MARKETING-RESEARCH-FINDING SENSITIVE VISUALISATION (MRFSV) METHOD FOR PRODUCT DESIGN WITH SPECIAL REFERENCE TO DOMESTIC DISHWASHING IN INDIAN CONTEXT

Thesis submitted in partial fulfillment of the requirement
for the award of the Degree of
Doctor of Philosophy

Pratul Ch. Kalita

Department of Design

INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
Guwahati–781039
April, 2012

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Certificate

24th April 2012

The research work presented in this thesis entitled 'Marketing-Research-Finding Sensitive Visualisation (MRFSV) Method for Product Design with Special Reference to Domestic Dishwashing in Indian Context' has been carried out under my supervision and is a bonafide work of Shri Pratul Chandra Kalita. This work submitted for the degree of Doctor of Philosophy is original and has not been submitted for any other degree or diploma to this institute or to any other institute or university. He has also fulfilled all the requirements including mandatory coursework as per the rules and regulations for the award of the degree of Doctor of Philosophy of Indian Institute of Technology Guwahati.

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Acknowledgement

I express my sincere gratitude to all those people who helped me during the research work and acknowledge the support received from various institutions; therefore I dedicate my works to all of them. Although it is impossible to name all people and institutions involved in this endeavor without missing some of them inadvertently, I would like to mention a few specifically. Shri Shantikam Hazarika, former and founder Director of Assam Institute of Management Guwahati, Shri Prafulla Kumar Sharma, IAS (Retd.) former chairman of the Assam Institute of Management and Chief Secretary to the Government of Assam, Shri Nakul Chandra Kalita, Administrative and Accounts officer of Assam Institute of Management, Dr. Nripendra Narayan Sarma, Director and ONGC Chair professor of Assam Institute of Management, Prof Maya Kant Awasthi of Indian Institute of Management, Lucknow are some of them who have helped me in many ways including academic suggestions and providing administrative facilities. I would like to express my sincere gratitude to Shri Abhijit Barooah, Managing Director, Premier Cryogenics for his sponsorship during my research paper presentation at the University of Illinois, Chicago. Here I take the opportunity to express my sincere gratitude to all the faculty members of Department of Design, IIT Guwahati for their inspiration and guidance.

I would like to offer my heartiest gratitude to all my post graduate management students of Assam Institute of Management for helping me in data collection and evaluation of the design ideas with focus group. I am grateful to the M. Des students of Department of Design, IIT Guwahati who helped me in the design idea generation process in the study.

Many individuals from industries encouraged me in this academic endeavor. I am grateful to Shri Kaushik Kr. Sharma of Alcatel Lucent, Bangalore, Ms. Anakshi Dev Choudhury of Millward Brown India, Shri Partha Gogoi of Deloitte, Washington DC for their valuable inputs, opinions and feedbacks.

I am grateful to my faculty colleagues of Assam Institute of Management for their inspiration and goodwill. I take the opportunity to express my sincere gratitude to all my friends and colleagues of Department of Design, IIT Guwahati, especially Nandita, Manoj, Sangeeta, Vikash and Prakash.

I must sincerely admit that the research work became productive due to the fact that my wife Smita, my parents Smti Daibaki and Ananda Ch. Kalita had borne all the hardship by allowing me to be free to work unhindered. I am indeed indebted to my two

sisters Jyotsna and Sorojini, my brothers-in-law Dhan and Sun and my beloved nephews Upasana and Niraj for their inspiration. The words of wisdom of my good old friend Shri Raktim Duarah will always remain with me. Their support would remain an inspiration for me forever.

Pratul Chandra Kalita

Abstract

Marketing Research is always a debatable topic. Serious questions are raised about the relevance of marketing research in successful introduction of products and services in the society. It has been observed several times that, marketing research studies may also lead to wrong decisions. In the context of product design, the failure may also occur due to ineffective communication of marketing research findings to the designers. In order to validate the idea that Marketing Research needs to consider actual user behaviour, and integrate the same with marketing research for ideation of design solution, a case study of 'domestic dishwashing in Indian context' has been considered. Dishwashing behaviour largely depends on food habit, type of cookware and utensils etc. Therefore a study was conducted to understand the consumer behaviour related to cookware, crockery and utensils in Indian context. Another study was conducted also to understand the consumer behaviour related to dishwashing in Indian context. The marketing research findings of the aforesaid consumer behaviour studies were communicated to the designers in conventional way. The design ideas generated through this conventional sharing of marketing research findings were evaluated using idea screening matrix and a focus group. The total score of the design ideas in idea screening matrix in this case was found to be low. A new method termed 'Marketing-Research-Finding Sensitive Visualisation (MRFSV)' was evolved to communicate the marketing research findings to the designers. Marketing research findings were further transformed with MRFSV method for ideation. The ideas generated from this process were evaluated with idea screening matrix and the same focus group. The comparative analysis of the design ideas generated with conventional sharing of marketing research findings and the design ideas generated after application of the MRFSV method was conducted. A very high significant improvement was observed in the scores of design ideas generated after application of MRFSV method. The study reveals that conventional sharing of consumer behavior to the designers may move away the designers from the design objective. The MRFSV method helps the designers in defining design problem. This method helps in establishing a direct relationship of defined design problem to designer's design solution. The synthesis of all the ideas generated through MRFSV yields wonderful design ideas.

Hypothesis

Design ideation improves with application of Marketing-Research-Finding Sensitive Visualisation (MRFSV) method in solving the design problem of domestic dishwashing in Indian context.

Preface and Background

We survive if we have food, clothing and shelter; but we create families, communities and civilizations by imbuing these basic requirements with meaning. Design allows us to both respond and invent. It is driven as much by desire as by necessity. Design occurs on many different levels, employing different processes and degrees of expertise. Design can be understood variously as craft, style, engineering, innovation, planning, refinement, management, as an exercise in taste or an act of choice.

Design existed in Paleolithic to Neolithic transformation. It was design for survival. The creative art aspects of design may be found in ancient cave arts. Therefore the basic urge for design is inbuilt in human nerve; creativity and necessity.

Designers are influenced by the prevailing ideologies of their times. Architects and designers are the first to respond to technology's seductive call. They were the first to experiment sensitive amalgamation of technology and art. The dominant design ideology in 20th century has been that of modernism. For instance, 'Kant Garage', Berlin, made in 1930 was first multistory garage in Berlin and is regarded as an early monument to the automobile. Six levels high, the RC concrete structure offered parking spaces for roughly 300 cars. The Bauhaus school, Germany, founded by Walter Gropius made a significant contribution in the field of industrial design. Bauhaus designers aimed to create standardized functional objects with universal appeal.

In modernism it was exclusive design for the elite. Some of the designs resulted in to very complex form and shape. Then in the post-world war and after the rock culture of 60s, simplicity of design came. It was the mass appeal in design, designed for mass production, and design for all.

Now in this new millennium when mass customization is coming up we need to design to satisfy individual customers need and that too in mass scale. A perfect blend of aesthetic, utility, usability, ergonomics and affordability components is needed to develop the quality of life of the customers.

In Indian context, this is the high time that the industrial designers pay attention to the needs of the poor. In the Voices of the Poor study conducted by the World Bank,

60,000 people were asked to name the number one thing they wanted. They said, "Technology and information, not food and charity." Poor people know that what keeps them poor is lack of competitiveness and knowledge. In the bottom of the pyramid what is required is both market development and creating technology solutions. The poor gets the products of world class quality at the most affordable price and they get empowered. We need the most advanced technologies in order to solve the problems of the poor (Prahlad C.K, 2003). Aesthetic and trendiness are becoming as important factors to Indian consumers as price. Now Business has discovered that Indian consumers are sensitive to design even at low cost price.

Today, one of the challenges posed to designers is presenting a humanistic and romantic image for high tech industries. If the enterprises of India are to survive and grow amidst intense competition they will have to go beyond importing western and Japanese technologies and management models to innovation. As far as product design is concerned, we need to integrate management tools for product design in Indian context. In the competitive environment of this complex world, product designers and the managers should work together in a team for sustainable growth of enterprises in India. In a country with a million contrasts what could be more constant and expected than change itself. This change may occur with design intervention with proper understanding of consumer behavior in Indian context. Interdisciplinary research in the field design and management is the need of the time. This study is an interdisciplinary research of product design and marketing research. In the course curriculum of business schools, product design is normally discussed in the production and operations management course. Product design is also discussed in course curriculums viz. marketing management, innovation management, technology management, corporate strategy etc. On the other hand, in design schools, marketing management tools and techniques are integrated in course curriculums viz design methods, design management etc. Again concepts of production and operations management, innovation management, technology management, corporate strategy etc. are integrated in product design courses of design schools. This study is an attempt to impart a holistic view of the academic discipline of product design and marketing research.

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2.0 ConsumerBehaviour Related to Cookware, Crockery and Utensils

A descriptive study was carried out to study the consumer behaviour in case of kitchenware. Results were published in the research paper entitled 'Identification of Design strategy for cookware products in Indian multi cultural context', conference proceedings, Vol.2, The seventh international symposium of Tools and Methods of Competitive Engineering (TMCE 2008) held in Izmir, Turkey on April 21-25, 2008. Simple random sampling technique was applied for the survey. Following is the descriptive statistics of the respondents' demographic profile.

2.1 Descriptive statistics of the respondents' demographic profile

2.1.1 Age of the respondent

Age Groups of the respondents	Frequency	Percent
Below 25 years	61	30.5
26-35 years	44	22.0
36-45 years	44	22.0
Above 45 years	51	25.5
Total	200	100.0

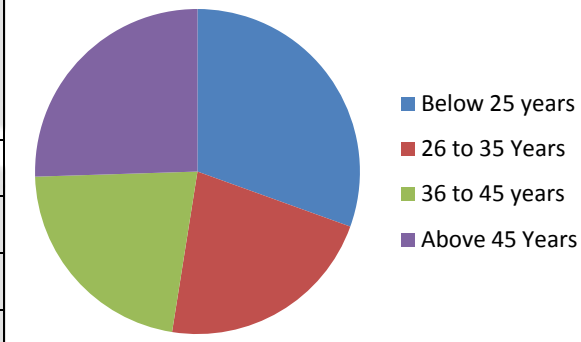


Figure 2.1: Descriptive statistics of age of the respondent

The number of respondents in each age group is almost evenly distributed. Altogether 30.5% respondents were below 25 years and 22.0% respondents were from age group of 26-35 years and 36-45 years. Altogether 25.5% respondents were from above the age group of 45 years.

2.1.2 Gender of the respondent

Gender of the respondent	Frequency	Percent
Male	50	25.0
Female	150	75.0
Total	200	100.0

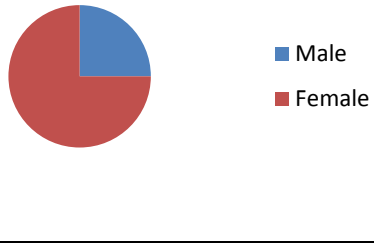


Figure 2.2: Descriptive statistics of gender of the respondent

Altogether 75% respondents were female and only 25% respondents were male. This is because of the fact that, in Indian context, in case of kitchenware the consumer behaviour of women is more significant.

2.1.3 Educational qualification of the respondents

Educational qualification	Frequency	Percent
Matriculate	6	3.0
Higher Secondary	34	17.0
Graduate	86	43.0
Post graduate	62	31.0
Others	12	6.0
Total	200	100.0

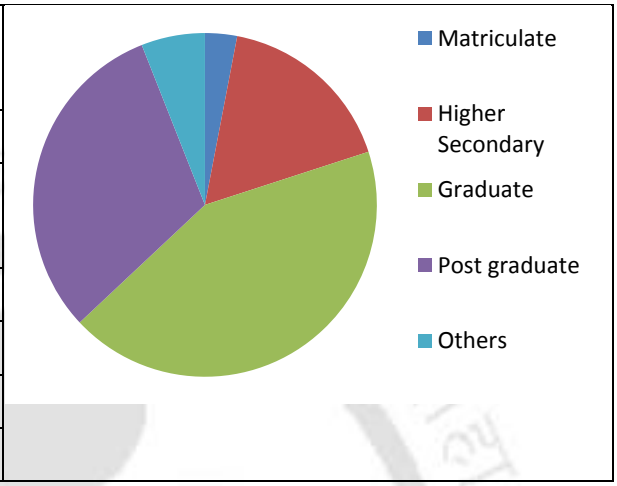


Figure: 2.3: Descriptive statistics of educational qualification of the respondents

The majority of the respondents were well educated. Altogether 43% respondents were graduates and 31% respondents had post graduate qualifications. Only 3% respondents had studied till matriculation. i.e 10^{th} standard.

2.1.4 Occupation of the respondents

Occupation	Frequency	Percent
Student	48	24.0
Housewife	49	24.5
Government employee	46	23.0
Corporate executive	11	5.5
Businessman	17	8.5
Any other	29	14.5
Total	200	100.0

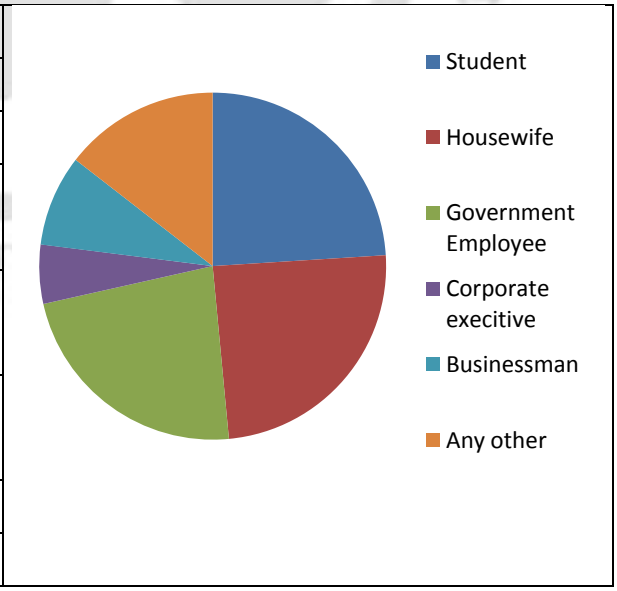


Figure 2.4 Descriptive statistics of occupation of the respondents

Respondents having various occupations were considered in the survey. Amongst all the segments, numbers of housewives were the highest.

2.1.5 Number of family members of the respondents' household

Number of family members	Frequency	Percent
2 to 4	129	64.5
5 to 7	63	31.5
8 to 10	7	3.5
Above 10	1	.5
Total	200	100.0

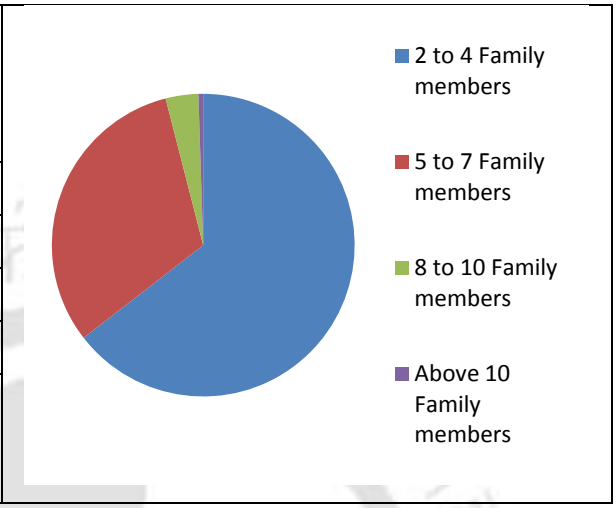


Figure 2.5: Descriptive statistics of number of family members of the respondents' household

Information regarding the numbers of family members was collected during the survey. It was found that the majority of the respondents had 2 to 4 family members in their household (64.5%). Altogether 31.5% of the respondents had 5 to 7 family members in their household. Therefore the majority of the families surveyed were nuclear and small families.

2.1.6 Monthly household income of the respondents

Monthly household income	Frequency	Percent
Below Rs.10,000	31	15.5
Rs.10,001-Rs.25,000	105	52.5
Rs.25,001-Rs.35,000	46	23.0
Above 35,000	18	9.0
Total	200	100.0

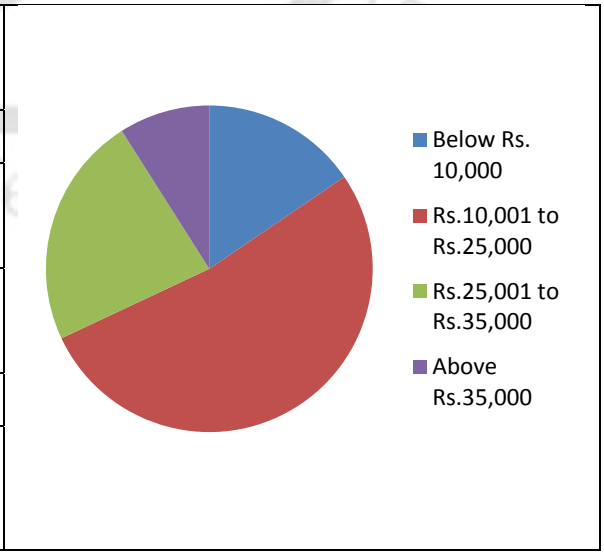


Figure 2.6: Descriptive statistics of monthly household income of the respondents

Respondents belonging from various income levels were considered in the survey. Majority of the respondents were from middle income group having monthly household income ranging from Rs.10,001 to Rs.25,000. Altogether 23% respondents were having monthly household income ranging from Rs.25,001 to Rs.35,000. Altogether 15.5% respondents were having monthly household income below Rs.10,000.

2.2 Design of kitchenware and food habit

India is a vast country with varied culture and food habit. With changing life style of the population, there is a trend to design and market various kitchenware without considering the relevance of these products for the customer. Also there are still no guidelines available to base design strategy taking in consideration all these aspect. There is a direct relationship between food habits and method of cooking leading to choice of cookware. There is a perception that the tastes of food cooked using cookware of modern design are not the same or comparative to the food cooked using traditional cookware. The work conclusively establishes the need to evolve a design methodology for culturally relevant cookware to suit the food habits of the users. Awareness regarding health by the users is another aspect that influences the design process through food consumption pattern. Availability of ready to eat food in recent time will also influence the design parameters.

Food is prepared in several ways in different parts of India. A large number of traditional and modern recipes have been developed through ages. The ingredients that go in to recipes vary with geographic location and vibrant culture of different people living in India. Culinary habit of different ethnic group is varied and taste of food depends largely on the type of pan or cooker and other kitchenware used for preparing the food item. Therefore customer segmentation on the basis of culinary habits of customers of different regions is important. In India people of different regions have different items for breakfast viz. idli, plain dosa, pongal, wheat uppuma, paratha etc. For lunch they have rice, roti, paratha, puri etc. Again there are various kinds of dosa and paratha and rice. We need different kitchenware for preparing all these recipes. Karai, tawa, deksi are some of the traditional kitchenware found in Indian kitchen. Modern idli maker based on pressure cooker has been successful in the market, but the chapatti maker, paratha maker, or dosa maker is yet to make their presence felt in common Indian households. The need for these kitchenware item is very much there in the Indian market, but only due to lack of appropriate designs, the manufacturers are not been able to capture the market of these products with new designs to suit modern lifestyle.

Figure 2.7: Karai, Tawa and Sauce pan in Indian kitchen

Respondents were asked about their preferred food for breakfast. Data was collected through a question in nominal scale. The options given were (a) Paratha/luchi (b) Bread/loaf/sandwich (c) Idli (d) Rice (e) Any other. Respondents were allowed to go for multiple choices of options. Following is the descriptive statistics of preference of the respondents on food item in breakfast.

2.2.1 Preference of food for breakfast

Item for breakfast	Frequency	Percent
Paratha/luchi	51	25.5
Bread/sandwich	46	23.0
Idli	1	.5
Rice	29	14.5
Any other	5	2.5
Paratha/luchi,Idli, Rice	68	34.0
Total	200	100.0

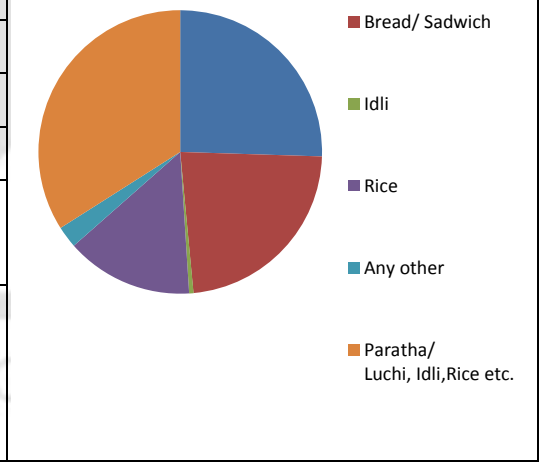


Figure 2.8: Descriptive statistics of preference of food for breakfast

The study reveals that most of the respondents prefer to have Indian traditional food in their breakfast. People prefer food items like paratha, luchi,idli, rice etc. over bread and sandwich in their breakfast. In order to prepare these food items typical Indian traditional cookware is required. After use of this cookware dishwashing remains a major

problem for the users. The most of the respondents were from Assam, where idli is not very popular unlike southern part of India, where idli is a very popular breakfast.

2.2.2 Preference of food for Lunch/Dinner

Respondents were asked about their preferred food in lunch and dinner. Data was collected through a question in nominal scale. The options given were (a) Rice/ chapatti (b) Dosa (c) Chicken/fish/paneer (d) Tandoor items (e) Any other. Respondents were allowed to go for multiple choices of options. Following is the descriptive statistics of preference of the respondents on food item in lunch and dinner.

