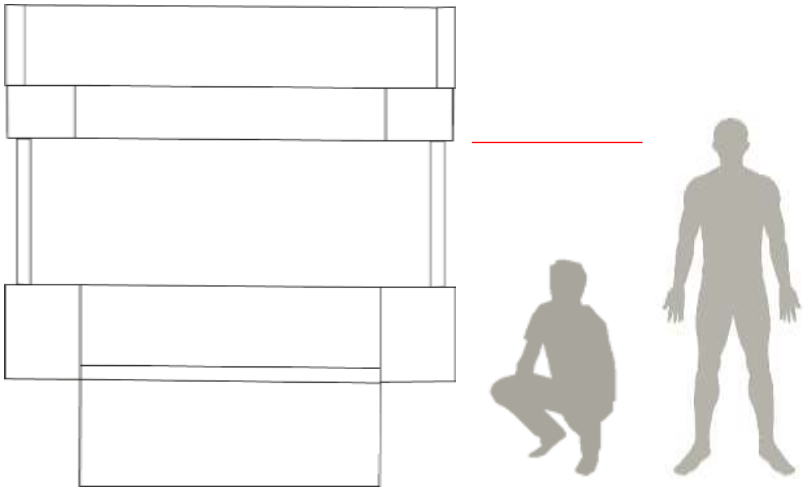

Figure 11: Human proportion with the cart

Figure 11 represents the vendor's proportion to the cart while bending and standing. It is observed that the vendor can access 3/4th of the cart. The vendor must stretch to reach the roof area and bend to reach the space under the preparation area.

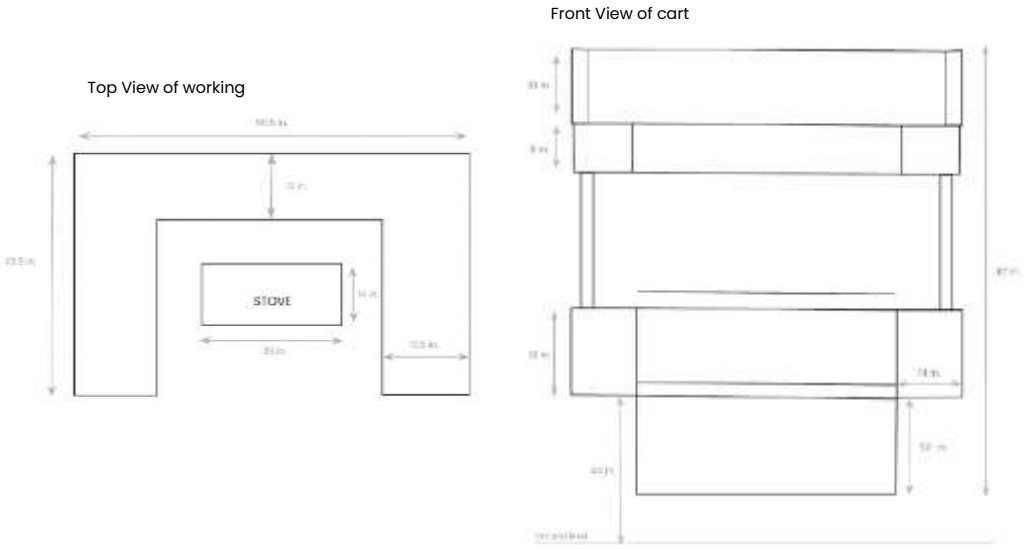

Figure 12: Dimension of the cart in inches

Figure 12 represents the dimensions of various cart sections. It shows that, despite the large area occupied by the cart, there are still space and ergonomic issues observed in the Ergonomic Study.

2.1.1.6. Hygiene Study:

Figure 13: Cutlery and additional material storage

Figure 14: Water storage and vessel condition

Figure 15: Handling of momos steamer

Figure 16: Use of bucket as dustbin

Figure 13 shows the cutlery and raw vegetable storage area. Again, the area looks dirty. The steel water storage tank is near the cooking equipment in Figure 14. Water is handled with bare hands and a steel glass. The study found that the vendor cooks multiple meals in one vessel without cleaning it. When the day ends, the vendor cleans the vessel by the road. Figure 15 shows vendor accessing the Momos steamer on the cart's rooftop. Figure 16

Figure 17: Hygiene practice while preparation of food

shows a bucket being used as a dustbin which remained open was was surrounded by flies. The vendor doesn't use the dustbin provided by the government.

Figure 17 shows that, despite being aware, the vendor does not adhere to basic hygiene practises. Before starting to prepare a new meal, the vendor does not wash his hands. He doesn't wear a cap or gloves. He uses his bare hands to gain access to all of the raw materials.

Figure 18: Hygiene practice after serving of food

Figure 18 shows how the vendor cleans cooking equipment and prep space. The study found that the vendor cleaned with the same cloth after each meal and washed it at home. The vendor also uses the same cloth to clean his hands after discarding plates and cutlery. While cleaning, small preparation leftovers were thrown on the ground. Vendors ignore the Municipal Corporation's Covid Protocol guidelines.

2.1.1.7. Form and Material Study of the Cart:

Figure 19: View of the cart

Figure 19 shows the cart's front and back views. The cart has a rectilinear, boxy, and geometric design, as seen in the photo.

Figure 20 captures the cart's main base structure, which is made of mild steel and wood to ensure its durability. The cart's pillars are made of stainless steel. The area where food is prepared is covered with sheet metal to make it easy to clean. The utilization of durable materials decreases the need for repair and maintenance.

Figure 20: Material of the cart

2.1.1.8. Aesthetics & Communication on the Cart:

Figure 21: Aesthetics on the cart

Figure 21 shows how vendors display food in closeup photos. Internet reference photos are not from the same cart. Figure 21 illustrates how the cart communicates graphics, colour, finish, and typography.

Figure 21 shows red, yellow, and blue as the cart's aesthetic and communication colours. Bright colours attract customers but look monotonous like other street carts. The placement of elements is cluttered; dust covers the food photos, dulling them even when gloss vinyl is pasted for cart communication.

Figure 22: Banner on cart

Figure 23: Font styles used on banner of the cart

Figure 22 shows the banner being placed on the cart. Three font styles are used with varying weights and styles. Figure 23 depicts a font style that is used for specific communication.

Figure 24: Menu card available at the cart

Figure 24 shows the menu card that is available on the cart. The communication language used in the menu card design is similar to the language used in the banner design. However, photographs of food items on the menu card are more specific and provide better communication than the banner. There are only a few spelling and detailing mistakes.