Items for Lunch and dinner	Frequency	Percent
Rice/chapatti	47	23.5
Dosa	2	1.0
Chicken/fish/ paneer	3	1.5
Rice/Chapati, Chicken/fish/paneer, Tandoor items	148	74.0
Total	200	100.0

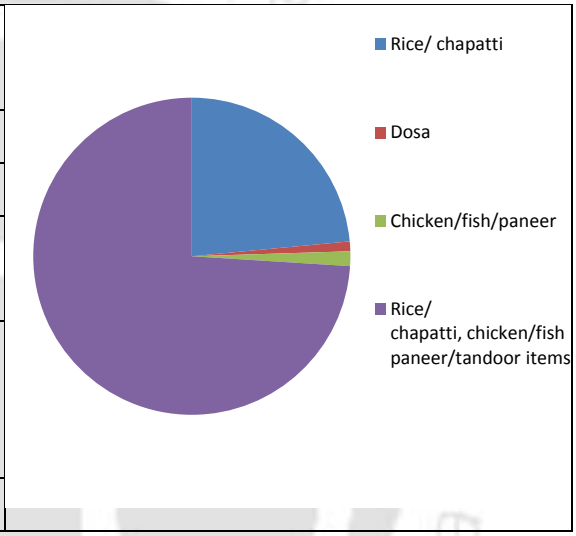


Figure 2.9: Descriptive statistics of preference of food for lunch/dinner

The study reveals that most of the respondents prefer to have Indian traditional food in their lunch and dinner. People prefer food items like rice and chapatti with chicken, fish, tandoor items etc. over any other items in their lunch and dinner. In order to prepare these food items typical Indian traditional cookware is required. After use of this cookware dishwashing appears to be a major problem for the users. Normally the aforesaid food items have more amounts of spices. The most of the respondents were from Assam, where dosa is not very popular unlike southern part of India, where dosa is very popular.

2.3 Consumer perception on modern sophisticated kitchenware like microwave oven

2.3.1 Consumers' response on preferred process of cooking

In last three decades a major variation in the kitchenware products is seen in Indian household. Pressure cooker has become an integral part of Indian kitchen. Mixer, grinder,

juicer, oven, blenders etc. are now common products found in kitchen of Indian middle class family. Consumer behaviour is very complex in case of procurement of these products. They frequently expect products with new designs and the product life cycle of these products are becoming shorter every day. Marketers have become increasingly culpable for their role in societal problems which affect a myriad of sensitive groups. The publicity engendered from this relationship has translated into a new arena of competition, largely based on perceptions of corporate social responsibility. Designers of these products have plenty of challenges to sustain in this competitive environment. Effort was to formulate an effective design strategy to take advantage of variety of culinary habits in Indian multicultural context.

The factors influencing consumer behaviour in case of modern sophisticated kitchenware was considered in the study. The study reveals some important findings on the preferred process of cooking. Following is the descriptive statistics of consumers' response on preferred process of cooking viz. heating, steaming, roasting and baking.

Preferred process of cooking	Frequency	Percent
Heating and frying	51	25.5
Steaming	3	1.5
Roasting	2	1.0
Heating, steaming and roasting	144	72.0
Total	200	100.0

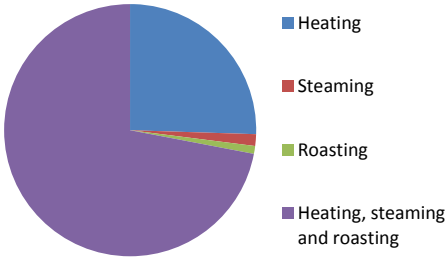


Figure 2.10: Descriptive statistics of consumers' response on preferred process of cooking

The study reveals that the most preferred process of cooking is the combination of heating and frying, steaming and roasting. Consumers preferred heating and frying process over steaming or roasting. Consumers do not prefer baking process in their home. The process of heating results in sticking food remains in cookware; therefore making washing of cookware and dishes more difficult.

2.3.2 Availability of microwave oven/OTG etc

Respondents were asked whether they had a microwave oven/ OTG etc in their home. The study reveals that the majority of the respondents do not have a microwave

oven/OTG etc in their home. However some respondents had microwave oven in their home. Following is the descriptive statistics.

Own a microwave oven?	Frequency	Percent
Yes	61	30.5
No	139	69.5
Total	200	100.0

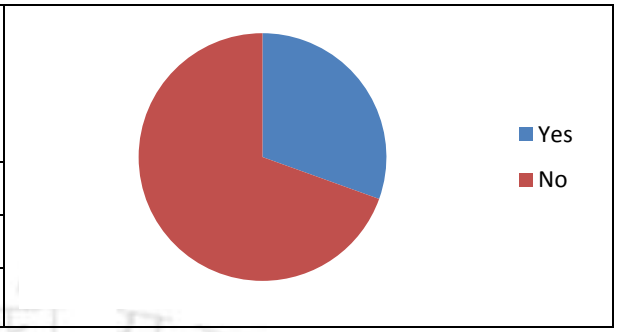


Figure 2.11: Descriptive statistics of availability of microwave oven/OTG etc

2.3.3 Perceived importance on variety of product features

Respondents were asked about their perceived importance on variety of product features in a single cookware. Respondents were asked to rate in an ordinal scale ranging from most important to least important. Majority of the respondents i.e. 40% did not find the variety of product features to be of much importance in a cookware. Only a minority of 15% found it to be most important. This implies that consumer prefer simple cook wares with limited features. On being asked to the respondents on this issue they revealed that cook wares with more accessories for various product features make the cookware difficult for washing. That is the main reason why consumers do not prefer cookware with variety of product features. Following is the descriptive statistics of the aforesaid finding.

Importance on variety of product features	Frequency	Percent
Most important	30	15.0
Important	40	20.0
Not so important	50	25.0
Least important	80	40.0
Total	200	100.0

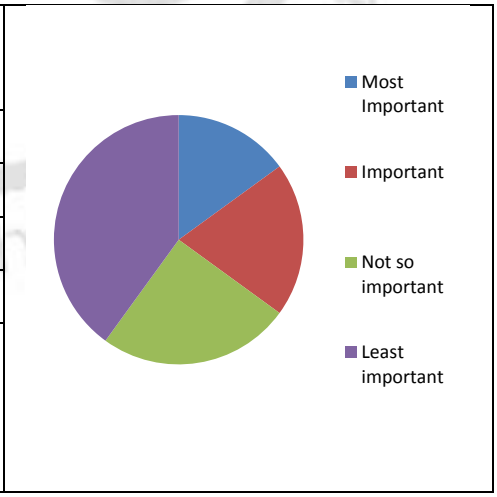


Figure 2.12: Descriptive statistics of perceived importance on variety of product features

2.3.4 Reasons for not buying modern sophisticated kitchenwares like microwave oven/OTG

Respondents were asked about the reasons for not preferring modern sophisticated kitchenwares like microwave oven, Oven Toaster Grill (OTG) etc. Respondents were given options viz. price, electricity, taste variation, safety issues and any other factors. It has been observed that the main factor preventing people from buying modern sophisticated new cookware is taste variation (27%). Respondents feel that the taste of food prepared in modern cookware is not the same as food prepared using traditional cookware. The next factors that bother them are the price and electricity consumption.

Reasons	Frequency	Percent
Price	39	19.5
Electricity	26	13.0
Taste variation	54	27.0
Safety matters	19	9.5
Any other	45	22.5
price; any other	6	3.0
electricity; any other	3	1.5
taste variation; any other	5	2.5
safety matters; any other	3	1.5
Total	200	100.0

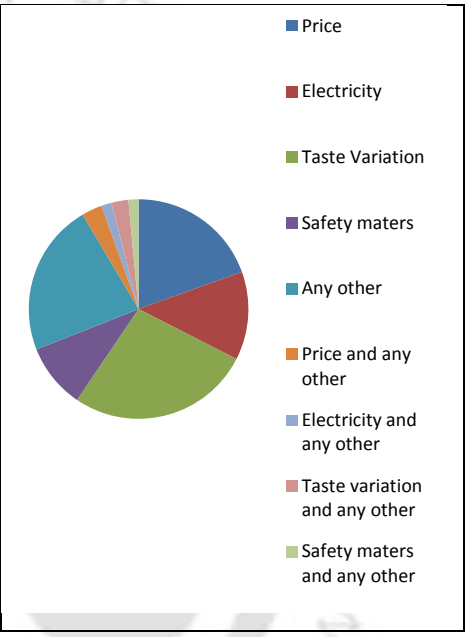


Figure 2.13: Reasons for not buying modern sophisticated kitchenwares like microwave oven/OTG

2.4 Disliked activity in kitchen

Respondents were asked to provide ratings on activities in kitchen they dislike most. These activities are preparing raw food ingredients, cooking and dish washing. The ratings were taken in a five point semantic differential scale; 1 being the 'dislike most' and 5 being the 'like most'. It was found that dishwashing is the most disliked activity. Altogether 43% respondents commented that they do not like dishwashing at all. 19.5% of the respondents said that they don't like the activity of preparation of the raw food ingredients. It is observed that people normally enjoy cooking and only 7.5% of the respondents commented that they do not like cooking. Following is the descriptive statistics

2.4.1 Descriptive statistics of rating on 'cooking' activity

Ratings on 5 point semantic differential scale	Frequency	Percent
1.00 (Dislike most)	15	7.5
2.00	13	6.5
3.00	55	27.5
4.00	41	20.5
5.00 (Like most)	76	38.0
Total	200	100.0

Mean	3.75
Median	4.00
Mode	5.00

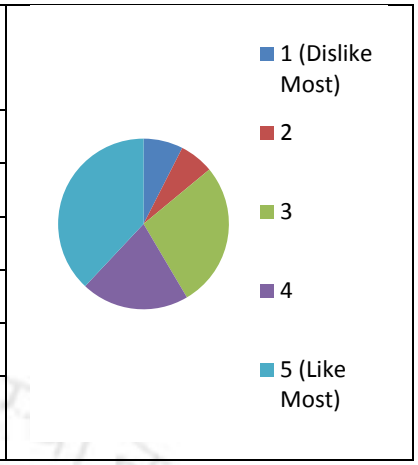


Figure 2.14: Descriptive statistics of rating on 'cooking' activity

The mean value of rating is 3.75 and mode is 5. Again looking at the descriptive statistics we found that altogether 38% respondents have given a rating of 5 and 20.5% respondents have given a rating of 4. Only 7.5% respondents have given a rating of 1. Therefore we may conclude that respondents like cooking as compared to the other activities in the kitchen.

2.4.2 Descriptive statistics of rating on 'dishwashing' activity

Ratings on 5 point semantic differential scale	Frequency	Percent
1.00 (Dislike most)	87	43.5
2.00	56	28.0
3.00	57	28.5
Total	200	100.0

Mean	1.85
Median	2.00
Mode	1.00

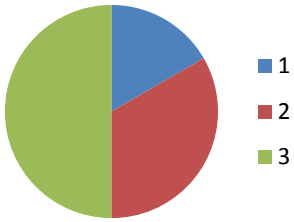


Figure 2.15: Descriptive statistics of rating on 'dishwashing' activity

The mean value of rating is 1.85 and mode is 1. Again looking at the descriptive statistics we found that altogether 43.5% respondents have given the rating 1 and 28%

respondents have given rating 2 followed by 28.5% in rating 3. No respondents have given a rating of 4 and 5. Therefore we may conclude that respondents most dislike dishwashing activity as compared to the other activities in the kitchen.

2.4.3 Descriptive statistics of rating on 'Preparing raw food ingredients' activity

Ratings on 5 point semantic differential scale	Frequency	Percent
2.00	39	19.5
3.00	87	43.5
4.00	60	30.0
5.00	14	7.0
Total	200	100.0

Mean	3.2450
Median	3.0000
Mode	3.00

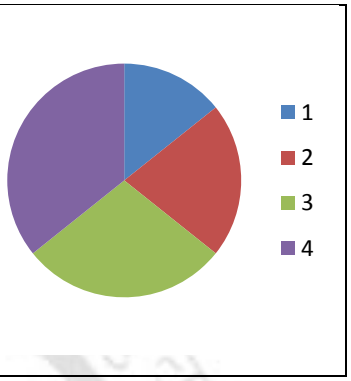


Figure 2.16: Descriptive statistics of rating on 'Preparing raw food ingredients' activity

The mean value of rating is 3 and mode is 3. Again looking at the descriptive statistics we found that altogether 43.5% respondents have given the rating 3 and 30% respondents have given rating 4. No respondents have given a rating of 1. Therefore we may conclude that respondents moderately enjoy the activity of preparing raw food ingredients as compared to the other activities in the kitchen.

From the above analysis and findings it is pertinent that dishwashing is the most disliked activity amongst all the activities in a kitchen. But is has been observed that enterprises engaged in design, production and marketing of kitchenware products are giving more emphasis on products related to cooking (OTG, microwave oven, non stick cookware) and preparation of raw food ingredients (grinder, mixer). But there is a sheer need of design products to solve the dishwashing problem in Indian context.

2.5 Preference rating on materials of cookware, utensils and crockery

The effort in the dishwashing activity largely depends on the type of cookware, utensils and crockery. Therefore, in order to analyse the dishwashing problem it is important to understand the consumer behaviour related to cookware, utensils and crockery. Respondents were asked to provide ratings on their preference of materials of cookware, utensils and crockery. Altogether ten materials were considered viz. cast iron, brass, bell

metal, copper, non-stick, plastic, wood, steel, ceramic, clay, melamine and glass. The ratings were taken in a ten point semantic differential scale; 1being the least preferred and 10 being the most preferred.

2.5.1 Preference rating on materials of cookware

It has been observed that majority of the respondents preferred nonstick cookware (Mean: 8.97, mode: 10) followed by cast iron cookware (mean: 6.8, mode:7). A large number of respondents prefer cookware made of bell metal (mean: 7.5, mode:10) and brass (mean: 6.8, mode: 7). It is worth mentioning here that Indian traditional cookware is normally made of brass, bell metal and copper.

	CI Cookware	**Brass Cookware**	**Bell Metal Cookware**	**Cooper Cookware**
Mean	6.81	6.03	7.50	4.62
Median	7.00	7.00	8.00	5.00
Mode	7.00	7.00	10.00	6.00

	Nonstick Cookware	**Steel Cookware**	**Ceramic Cookware**	**Melamine Cookware**
Mean	8.97	6.18	3.26	4.17
Median	10.00	6.00	3.00	3.00
Mode	10.00	6.00	3.00	6.00

Table 2.1: Preference rating on materials of cookware

2.5.2 Preference rating on materials of utensils

It has been observed that respondents prefer serving utensils/ crockery made of steel (Mean: 7.16, mode: 10), bell metal (mean: 7.35, mode: 7), brass (mean: 6.62, mode: 8) and glass (mean: 7.42, mode: 10). Utensils/ crockery made of steel are comparatively new in the market where as Indian consumers are using serving utensils/ crockery made of bell metal, brass and glass since long. These are again Indian traditional designs.

	Cast Iron Utensil	Brass Utensil	Bell Metal Utensil	Copper Utensil	Plastic Utensil	Wood Cane Bamboo Utensil
Mean	3.81	6.62	7.35	4.65	5.59	4.67
Median	3.00	7.00	7.00	4.00	3.00	2.00
Mode	5.00	8.00	7.00	3.00	10.00	2.00

	China clay Utensil	Melamine Utensil	Glass Utensil	Steel Utensil	Ceramic Utensil
Mean	5.64	5.67	7.42	7.16	4.33
Median	6.00	5.00	7.00	8.00	4.00
Mode	10.00	4.00	10.00	10.00	2.00

Table 2.2: Preference rating on materials of utensils

Figure 2.17: Utensils of bell metal in Indian household and non stick cookware in Indian market

2.6 Importance level on various attributes of cookware, crockery and utensils

Respondents were asked to give their ratings of importance on various attributes of cookware, crockery and utensils. A seven point semantic differential rating scale was considered; 1 being the least important and 7 being the most important. Various attributes under consideration for cookware, crockery and utensils are; ease of use, aesthetic look, traditional design, and taste of food, ease for washing, durability / robustness, variety in design, brand name, hygiene, weight and associated status symbol.

2.6.1 Importance level on various attributes of cookware

	Ease of Use for Cookware	Aesthetic Look for Cookware	Traditional Design for cookware	Taste of Food for Cookware	Ease for Washing for Cookware	Longevity & Robustness for Cookware
Mean	4.40	6.20	5.04	5.53	4.6200	4.88
Median	5.00	6.00	5.00	5.00	5.0000	5.00
Mode	6.00	6.00	5.00	5.00	5.00	7.00

	Hygiene for Cookware	Weight for Cookware	Stats symbol for Cookware	Variety of Design for Cookware	Brand Name for Cookware
Mean	5.53	4.40	6.20	4.40	5.42
Median	6.00	5.00	6.00	5.00	6.00
Mode	7.00	6.00	6.00	5.00	7.00

Table 2.3: Descriptive statistics of ratings of importance level on various attributes of cookware

It has been observed that the aesthetic look in the cookware is something consumers always look for (mean; 6.20, mode: 6). They also identify themselves with the design of the cookware since they have started considering it as a status symbol (mean: 6.20, mode: 6). Respondents give a lot of importance to the taste of food (mean: 5.53) and hygiene (mean: 5.53) while selecting cookware.

2.6.2 Importance level on various attributes of crockery

	Ease of Use for Crockery	Aesthetic Look for Crockery	Traditional Design for Crockery	Taste of Food for Crockery	Ease for Washing for crockery	Longevity& Robustness for Crockery
Mean	4.64	5.75	5.86	5.07	4.41	3.57
Median	5.00	6.00	6.00	6.00	4.00	3.50
Mode	5.00	7.00	6.00	6.00	6.00	5.00

	Weight for Crockery	Status symbol for Crockery	Variety of Design for Crockery	Brand Name for Crockery	Hygiene for Crockery
Mean	5.01	5.95	6.00	5.60	5.03
Median	5.00	7.00	7.00	6.00	5.00
Mode	6.00	7.00	7.00	6.00	4.00

Table 2.4: Descriptive statistics of ratings of importance level on various attributes of crockery

It has been observed that people look for 'variety of design' (mean: 6, mode: 7) as most important aspect in case of crockery. Consumers prefer their traditional design in crockery (mean: 5.86 mode:6). Consumers also give lots of importance to aesthetic look in case of crockery (mean: 5.75, mode: 7).They tend to identify themselves with the product and status symbol (mean: 5.95, mode: 7) is very important for them in case of crockery.

2.6.3 Importance level on various attributes of utensils

	Ease of Use for Utensil	Aesthetic Look for Utensils	Traditional Design for Utensils	Taste of Food for Utensils	Ease for Washing for Utensils	Longevity & Robustness for Utensils
Mean	6.45	5.10	6.09	5.36	6.09	5.70
Median	7.00	6.00	6.00	6.00	7.00	6.00
Mode	7.00	6.00	7.00	6.00	7.00	7.00

	Weight for Utensil	Status symbol for Utensils	Variety of Design for Utensils	Brand Name for utensils	Hygiene for utensils
Mean	6.45	5.10	4.01	3.70	5.51
Median	7.00	6.00	3.00	3.00	6.00
Mode	7.00	6.00	2.00	3.00	7.00

Table 2.5: Descriptive statistics of ratings of importance level on various attributes of utensils

It has been observed that 'ease of use' (mean: 6.45, mode: 7) and 'weight of utensils' (mean: 6.45, mode: 7) is the foremost important attribute in case of utensils. The

'ease of washing' (mean: 6.09, mode: 7) and impact of 'traditional design' (mean: 6.09, mode: 7) in the utensil and is also equally important for the users.

2.6.4 Inferential statistics of preference ratings on various materials of cookware

One way ANOVA was conducted for preference ratings on various materials of cookware viz. cast iron, brass, bell metal, copper, non-stick, plastic, wood/ cane/ bamboo, stainless steel, ceramic, China clay, melamine and glass with occupation of the respondent.

Null Hypothesis: There is no significant difference in preference rating in materials of cookware with occupation of the respondents.

One way ANOVA was conducted and the above hypothesis is rejected for a significance level of 0.05 and concluded that a very high significant difference exists in the preference on materials of cookware by respondents of various occupations. Following are the sig. values generated by the one way ANOVA for variables indicating material for cookware. Occupation is the fixed factor for this test.

Materials of cookware	Sig.
CI Cookware	.000
Brass Cookware	.000
Bell Metal Cookware	.000
Cooper Cookware	.000
Nonstick Cookware	.000
Steel Cookware	.000
Ceramic Cookware	.011
Melamine Cookware	.000

Table 2.6: Results of ANOVA of preference ratings on various materials of cookware with occupation of the respondent

Null Hypothesis: There is no significant difference in preference rating in materials of cookware with income levels of the respondents.

One-way ANOVA was conducted and the above hypothesis is rejected for a significance level of 0.05 and concluded that a very high significant difference exists in the preference on materials of cookware by respondents of various income groups. Following are the sig. values generated by the one way ANOVA for variables indicating material for cookware. Income level is the fixed factor for this test.

Materials of cookware	Sig.
CI Cookware	.000
Brass Cookware	.000
Bell Metal Cookware	.000
Cooper Cookware	.000
Nonstick Cookware	.000
Steel Cookware	.000
Ceramic Cookware	.000
Melamine Cookware	.000

Table 2.7: Results of ANOVA of preference ratings on various materials of cookware with income levels of the respondent

Null Hypothesis: There is no significant difference in preference rating in materials of cookware with number of family members in the respondents' household.

One-way ANOVA was conducted.

In case of materials viz. cast iron, bell metal, non stick, steel, ceramic, and melamine the above hypothesis is rejected for a significance level of 0.05 and concluded that a very high significant difference exists in the preference on aforesaid materials of cookware by respondents having different number of family members in the respondents' household. Following are the sig. values generated by the one way ANOVA for variables indicating material for cookware. The number of family members in the respondents' household is the fixed factor for this test.