Overall, the cart's communication and design language are inconsistent.

2.1.1.9. Other factors related to Cart:

Figure 25: Cart's relation with the environment

The cart is on a busy route. The cart's customer are mostly local college students. Many people stop by the cart because it's in one of the city's most renowned khau gallis. Figure 25 displays no weather protection for the cart's open parts or vendor. Therefore, the seller carries plastic sheets to hang over the cart during strong rains and storms. Figure 25 shows the cart's folds. These parts help lock and clothe the cart. After the day, the cart is placed on the roadside. The cart's weight and tires make it hard for the seller to move from the parking place.

The cart lies beneath a tree along the route, so natural light is enough for repairs on bright days. It also gives shade to the vendor during Ahmedabad's hot summers. In the nighttime, the cart features a battery-powered lamp on top. The lamp only illuminates kitchen areas, not dining areas. No ornamental lights on the trolley. Thus, only spotlights can identify the cart.

2.1.1.10. Legal Compliance Study:

The vendor lacks FSSAI and Hawking licenses. He is unfamiliar with government food preparation, storage, and vending hygiene regulations. Vendor has no reason for not registering for either License. Additionally, the vendor is unaware that he can register with the Ahmedabad Municipal Corporation's Street Vendors portal. He is unaware of government subsidies, tax benefits, and schemes.

2.1.2. The summary of the entire preliminary study of forty street food vendors is shown below.

2.1.2.1. Demographics Study

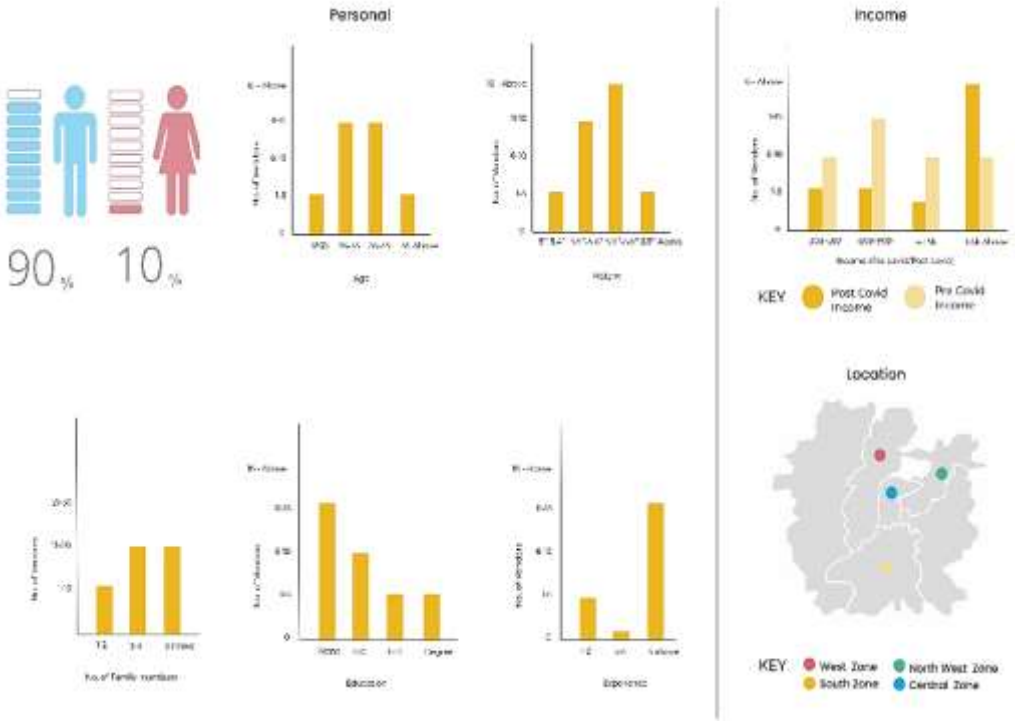

Figure 26: Demography Analysis

According to the study, most street food vendors are concentrated in Ahmedabad's West Zone and North-West Zone.

According to the study, the cart is mostly used by middle-aged men. Most vendors are illiterate but have more than four years of street food vending experience. Most importantly, their income has decreased since the Covid pandemic.

2.1.2.2. Preparation Study

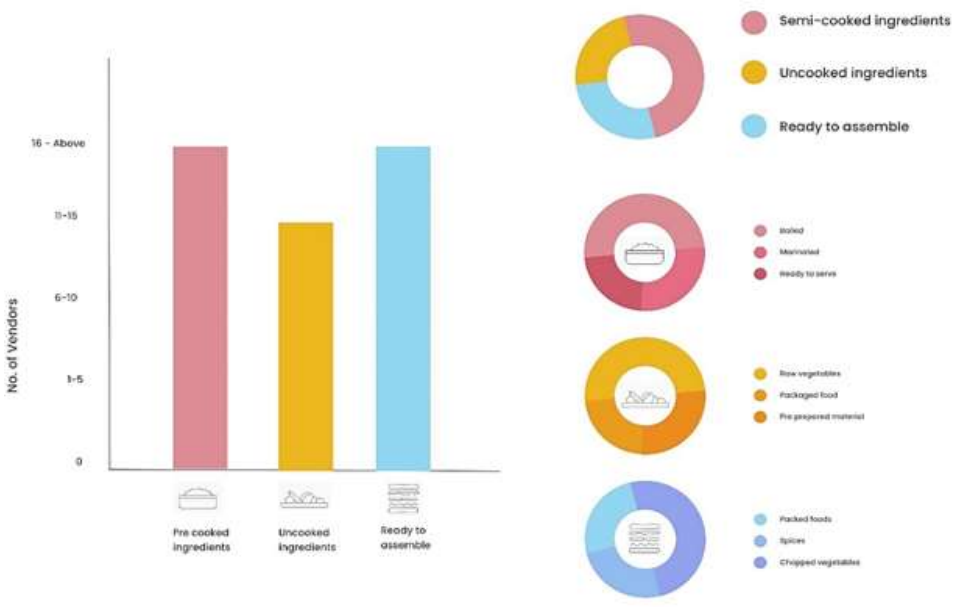

Figure 26: Preparation Study

According to the preparation study, vendors have a wide range of ingredients and use different cooking methods for different food items.