In case of materials viz. brass and copper the above hypothesis is accepted for a significance level of 0.05 and concluded that a there is no significant difference in the preference on aforesaid materials of cookware by respondents having different number of family members in the respondents' household. It is quite pertinent from the descriptive statistics that respondents prefer traditional cookware and utensils. The Indian traditional cookware and utensils are normally made of metals like brass, bell metal, copper etc. The analysis clearly indicates that irrespective of number of family members in respondents' household they prefer traditional Indian cookware. However it appears that respondents got confused between bell metal and brass while providing ratings. Following are the sig. values generated by the one way ANOVA for variables indicating material for cookware. The number of family members in the respondents' household is the fixed factor for this test.

Materials of cookware	Sig.
CI Cookware	.018
Brass Cookware	.136
Bell Metal Cookware	.008
Cooper Cookware	.248
Nonstick Cookware	.000
Steel Cookware	.000
Ceramic Cookware	.000
Melamine Cookware	.018

Table 2.8: Results of ANOVA of preference ratings on various materials of cookware with the number of family members in the respondents' household

2.6.5 Inferential statistics of ratings of importance level on various attributes of cookware

One Way ANOVA was conducted for ratings on various attributes for preference of cookware viz. ease of use, aesthetic look, traditional design, taste of food, ease for washing, longevity/ robustness, variety in design, brand name, hygiene, weight and status symbol.

Null Hypothesis: There is no significant difference in rating on various attributes of cookware with occupations of the respondents.

One-way ANOVA was conducted and the above hypothesis is rejected for a significance level of 0.05 and concluded that there is a significant difference of preference ratings of various attributes of cookware with occupations of the respondents. Following are the sig. values generated by the one way ANOVA for variables indicating various attributes of cookware. Occupation of the respondents is the fixed factor for this test.

Attributes of cookware	Sig.
Ease of Use for Cookware	.000
Aesthetic Look for Cookware	.000
Traditional Design for cookware	.000
Taste of Food for Cookware	.000
Ease for Washing for Cookware	.000
Longevity & Robustness for Cookware	.000
Variety of Design for Cookware	.000
Brand Name for Cookware	.000
Hygiene for Cookware	.023
Weight for cookware	.000
Status Symbol for Cookware	.000

Table 2.9: Results of ANOVA of various attributes of cookware with occupations of the respondents

Null Hypothesis: There is no significant difference in rating on various attributes of cookware with income level of the respondents.

One-way ANOVA was conducted and the above hypothesis is rejected for a significance level of 0.05 and concluded that the preference ratings of various attributes of cookware depend on income level of the respondents (Sig: 0.000). But for the attribute ‘ Variety in Design’ the null hypothesis is accepted and concluded that respondents preference rating on ‘Variety in Design’ do not significantly vary with income level of the respondents (Sig: 0.083). This implies that irrespective of income level all users are equally sensitive about variety in design. Following are the sig. values generated by the one way ANOVA for variables indicating various attributes of cookware. Income level of the respondents is the fixed factor for this test.

Attributes of cookware	Sig.
Ease of Use for Cookware	.000
Aesthetic Look for Cookware	.000
Traditional Design for cookware	.000
Taste of Food for Cookware	.000
Ease for Washing for Cookware	.000
Longevity& Robustness for Cookware	.000
Variety of Design for Cookware	.083
Brand Name for Cookware	.000
Hygiene for Cookware	.000
Weight for cookware	.000
Status Symbol for Cookware	.000

Table 2.10: Results of ANOVA of various attributes of cookware with income level of the respondents

Null Hypothesis: There is no significant difference in rating on various attributes of cookware with number of family members in the respondents' household.

One-way ANOVA was conducted.

In case of attributes of cookware viz. 'taste of food for cookware', 'variety of design for cookware', 'brand name for cookware' and 'hygiene for cookware' the above hypothesis is accepted for a significance level of 0.05 and concluded that respondents preference rating on 'taste of food for cookware', 'variety of design for cookware', 'brand name for cookware' and 'hygiene for cookware' do not significantly vary with number of family members in the respondents' household. This implies that irrespective of number of family members in a household users are equally sensitive about taste of food prepared in a cookware, variety of design for cookware, brand name for cookware and hygiene for cookware. Following are the sig. values generated by the one way ANOVA for variables indicating various attributes of cookware. Number of family members in the respondents' household is the fixed factor for this test.

In case of attributes of cookware viz. 'ease of use for cookware', 'aesthetic look for cookware', 'traditional design of cookware', 'ease of washing for cookware', 'longevity & robustness of cookware', 'weight of cookware', 'status symbol for cookware' the null hypothesis is rejected and concluded that the preference ratings on

aforesaid attributes of cookware significantly vary with number of family members in the respondents' household. Number of family members in the respondents' household is the fixed factor for this test.

It is interesting to observe that respondents rating on preference on 'traditional materials' of cookware do not significantly vary with number of family members in the respondents' household, but it significantly vary in case of ratings on traditional design of cookware.

Attributes of cookware	Sig.
Ease of Use for Cookware	.005
Aesthetic Look for Cookware	.022
Traditional Design for cookware	.001
Taste of Food for Cookware	.649
Ease of Washing for Cookware	.000
Longevity & Robustness for Cookware	.017
Variety of Design for Cookware	.781
Brand Name for Cookware	.119
Hygiene for Cookware	.451
Weight for cookware	.000
Status Symbol for Cookware	.000

Table 2.11: Results of ANOVA of various attributes of cookware with number of family members in the respondents' household

2.6.6 Inferential statistics of preference ratings on various materials of utensils/ crockery

One way ANOVA was conducted for preference ratings on various materials of utensils/ crockery viz. cast iron, brass, bell metal, copper, non-stick, plastic, wood/ cane/ bamboo, stainless steel, ceramic, China clay, melamine and glass with occupation of the respondent.

Null Hypothesis: There is no significant difference in preference rating in materials of utensils/ crockery with occupation of the respondents.

One way ANOVA was conducted and the above hypothesis is rejected for a significance level of 0.05 and concluded that a very high significant difference exists in the preference on materials of utensils/ crockery by respondents of various occupations.

Following are the sig. values generated by the one way ANOVA for variables indicating material for cookware. Occupation is the fixed factor for this test.

Materials of utensils/ crockery	Sig.
Cast Iron Utensil	.000
Brass Utensil	.000
Bell Metal Utensil	.000
Copper Utensil	.000
Plastic Utensil	.000
Wood Cane Bamboo Utensil	.000
Steel Utensil	.000
Ceramic Utensil	.000
China Clay Utensil	.000
Melamine Utensil	.000
Glass Utensil	.000

Table 2.12: Results of ANOVA of preference ratings on various materials of utensils/ crockery with occupation of the respondent

Null Hypothesis: There is no significant difference in preference rating in materials of utensils/ crockery with income level of the respondents.

One way ANOVA was conducted and the above hypothesis is rejected for a significance level of 0.05 and concluded that a very high significance difference exists in the preference on materials of utensils/ crockery by respondents of different income level. Following are the sig. values generated by the one way ANOVA for variables indicating material for cookware. Income level is the fixed factor for this test.

Materials of utensils/ crockery	Sig.
Cast Iron Utensil	.000
Brass Utensil	.000
Bell Metal Utensil	.000
Copper Utensil	.000
Plastic Utensil	.000
Wood Cane Bamboo Utensil	.000
Steel Utensil	.000
Ceramic Utensil	.000
China Clay Utensil	.000
Melamine Utensil	.000
Glass Utensil	.000

Table 2.13: Results of ANOVA of preference ratings on various materials of utensils/ crockery with income level of the respondent

Null Hypothesis: There is no significant difference in preference rating in materials of utensils/ crockery with number of family members in respondent's household.

One way ANOVA was conducted and the above hypothesis is rejected for a significance level of 0.05 and concluded that a very high significant difference exists in the preference on materials of utensils/ crockery by respondents having different number of family members in respondent's household. Following are the sig. values generated by the one way ANOVA for variables indicating material for cookware. Number of family members in respondent's household is the fixed factor for this test.

Material of utensils/ crockery	Sig.
Cast Iron Utensil	.000
Brass Utensil	.146
Bell Metal Utensil	.000
Copper Utensil	.000
Plastic Utensil	.000
Wood Cane Bamboo Utensil	.000
Steel Utensil	.000
Ceramic Utensil	.000
China Clay Utensil	.000
Melamine Utensil	.000
Glass Utensil	.000

Table 2.14: Results of ANOVA of preference ratings on various materials of utensils/ crockery with number of family members in respondent's household

However in case of utensils made of brass the null hypothesis is accepted and concluded that there is no significant difference in the preference on materials of utensils/ crockery by respondents having different number of family members in respondent's household.

2.6.7 Inferential statistics of ratings of importance level on various attributes of utensils

One Way ANOVA was conducted for ratings on various attributes for preference of utensils viz. ease of use, aesthetic look, traditional design, taste of food, ease for washing, longevity/ robustness, variety in design, brand name, hygiene, weight and status symbol.

Null Hypothesis: There is no significant difference in rating on various attributes of utensils with occupations of the respondents.

One-way ANOVA was conducted and the above hypothesis is rejected for a significance level of 0.05 and concluded that there is a significant difference of preference ratings of various attributes of utensils with occupation of the respondents. Following are the sig. values generated by the one way ANOVA for variables indicating various attributes of utensils. Occupation of the respondents is the fixed factor for this test.

Attributes for preference of utensils	Sig.
Ease of Use for Utensil	.000
Aesthetic Look for Utensils	.000
Traditional Design for Utensils	.000
Taste of Food for Utensils	.000
Ease of Washing for Utensils	.000
Longevity& Robustness for Utensils	.000
Variety of Design for Utensils	.001
Brand Name for Utensils	.000
Hygiene for Utensils	.006
Weight for Utensils	.000
Status Symbol for Utensils	.000

Table 2.15: Results of ANOVA of rating on various attributes of utensils with occupations of the respondents

Null Hypothesis: There is no significant difference in rating on various attributes of utensils with income level of the respondents.

One-way ANOVA was conducted and the above hypothesis is rejected for a significance level of 0.05 and concluded that there is a significant difference of preference ratings of various attributes of utensils with income level of the respondents. Following are the sig. values generated by the one way ANOVA for variables indicating various attributes of utensils. Income level of the respondents is the fixed factor for this test.

Attributes for preference of utensils	Sig.
Ease of Use for Utensil	.000
Aesthetic Look for Utensils	.000
Traditional Design for Utensils	.000
Taste of Food for Utensils	.000
Ease of Washing for Utensils	.000
Longevity& Robustness for Utensils	.000
Variety of Design for Utensils	.000
Brand Name for utensils	.000
Hygiene for utensils	.007
Weight for Utensils	.000
Status Symbol for Utensils	.000

Table 2.16: Results of ANOVA of rating on various attributes of utensils with income level of the respondents

Null Hypothesis: There is no significant difference in rating on various attributes of utensils with number of family members in the respondents' household.

One-way ANOVA was conducted.

In case of attributes viz. 'ease of use for utensil', 'traditional design for utensils', 'taste of Food for utensils', 'ease for washing for utensils', 'longevity & robustness for utensils', 'brand name for utensils', 'weight for utensils' and 'status symbol for utensils' the above hypothesis is rejected for a significance level of 0.05 and concluded that there is a significant difference of preference ratings of aforesaid attributes of utensils with number of family members in the respondents' household.

On the other hand, in case of attributes viz. 'aesthetic look for utensils', 'variety of design for utensils' and 'hygiene for utensils' the null hypothesis is accepted and concluded that there is no significant difference in preference ratings on the aforesaid attributes of utensils with number of family members in the respondents' household. Following are the sig. values generated by the one way ANOVA for variables indicating various attributes of utensils. Number of family members in the respondents' household of the respondents is the fixed factor for this test.

Attributes for preference of utensils	Sig.
Ease of Use for Utensil	.013
Aesthetic Look for Utensils	.818
Traditional Design for Utensils	.000
Taste of Food for Utensils	.000
Ease for Washing for Utensils	.002
Longevity & Robustness for Utensils	.000
Variety of Design for Utensils	.193
Brand Name for Utensils	.006
Hygiene for Utensils	.846
Weight for Utensils	.000
Status Symbol for Utensils	.000

Table 2.17: Results of ANOVA of rating on various attributes of utensils with number of family members in the respondents' household

2.6.8 Inferential statistics of ratings of importance level on various attributes of crockery

One Way ANOVA was conducted for ratings on various attributes for preference of crockery viz. ease of use, aesthetic look, traditional design, taste of food, ease for washing, longevity/ robustness, variety in design, brand name, hygiene, weight and status symbol.

Null Hypothesis: There is no significant difference in rating on various attributes of crockery with occupations of the respondents.

One-way ANOVA was conducted and the above hypothesis is rejected for a significance level of 0.05 and concluded that there is a significant difference of preference ratings of various attributes of crockery with occupations of the respondents. But the ratings on 'traditional design' factor in case of crockery are not significantly different with occupation of the respondent. Again it has been observed from the descriptive statistics that consumers prefer their traditional design in crockery (mean: 5.86 mode: 6). This clearly concluded that irrespective of different occupation, consumers prefer traditional design in crockery. Following are the sig. values generated by the one way ANOVA for variables indicating various attributes of crockery. Occupation of the respondents is the fixed factor for this test.

Attributes for preference of crockery	Sig.
Ease of Use for Crockery	.000
Aesthetic Look for Crockery	.000
Traditional Design for Crockery	.286
Taste of Food for Crockery	.000
Ease of Washing for Crockery	.000
Longevity & Robustness for Crockery	.000
Variety of Design for Crockery	.000
Brand Name for Crockery	.000
Hygiene for Crockery	.000
Weight for Crockery	.000
Status Symbol for Crockery	.000

Table 2.18: Results of ANOVA of ratings of importance level on various attributes of crockery with occupations of the respondents

Null Hypothesis: There is no significant difference in rating on various attributes of crockery with income level of the respondents.

One-way ANOVA was conducted and the above hypothesis is rejected for a significance level of 0.05 and concluded that there is a significant difference of preference ratings of various attributes of crockery with income level of the respondents. Following are the sig. values generated by the one way ANOVA for variables indicating various attributes of crockery. Income level of the respondents is the fixed factor for this test.

Attributes for preference of crockery	Sig.
Ease of Use for Crockery	.000
Aesthetic Look for Crockery	.000
Traditional Design for Crockery	.000
Taste of Food for Crockery	.000
Ease of Washing for Crockery	.000
Longevity & Robustness for Crockery	.000
Variety of Design for Crockery	.000
Brand Name for Crockery	.000
Hygiene for Crockery	.000
Weight for Crockery	.000
Status Symbol for Crockery	.000

Table 2.19: Results of ANOVA of ratings of importance level on various attributes of crockery with income level of the respondents

Null Hypothesis: There is no significant difference in rating on various attributes of crockery with number of family members in respondents' household.

One-way ANOVA was conducted.

In case of attributes viz. 'ease of use for crockery', 'traditional design for crockery', 'ease of washing for crockery', 'longevity & robustness for crockery', 'variety of design for crockery', 'hygiene for crockery', and 'taste of food for crockery' the above hypothesis is rejected for a significance level of 0.05 and concluded that there is a significant difference of preference ratings of aforesaid attributes of crockery with number of family members in respondents' household.

On the other hand, in case of attributes viz. 'aesthetic look for crockery', 'brand name for crockery', 'weight for crockery' and 'status symbol for crockery' the null hypothesis is accepted and concluded that there is no significant difference in preference ratings on the aforesaid attributes of crockery with number of family members in the respondents' household. Following are the sig. values generated by the one way ANOVA for variables indicating various attributes of crockery. Number of family members in the respondents' household of the respondents is the fixed factor for this test.

Attributes for preference of crockery	Sig.
Ease of Use for Crockery	.000
Aesthetic Look for Crockery	.162
Traditional Design for Crockery	.000
Ease of Washing for Crockery	.000
Longevity & Robustness for Crockery	.001
Variety of Design for Crockery	.000
Brand Name for Crockery	.099
Hygiene for Crockery	.000
Weight for Crockery	.133
Status Symbol for Crockery	.064
Taste of Food for Crockery	.000

Table 2.20: Results of ANOVA of ratings of importance level on various attributes of crockery with number of family members in respondents' household

2.7 Conclusion of the study of consumer behaviour related to cookware, crockery and utensils

It has been observed that preference of cookware and utensils largely depends on food habit. Various attributes viz. design and aesthetic look, additional features, safety considerations and ability to save energy affect the purchase decision of kitchenware products. It was observed that respondents prefer serving utensils/ crockery made of stainless steel, bell metal, brass and glass (Indian traditional designs). Majority of the urban respondents prefer nonstick cookware followed by steel made cookware. A large number of respondents also prefer cookware made of cast iron, brass, bell metal and copper (Indian traditional designs). It has been observed that 'Ease of Use' is the foremost important attribute in case of utensils/kitchenware. Occupation and education plays a crucial role in purchasing decision in this context; as they create awareness and the need of an efficient time saving kitchenware. Consumers are not using modern sophisticated kitchenware because of the reasons viz. (i) People find it complex to use especially when the job has to be done by domestic help,(ii) Operation process does not match with the traditional/ conventional way, (iii) Power failures.

3.0 Consumer Behaviour Related to Dishwashing

A descriptive study was carried out to study the dishwashing behaviour. Results were published in the international journal, 'Design Principles and Practices, Volume 4, Issue 2, pp.83-94'. The research paper entitled 'The use of visual research method in the study of dishwashing process to identify the design need and idea generation' was presented in the 'Design Principles and Practices 2010' conference held from 13th to 15th February 2010 at the University of Illinois, Chicago, USA.

The study in hand was the consumer behaviour study of the dishwashing process. This study efforts to understand the dishwashing process using visual research method and other quantitative research methods. Visual Ethnographic Narrative technique was used to study the process of dishwashing. Other qualitative and quantitative techniques were used to interpret the visual data.

3.1 The Dishwashing Process

Daily life is full of tasks, chores and small pleasures that constantly engage us with objects. People enjoy some of the activities in their daily life and for them some activities are irritating. Physical efforts required to perform these different activities are significantly different (Sidhu M. et. al, 2005). The household work now a day has become very strenuous and consumes 2700 k.cal to 2800 k.cal. of energy in every day and it can be compared with any type of hard occupation outside the home in terms of energy costs and time utilization. (Grandjean, 1971). In India, improvement of health and hygiene of women and their economic empowerment is a major challenge. This can be met by improving working condition by design intervention in the social developmental initiatives. Almost thirty-five years ago, Victor Papanek (1985) pointed out the designers' responsibilities with respect to major social and environmental needs. The underprivileged needs attention from the industrial designers. The traditional market-driven approach is based on the idea of relieving people of the many tasks of everyday life. The everyday tasks, that required individual manual effort in the past, are now performed by something (a product) or someone else (a service) (Morelli Nicola, 2007).

Dishwasher could not full fill the expectations of the consumers living in urban India. A mechanized dishwasher may not be the only solution to solve the dishwashing problem. People prefer to get the dishwashing job done by the domestic help, which are mostly maid. Normally, the domestic helps belong to the economically weaker section of the society. They earn their livelihood from the dishwashing service and run their families including providing food and shelter to their children. They want to increase their income

level, want to have better health and hygiene and also want to save time so that they can earn more and spend more time with their families. Facilitating the domestic helps in the dishwashing activity by introduction of equipments and accessories may be a better design management strategy than to sell European designed dishwashers in the Indian market. D Leonard (1998) defines social quality as the 'measure of citizens' capability of participating to the social and economic life of their community in conditions that improve both their individual wealth and the conditions of their community.' In the context of dishwashing, a strategy may be suggested to design a product, targeting the middle and higher income group but the economic benefit goes to the poor and the underprivileged and hence the improvement of their quality of life. For example, if we find a design solution for the dishwashing problem and introduce some range of products to ease the dishwashing activity, it will ease the work of the domestic help. In this case the target customer will be the middle income group or the upper income group, but the social and economic benefit will go to the poor. On being asked to the individual household heads, whether a dishwasher or a cloth washer is a substitute for domestic help, majority of the respondents disagreed. It has been observed that though washing machine has become very popular in the middle class families, it could not eliminate the domestic help. Similarly it is expected that a socially responsible solution to the dishwashing problem will not eliminate the domestic help. Their employment opportunity will not be threatened. As the solution is expected to reduce the time and fatigue caused to the domestic help, therefore their productivity is also expected to increase. Their health and hygiene condition is also expected to improve. Therefore their capability (Sen Amartya, 1999) will also increase.

The study conducted in rural areas by M. Sidhu, R. Bakshi and P. Sandhu of Punjab Agriculture University, Ludhiana, India reveals that most of the women in the rural areas carry out the dishwashing activity in squatting posture (Sidhu M. et al, 2005). Percentage increase in heart rate after the dishwashing activity is 23.28%. Similarly the percentage increase in respiration frequency is 62.79%, increase in Pulmonary Ventilation rate is 238.29 % and increase in energy expenditure is 62.96%. As the activity becomes more strenuous, energy expenditure of body increases proportionately. It is especially true when heights of work surface are involved and when specific posture need to be followed. In such cases excessive bending of legs and abdominal muscles take place, which may increase oxygen consumption, resulting in increased energy expenditure (Park and Rodbard, 1962). Finding of Dhillon (1982), Oberoi et al (1983) are also in the same

line. In another study conducted for grip assessment of rural women performing dishwashing activity (Khatoon Jahida et al, 2009) reveals that majority of the rural respondents (60%) adopted bending posture for bringing utensils from kitchen to the cleaning area and 75% of the respondents adopted sitting with bending posture for scrubbing utensils. Maximum deviation in body angle was found to be 52 deg in scrubbing activity. The maximum decrease in grip strength was 25.93 kg for left hand followed by 22.59 kg for right hand and 16.07 kg for both hands after completion of the dishwashing activity. The average heart rate during dishwashing was 116 beats/min, blood pressure of 142/95 mmHg and pulse pressure of 61mmHg was recorded. From the population surveyed, 52.5% respondents adopted sitting with bending posture and 42.5% adopted squatting with bending posture for rinsing utensils. Only 5 percent adopted standing posture for rinsing utensils. The case of dishwashing was hence selected for this study. A socially responsible design solution to the dishwashing problem may improve the efficiency, health & hygiene and satisfaction level of people and therefore the capability (AmartyaSen) will increase.