2.1.2.3. Storage Study

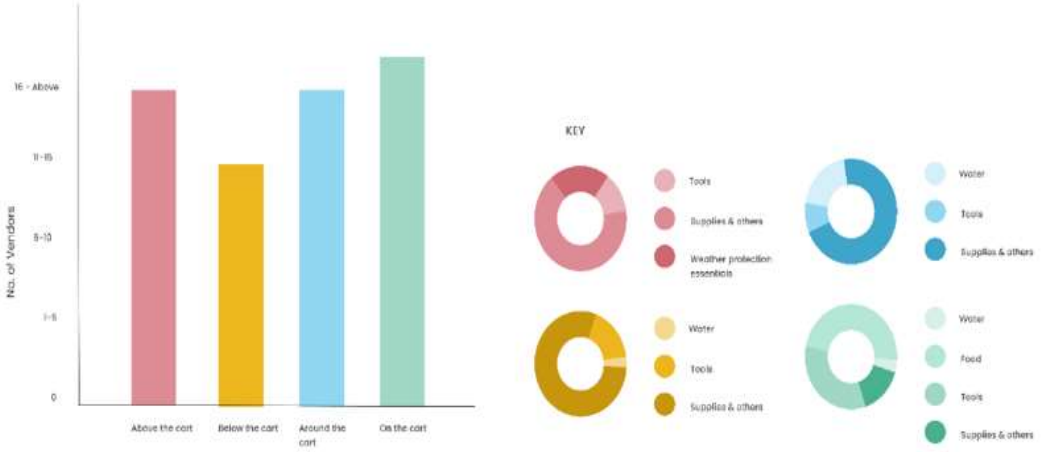

Figure 27: Storage Study

The storage study discovered the location of storage in relation to the cart. It also reveals the maximum amount of space occupied by various supplies on the cart in relation to the storage location.

2.1.2.4. Utility Study

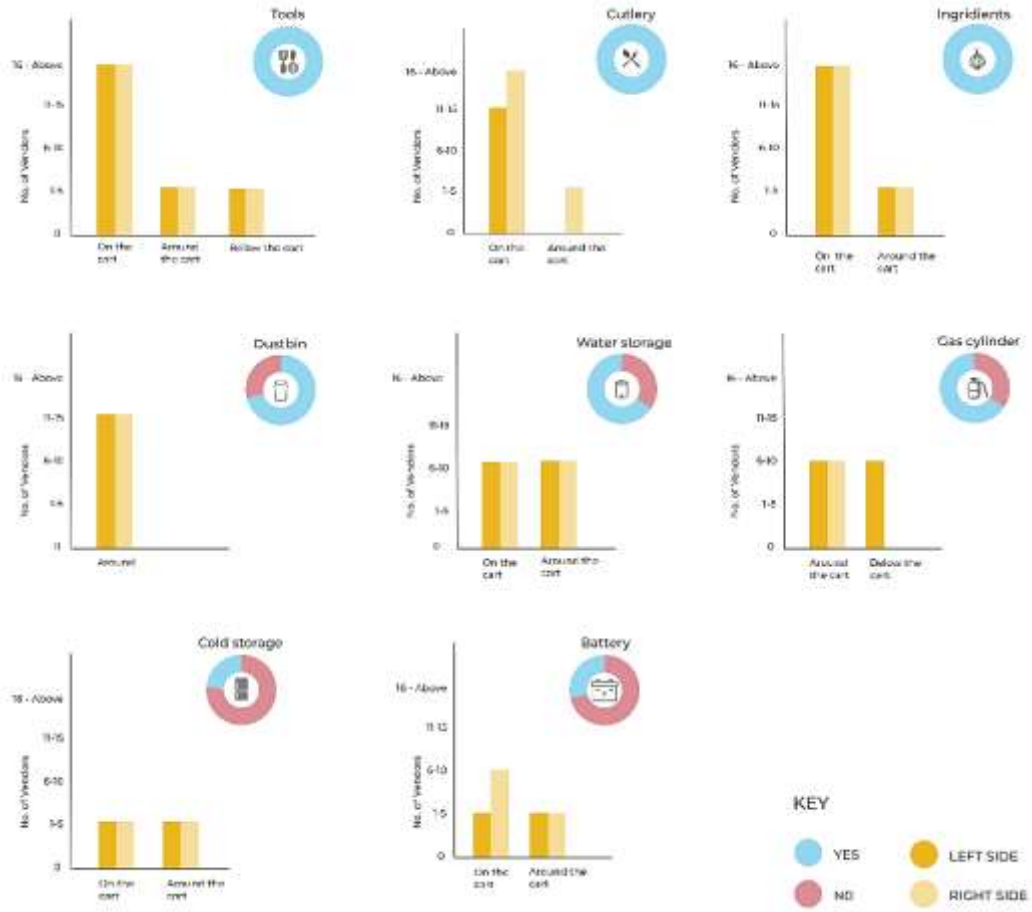

Figure 28: Utility Study

Utility Study aided in understanding the position of utilities in relation to the cart. Various utilities such as tools, cutlery, ingredients, dustbin, water, battery, and gas cylinder were considered during the study.

2.1.2.5. Storage Analysis

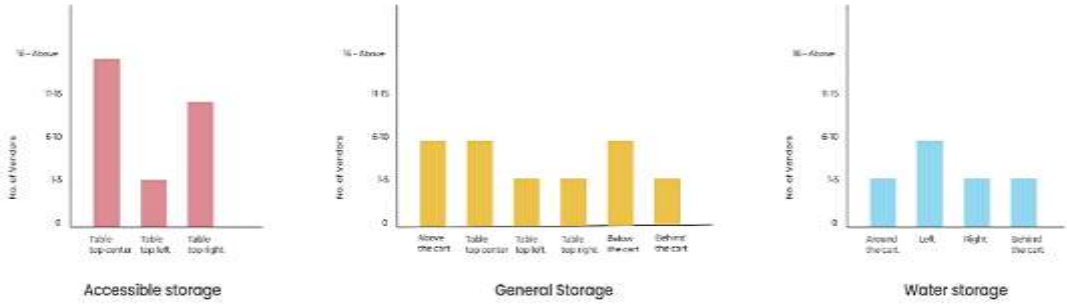

Figure 29: Storage Analysis

The vendor's storage needs are classified into three categories: accessible storage, general storage, and water storage. Items frequently used while preparing each meal are kept in easily accessible storage. General storage includes items that are needed daily, whereas water storage includes potable and drinking water storage.

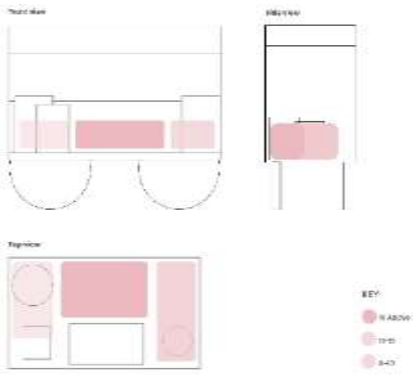

Figure 30: Accessible storage mapping

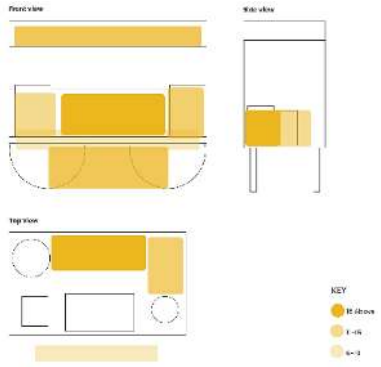

Figure 31: General storage mapping

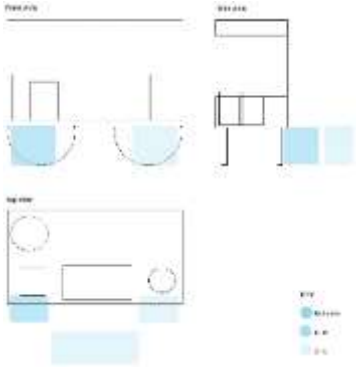

Figure 32: Water storage mapping

Figures 29 and 30 show that the vendor prefers accessible storage to be in the centre of the preparation area above the cart. Figures 29 and 31 also show that vendors use different locations above and below the cart for general storage. Figures 29 and 32 show that the water storage should be on the left side, next to the cart.

2.1.2.6. Reachability Analysis

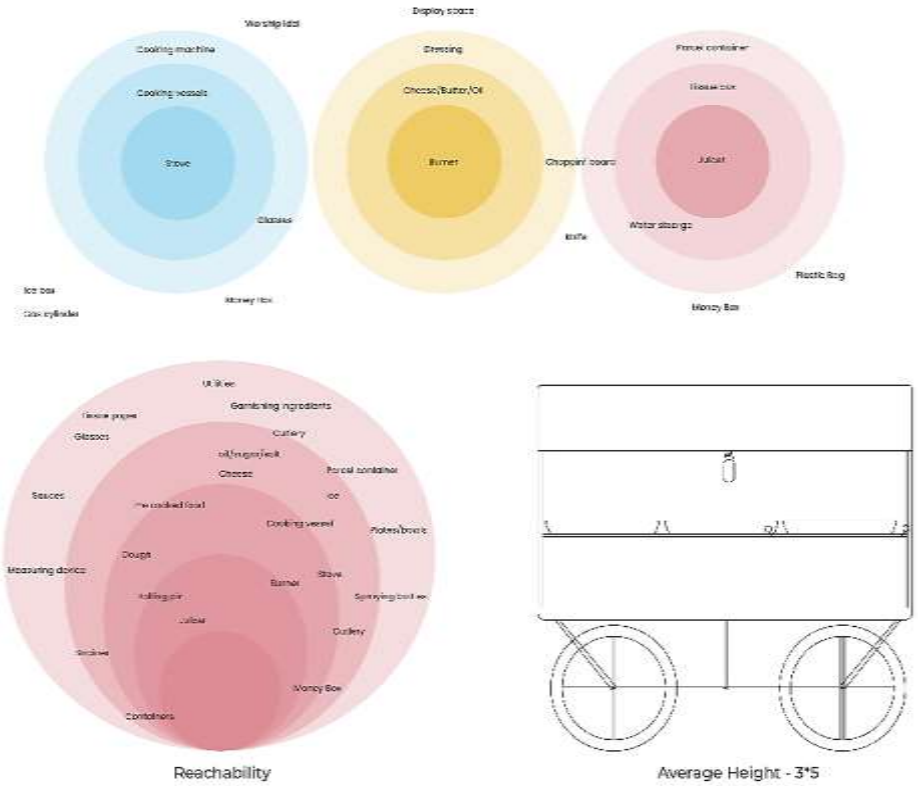

Figure 33: Reachability Analysis

Reachability analysis demonstrates how vendors reach from the centre of the cart to various parts of the cart for a variety of activities. Figure 33 depicts the vendor's current reachability and how he has placed various components within his reach.

2.1.2.7. Pain & Discomfort Analysis

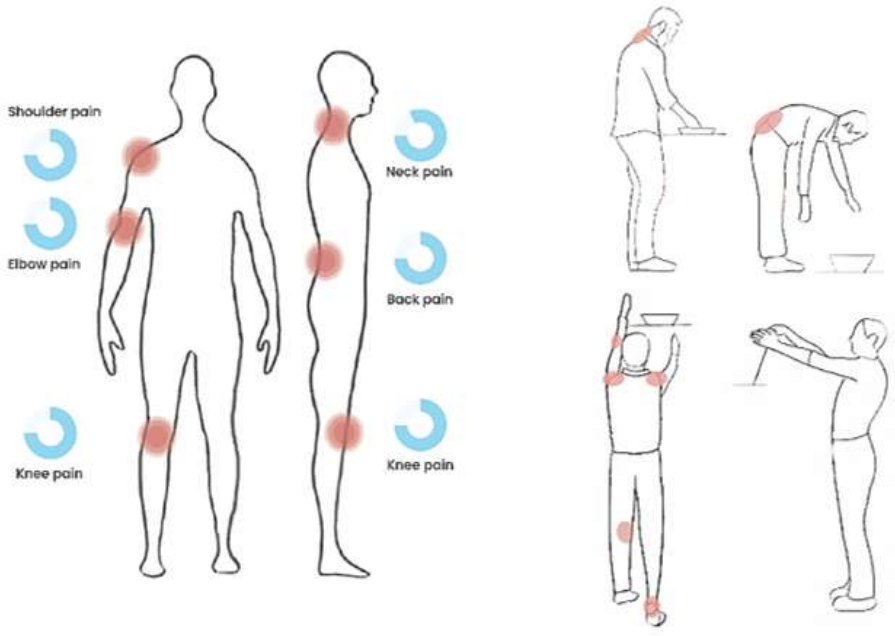

Figure 34: Pain and Discomfort Analysis

Figure 34 shows that most vendors suffer shoulder, elbow, knee, neck, and lower back pain. Figure 34 also shows how bending, picking items from the roof and continuously working at the preparation area causes the vendor discomfort.