Figure 3.1: Dishwashing behaviour in urban area

Figure 3.2: Dishwashing behaviour in rural area

3.2. Consumer behaviour of the urban respondents

A structured questionnaire was developed to study the dishwashing related consumer behaviour of people residing in urban areas. The questions were asked to the household member involved with the dishwashing activity. The opinions of the domestic helps were also taken in to account in filling up the questionnaire.

3.2.1 Domestic help related consumer behaviour (urban respondent)

Respondents were asked whether they have a domestic help in their home. It was observed that 96% of the respondents have domestic help in their home. Only 4% respondents do not have domestic help in their home.

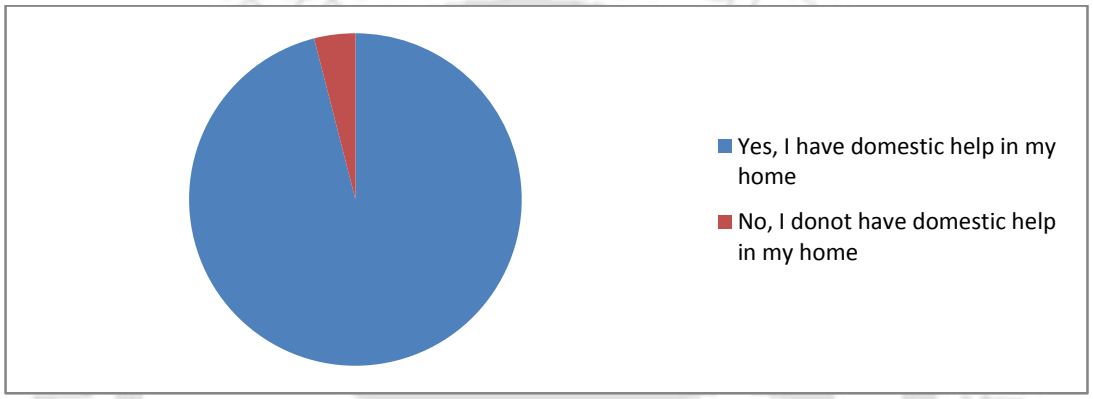


Figure 3.3: Availability of domestic help (urban respondent)

Respondents were asked whether they have part time or full time domestic help in their home. It was observed that 87% of the respondents have part time domestic help in their home. Only 9% respondents have full time domestic help in their home. Altogether 4% respondents do not have domestic help in their home.

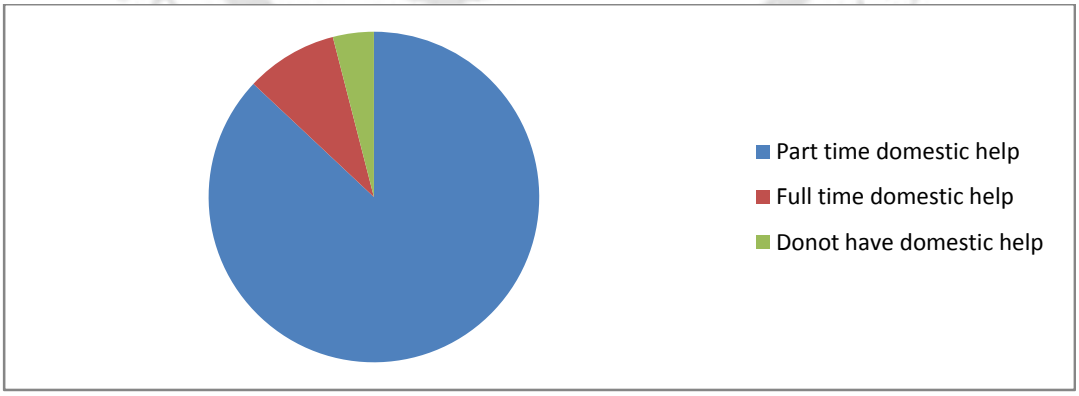


Figure 3.4: Type (Part time/ full time) of domestic help (urban respondent)

Respondents were asked whether they have male or maid domestic help in their home. It was observed that 96% of the respondents have maid domestic help in their

home. Altogether 4% respondents do not have domestic help in their home. No respondents have male domestic help in their home.

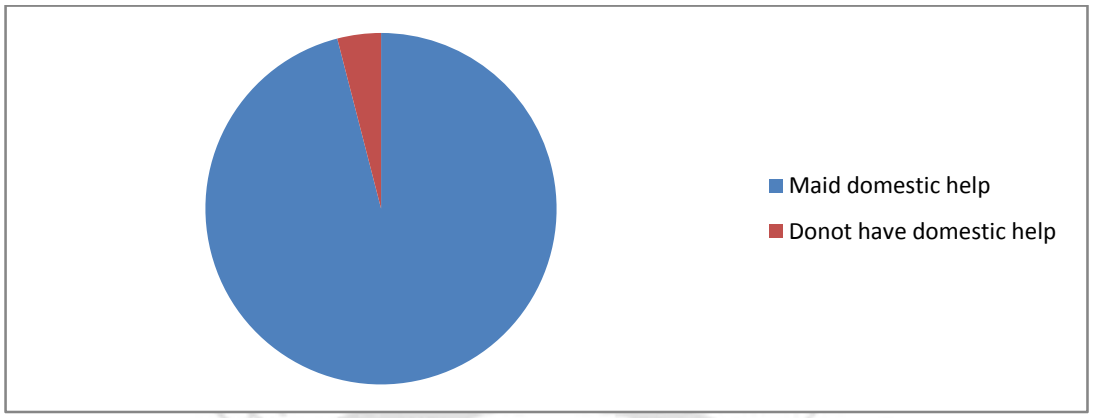


Figure 3.5: Gender of domestic help (urban respondent)

Respondents were asked about their dependence on domestic help for various types of household activities viz. dishwashing, taking care of kids, dishwashing and cloth washing combined etc. The study reveals that 65% respondents depend on domestic help for the dishwashing activity. Altogether 22% respondents take services of domestic help for dishwashing and cloth washing activity combined and only 9% respondents take help of domestic help for taking care of kids. This means that respondents keep domestic help primarily for dishwashing activity.

Dependence on domestic help for the activity	**Percent**
Dishwashing	65.0
Taking care of kids	9.0
Dishwashing and Cloth washing	22.0
Do not have domestic help	4.0

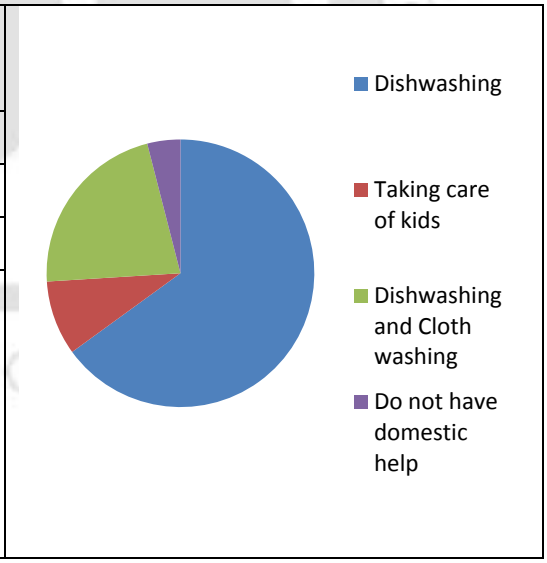


Figure 3.6: Dependence on domestic help for various household activities (urban respondent)

On being asked about the monthly compensation of the domestic help the respondents revealed that 53% of them pay Rs.300 to Rs.500 per month. Altogether 34%

respondents pay Rs.501 to Rs. 700 per month to the domestic help. Only 9% respondents pay Rs.901 to Rs.1100 to their domestic help.

Monthly compensation of the domestic help	Percent
Rs.300-Rs.500	53.0
Rs.501-Rs.700	34.0
Rs.901-Rs.1100	9.0
Do not have domestic help	4.0

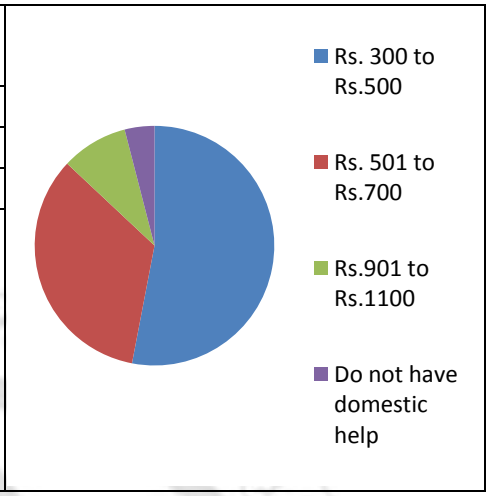


Figure 3.7: Monthly compensation of the domestic help (urban respondent)

Respondents were asked about the number of household their domestic help visit. It was observed that 77% of the domestic help visit two household followed by 10% domestic help visit three household. Altogether 9% respondents have full time domestic help and 4% respondents do not have domestic help.

Number of household visited by the domestic help	Percent
2 household	77.0
3 households	10.0
I have full Time	9.0
Do not have domestic help	4.0

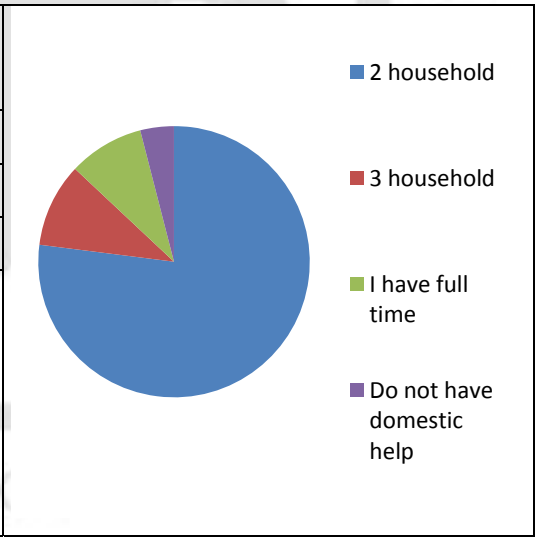


Figure 3.8: Number of household visited by the domestic help (urban respondent)

Respondents were asked about their preference on part time or full time domestic help for performing different activities. It was observed that 95% respondents prefer part time domestic help for performing dishwashing activity. Only 5% respondents prefer full time domestic help for performing dishwashing activity.

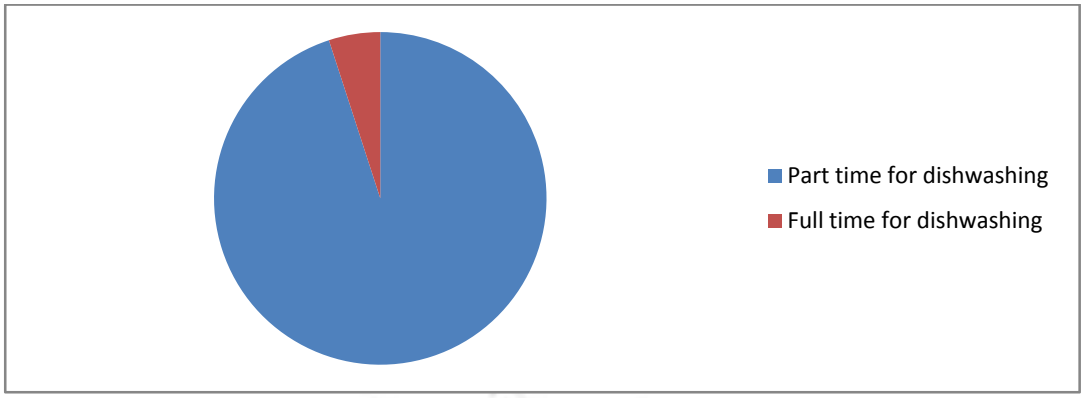


Figure 3.9: Type (Part time/ Full time) of domestic help for dishwashing (urban respondent)

The study reveals that 78% respondents prefer part time domestic help for performing cooking activity. Altogether 22% respondents prefer full time domestic help for performing cooking activity.

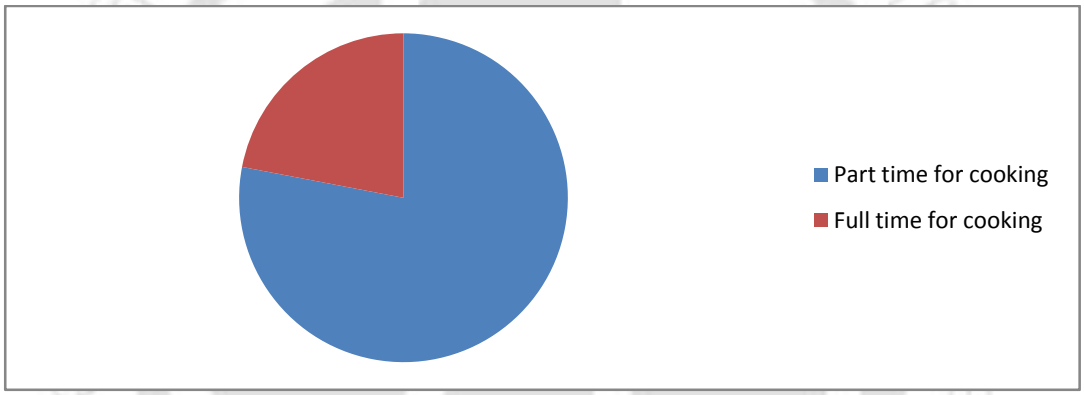


Figure 3.10: Type (Part time/ Full time) of domestic help for cooking (urban respondent)

Respondents were asked about their preference on part time or full time domestic help for taking care of kids. It was observed that 98% respondents prefer full time domestic help for taking care of kids. Only 2% respondents prefer part time domestic help for taking care of kids.

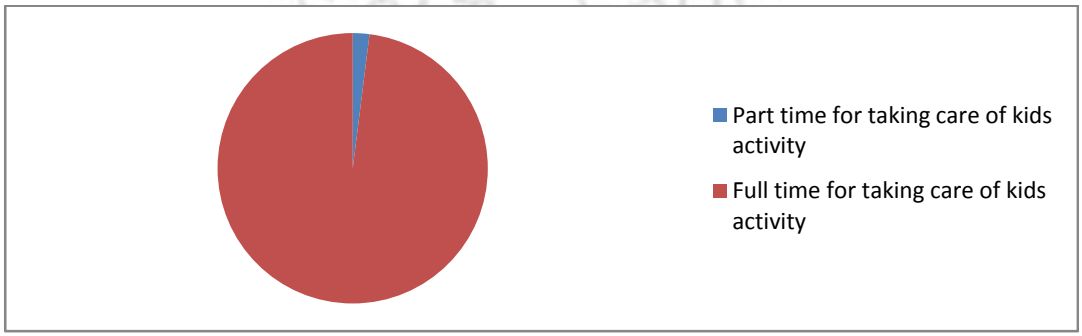


Figure 3.11: Type (Part time/ Full time) of domestic help for taking care of kids (urban respondent)

Respondents were asked about their preference on part time or full time domestic help for cloth washing activity. It was observed that 97% respondents prefer part time domestic help for cloth washing activity. Only 3% respondents prefer full time domestic help for cloth washing activity.

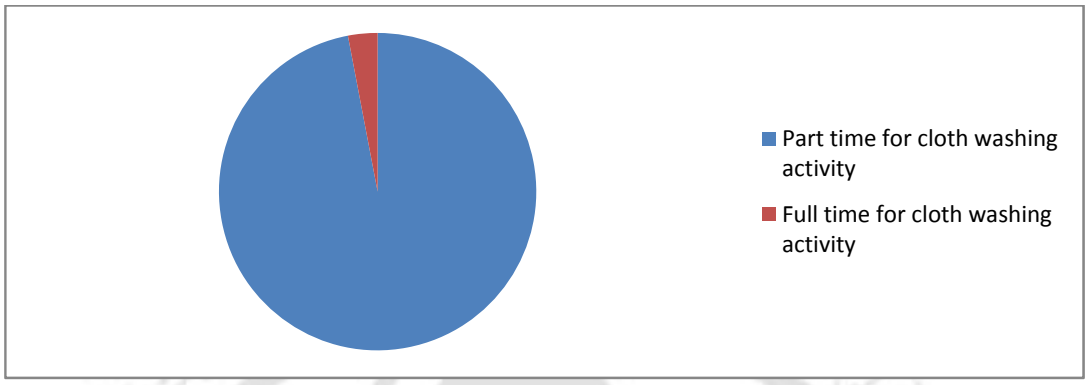


Figure 3.12: Type (Part time/ Full time) of domestic help for cloth washing activity (urban respondent)

3.2.2 Consumer behaviour related to dishwasher/ washing machine (urban respondent)

Respondents were asked whether they have a dishwasher in their home or not. It was observed that 98% respondents do not have dishwasher in their home. Only 2% respondents have dishwasher in their home.

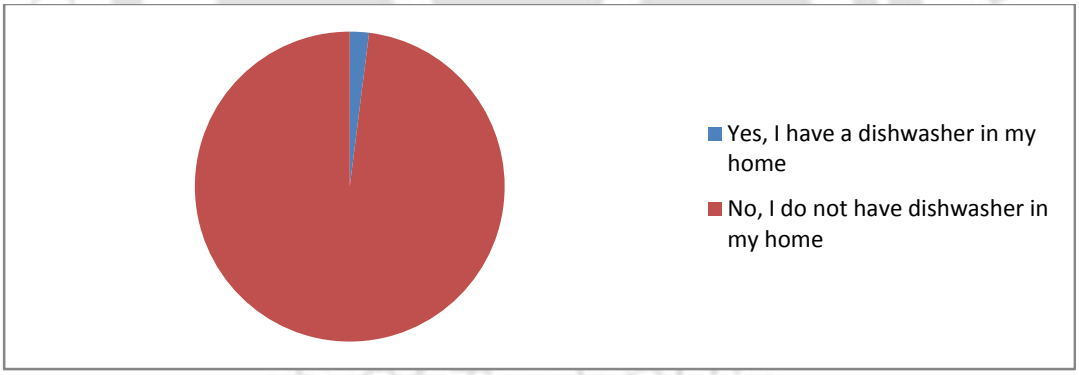


Figure 3.13: Availability of a dishwasher (urban respondent)

Respondents were asked whether they have a washing machine for cloth washing in their home or not. It was observed that 94% respondents have washing machine for cloth washing in their home. Only 6% respondents do not have washing machine for cloth washing in their home.

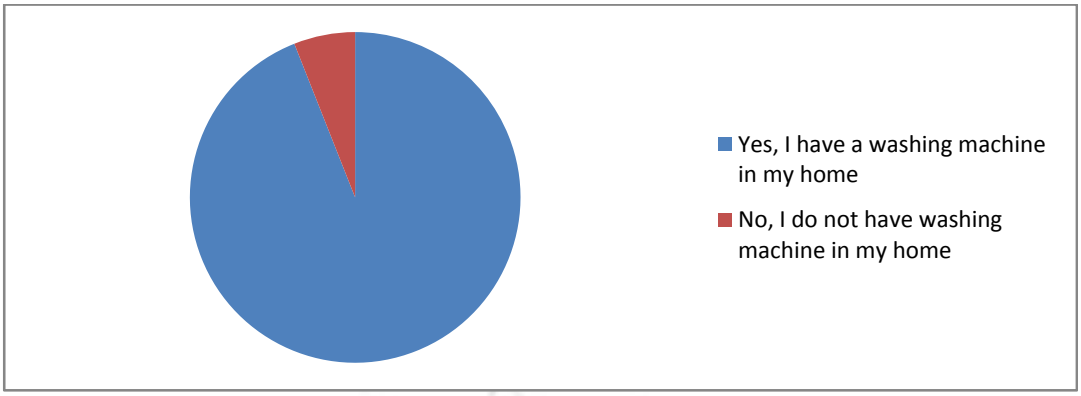


Figure 3.14: Availability of a washing machine (urban respondent)

Respondents were asked about their views on dishwasher or washing machine being a substitute for domestic help. It was observed that 90% of the respondents do not think that dishwasher or washing machine may act as a substitute for domestic help. Only 10% respondents feel that dishwasher or washing machine may act as a substitute for domestic help.

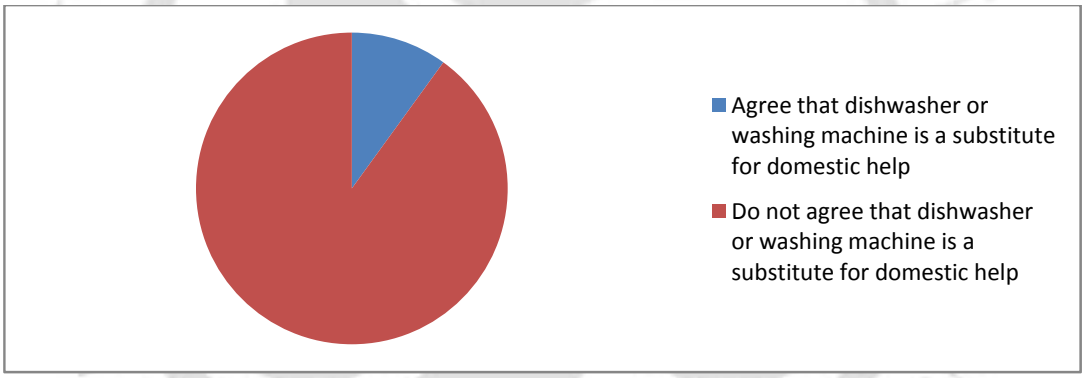


Figure 3.15: Respondents' opinion on dishwasher or washing machine being a substitute for domestic help (urban respondent)

3.2.3 Consumer behaviour for scrubber (urban respondent)

Respondents were asked about their preference on various types of scrubbers viz. sponge, steel, plastic and coir for washing utensils and cookware.