2.1.2.8. Other features Study

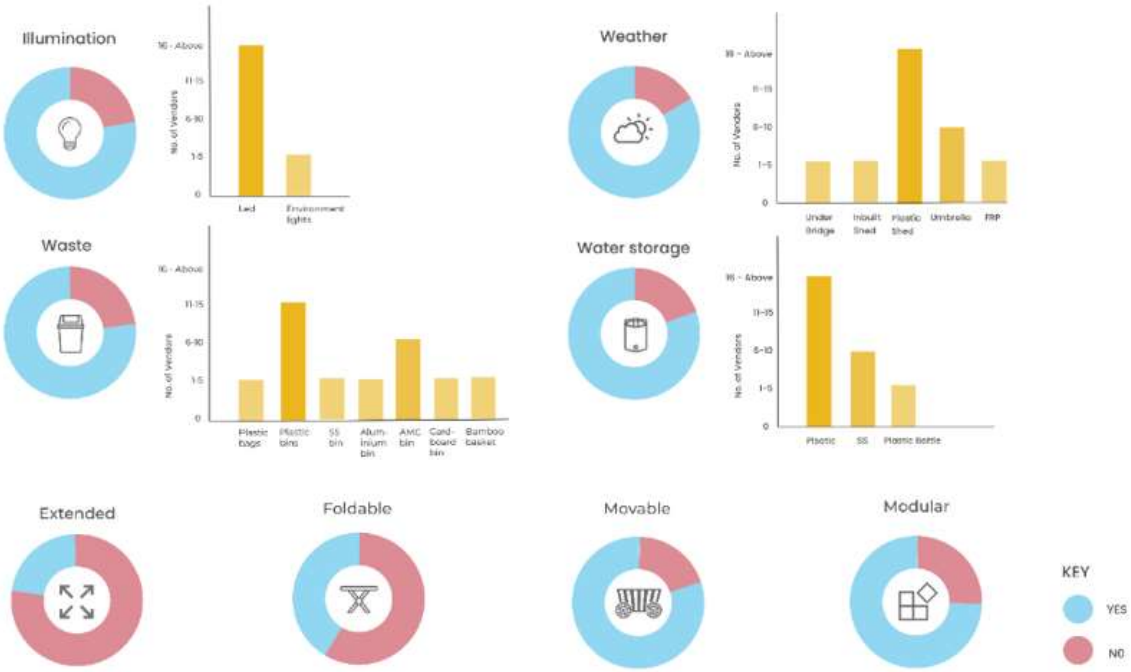

Figure 35: Other features study

Figure 35 shows that most vendors have LED lighting in their work areas. Most vendors cover their carts with plastic during extreme heat and heavy rains. According to the study, most vendors store water in plastic drums. Regarding waste disposal, most vendors use municipally provided plastic bins.

Figure 35 shows that most of the carts don't have extensions that are attached to the main body of the cart. Half of the carts have flaps that can fold down to close the central body area of the cart. Most carts can move from one place to another. Finally, the majority of carts have modular components.

3.1.3. Conclusion of Preliminary Study

The overall visual documentation was based on visual ethnographic narratives, observations, and interviews, which led to the development of a base structure for a questionnaire for a future survey. Demography study, business details, satisfaction and importance to the vendor of aesthetics, ergonomics, usability, convenience, storage, safety, maintenance, hygiene, legal benefits, customization, and adaptability were the major sections identified for survey-based study.

2.2. Results from Survey

The results reported in this section are from the survey and are primarily concerned with food carts. 35% of the 100 urban street food vendors interviewed are from Gujarat, 36%

are from Rajasthan, 23% are from Bihar, and 4% are from other places, including Nepal. Most street food vendors were migrants from rural areas looking for work.

22% of the street food vendors were aged 18 to 25, 35% were aged 25 to 35, 30% were aged 35 to 45, and only 13% were over 45. Female street food vendors made up only 2% of the total.

Regarding educational qualifications, 34% had completed primary education, 36% had completed secondary education, 18% had completed higher secondary education, 5% had completed their graduation, and only 5% were illiterate.

56% of street food vendors know about the FSSAI License, but only 29% of them have gotten it. Even though 64% of street food vendors know about the Hawking License, only 33% of them have it.

15% of street food vendors sell Chole Kulche/ Bhature, 14% sell Maggie/ Pasta/ Momos & Frankie, 10% sell eggs, 9% sell Bhel/ Chaat/ Pani Puri, and the remaining street vendors sell a variety of items listed in Table 1.

Table 1: Distribution of sample by type of food sold at the cart

Food Item	**Frequency**	**Percentage**
Chole Kulche/ Bhature	21	15.00
Maggie / Pasta / Momos / Frankie	19	13.57
Eggs / Omelette	14	10.00
Bhel /Chaat/ Pani Puri	12	8.57
Pizza / Sandwich /Puff / Maska Bun	11	7.86
Samosa / Kachori/ Gathiya / Dal Vada	9	6.43
Pav Bhaji/ Dosa	9	6.43
Idli Wada Sambhar / Poha	9	6.43
Vada Pav / Dabeli	9	6.43
Sev Puri	7	5.00
Paratha / Puri Shak	7	5.00
Dhana Chicken/ Silly Ghosh/ Non. Veg	3	2.14
Chinese / Momos / Barbeque	7	5.00
Dhokla	1	0.71
Choda Fali	1	0.71
Corn	1	0.71
Total	**140**	**100**

Most of the people who visited the street food carts were students (25%) and passers-by (25%), with 21% being service professionals, 15% being auto rickshaws and cab drivers, and 14% being labourers/daily wagers.

Only 39% of street food vendors use stand-alone setups, while 61% use various sizes of Push Carts. 60% of the carts are made of wood and metal, and around 20% are made of wood, metal, and plastic. The remaining carts are made of a single material of metal or a combination of metal and plastic or wood and plastic. 42% of vendors use carts that are 6x4 feet in dimensions, 35% use carts that are 5x3 feet, 16% use carts that are 3.5x2.5 feet, and the remaining 5% have frugal setups that are odd sizes.

56% of vendors use more than 60% of the cart space for preparation. 47% of vendors use 40-70% of the cart area for storage, which includes above the preparation area, on the preparation area, and below the preparation area. Figure 36 depicts the same thing visually.