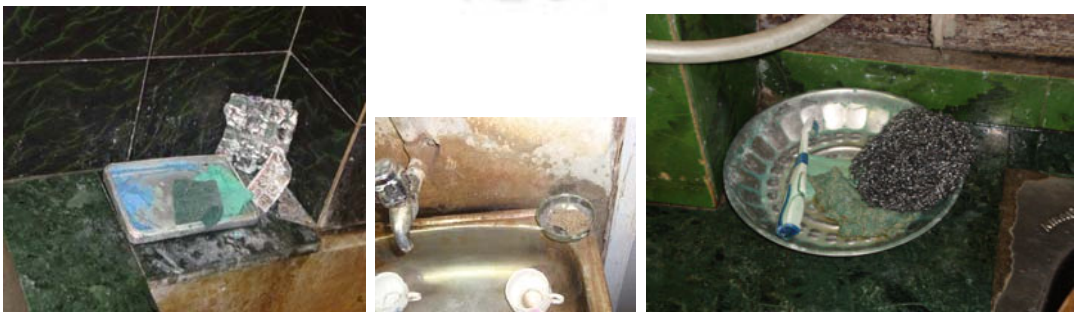


Figure 3.16: Use of various types of scrubbers in urban area

Types of scrubbers	Percent
Sponge scrubber	2.0
Plastic scrubber	15.0
Coir scrubber	83.0

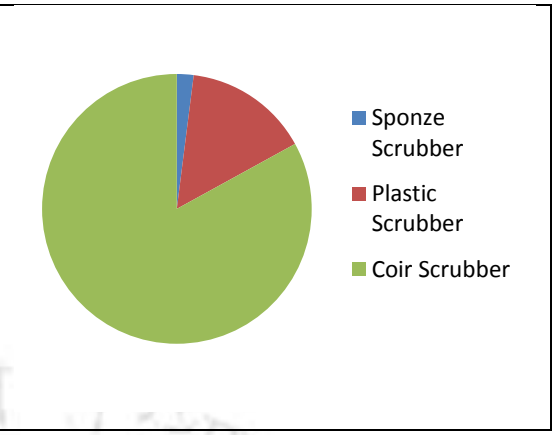
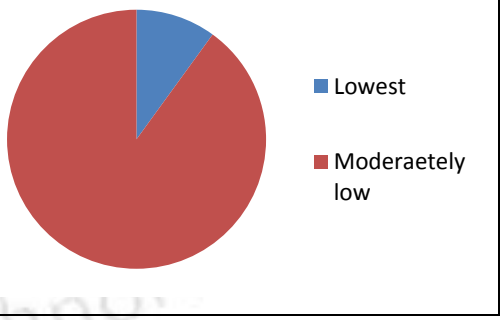


Figure 3.17: Preference on various types of scrubbers (urban respondent)

Respondents were also asked about their satisfaction level on various types of scrubbers viz. sponge, steel, plastic and coir for washing utensils and cookware. Ratings were taken in a five point semantic differential scale, five (5) being the highest level of satisfaction and one (1) being the lowest level of satisfaction. Respondents were asked to give their ratings on the basis of their experience with the existing varieties of scrubbers available in the market.

In case of sponge scrubber the study reveals that the satisfaction level on existing sponge scrubbers is very less (mean=1.9). Altogether 10% respondents have given lowest rating and 90% of the respondents have given moderately low rating.

Ratings on satisfaction level of sponge scrubber	Percent
Lowest	10.0
Moderately low	90.0



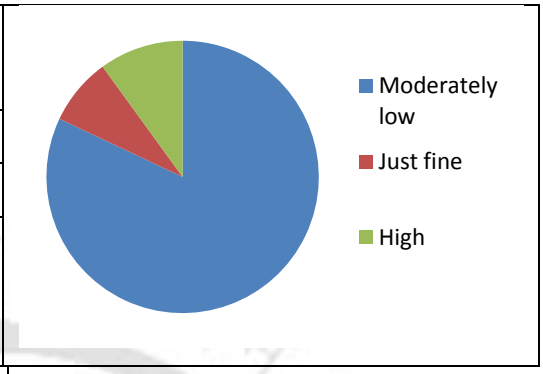
Mean	1.90
Median	2.00
Mode	2.00

Figure 3.18: Descriptive statistics of ratings on satisfaction level of sponge scrubber (urban respondent)

It has been observed that the satisfaction level on existing steel scrubbers is also less (mean= 2.28, median = 2, mode = 2). However the satisfaction level in case of steel scrubber is slightly higher than that of sponge scrubbers available in the market.

Altogether 82% respondents have given moderately low rating and 8% of the respondents appear to be just satisfied with the steel scrubbers. Altogether 10% respondents are highly satisfied with steel scrubber.

Ratings on satisfaction level of steel scrubber	Percent
Moderately low	82.0
Just fine	8.0
High	10.0

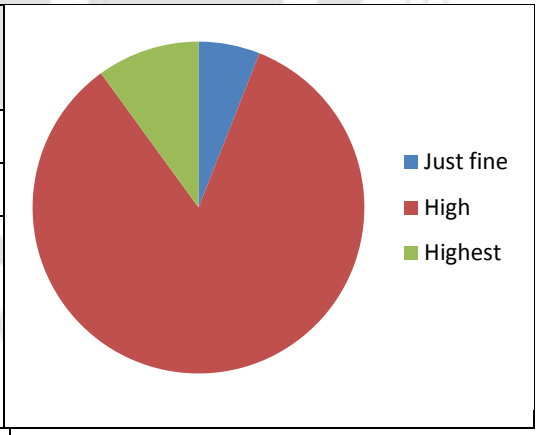


Mean	2.28
Median	2.00
Mode	2.00

Figure 3.19: Descriptive statistics of ratings on satisfaction level of steel scrubber (urban respondent)

It has been observed that the satisfaction level on plastic scrubbers available in the market is high (mean= 4.04, median = 4, mode = 4). However, only 10% respondents have rated it highest. Altogether 84% respondents have given high rating to the satisfaction level on plastic scrubbers available in the market.

Ratings on satisfaction level of plastic scrubber	Percent
Just fine	6.0
High	84.0
Highest	10.0

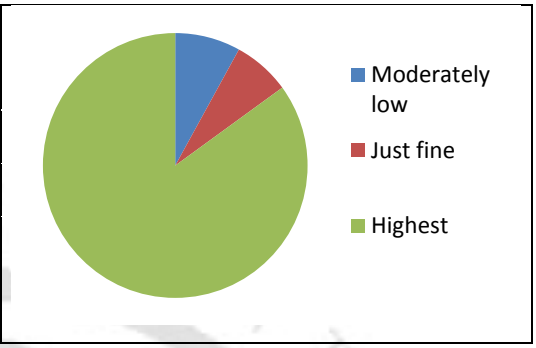


Mean	4.04
Median	4.00
Mode	4.00

Figure 3.20: Descriptive statistics of ratings on satisfaction level of plastic scrubber (urban respondent)

It has been observed that the satisfaction level on coir scrubbers available in the market is the highest among all the varieties of scrubbers (mean= 4.62, median = 5, mode = 5). Altogether 85% respondents have given highest rating to the satisfaction level on coir scrubbers available in the market. Only 8% respondents have rated it moderately low.

Ratings on satisfaction level of coir scrubber	Percent
Moderately low	8.0
Just fine	7.0
Highest	85.0



Mean	4.62
Median	5.00
Mode	5.00

Figure 3.21: Descriptive statistics of ratings on satisfaction level of coir scrubber (urban respondent)

Respondents were asked about their preference on different types of detergents for dishwashing viz. bar detergent, liquid detergent and powder detergent. It has been observed that respondents prefer bar detergent over powder detergent for dishwashing. Altogether 90% respondents prefer bar detergent for dishwashing. Only 10% respondents prefer powder detergent for dishwashing.

Types of detergent	Percent
Bar detergent	90.0
Powder detergent	10.0

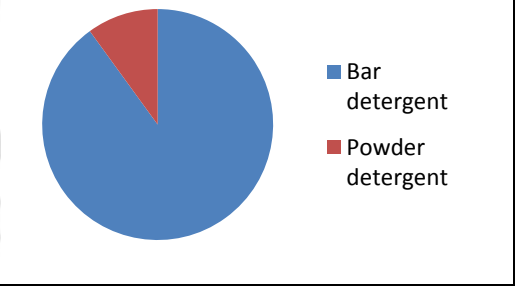


Figure 3.22: Descriptive statistics of preference of types of detergent for dishwashing (urban respondent)

3.2.4 Relationship of dishwashing behavior with number of family members in the respondents' household (urban respondent)

Information regarding the number of family members in respondents household was collected using a nominal scale. The categories were viz. two numbers, three to four

numbers, five to six numbers, seven to eight numbers and more than eight numbers. Various inferential statistical analyses were conducted to observe the relationship of dishwashing behaviour with number of family members in the respondents' household.

Null hypothesis: There is no significant difference of respondents having a domestic help or not with number of family members.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.799, Contingency Coefficient = 0.026) and concluded that there is no significant difference of respondents having a domestic help or not with number of family members. Descriptive statistics reveals that that 96% of the respondents have domestic help in their home. This means that irrespective of family size people keep domestic help for their household activities.

Null hypothesis: There is no significant difference of respondents having part time or full time domestic help with number of family members.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.00), Contingency Coefficient = 0.544) and concluded that there is a strong relationship of respondents having part time or full time domestic help with number of family members.

It has been observed that 88.5% part time domestic help work in household having 3 to 4 family members. Altogether 11.5% part time domestic help work in household having 5 to 6 family members. Amongst the full time domestic help, 100% of them work in household having 5 to 6 family members. This revels that the families having more family members prefer full time domestic help over part time domestic help.

Part Time or Full Time Domestic Help * Number of family members Cross tabulation

			Number of family members		Total
			3 to 4 numbers	5 to 6 numbers	
Part Time or Full Time Domestic Help	Part Time	Count	77	10	87
		% within Part Time or Full Time Domestic Help	88.5%	11.5%	100%
		% within Number of family members	100%	52.6%	90.6%
		% of Total	80.2%	10.4%	90.6%
Part Time or Full Time Domestic Help	Full Time	Count		9	9
		% within Part Time or Full Time Domestic Help		100%	100%
		% within Number of family members		47.4%	9.4%
		% of Total		9.4%	9.4%

Table 3.1: Cross tabulation of type of domestic help and number of family members (urban respondent)

Null hypothesis: There is no significant difference of type of activity assigned to domestic help with number of family members.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.00), Contingency Coefficient = 0.564) and concluded that there is a strong relationship of type of activity assigned to domestic help with number of family members in the respondents' household.

			Number of family members		Total
			3 to 4 numbers	5 to 6 numbers	
Dependence on domestic help for the activity	Dishwashing	Count	61	4	65
		% within Dependence on domestic help for the activity	93.8%	6.2%	100%
		% within Number of family members	79.2%	21.1%	67.7%
		% of Total	63.5%	4.2%	67.7%
Dependence on domestic help for the activity	Taking care of kids	Count		9	9
		% within Dependence on domestic help for the activity		100%	100%
		% within Number of family members		47.4%	9.4%
		% of Total		9.4%	9.4%
Dependence on domestic help for the activity	Dishwashing and Cloth washing	Count	16	6	22
		% within Dependence on domestic help for the activity	72.7%	27.3%	100%
		% within Number of family members	20.8%	31.6%	22.9%
		% of Total	16.7%	6.3%	22.9%

Table 3.2: Cross tabulation of dependence on domestic help for the household activity and number of family members (urban respondent)

It has been observed that the 93.8% respondent depending on domestic help for the dishwashing activity have number of family members ranging from 3 to 4. Again 79.2% respondents having family size 3 to 4 depend on domestic help for the dishwashing activity. It has been observed that the families having larger family size depend on domestic help for taking care of kids. Altogether 72.2% respondents depending on domestic help for the dishwashing and cloth washing activity combined, have number of family members ranging from 3 to 4. It clearly reveals that small families depend more on domestic help for their dishwashing activity.

Null hypothesis: There is no significant difference of respondent's preference on part time or full time domestic help for the dishwashing activity with number of family members in respondent's household.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.251) and concluded that there is no significant difference of respondent's preference on part time or full time domestic help for the dishwashing activity with number of family members in respondent's household. From the descriptive statistics we have found that 95% respondents prefer part time domestic help for

performing dishwashing activity. This means that irrespective of the family size majority of the respondents prefer part time domestic help for the dishwashing activity.

Null hypothesis: There is no significant difference of respondent's preference on part time or full time domestic help for the cooking activity with number of family members in respondent's household.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.717) and concluded that there is no significant difference of respondent's preference on part time or full time domestic help for the cooking activity with number of family members in respondent's household. From the descriptive statistics we have found that 78% respondents prefer part time domestic help for performing cooking activity. This means that irrespective of the family size majority of the respondents prefer part time domestic help for the cooking activity.

Null hypothesis: There is no significant difference of respondent's preference on part time or full time domestic help for kids care with number of family members in respondent's household.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.284) and concluded that there is no significant difference of respondent's preference on part time or full time domestic help for kids care with number of family members in respondent's household. From the descriptive statistics we have found that 98% respondents prefer full time domestic help for taking care of kids. This means that irrespective of the family size majority of the respondents prefer full time domestic help for kids care.

Null hypothesis: There is no significant difference of respondent's preference on part time or full time domestic help for cloth washing activity with number of family members in respondent's household.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.379) and concluded that there is no significant difference of respondent's preference on part time or full time domestic help for cloth washing activity with number of family members in respondent's household. From the descriptive statistics we have found that 97% respondents prefer part time domestic help for cloth washing activity. This means that irrespective of the family size majority of the respondents prefer part time domestic help for cloth washing activity.

Null hypothesis: There is no significant difference of respondents having a dishwasher or not with number of family members in the respondents' household.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.284) and concluded that there is no significant difference of respondents having a dishwasher or not with number of family members in respondent's household. From the descriptive statistics we have found that 98% respondents do not have dishwasher in their home. This means that irrespective of the family size, majority of the respondents do not have a dishwasher in their home.

Null hypothesis: There is no significant difference of respondents having a washing machine for cloth washing or not with number of family members in respondents' household.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.40) and concluded that there is no significant difference of respondents having a washing machine for cloth washing or not with number of family members in respondent's household. From the descriptive statistics we have found that 94% respondents have washing machine in their home. This means that irrespective of the family size, majority of the respondents have a washing machine in their home.

Null hypothesis: There is no significant difference of respondent's view on dishwasher/ washing machine being a substitute of domestic help with number of family members in the respondents' household.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.000) and concluded that there is a strong relationship of respondent's view on dishwasher/ washing machine being a substitute of domestic help with number of family members in respondent's household. In the semantic differential scale used for this purpose 1 represents 'strongly agree' and 5 represents 'strongly disagree'. It was observed that in comparison to larger family size, the respondents belonging to small family size strongly feel that a dishwasher or washing machine cannot be a substitute of domestic help.

Number of family members	Respondent's view on dishwasher/ washing machine being a substitute of domestic help (1=Strongly agree, 5=Strongly disagree)		
	Mean	Minimum	Maximum
3 to 4 numbers	5.0000	5.00	5.00
5 to 6 numbers	4.5000	4.00	5.00

Table 3.3: Cross tabulation of respondents' view on dishwasher/ washing machine being a substitute of domestic help and number of family members (urban respondent)

Null hypothesis: There is no significant difference of respondent's preferred types of scrubber viz. sponge scrubber, plastic scrubber, coir scrubber and steel scrubber with number of family members in respondents' household.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.00, Contingency Coefficient: 0.441) and concluded that there is a strong relationship of respondent's preferred types of scrubber viz. sponge scrubber, plastic scrubber, coir scrubber and steel scrubber with number of family members in respondent's household. It has been observed that the majority of the respondents preferring plastic scrubbers (66.7%) belong to family size of 5 to 6 members. Altogether 33.3% respondents preferring plastic scrubber belong to family size of 3 to 4 members. The study reveals that the majority of the respondents preferring coir scrubbers (88%) belong to family size of 3 to 4 members. Altogether 12% respondents preferring plastic scrubber belong to family size of 5 to 6 members. It is quite evident that as the number of family members increases the number of utensils, crockery and other cookware for daily use for that family also increases. From the above statistics it appears that the members of the larger family sizes prefer plastic scrubber over coir scrubbers. On the other hand the preference rating on coir scrubber is always high over other types of scrubber.

			Number of family members		Total
			3 to 4 numbers	5 to 6 numbers	
Types of scrubber use for dishwashing	Sponge scrubber	Count	2		2
		% within scrubber use for washing the utensils	100%		100%
		% within Number of family members	2.5%		2.0%
		% of Total	2.0%		2.0%
	Plastic scrubber	Count	5	10	15
		% within scrubber use for washing the utensils	33.3%	66.7%	100%
		% within Number of family members	6.3%	50.0%	15.0%
		% of Total	5.0%	10.0%	15.0%
	Coir scrubber	Count	73	10	83
		% within scrubber use for washing the utensils	88.0%	12.0%	100%
		% within Number of family members	91.3%	50.0%	83.0%
		% of Total	73.0%	10.0%	83.0%

Table 3.4: Cross tabulation of Types of scrubber use for dishwashing and number of family members (urban respondent)

Null hypothesis: There is no significant difference of respondent's satisfaction level on sponge scrubber with number of family members in respondents' household.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.000) and concluded that there is a strong relationship of respondent's satisfaction level on sponge scrubber with number of family members in respondent's household. In the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. It was observed that in comparison to larger family size, the respondents belonging to small family size are more satisfied with the sponge scrubbers available in the market. However the overall satisfaction level for sponge scrubbers is less.

Number of family members	**Satisfaction level on sponge scrubber**		
	Mean	**Minimum**	**Maximum**
3 to 4 numbers	2.00	2.00	2.00
5 to 6 numbers	1.50	1.00	2.00

Table 3.5: Cross tabulation of satisfaction level on sponge scrubber and number of family members (urban respondent)

Null hypothesis: There is no significant difference of respondent's satisfaction level on steel scrubber with number of family members in respondents' household.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.000) and concluded that there is a strong relationship of respondent's satisfaction level on steel scrubber with number of family members in respondent's household. In the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. It was observed that in comparison to respondents of small family size, the respondents belonging to large family size are more satisfied with the steel scrubbers available in the market. However the overall satisfaction level for steel scrubbers is not very high.

Number of family members	**Satisfaction level on steel scrubber**		
	Mean	**Minimum**	**Maximum**
3 to 4 numbers	2.10	2.00	3.00
5 to 6 numbers	3.00	2.00	4.00

Table 3.6: Cross tabulation of satisfaction level on steel scrubber and number of family members (urban respondent)

Null hypothesis: There is no significant difference of respondent's satisfaction level on plastic scrubber with number of family members in respondents' household.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.000) and concluded that there is a strong relationship of respondent's satisfaction level on plastic scrubber with number of family members in respondent's household. In the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. It was observed that in comparison to respondents of small family size, the respondents belonging to large family size are more satisfied with the plastic scrubbers available in the market. Overall satisfaction level for plastic scrubbers is significantly high.

Number of family members	**Satisfaction level on plastic scrubber**		
	Mean	**Minimum**	**Maximum**
3 to 4 numbers	3.93	3.00	4.00
5 to 6 numbers	4.45	3.00	5.00

Table 3.7: Cross tabulation of satisfaction level on plastic scrubber and number of family members (urban respondent)

Null hypothesis: There is no significant difference of respondent's satisfaction level on coir scrubber with number of family members in respondents' household.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.000) and concluded that there is a strong relationship of respondent's satisfaction level on coir scrubber with number of family members in respondent's household. In the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. It was observed that in comparison to respondents of large family size, the respondents belonging to small family size are more satisfied with the coir scrubbers available in the market. Overall satisfaction level for coir scrubbers is significantly high.

Number of family members	**Satisfaction level on coir scrubber**		
	Mean	**Minimum**	**Maximum**
3 to 4 numbers	4.8750	3.00	5.00
5 to 6 numbers	3.6000	2.00	5.00

Table 3.8: Cross tabulation of satisfaction level on coir scrubber and number of family members (urban respondent)

Null hypothesis: There is no significant difference of respondent's preferred types of detergent for dishwashing viz. bar detergent, powder detergent, liquid detergent with number of family members in respondent's household.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.00, Contingency Coefficient: 0.555) and concluded that there is a strong relationship of respondent's preferred types of detergent viz. bar detergent, powder detergent, liquid detergent with number of family members in respondent's household. It has been observed that the majority of the respondents preferring bar detergent (88.9%) belong to family size of 3 to 4 members. Altogether 11.1% respondents preferring bar detergent belong to family size of 5 to 6 members. The study reveals that the all respondents preferring powder detergent belong to family size of 5 to 6 members. It is quite evident that as the number of family members increases the number of utensils, crockery and other cookware for daily use for that family also increases. From the above statistics it appears that the members of the larger family size prefer powder detergent over bar detergent.

			Number of family members		Total
			3 to 4 numbers	5 to 6 numbers	
Detergent use for dishwashing	Bar detergent	Count	80	10	90
		% within detergent use for washing the utensils	88.9%	11.1%	100%
		% within Number of family members	100%	50.0%	90.0%
		% of Total	80.0%	10.0%	90.0%
	Powder detergent	Count		10	10
		% within detergent use for washing the utensils		100%	100%
		% within Number of family members		50.0%	10.0%
		% of Total		10.0%	10.0%

Table 3.9: Cross tabulation of type of detergent use for dishwashing and number of family members (urban respondent)

Null hypothesis: There is no significant difference of respondent's preferred types of detergent viz. bar detergent, powder detergent, liquid detergent with number of family members in respondent's household.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.00, Contingency Coefficient: 0.555) and concluded that there is a strong relationship of respondent's preferred types of detergent viz. bar detergent, powder detergent, liquid detergent with number of family members in respondent's household. It has been observed that the majority of the respondents preferring bar detergent (88.9%) belong to family size of 3 to 4 members. Altogether 11.1% respondents preferring bar detergent belong to family size of 5 to 6 members. The study reveals that the all respondents preferring powder detergent belong to family size of 5 to 6 members. It is quite evident that as the number of family members increases the number of utensils, crockery and other cookware for daily use for that family also increases. From the above statistics it appears that the members of the larger family size prefer powder detergent over bar detergent.

3.2.5 Relationship of dishwashing behavior with income level of the respondent (urban respondent)

Information regarding the annual income level of the respondent was collected using a nominal scale. The categories were viz. below Rs.1,00,000; Rs.1,00,001 to Rs.2,00,000;

Rs.2,00,001 to Rs.3,00,000; Rs.3,00,001 to Rs.4,00,000; Rs.4,00,001 to Rs.5,00,000 and above Rs.5,00,000 per annum. Various inferential statistical analyses were conducted to observe the relationship of dishwashing behaviour with income level of the respondents.

Null hypothesis: There is no significant difference of respondents having a domestic help or not with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.525, Contingency Coefficient = 0.176) and concluded that there is no significant difference of respondents having a domestic help or not with income level of the respondent. Descriptive statistics reveals that that 96% of the respondents have domestic help in their home. This means that irrespective of income level of the respondent people keep domestic help for their household activities.

Null hypothesis: There is no significant difference of respondents having part time or full time domestic help with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.002), Contingency Coefficient = 0.385) and concluded that there is a strong relationship of respondents having part time or full time domestic help with income level of the respondent. The study reveals that respondents having annual income less than Rs.4,00,000 do not have full time domestic help in their home. A few respondents having annual income more than Rs.4,00,000 have full time domestic help in their household.

			Part Time or Full Time Domestic Help		Total
			Part Time	Full Time	
Annual income	Rs.100,000 to Rs.200,000	Count	2		2
		% within annual income	100%		100%
		% within Part Time or Full Time Domestic Help	2.3%		2.1%
		% of Total	2.1%		2.1%
	Rs.200,001 to Rs.300,000	Count	4		4
		% within annual income	100%		100%
		% within Part Time or Full Time Domestic Help	4.6%		4.2%
		% of Total	4.2%		4.2%
	Rs.300,001 to Rs.400,000	Count	54		54
		% within annual income	100%		100%
		% within Part Time or Full Time Domestic Help	62.1%		56.3%
		% of Total	56.3%		56.3%
	Rs.400,001 to Rs.500,000	Count	23	8	31
		% within annual income	74.2%	25.8%	100%
		% within Part Time or Full Time Domestic Help	26.4%	88.9%	32.3%
		% of Total	24.0%	8.3%	32.3%
	Above Rs.500,000	Count	4	1	5
		% within annual income	80.0%	20.0%	100%
		% within Part Time or Full Time Domestic Help	4.6%	11.1%	5.2%
		% of Total	4.2%	1.0%	5.2%

Table 3.10: Cross tabulation of type of domestic help with income level of the respondent (urban respondent)

Null hypothesis: There is no significant difference of type of activity assigned to domestic help with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.00), Contingency Coefficient = 0.695) and concluded that there is a strong relationship of type of activity assigned to domestic help with income level of the respondent.

The study reveals that respondents having annual income less than Rs.4,00,000 do not prefer domestic help for other activities apart from dishwashing viz. taking care of kids, cloth washing etc. A few respondents having annual income more than Rs.4,00,000 have domestic help for other activities viz. kids care, cloth washing etc. Most of the respondents keep domestic help for dishwashing activity only.

Annual income		Dependence on domestic help for the household activity			Total
		Dishwashing	Taking care of kids	Dishwashing and cloth washing	
Rs.100,000 to Rs.200,000	Count	2			2
	% within annual income	100%			100%
	% within Dependence on domestic help for the activity	3.1%			2.1%
	% of Total	2.1%			2.1%
Rs.200,001 to Rs.300,000	Count	4			4
	% within annual income	100%			100%
	% within Dependence on domestic help for the activity	6.2%			4.2%
	% of Total	4.2%			4.2%
Rs.300,001 to Rs.400,000	Count	54			54
	% within annual income	100%			100%
	% within Dependence on domestic help for the activity	83.1%			56.3%
	% of Total	56.3%			56.3%
Rs.400,001 to Rs.500,000	Count	1	8	22	31
	% within annual income	3.2%	25.8%	71.0%	100%
	% within Dependence on domestic help for the activity	1.5%	88.9%	100%	32.3%
	% of Total	1.0%	8.3%	22.9%	32.3%
Above Rs.500,000	Count	4	1		5
	% within annual income	80.0%	20.0%		100%
	% within Dependence on domestic help for the activity	6.2%	11.1%		5.2%
	% of Total	4.2%	1.0%		5.2%

Table 3.11: Cross tabulation of Dependence on domestic help for the activity with income level (urban respondent)

Null hypothesis: There is no significant difference of respondent's preference on part time or full time domestic help for the cooking activity with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.580, Contingency Coefficient: 0.167) and concluded that there is no significant difference of respondent's preference on part time or full time domestic help for the cooking activity with income level of the respondent. From the descriptive statistics we have found that 78% respondents prefer part time domestic help for performing cooking activity. This means that irrespective of the income level of the respondents prefer part time domestic help for the cooking activity.

Null hypothesis: There is no significant difference of respondent's preference on part time or full time domestic help for the dishwashing activity with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.003, Contingency Coefficient: 0.369) and concluded that there is a significant difference of respondent's preference on part time or full time domestic help for the dishwashing activity with income level of the respondent. However the relationship is not very strong. From the descriptive statistics we have found that 95% respondents prefer part time domestic help for performing dishwashing activity.

Annual income of the respondent		Part Time or Full Time for Dishwashing		Total
		Part Time	Full Time	
Rs.100,000 to Rs.200,000	Count	1	1	2
	% within annual income	50.0%	50.0%	100%
	% within Part Time or Full Time for Dishwashing	1.1%	20.0%	2.0%
	% of Total	1.0%	1.0%	2.0%
Rs.200,001 to Rs.300,000	Count	3	1	4
	% within annual income	75.0%	25.0%	100%
	% within Part Time or Full Time for Dishwashing	3.2%	20.0%	4.0%
	% of Total	3.0%	1.0%	4.0%
Rs.300,001 to Rs.400,000	Count	54	1	55
	% within annual income	98.2%	1.8%	100%
	% within Part Time or Full Time for Dishwashing	56.8%	20.0%	55.0%
	% of Total	54.0%	1.0%	55.0%
Rs.400,001 to Rs.500,000	Count	33	1	34
	% within annual income	97.1%	2.9%	100%
	% within Part Time or Full Time for Dishwashing	34.7%	20.0%	34.0%
	% of Total	33.0%	1.0%	34.0%
Above Rs.500,000	Count	4	1	5
	% within annual income	80.0%	20.0%	100%
	% within Part Time or Full Time for Dishwashing	4.2%	20.0%	5.0%
	% of Total	4.0%	1.0%	5.0%

Table 3.12: Cross tabulation of preference of type of domestic help with income level (urban respondent)

Null hypothesis: There is no significant difference of respondent's preference on part time or full time domestic help for the kids care activity with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.796, Contingency Coefficient: 0.128) and concluded that there is no significant difference of respondent's preference on part time or full time domestic help for the kids care activity with income level of the respondent. From the descriptive statistics we have found that 78% respondents prefer part time domestic help

for performing kids care activity. This means that irrespective of the income level of the respondents prefer part time domestic help for the kids care activity.

Null hypothesis: There is no significant difference of respondent's preference on part time or full time domestic help for the cloth washing activity with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.258, Contingency Coefficient: 0.129) and concluded that there is no significant difference of respondent's preference on part time or full time domestic help for the cloth washing activity with income level of the respondent. From the descriptive statistics we have found that 97% respondents prefer part time domestic help for performing cloth washing activity. This means that irrespective of the income level of the respondents prefer part time domestic help for the cloth washing activity.

Null hypothesis: There is no significant difference of respondents having a dishwasher or not with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.411, Contingency Coefficient: 0.195) and concluded that there is no significant difference of respondents having a dishwasher or not with income level of the respondent. From the descriptive statistics we have found that 98% respondents do not have dishwasher in their home. This means that irrespective of the income level, majority of the respondents do not have a dishwasher in their home.

Null hypothesis: There is no significant difference of respondents having a cloth washing machine or not with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.552, Contingency Coefficient: 0.172) and concluded that there is no significant difference of respondents having a cloth washing machine or not with income level of the respondent. From the descriptive statistics we have found that 94% respondents have cloth washing machine in their home. This means that irrespective of the income level, majority of the respondents have a cloth washing machine in their home.

Null hypothesis: There is no significant difference of respondent's view on dishwasher/ washing machine being a substitute of domestic help with number of family members in respondent's household.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.000) and concluded that there is a significant difference of

respondent's view on dishwasher/ washing machine being a substitute of domestic help with number of family members in respondent's household. In the semantic differential scale used for this purpose 1 represents 'strongly disagree' and 5 represents 'strongly agree'. It was observed that in comparison to the respondents belonging to income group of annual income above Rs.4,00,000; respondents having annual income less than Rs.4,00,000 strongly feel that a dishwasher or washing machine cannot be a substitute of domestic help.

Income level of the respondents	**Respondent's view on dishwasher/ washing machine being a substitute of domestic help (1: Strongly agree, 5: strongly disagree)**		
	Mean	**Minimum**	**Maximum**
Rs.100,000 to Rs.200,000	5.0000	5.00	5.00
Rs.200,001 to 300,000	5.0000	5.00	5.00
Rs.300,001 to Rs.400,000	5.0000	5.00	5.00
Rs.400,001 to Rs.500,000	4.7353	4.00	5.00
Above Rs.500,000	4.8000	4.00	5.00

Table 3.13: Cross tabulation of respondent's view on dishwasher/ washing machine being a substitute of domestic help with income level of the respondent (urban respondent)

Null hypothesis: There is no significant difference of respondent's preference of various types of scrubber viz. sponge scrubber, plastic scrubber, steel scrubber and coir scrubber with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.258, Contingency Coefficient: 0.303) and concluded that there is no significant difference of respondent's preference of various types of scrubber viz. sponge scrubber, plastic scrubber, steel scrubber and coir scrubber with income level of the respondent.

From the descriptive statistics we have found that 83% respondents prefer coir scrubber. This means that irrespective of the income level, majority of the respondents prefer coir scrubber for dishwashing.

Null hypothesis: There is no significant difference of respondent's satisfaction level on sponge scrubber with income level of the respondent.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.001) and concluded that there is a significant difference of respondent's satisfaction level on sponge scrubber with income level of the respondent. In

the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. It was observed that in comparison to respondents belonging to income group of annual income more than Rs.4,00,000; the respondents belonging to the income group of annual income between Rs.1,00,000 and Rs. 4,00,000 are more satisfied with the sponge scrubbers available in the market. However the overall satisfaction level for sponge scrubbers is significantly low.

Income level of the respondent	**Satisfaction level on sponge scrubber**		
	Mean	**Minimum**	**Maximum**
Rs.100,000 to Rs.200,000	2.00	2.00	2.00
Rs.200,001 to 300,000	2.00	2.00	2.00
Rs.300,001 to Rs.400,000	2.00	2.00	2.00
Rs.400,001 to Rs.500,000	1.73	1.00	2.00
Above Rs.500,000	1.80	1.00	2.00

Table 3.14: Cross tabulation of satisfaction level on sponge scrubber with income level of the respondent (urban respondent)

Null hypothesis: There is no significant difference of respondent's satisfaction level on steel scrubber with income level of the respondent.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.002) and concluded that there is a significant difference of respondent's satisfaction level on steel scrubber with income level of the respondent. In the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. It was observed that in comparison to respondents belonging to income group of annual income more than Rs.4,00,000; the respondents belonging to the income group of annual income between Rs.1,00,000 and Rs. 4,00,000 are less satisfied with the steel scrubbers available in the market. However the overall satisfaction level for steel scrubbers is significantly low.

Income level of the respondent	Satisfaction level on steel scrubber		
	Mean	Minimum	Maximum
Rs.100,000 to Rs.200,000	2.00	2.00	2.00
Rs.200,001 to 300,000	2.00	2.00	2.00
Rs.300,001 to Rs.400,000	2.09	2.00	3.00
Rs.400,001 to Rs.500,000	2.61	2.00	4.00
Above Rs.500,000	2.40	2.00	4.00

Table 3.15: Cross tabulation of satisfaction level on steel scrubber with income level of the respondent (urban respondent)

Null hypothesis: There is no significant difference of respondent's satisfaction level on plastic scrubber with income level of the respondent.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.093) and concluded that there is no significant difference of respondent's satisfaction level on plastic scrubber with income level of the respondent. The descriptive statistics reveals that the overall satisfaction level on plastic scrubber is substantially high irrespective of income level of the respondent.

Null hypothesis: There is no significant difference of respondent's satisfaction level on coir scrubber with income level of the respondent.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.001) and concluded that there is a significant difference of respondent's satisfaction level on coir scrubber with income level of the respondent. Descriptive statistics reveals that the overall satisfaction level for coir scrubbers is significantly high.

Income level of the respondent	Satisfaction level on coir scrubber		
	Mean	Minimum	Maximum
Rs.100,000 to Rs.200,000	4.0000	3.00	5.00
Rs.200,001 to 300,000	5.0000	5.00	5.00
Rs.300,001 to Rs.400,000	4.9273	3.00	5.00
Rs.400,001 to Rs.500,000	4.1471	2.00	5.00
Above Rs.500,000	4.4000	2.00	5.00

Table 3.16: Cross tabulation of satisfaction level on steel scrubber with income level of the respondent (urban respondent)

Null hypothesis: There is no significant difference of respondent's preference on type of detergent viz. bar detergent, liquid detergent and powder detergent with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.001, Contingency Coefficient: 0.387) and concluded that there is a significant difference of respondent's preference on type of detergent viz. bar detergent, liquid detergent and powder detergent with income level of the respondent. However the relationship is not very strong. From the descriptive statistics we have found that 90% respondents prefer bar detergent over powder detergent.

			Detergent use for washing the utensils		Total
			Bar detergent	Powder detergent	
Annual income	Rs.100,000 to Rs.200,000	Count	2		2
		% within annual income	100%		100%
		% within detergent use for washing the utensils	2.2%		2.0%
		% of Total	2.0%		2.0%
	Rs.200,001 to Rs.300,000	Count	4		4
		% within annual income	100%		100%
		% within detergent use for washing the utensils	4.4%		4.0%
		% of Total	4.0%		4.0%
	Rs.300,001 to Rs.400,000	Count	55		55
		% within annual income	100%		100%
		% within detergent use for washing the utensils	61.1%		55.0%
		% of Total	55.0%		55.0%
	Rs.400,001 to Rs.500,000	Count	25	9	34
		% within annual income	73.5%	26.5%	100%
		% within detergent use for washing the utensils	27.8%	90.0%	34.0%
		% of Total	25.0%	9.0%	34.0%
	Above Rs.500,000	Count	4	1	5
		% within annual income	80.0%	20.0%	100%
		% within detergent use for washing the utensils	4.4%	10.0%	5.0%
		% of Total	4.0%	1.0%	5.0%

Table 3.17: Cross tabulation of respondents' preference on type of detergent with income level of the respondent (urban respondent)

3.3 Consumer behavior of the rural respondents

A structured questionnaire was developed to study the dishwashing related consumer behaviour of people residing in rural areas. The questions were asked to the household member involved with the dishwashing activity. The enumerators filled up the questionnaire on the basis of responses from the rural respondents; as they were finding it difficult to read the questionnaire in English.

Respondents were asked whether they have a domestic help in their home. It was observed that 95% of the respondents do not have domestic help in their home. Only 5% respondents have domestic help in their home.

Figure 3.23: Availability of domestic helps in the household (rural respondent)

3.3.1 Likings and disliking about activities performed in the kitchen (rural respondent)

Respondents were asked about liking and disliking about the activities they perform in kitchen. The activities considered for the study were cooking, washing utensils and preparing raw food ingredients. It has been observed that 80% respondents like cooking activity and 20% like it the most.

Liking rates of cooking activity	Percent
Like	80.0
Like most	20.0

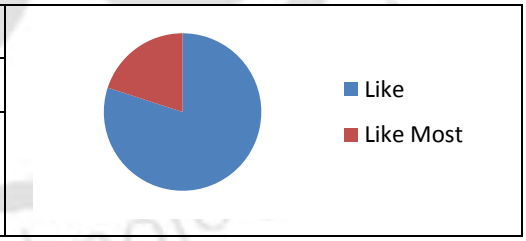


Figure 3.24: Likings and disliking about cooking activity (rural respondent)

It has been observed that 72.5% respondents dislike dishwashing activity to the most and 27.5% respondents moderately dislike it.

Liking of dishwashing activity	Percent
dislike most	72.5
moderately dislike	27.5

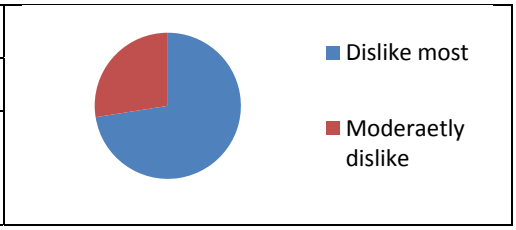


Figure 3.25: Likings and disliking about dishwashing activity (rural respondent)

It has been observed that 72.5% respondents dislike dishwashing activity to the most and 27.5% respondents moderately dislike it.

Liking of preparing raw food ingredient activity	Percent
Like	72.5
moderately dislike	27.5

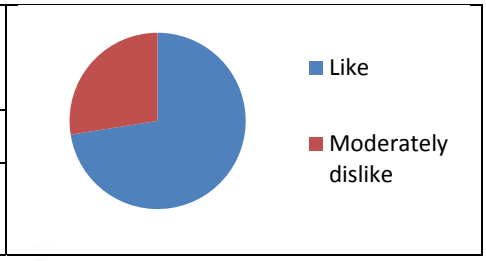


Figure 3.26: Likings and disliking about preparing raw food ingredient activity (rural respondent)

3.3.2 Consumer behaviour for scrubber (rural respondent)

Respondents were asked about their preference on various types of scrubbers viz. sponge, steel, plastic and coir for washing utensils and cookware. It has been observed that 27.5% respondents prefer plastic scrubber and 72.5% respondents prefer coir scrubber.

Types of scrubbers	Percent
Plastic scrubber	27.5
Coir scrubber	72.5

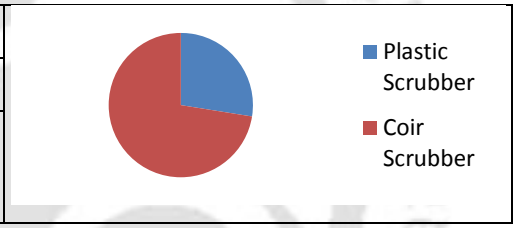
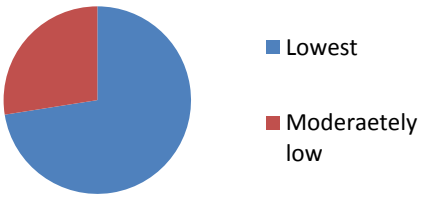


Figure 3.27: Preference on various types of scrubbers (rural respondent)

Respondents were also asked about their satisfaction level on various types of scrubbers viz. sponge, steel, plastic and coir for washing utensils and cookware. Ratings were taken in a five point semantic differential scale, five (5) being the highest level of satisfaction and one (1) being the lowest level of satisfaction. Respondents were asked to give their ratings on the basis of their experience with the existing varieties of scrubbers available in the market.

In case of sponge scrubber the study reveals that the satisfaction level on existing sponge scrubbers is very less (mean=1.27). Altogether 72.5% respondents have given lowest rating and 27.5% of the respondents have given moderately low rating.

Ratings on satisfaction level of sponge scrubber	Percent
Lowest	72.5
Moderately low	27.5

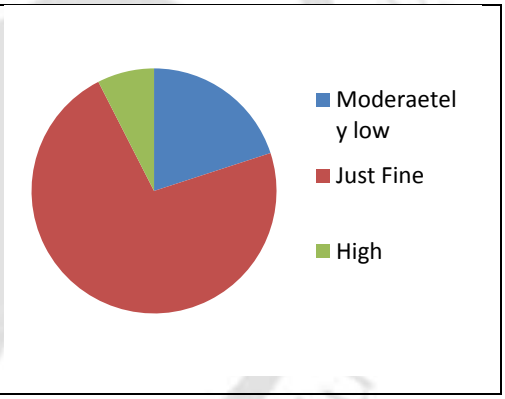


Mean	1.27
Median	1.00
Mode	1.00

Figure 3.28: Satisfaction level of sponge scrubber (rural respondent)

It has been observed that the satisfaction level on existing steel scrubbers is moderately higher than that of sponge scrubbers (mean= 2.87, median = 3, mode = 3). Altogether 20.0% respondents have given moderately low rating and 72.5% of the respondents appear to be just satisfied with the steel scrubbers. Altogether 7.5% respondents are highly satisfied with steel scrubber.