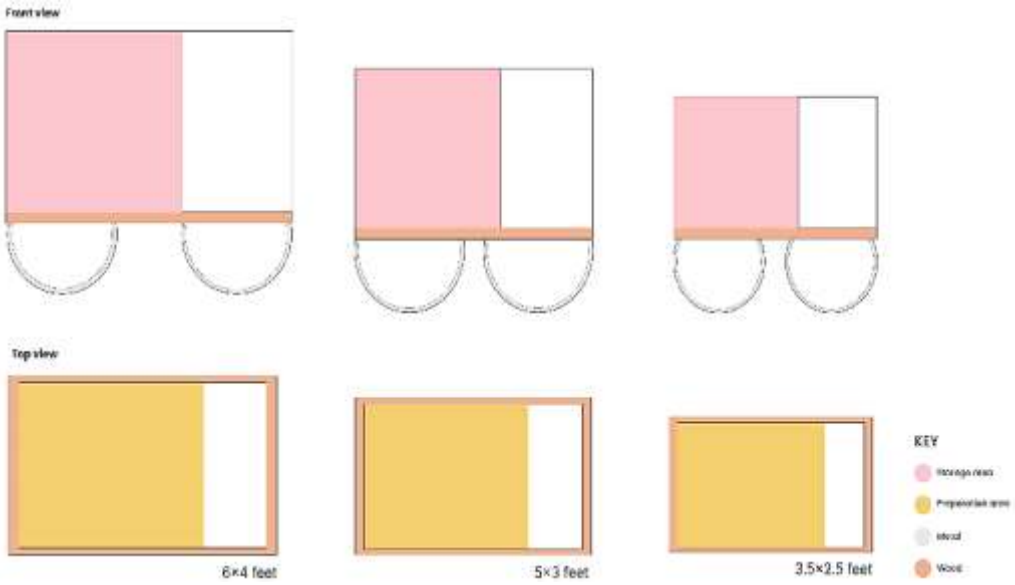

Figure 36: Representation of cart sizes vs storage area

67% of vendors keep pre-cooked food on the cart, 60% keep raw food on the cart, and similarly, major regular required items for preparation and serving are kept on the cart. Most vendors keep drinking and potable water, garbage bags, and fuel sources near the cart, while most keep fuel sources below the cart. According to research, vendors prefer to store all items on the cart's left side in a detachable storage unit. Only the potable water storage unit, fuel supply, battery, and garbage bins are on the cart's right side. Table 2 contains detailed information about the placement of items in relation to the cart. Furthermore, most vendors display food in an open or near the preparation area by storing food in an open cooking vessel. Figure 37 shows the storage mapping of various containers based on their placement, position, and material.

Table 2: Distribution of sample by placement of storage container used to store 'Pre-Cooked Food Supply' at the cart

	On the cart	**Above the cart**	**Below the cart**	**Around the cart**	**NA**	**Total**
Pre-Cooked Food Supply	67	14	3	6	9	100
Raw Food Supply	60	14	12	6	7	100
Drinking Water	27	10	11	39	13	100
Potable Water	19	9	11	45	15	100
Packaging Material	59	29	8	2	2	100
Cutlery	70	17	5	2	5	100
Fuel Source	11	7	35	27	20	100
Battery Supply	29	14	21	9	27	100
Ice	17	9	6	15	52	100
Garbage Bags	12	7	24	34	22	100
Tools	71	17	6	4	1	100

Accessories	64	15	9	8	3	100
Apparatus	63	14	8	8	6	100

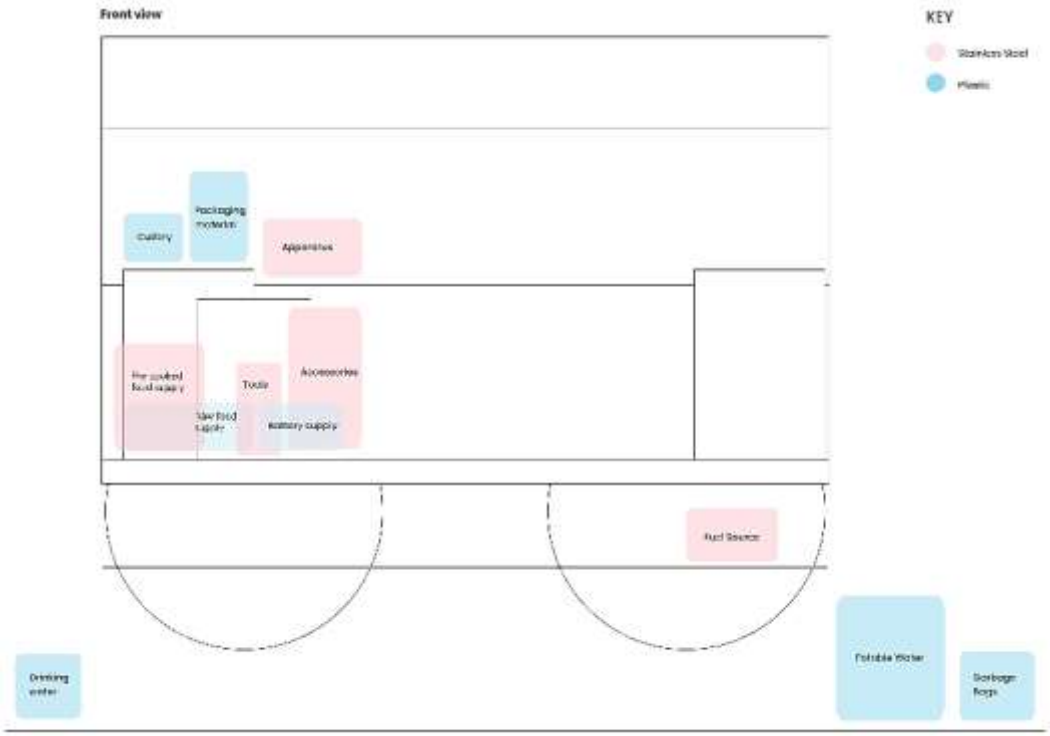

Figure 37: Storage mapping

51% of vendors use Ahmedabad Municipal Corporation garbage bins, 36% use baskets, and the rest manage it frugally. 60% of vendors put their trash in a corporation container, 32% use another bag, and the rest throw it on the roadside.

63% of vendors had personalized carts at the time of purchase. More than 65% of vendors consider cart selection factors "moderate to extremely important." Table 3 details it. However, nearly half of vendors are "not at all to moderately satisfied" with cart selection factors. The details are in Table 4.

Table 3: Opinions on the significance of various factors when selecting the existing cart

	Not at all important	**Slightly important**	**Moderately important**	**Very Important**	**Extremely important**	**Total**
Aesthetics	8.2	30.6	39.8	16.3	5.1	100
Scope of Modification	4.1	22.4	40.8	24.5	8.2	100
Ease of Repairability	3.1	22.4	28.6	30.6	15.3	100
Storage Facility	3.1	19.4	35.7	32.7	9.2	100
Water Storage Facility	6.1	20.4	32.7	29.6	11.2	100
Safety during the Operations	4.1	25.5	34.7	28.6	7.1	100
Safety at the Parking	11.2	19.4	28.6	33.7	7.1	100

Garbage Disposal Facility	5.1	11.2	40.8	31.6	11.2	100

Table 4: Opinions on the level of satisfaction with factors influencing cart selection

	Not at all Satisfied	**Slightly Satisfied**	**Moderately Satisfied**	**Very Satisfied**	**Completely Satisfied**	**Total**
Aesthetics	7.1	26.5	42.9	18.4	5	100
Ease of Usage	3.1	13.3	37.8	38.8	7	100
Ease of Setting up	4.1	14.3	40.8	31.6	9	100
Scope of Modification	5.1	21.4	36.7	27.6	9.2	100
Ease of Repairability	4.1	17.3	44.9	25.5	8.2	100
Storage Facility	8.2	27.6	37.8	20.4	6.1	100
Water Storage Facility	10.2	33.7	32.7	17.3	6.1	100
Safety during the Operations	7.1	27.6	39.8	22.4	3.1	100
Safety at the Parking	16.3	29.6	26.5	21.4	6.1	100
Protection from Environment	10.2	30.6	33.7	22.4	3	100
Ease of maintaining Hygiene	5.1	16.3	40.8	29.6	8	100
Garbage Disposal Facility	4.1	21.4	37.8	30.6	6.1	100
Scope of Illuminating the cart	5.1	23.5	38.8	25.7	7	100

About 57% of street food vendors want to upgrade their water storage. Nearly 60% of vendors want better cart money storage and security. Over 60% of vendors want built-in storage facilities, food display facilities and dedicated fuel source storage, 48% want dedicated inverter storage, and 75% want modular storage.

56% of vendors store pre-cooked food in stainless steel. Other cart items are kept in stainless steel or plastic containers. 61% of vendors want better cart working lighting. Cart vendors prefer matte or gloss finishes. The vendors are open to adding multiple languages to their cart, especially English. 61% of vendors want cart usage and parking safety improvements. 73% of vendors wish for a better cart weather safety feature. About 62% of vendors want better garbage and leftover disposal management.

61% of vendors are willing to change cart sizes. 75% of vendors want cart redesigns. 54% of vendors prefer better cart fabrication and development materials. Backlit or frontlet signage is fine for vendor carts. 60% of vendors prefer white LED lighting for cart illumination and ambience. 60% of vendors prefer red and yellow cart branding. Table 6 lists the details of the study.

Table 5: Preference for upgradation of existing features of the cart.

	I have and I am willing to update	**I don't have but I am willing to update**	**I have but I am not willing to update**	**I don't have and I am not willing to update**	**Total**

Availability of Drinking Water	32.7	24.5	33.7	9.2	100
Availability of Potable Water	35.7	23.5	28.6	12.2	100
Security of Money	28.6	32.7	31.6	7.1	100
Built in Storage Facility	32.7	35.7	25.5	6.1	100
Space for Fuel Setup	11.2	49.0	23.5	16.3	100
Space for Inverter	14.3	34.7	14.3	36.7	100
Modular Storage space	20.4	55.1	9.2	15.3	100
Matte finish	13.3	33.7	12.2	40.8	100
Glossy finish	16.3	28.6	21.4	33.7	100
English language for Communication	18.4	29.6	25.5	26.5	100
Hindi language for Communication	21.4	28.6	27.6	22.4	100
Gujarati language for Communication	25.5	21.4	36.7	16.3	100
Multi language for Communication	18.1	32.7	13.3	35.7	100
Illumination around the Working Area	37.8	24.5	26.5	11.2	100
Built in Food Display Facility	20.4	42.9	16.3	20.4	100
Safety of Cart	26.5	35.7	28.6	9.2	100
Safety of Goods During Parking	19.4	40.8	24.5	15.3	100
Weather Protection	37.8	35.7	19.4	7.1	100
Provision of Dumping Leftover	31.6	30.6	27.6	10.2	100
Garbage Disposal Facility	41.8	25.5	24.5	8.2	100
Customizing Size	33.7	27.6	22.4	16.3	100
Modifying Shape	24.5	29.6	21.4	24.5	100
Modification of Material	22.4	31.6	23.5	22.4	100
Back Lighted Signage	15.3	41.8	11.2	31.6	100
Front Lighted Signage	18.4	36.7	11.2	33.7	100
Vinyl Pasted Signage	20.4	31.6	21.4	26.5	100
Surface painted Signage	24.5	28.6	16.3	30.6	100
White Light Illumination	33.7	26.5	23.5	16.3	100
Yellow Light Illumination	13.3	26.5	7.1	53.1	100
Red, Yellow Colour Palette (Warm Colours)	29.6	31.6	16.3	22.4	100
Blue, Green Colour Palette (Cool Colours)	16.3	23.5	15.3	44.9	100
Multi Colour Palette	19.4	32.7	11.2	36.7	100

52% of street food sellers sell 50–100 plates each day, 26% sell 10–50 plates, and 22% sell more than 100 plates. About 50% of vendors offer plates between Rs. 50-100, 38% between Rs. 15-50, and 12% over Rs. 100.

Street food sellers have invested less than Rs. 15000 in their cart, while 20% have invested more than Rs. 50000. 25% of merchants invested Rs. 15000–Rs. 30000, while 18% invested Rs. 30000–Rs. 50000. 33% of sellers will rebuild their cart, but 29% will not update it.

24% of merchants want their cart fixed, while 14% want a new one. For cart improvements, 28% of vendors are willing to invest between Rs. 10000 and Rs. 20000, 21% are willing to pay more than Rs. 30000, 15% are willing to invest between Rs. 10000 and Rs. 30000, and 18% are willing to invest less than Rs. 10000.

Despite this, 76% are unwilling and 24% will take credit or loans for the improvement.