Ratings on satisfaction level of steel scrubber	Percent
Moderately low	20.0
Just fine	72.5
High	7.5



Mean	2.87
Median	3.00
Mode	3.00

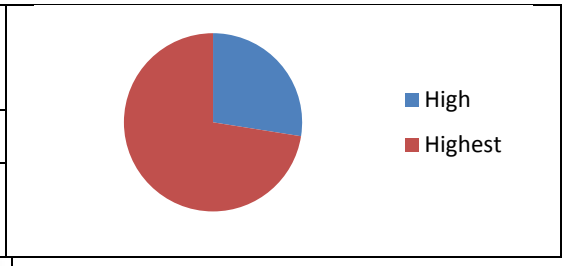
Figure 3.29: Satisfaction level of steel scrubber (rural respondent)

It has been observed that the satisfaction level on plastic scrubbers available in the market is moderately low (mean= 2.00, median = 2.00, mode = 2.00). All the respondents interviewed in the rural segment have given moderately low rating to the satisfaction level on plastic scrubbers available in the market.

It has been observed that the satisfaction level on coir scrubbers available in the market is the highest among all the varieties of scrubbers (mean= 4.72, median = 5, mode

= 5). Altogether 72.5% respondents have given highest rating to the satisfaction level on coir scrubbers available in the market. Altogether 27.5% respondents have rated it high.

Ratings on satisfaction level of coir scrubber	Percent
High	27.5
Highest	72.5



Mean	4.72
Median	5.00
Mode	5.00

Figure 3.30: Satisfaction level of coir scrubber (rural respondent)

Respondents were asked about their preference on different types of detergents for dishwashing viz. bar detergent, liquid detergent, powder detergent and charcoal & ash.

Types of detergent	Percent
Bar detergent	10
Powder detergent	27.5
Charcoal and ash	62.5

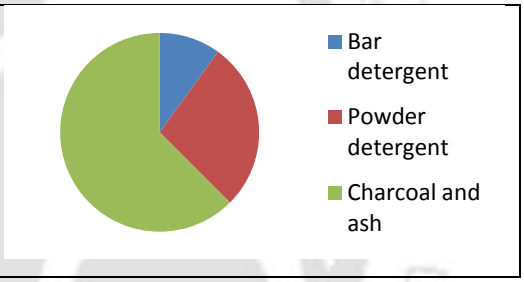


Figure 3.31: Preference on different types of detergents (rural respondent)

Figure 3.32: Use of charcoal and ash for dishwashing in rural area

3.3.3 Relationship of dishwashing behavior with number of family members in the respondents' household

Information regarding the number of family members in respondents household was collected using a nominal scale. The categories were viz. two numbers, three to four numbers, five to six numbers, seven to eight numbers and more than eight numbers.

Null hypothesis: There is no significant difference of respondents having a domestic help or not with number of family members.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.372, Contingency Coefficient = 0.140) and concluded that there is no significant difference of respondents having a domestic help or not with number of family members. Descriptive statistics reveals that that 95% of the respondents do not have domestic help in their home. This means that irrespective of family size people living in rural area do not prefer domestic help for their household activities.

Null hypothesis: There is no significant difference of respondent's disliking rating on dishwashing activity with number of family members in respondents' household.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.000) and concluded that there is a strong relationship of respondents' disliking rating on dishwashing activity with number of family members in respondents' household. In the 5 point semantic differential scale used for this purpose 1 represents 'dislike most' and 5 represents 'like most'. It was observed that in comparison to small family size, the respondents belonging to large family size dislike more the dishwashing activity. It is quite evident that with increase in number of family members number of utensils and cookware for daily use also increases. That probably makes the dishwashing activity more irritating for the respondents having more numbers of family members in their household.

Number of family members	Mean	Minimum	Maximum
3 to 4 numbers	2.0000	2.00	2.00
5 to 6 numbers	1.0000	1.00	1.00

Table 3.18: Cross tabulation of respondents' disliking rating on dishwashing activity with number of family members in respondent's household (rural respondent)

Null hypothesis: There is no significant difference of respondent's preference of various types of scrubber viz. sponge scrubber, plastic scrubber, steel scrubber and coir scrubber with number of family members in respondents' household.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.000, Contingency Coefficient: 0.707) and concluded that there is a strong relationship of respondent's preference of various types of scrubber viz. sponge scrubber, plastic scrubber, steel scrubber and coir scrubber with number of family members in respondents' household.

			Number of family members		Total
			3 to 4 numbers	5 to 6 numbers	
Scrubber use for washing the utensils	plastic scrubber	Count	11		11
		% within scrubber use for washing the utensils	100%		100%
		% within Number of family members	100%		27.5%
		% of Total	27.5%		27.5%
	coir scrubber	Count		29	29
		% within scrubber use for washing the utensils		100%	100%
		% within Number of family members		100%	72.5%
		% of Total		72.5%	72.5%

Table 3.19: Cross tabulation of respondent's preference of various types of scrubber viz. sponge scrubber, plastic scrubber, steel scrubber and coir scrubber with number of family members in respondent's household (rural respondent)

The study reveals that the majority of the respondents belonging to the household having 3 to 4 members prefer plastic scrubber. Majority of the respondents belonging to the household having 5 to 6 members prefer coir scrubber.

Null hypothesis: There is no significant difference of respondent's satisfaction level on sponge scrubber with number of family members in the respondents' household.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.000) and concluded that there is a strong relationship of respondent's satisfaction level on sponge scrubber with number of family members in respondents' household. In the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. It was observed that in comparison to larger family size, the respondents belonging to small family size are more satisfied with the sponge scrubbers available in the market. However the overall satisfaction level for sponge scrubbers is less.

Number of family members	Mean (satisfaction level on sponge scrubber)	Minimum (satisfaction level on sponge scrubber)	Maximum (satisfaction level on sponge scrubber)
3 to 4 numbers	2.00	2.00	2.00
5 to 6 numbers	1.00	1.00	1.00

Table 3.20: Cross tabulation of satisfaction level on sponge scrubber with number of family members in respondent's household (rural respondent)

Null hypothesis: There is no significant difference of respondent's satisfaction level on steel scrubber with number of family members in respondents' household.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.352) and concluded that there is no significant difference of respondent's satisfaction level on steel scrubber with number of family members in respondents' household. In the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. However the overall satisfaction level for steel scrubbers is moderately high. This means that irrespective of family size respondents prefer steel scrubber.

Null hypothesis: There is no significant difference of respondent's satisfaction level on plastic scrubber with number of family members in respondents' household.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was accepted and concluded that there is no significant difference of respondent's satisfaction level on plastic scrubber with number of family members in respondent's household. In the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. Overall satisfaction level for plastic scrubbers is significantly low (mean=2). This means that irrespective of family size respondents do not prefer plastic scrubber.

Null hypothesis: There is no significant difference of respondent's satisfaction level on coir scrubber with number of family members in respondents' household.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was accepted and concluded that there is no significant difference of respondent's satisfaction level on coir scrubber with number of family members in respondents' household. In the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. Overall

satisfaction level for coir scrubbers is significantly high (mean=4.72, Min=4, Max=5). This means that irrespective of family size respondents highly prefer coir scrubber.

Null hypothesis: There is no significant difference of respondent's preferred types of detergent viz. bar detergent, powder detergent, liquid detergent and charcoal and ash with number of family members in respondents' household.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.00, Contingency Coefficient: 0.707) and concluded that there is a strong relationship of respondent's preferred types of detergent viz. bar detergent, powder detergent, liquid detergent and charcoal & ash with number of family members in respondents' household.

It has been observed that the majority of the respondents preferring bar detergent and charcoal & ash belong to family size of 5 to 6 members. The study reveals that the all respondents preferring powder detergent belong to family size of 3 to 4 members. It is quite evident that as the number of family members increases the number of utensils, crockery and other cookware for daily use for that family also increases. From the above statistics it appears that the members of the larger family size prefer bar detergent and charcoal & ash.

			Number of family members		Total
			3 to 4 numbers	5 to 6 numbers	
Detergent use for washing the utensils	Bar detergent	Count		4	4
		% within detergent use for washing the utensils		100.0%	100%
		% within Number of family members		13.8%	10.0%
		% of Total		10.0%	10.0%
	Powder detergent	Count	11		11
		% within detergent use for washing the utensils	100%		100%
		% within Number of family members	100%		27.5%
		% of Total	27.5%		27.5%
	Charcoal and ash	Count		25	25
		% within detergent use for washing the utensils		100%	100%
		% within Number of family members		86.2%	62.5%
		% of Total		62.5%	62.5%

Table 3.21: Cross tabulation of preferred type of detergent for washing utensils with number of family members in respondent's household (rural respondent)

3.3.4 Relationship of dishwashing behavior with income level of the respondent (rural respondent)

Information regarding the annual income level of the respondent was collected using a nominal scale. The categories were viz. below Rs.1,00,000; Rs.1,00,001 to Rs.2,00,000; Rs.2,00,001 to Rs.3,00,000; Rs.3,00,001 to Rs.4,00,000; and above Rs.4,00,000 per annum.

Null hypothesis: There is no significant difference of respondents having a domestic help or not with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.001, Contingency Coefficient = 0.528) and concluded that there is a moderately strong relationship of respondents having a domestic help or not with income level of the respondent.

			Do you have a domestic help in your home		Total
			yes	no	
Annual income	Less than Rs. 1,00,000	Count		24	24
		% within annual income		100%	100%
		% within do you have a domestic help in your home		63.2%	60%
		% of Total		60.0%	60%
	Rs.1,00,001 to Rs.2,00,000	Count		11	11
		% within annual income		100%	100%
		% within do you have a domestic help in your home		28.9%	27.5%
		% of Total		27.5%	27.5%
	Rs.2,00,000 to Rs.3,00,000	Count	1	2	3
		% within annual income	33.3%	66.7%	100%
		% within do you have a domestic help in your home	50.0%	5.3%	7.5%
		% of Total	2.5%	5.0%	7.5%
	Rs.3,00,001 to Rs.4,00,000	Count	1	1	2
		% within annual income	50.0%	50.0%	100%
		% within do you have a domestic help in your home	50.0%	2.6%	5.0%
		% of Total	2.5%	2.5%	5.0%

Table 3.22: Cross tabulation of availability of domestic help with annual income of the respondent (rural respondent)

It has been observed that respondents having income level below Rs. 2,00,000 per annum do not prefer domestic help in their home. A few respondents having income level more than Rs.2,00,000 per annum have domestic help in their household. However

descriptive statistics reveals that 95% respondents do not have domestic help in their household.

Null hypothesis: There is no significant difference of respondent's disliking rating on dishwashing activity with income level of the respondent.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was accepted and concluded that there is no significant difference of respondents' disliking rating on dishwashing activity with income level of the respondent. In the 5 point semantic differential scale used for this purpose 1 represents 'dislike most' and 5 represents 'like most'. This reveals that the respondents do not like the dishwashing activity irrespective of their income level (mean=1.27, min=1, max=2)

Null hypothesis: There is no significant difference of respondent's preference of various types of scrubber viz. sponge scrubber, plastic scrubber, steel scrubber and coir scrubber with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.000, Contingency Coefficient: 0.707) and concluded that there is a strong relationship of respondent's preference of various types of scrubber viz. sponge scrubber, plastic scrubber, steel scrubber and coir scrubber with income level of the respondent.

			Annual income				Total
			Less than Rs. 1,00,000	Rs.1,00,001 to Rs.2,00,000	Rs.2,00,000 to Rs.3,00,000	Rs.3,00,001 to Rs.4,00,000	
Scrubber use for washing the utensils	Plastic scrubber	Count		11			11
		% within scrubber use for washing the utensils		100.0%			100%
		% within annual income		100.0%			27.5%
		% of Total		27.5%			27.5%
	Coir scrubber	Count	24		3	2	29
		% within scrubber use for washing the utensils	82.8%		10.3%	6.9%	100%
		% within annual income	100.0%		100.0%	100.0%	72.5%
		% of Total	60.0%		7.5%	5.0%	72.5%

Table 3.23: Cross tabulation of preference of various types of scrubbers with annual income of the respondent (rural respondent)

The study reveals that the respondents having annual income in the range of Rs.1,00,000 to Rs.2,00,000 prefer plastic scrubber. Majority of the respondents preferring coir scrubber belongs to the income group of annual income less than Rs.1,00,000. However the overall preference of coir scrubber is high in comparison to the other types of scrubbers.

Null hypothesis: There is no significant difference of respondent's satisfaction level on sponge scrubber with income level of the respondent.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was accepted and concluded that there is no significant difference of respondent's satisfaction level on sponge scrubber with income level of the respondent. In the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. However the overall satisfaction level for sponge scrubbers is significantly low (mean=1.27, Min=1, max=2)

Null hypothesis: There is no significant difference of respondent's satisfaction level on steel scrubber with income level of the respondent.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.211) and concluded that there is no significant difference of respondent's satisfaction level on steel scrubber with income level of the respondent. In the 5 point semantic differential scale used for this purpose 1 represents 'lowest satisfaction level' and 5 represents 'highest satisfaction level'. The overall satisfaction level for steel scrubbers is just satisfactory (mean=2.87, min=2, max=4).

Null hypothesis: There is no significant difference of respondent's satisfaction level on plastic scrubber with income level of the respondent.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was accepted and concluded that there is no significant difference of respondent's satisfaction level on plastic scrubber with income level of the respondent. The descriptive statistics reveals that the overall satisfaction level on plastic scrubber is substantially low irrespective of income level of the respondent (mean=2, max=2, min=2).

Null hypothesis: There is no significant difference of respondent's satisfaction level on coir scrubber with income level of the respondent.

One way ANOVA test was conducted for a significance level of 0.05. The null hypothesis was accepted and concluded that there is no significant difference of respondent's satisfaction level on coir scrubber with income level of the respondent.

Descriptive statistics reveals that the overall satisfaction level for coir scrubbers is significantly high (mean=4.72, max=4, min=5). This means that irrespective of their income level respondents prefer coir scrubber.

Null hypothesis: There is no significant difference of respondent's preference on type of detergent viz. bar detergent, liquid detergent, powder detergent and charcoal & ash with income level of the respondent.

A chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.000, Contingency Coefficient: 0.806) and concluded that there is strong relationship of respondent's preference on type of detergent viz. bar detergent, liquid detergent, powder detergent and charcoal & ash with income level of the respondent.

Type of detergent		Annual income				Total
		Less than Rs. 1,00,000	Rs.1,00,001 to Rs.2,00,000	Rs.2,00,000 to Rs.3,00,000	Rs.3,00,001 to Rs.4,00,000	
Bar detergent	Count			3	1	4
	% within detergent use for washing the utensils			75.0%	25.0%	100%
	% within annual income			100.0%	50.0%	10.0%
	% of Total			7.5%	2.5%	10.0%
Powder detergent	Count		11			11
	% within detergent use for washing the utensils		100.0%			100%
	% within annual income		100.0%			27.5%
	% of Total		27.5%			27.5%
Charcoal and ash	Count	24			1	25
	% within detergent use for washing the utensils	96.0%			4.0%	100%
	% within annual income	100.0%			50.0%	62.5%
	% of Total	60.0%			2.5%	62.5%

Table 3.24: Cross tabulation of preference of type of detergent with annual income of the respondent (rural respondent)

The study reveals that 96% of the charcoal & ash users belong to income group of annual income less than Rs.1,00,000 per annum. The respondents using bar detergent belong to income group of annual income ranging from Rs.2,00,000 to Rs.4,00,000. Altogether 75% respondents using bar detergent belong to income group of annual income ranging from Rs.2,00,000 to Rs.3,00,000 per annum. The respondents having annual income between Rs.1,00,000 to Rs.2,00,000 prefer powder detergent.

3.4. Visual research findings

Visual research was conducted to study the dishwashing behavior. Focus groups were formed to analyse the visual data. The focus group members were asked to give their individual ratings in a five point ordinal scale on the following questions. For question (i) the options were, highly acceptable, acceptable, cannot say, not acceptable and not at all acceptable. For questions (ii), (iii), (iv), (v) and (vi) the options were strongly agree, agree, cannot say, disagree and strongly disagree.

i. Do you think that the present scenario is acceptable to a progressive society?
ii. Do you think that with certain improvement in the present condition of dishwashing, the productivity of the people can be substantially increased
iii. Is the process environment friendly?
iv. Can the present process ensure the better health and hygiene of person?
v. Do you think that the existing dishwashing process is benefiting the poor?
vi. Do you think that the dishwashing problem needs immediate attention from designers, technologists and social scientists?

The records were tabulated for quantitative analysis. Following shows the frequency distributions of respondent's opinion on the aforesaid variables.

3.4.1 Acceptance of present condition of dishwashing to progressive society

Respondents were asked whether they thought that the present scenario was acceptable to a progressive society. It was observed that 62.5% respondents opined that the present scenario of dishwashing was not acceptable to a progressive society. Altogether 37.5% respondents opined that the present scenario of dishwashing was not at all acceptable to a progressive society.

Acceptance of present condition of dishwashing to progressive society	Percent	Cumulative Percent
Not Acceptable	62.5	62.5
Not at all acceptable	37.5	100.0

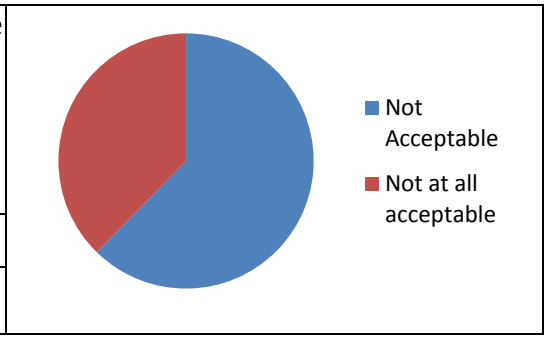


Figure 3.33: Respondents' opinion on acceptance of present condition of dishwashing to progressive society

3.4.2 Productivity and dishwashing

Respondents were asked whether they thought that with certain improvement in the present condition of dishwashing, the productivity of the people could be substantially increased. It was observed that 67.5% respondents agreed and 17.5% respondents strongly agreed that that with certain improvement in the present condition of dishwashing, the productivity of the people could be substantially increased.

Improvement of productivity with design intervention in the dishwashing problem	Percent	Cumulative Percent
Strongly agree	17.5	17.5
Agree	67.5	85.0
Cannot say	15.0	100.0

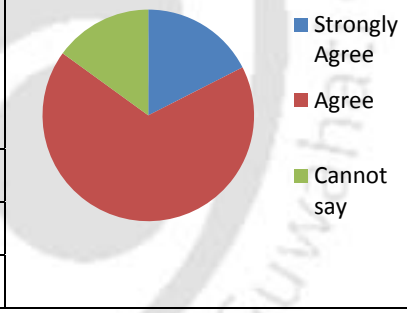


Figure 3.34: Respondents' opinion on productivity and dishwashing

3.4.3 Environment friendliness and dishwashing

Respondents were asked whether they found the dishwashing process environment friendly or not. It was found that 72.5% respondents did not find the dishwashing process environment friendly.

Dishwashing process environment friendly or not	Valid Percent	Cumulative Percent
Cannot say	27.5	27.5
Not environment friendly	72.5	100.0

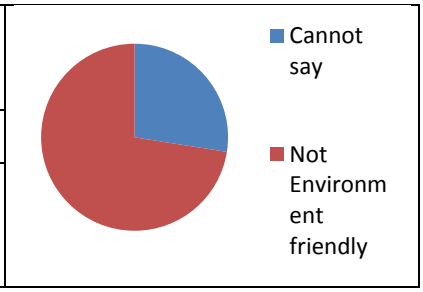


Figure 3.35: Respondents' opinion on environment friendliness and dishwashing

3.4.4 Hygiene and dishwashing

Respondents were asked whether the dishwashing process could ensure the better health and hygiene of person. It was observed that 62.5% respondents opined that the present dishwashing process was not hygienic. Altogether 37.5% respondents opined it to be not at all hygienic.

Opinion on hygiene and dishwashing	Valid Percent	Cumulative Percent
Not hygienic	62.5	62.5
Not at all hygienic	37.5	100.0

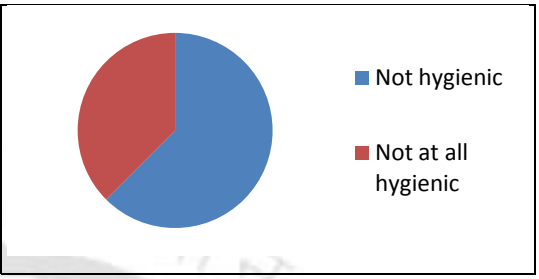


Figure 3.36: Respondents' opinion on hygiene and dishwashing

3.4.5 Dishwashing and benefit to the poor

Respondents were asked whether they thought that the existing dishwashing process was benefiting the poor. It was found that 70% respondents commented that the existing dishwashing process was not benefiting the poor. Altogether 20% respondents commented that the existing dishwashing process was not at all benefiting the poor.