3. Conclusion & Recommendations

User feedback on cart features was collected using visual ethnographic narratives, observations, interviews, and surveys. Cart design factors include aesthetics, utility, ergonomics, usability, and consumer enjoyment.

Street food cart design is crucial to regulatory compliance, says the study. A well-designed street food cart may increase vendor experience, food safety, and consumer satisfaction. Design literature provides many design methods. Some projects have improved street food cart design. Some solutions (Kalita et al., 2017) target a certain street dish. Kolberg (Cross et al., 2000), suggests splitting design challenges into smaller pieces for investigation. On the same principles, the identified design considerations are defined as below:

1. **Cart aesthetics and consumer delight:** Today, aesthetics is a crucial factor. The cart's shape has never changed. Therefore, changing it will make street carts look better. Contemporary colours, materials, and unique finishes will enhance its aesthetics. Cart graphics also have mostly remained unchanged. Adopting unique typefaces and creating food menu displays are areas for improvement. Adding colour and creativity to food displays will boost the cart's value and customer satisfaction.

2. **Cart functionality:** The cart structure should be sturdy. Functional material should be employed. The cart should be spacious for convenient use. It should also include space for ads, menus, FSSAI licenses, health and hygiene messages, and cart ratings. Cart safety, especially the fire extinguisher, is essential. Finally, the design should consider incorporating solar roofing, GPS, POS, etc.

3. **Ergonomics:** The new cart designs should suit men and women. The cart's design should be based on Indian anthropology data to meet various accessibility difficulties.

4. **Usability:** Considering the number of things a vendor stores on the cart, the cart should be effectively designed. In addition, there should be a designated storage area for raw materials, cooked/finished food, cutlery, etc. Furthermore, the cart should provide a solution for waste disposal and potable water usage. The solution should add modularity to enhance vendor convenience. The cart should be well-lit and shielded from the environment and mosquitos. The cart should be manoeuvrable and capable of towing.

In March 2017, doctorate students from the Academy of Scientific and Innovative Research (AcSIR) surveyed street food in Mysore and discovered that street vendor carts were deficient in infrastructure and ergonomics (CFTRI et.al., 2017), The Central Food Technological Research Institute (CFTRI) scientists created the "Smart Cart" model. An energy-efficient solar-powered modular street selling cart costs 50,000–2 lakhs. According to the literature and the study, many street food entrepreneurs may not want to acquire these expensive carts. Hence the study proposes following three directions:

1. Basic cart enhancements with an emphasis on usability and aesthetics
2. To design carts based on upcoming industrial design and food vending trends.
3. A cart that is future-ready by incorporating emerging technology.

The table below explains how the three directions of solutions would differentiate from one another:

	Traditional Cart	**Modern Cart**	**Futuristic Cart**
Cart Aesthetics:			
Form	Boxy, Linear	Minimal	Sleek, Dynamic
Colour	Warm Colours	Warm & Cool Colours	Theme based
Material	Wood + Metal	Metal + Glass	Plastic + Metal
Finish	Gloss	Matte	Metallic/ Gloss
Graphics	Direct photographs	Gradients & illustrations	Infographics, Motion graphics
Typeface	Sans Serif	Sans serif with elegant and minimal font styles	Sans serif with geometric, futuristic, abstract, or urban font styles
Cart Functionality:			
Size	6x4 ft, 5x3 ft., 3.5x2.5 ft.	8x5 ft., 3x6 ft. 2x7 ft., 3x3 ft.	6x3 ft. 3x2 ft.
Structure	Heavy Metal frame with Wooden planks	Design of Chassis with proper weight distribution	Unibody
Hygiene	Cleaning with a cloth and cleaning solution	Use of gloves, head gear and wipes	Use of hand sanitizer, equipment for personal hygiene, and the right uniform
Illumination	Use of fixtures and energy supply	Integrated wire management system and fixtures	Touch less illumination fixtures
Safety	Locking system for safety of cart and items on the cart	Integrated locking system into the chassis for better safety features	Integrated security cameras
Weather protection	Integration of hooks for	Integrated shed structure	Self-retractable structures

	mounting plastic sheets		
Maintenance	Simple to maintain and repair by the vendor	Integration of modular elements, making it easy to repair	Design based on compliance constraints
Technology	Integration of QR Code	Integration of POS, GPS, etc.	Solar panel, EV, and automation integration, as well as an app integration
Ergonomics:			
Placement	Better arrangement considering how it's being used now	Space planning as per vendor reachability analysis	Integrated space for placement as needed
Anthropology	Focus on male vendors	Focus on male & female vendors	Universal Design
Reachability	Adaptation of current vendor usage	Applying principles of physical, visual and cognitive ergonomics	Smart Mechanism integration to improve reachability
Usability:			
Storage	Stainless steel and plastic containers	Use of GN and PC Pans	Integrated food graded storage units
Waste Disposal	Waste bins that are enclosed and easy to clean and replace	Integrated waste bins	Waste bins that are modular and integrated into the chassis
Water Storage	Units that are lockable and transportable	Integrated potable water tank	Integrated water tank and drainage
Modularity	Detachable storage	Multi utility storage units	A homogeneous body with multiple utility storage units
Illumination	LED lighting to illuminate the work area	LED lights for illumination and aesthetics on the work surface	Smart Illumination and signage
Ventilation	NA	Use of exhaust fan	Use of chimney
Manoeuvrability	Simple to move and control	Improved wheel selection with a locking mechanism	Electric powered movement for convenience and control
Customization	Basic branding customization	Customization of the preparation area based on the type of food	Personalization extent

Legal Compliances:			
FSSAI License & Hawking License	Greater awareness of legal compliances	Carts that follow government guidelines and have a pre-approved licence	BIS-approved carts with pre-approved licence facility
Taxation	Awareness	Tax advantages for using such a cart	Tax exemptions for using such a cart
Govt. Loans & Schemes	Awareness	Subsidy and EMI based schemes	Bank microfinance and corporate social responsibility

The study proposes category-wise designs for standardising, similar to government-announced guidelines for the clean street hub initiative mentioned in (Street et al., 2020). The government may promote their adoption by providing information and creating financial incentives for street food entrepreneurs. Street food safety and consumer satisfaction require a combination of strategies, and standardizing street food cart design can help.

The solution will become more holistic when the study covers the viewpoints of consumers, designers, and fabricators. In addition, it would have a broader impact when it covers major street food destinations of the county.

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