The existing dishwashing process was benefiting the poor or not	Valid Percent	Cumulative Percent
Cannot say	10.0	10.0
Not benefiting the poor	70.0	80.0
Not at all benefiting the poor	20.0	100.0

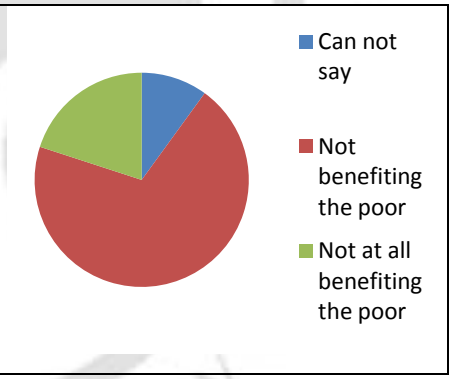


Figure 3.37: Respondents' opinion on dishwashing and benefit to the poor

3.4.6 Dishwashing and need of attention from designers

Respondents were asked whether the dishwashing process needed attention from the designers. Altogether 90% respondents agreed that the dishwashing process needed attention from the designers.

Dishwashing process needed attention from the designers or not	Valid Percent	Cumulative Percent
Agree	90.0	90.0
Cannot say	10.0	100.0

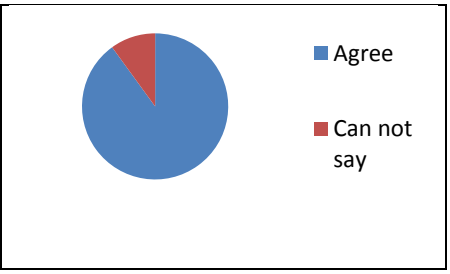


Figure 3.38: Respondents' opinion on need of design intervention on the dishwashing problem

3.4.7 Relationship of benefit to the poor with increase in productivity, environment friendliness and hygiene

A series of chi-square tests were conducted for a significance level of 0.05 to see the significance difference of ranking on the variable 'benefit to the poor' with other variables viz. increase in productivity, environment friendliness and hygiene. The results are as follows:

Null Hypothesis: There is no significant difference of ratings on argument that 'with certain improvement in the present condition of dishwashing, the productivity of the people could be substantially increased' with rating on the argument 'whether the existing dishwashing process was benefiting the poor'.

The null hypothesis was rejected and concluded that there is a strong significant difference of ratings on argument that 'with certain improvement in the present condition of dishwashing, the productivity of the people could be substantially increased' with rating on the argument 'whether the existing dishwashing process was benefiting the poor' (Sig: 0.003, Contingency Coefficient: 0.535).

Null Hypothesis: There is no significant difference of ratings on argument that 'whether the dishwashing process was environment friendly or not' with rating on the argument 'whether the existing dishwashing process was benefiting the poor'.

The null hypothesis was rejected and concluded that there is a significant difference of ratings on argument that 'whether the dishwashing process was environment friendly or not' with rating on the argument 'whether the existing dishwashing process was benefiting the poor' (Sig: 0.039, Contingency Coefficient: 0.374).

Null Hypothesis: There is no significant difference of ratings on argument that 'whether the dishwashing process could ensure the better health and hygiene of person' with rating on the argument 'whether the existing dishwashing process was benefiting the poor'.

The null hypothesis was rejected and concluded that there is a significant difference of ratings on argument that 'whether the dishwashing process could ensure the better health and hygiene of person' with rating on the argument 'whether the existing dishwashing process was benefiting the poor' (Sig: 0.012, Contingency Coefficient: 0.425).

Variable of the Chi-Square test	Asymp. Sig.	Contingency Coefficient
Benefit to the poor * Productivity	0.003	0.535
Benefit to the poor * Environment friendliness	0.039	0.374
Benefit to the poor * Hygiene	0.012	0.425

Table 3.25: Results of the chi square tests of the variable 'benefit to the poor' with other variables viz. increase in productivity, environment friendliness and hygiene.

It has been observed that the ranking of the variable 'benefit to the poor' varies significantly with other variables viz. increase in productivity, environment friendliness and hygiene. The comparatively higher contingency coefficients for the variables productivity and hygiene reveal that improvement in productivity and health & hygiene condition with proper design intervention may largely benefit the poor. It was observed from the descriptive statistics that the current condition of dishwashing process was not satisfactory from the point of view of hygiene, environment and productivity.

3.5 Conclusion of the study of dishwashing related consumer behaviour

It was found that the body posture during the dishwashing process tends to develop fatigue. In the kitchens of the urban household, dishwashing is normally done in standing position. They need to continuously bend while doing the dish washing activity. Normally in the kitchen same height of the platform is used for cooking and dishwashing activity. But while cooking, one normally needs to keep his hands moving over the platform height. This is because the cookware in placed over the gas stove, which is over the platform. Again due to food content in the cookware, the operation height increases. But for dishwashing, the operational height decreases from the platform height, because of the design and alignment of the washbasin. If the height of the washbasin base is increased, the splash out water creates problem. The continuous splashing of water makes the person wet mainly in the lower chest area. To avoid this, the bottom of the washbasin is lowered. But as a result the person has to bend a lot during scrubbing process of dishwashing. The scrubbing process requires more force in fingers, wrist and palm and therefore stress

develops in the entire hand specifically in fingers, palm and the wrist. The scrubbing process comparatively takes a lot of time in the dishwashing process. The continuous bending in this posture while applying pressure with fingers results in back pain, neck pain and fatigue. So, while deciding the bottom height of the washbasin for dishwashing the aforesaid issues are to be considered critically. Not much emphasis has been given in the design of the dishwashing area of the kitchen, because normally the domestic help does the dishwashing activity. It has been observed that comparatively more emphasis is given in the design and location of cooking area and its related accessories than the dishwashing area, in a modern modular kitchen of urban household. The result of the quantitative analysis reveals that amongst the activities performed in a kitchen, viz. cooking, dishwashing and preparing raw food ingredients, dishwashing is the most disliked activity. That is why most people depend on domestic help for the dishwashing activity. As dishwashing activity is being performed by the domestic help, who belong to the underprivileged, their voice is seldom heard of. The participation of the domestic help in the kitchenware design and the design of the integrated kitchen is abysmally low. Some alternative design ideas were emerging from the above findings. Some design modifications were suggested in the existing design of the washbasin. For example, it was suggested that there may be two distinct parts in the washbasin for scrubbing activity and rinsing activity with modification in the existing operational height, profile and form.

It has been observed that people mostly use coir and plastic scrubber. It has been observed that iron wire mesh scrubbers are also used to remove sticky dirt from the cookware. Very interestingly it was found that many of them use the thin metallic foils of used medicine tablets as scrubber instead of iron wire mesh. On being asked about the reason, they revealed that the thin metallic foils of used tablets work better than iron wire mesh scriber or any other hard scrubber available in the market. They face problems in holding the scrubber in position, because due to soap solution, it tends to slip out from the finger grip. Their fingers get eroded due to constant rubbing of utensils and cookware in presence of soap solution.

It has been observed that in rural areas the dependence on domestic help for dishwashing activity is very less. They perform the dishwashing activity in sitting and squatting body posture. They mostly use charcoal, ash and powder detergent for dishwashing. It was observed that most of them use natural coir as scrubber. The place for dishwashing is normally at a distance from the kitchen and is near to the main water source of the household like a well or a tube well. The process appears to be unhygienic

and unhealthy for the women performing the activity. Very high level of erosion in their palm, fingers and foot were noticed. This erosion in their hands and foot occurs due to prolonged soaking in alkaline solution during the dishwashing process.

Out of the total 100 households surveyed in the urban area, 80 households have 3 to 4 numbers of family members and rest have 5 to 6 numbers of family members. The majority of the respondents (55%) fall under the income group of Rs.300,001 to Rs.400,000 per annum and 34% fall under the income group of Rs.400,001 to Rs.500,000 per annum. The descriptive statistics of the data collected from the urban respondents reveal that 96% of the respondents keep domestic help and all of them are maid out of which 90.6 % of them are part time domestic helps. Regarding dependence on domestic help for the various domestic activities, 67.7% of the respondents depend on domestic help for dishwashing activity, followed by 22.9% for dishwashing and cloth washing combined and 9.4% for taking care of kids. Analysis on payments received by the domestic help reveals that 55.2% of them receive a payment ranging from Rs.300 to Rs.500 per month; 35.4% receive payment between Rs.500 to Rs.700 per month. Only 9.4% of them receive payment between Rs.900 to Rs.1100 per month. Altogether 80.2% of the domestic helps visit two houses per day and only 10.4% visit three households per day. Therefore their income is substantially low. They will be able to earn more if their productivity is increased and facilitate them to visit at least more than three households per day. It has been observed that 95% of the respondents prefer part time domestic help for dishwashing, 78% prefer part time domestic help for cooking, 98% prefer full time domestic help for kids' care and 97% prefer part time domestic help for cloth washing. None of the respondents have a dishwasher and 94% of them have a cloth washing machine. On being asked whether they thought that a dishwasher or a washing machine could be a substitute of domestic help (in a semantic differential rating scale of 5), 90% of the respondents strongly disagreed and 10% of them disagreed. The study reveals that amongst all the activities performed in a kitchen viz. cooking, dishwashing and preparing raw food ingredients; dishwashing is the most disliked activity (Dislike most: 90%, moderately dislike: 10%). The analysis on scrubber reveals that majority of the respondents (83%) use coir scrubber followed by 15% for plastic scrubber. Again satisfaction level for steel scrubber is moderately low for 82% of the respondents. The satisfaction level for coir scrubber is the highest (85%) followed by plastic scrubber. It has been observed that 90% of the respondents use bar detergent for dishwashing. Interestingly a very high negative correlation coefficient (-1) is observed between the

variables for ratings on disliking for the dishwashing activity (semantic differential scale of 5 between dislike most and like most) and rating on argument that a dishwasher/cloth washer is a substitute of domestic help (semantic differential scale of 5 between strongly agree and strongly disagree). The correlation is significant at the 0.01 level (2-tailed).

Out of total 40 household surveyed in the rural area altogether 72.5 % respondents have 5 to 6 members in their families followed by 27.5% have 3 to 4 family members. Altogether 60% of the respondents have annual income less than Rs.1,00,000 per annum, 27.5% have annual income between Rs.1,00,001 per annum to Rs.2,00,000 per annum. Only 5% of the respondents have domestic helps in their home. The study reveals that 80% like or enjoy cooking but for 72.5% respondents, the most disliked activity is dishwashing. Again 72.5% prefer coir scrubber over 27.5% for plastic scrubber. It has been observed that the satisfaction level on steel scrubber and plastic scrubber is low. The satisfaction level on coir scrubber is the highest (highest: 72.5%, high: 27.5%). The study reveals that 62.5% of the respondents use charcoal and ash for dishwashing, 27.5% use powder detergent and 10% use bar detergent for dishwashing. The findings of aforesaid quantitative analysis were shared and discussed along with the visual data during the stimulation process of idea generation.

The study reveals that majority of the respondents feel that the present dishwashing situation is not acceptable to a progressive society (cumulative 100%). Altogether 85 % (cumulative) of the respondents feel that with the improvement in the dishwashing condition, the productivity of the people can be improved hence the capability. The findings reveal that the process is not environment friendly (72%) and it is not ensuring the health and hygiene (cumulative 100%). Altogether 90% of the respondents feel that the ‘benefit to the poor’ component in the existing design solution for dishwashing problem is completely ignored. Again 90% of the respondents feel that the dishwashing problem must get special attention from engineers and designers. The new design solution may be analyzed by using the similar method and the rankings on the same attributes may be compared. This methodology is subjected to validation. There is an opportunity to conduct future research in the similar line and validate the methodology and thereby provide a new insight to design methods. A series of chi-square tests were conducted to see the significance of ranking on the variable ‘benefit to the poor’ with other variables viz. increase in productivity, environment friendliness and hygiene. It has been observed that the ranking of the aforesaid variables varies significantly. The comparatively higher contingency coefficients for the variables productivity and hygiene

reveal that improvement in productivity and health & hygiene condition with proper design intervention may largely benefit the poor.

4.0 The transformation of marketing research findings for design ideation

The marketing research findings of module I (study of consumer behaviour related to cookware, crockery and utensils) and module II (study of consumer behaviour related to dishwashing) were documented. The detail reports of the aforesaid marketing research studies were shared with the masters level design students of IIT Guwahati. The study of the transformation of marketing research findings for design ideation was carried out in two phases. In the first phase, designers were asked to generate design ideas for the dishwashing problem with conventional sharing of marketing research findings. In the second phasea new method termed Marketing-Research-Finding Sensitive Visualisation (MRFSV) was adopted to communicate the marketing research findings in a structured way to the design students of IIT Guwahati. The ideas generated in both the phases of module III were evaluated with the help of focus group's response on the idea screening matrix. Two focus groups were formed comprising of eleven members in the each group. The focus group members are the final trimester students of post graduate programme of management with specialization in marketing and product design. The members of the focus groups also represented consumers. The idea screening matrix was formulated considering the criteria viz. Ease of dishwashing in Indian context, Ease of use, Ergonomic considerations, Ease of manufacture and assembly, Aesthetic appeal/ design variety, Economic and financial feasibility and Environment friendliness. The codes used are: '+' for better than existing, '0' for same as existing, '-' for worse than existing (Pugh Stuart, 1990). The response of the focus group was further analysed using quantitative techniques.

4.1 The transformation of marketing research findings for design ideation with conventional sharing of marketing research findings (1st phase)

In the conventional sharing of marketing research findings of module I (study of consumer behaviour related to cookware, crockery and utensils) and module II (study of consumer behaviour related to dishwashing) altogether eighteen ideas were generated. Out of these, fifteen ideas were considered for ranking in the idea screening process. The design ideas were evaluated with the help of a focus group.

It has been observed that in conventional method of sharing of marketing research findings, designers were not going deep in to the understanding of consumer behavior and its related design problem. In the idea screening matrix, the total score of the fifteen design ideas generated in the first phase (conventional sharing of marketing research findings) was 15.39 and the average score is 1.03.

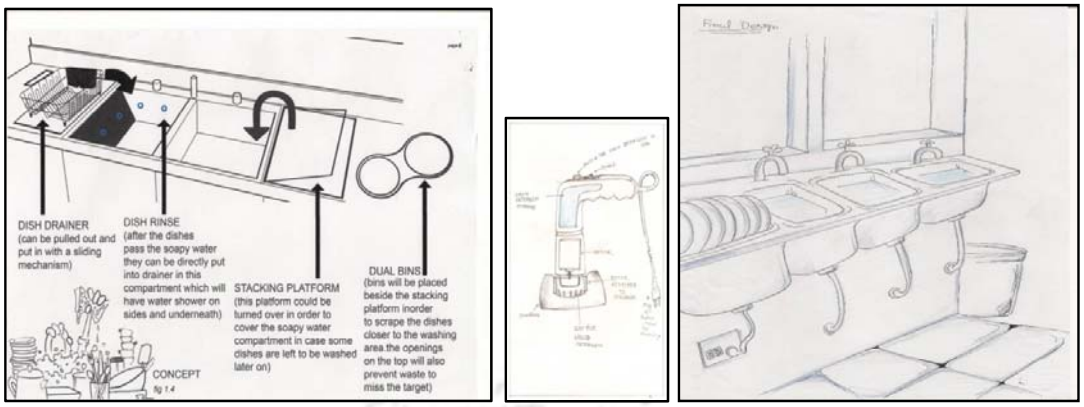


Figure 4.1: Design ideas generated with conventional sharing of marketing research findings (1st phase)

4.2 The transformation of marketing research findings for design ideation with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design (2nd phase)

The marketing research findings of module I *(study of consumer behaviour related to cookware, crockery and utensils)* and module II *(study of consumer behaviour related to dishwashing)* were shared with design students with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method.

The design ideas were evaluated by the idea screening matrix and the same focus group formed for the evaluation of design ideas generated from the conventional sharing of marketing research findings.

In the second phase *(sharing of MR findings with MRFSV method)* altogether seventeen ideas were generated and all were considered for the idea screening process. The ideas of the last two ranks were eliminated for further inferential and descriptive statistical analysis. Following exhibit shows the MRFSV method used in this study.

Marketing-Research-Findings	**Weightage in meeting design objective** (Divide total score 100 amongst the marketing research findings)	**Define Design Problem** (How would you like to define the design problem from the corresponding MR Findings?)	**Marketing Research Findings Sensitive Visualization (MRFSV)** (Description of Designer's design solution for the design problem)
MR Finding 1 Respondents prefer utensils/cookware made of steel, bell metal, brass, copper and Glass	15	Dishwashing kit should be able to clean utensils made of bell metal, brass, copper along with steel and glass.	Inspiration from Indian traditional designs. Use coir for scrubbing.
MR Finding 2			
MR Finding 3….			

Table 4.1: The MRFSV method used in this study

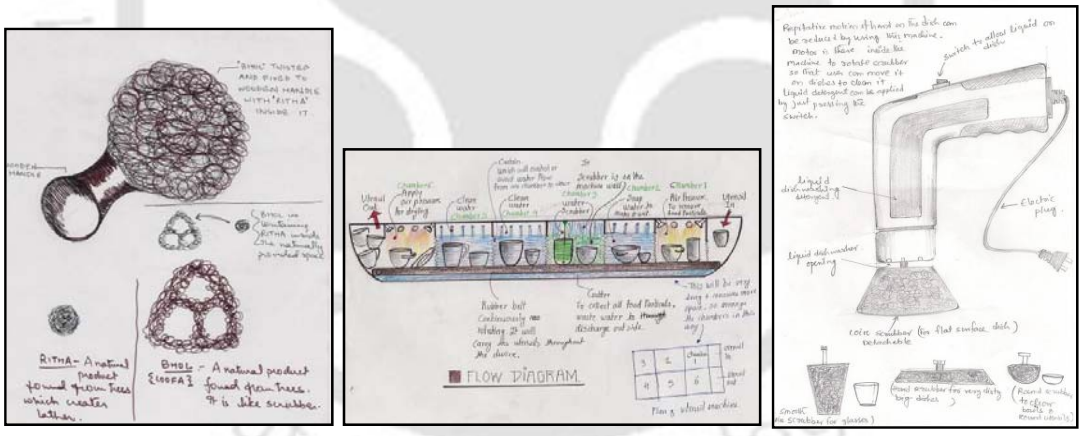


Fig 4.2: Design ideas generated with sharing of MR findings with MRFSV method (Phase 2)

4.3 Comparative evaluation of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and the 2nd phase (sharing of marketing research findings with Marketing-Research-Finding Sensitive Visualisation method)

Following are the descriptive statistics of the focus group's response on various attributes considered for evaluation of design ideas.

4.3.1 Evaluation of design ideas considering ease of dishwashing in Indian context

It has been observed that the design ideas generated in the second phase have substantially improved in terms of ease of dishwashing in Indian context. In the second phase 60.3% response was in favour of 'better than existing' over 47.6% that of the first phase. The response in favour of 'worse than exiting' has substantially decreased to 22.7% in the second phase from 40% in the first phase.

Opinion on design ideas in terms of ease of dishwashing in Indian context	Phase 1 (conventional sharing of MR findings)		Phase 2 (sharing of MR findings with MRFSV method)	
	Frequency	Percent	Frequency	Percent
Better than existing (+)	157	47.6	199	60.3
Same as existing (0)	41	12.4	56	17.0
Worse than existing (-)	132	40.0	75	22.7

Table 4.2: Respondents' opinion on design ideas in terms of ease of dishwashing in Indian context

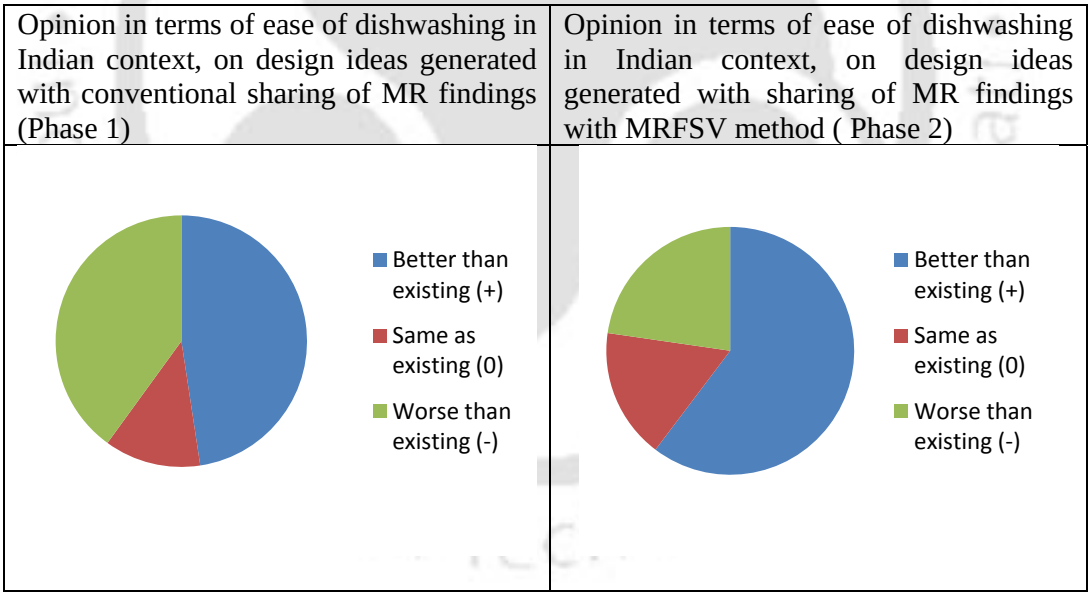


Figure 4.3: Respondents' opinion on design ideas in terms of ease of dishwashing in Indian context

4.3.2 Evaluation of design ideas considering ease of use

It has been observed that the design ideas generated in the second phase have substantially improved in terms of ease of use. In the second phase 59.1% response was in favour of 'better than existing' over 50.6% that of the first phase. The response in

favour of 'worse than exiting' has decreased to 20.9% in the second phase from 33% in the first phase.

Opinion on design ideas in terms of ease of use	Phase 1 (conventional sharing of MR findings)		Phase 2 (sharing of MR findings with MRFSV tool)	
	Frequency	Percent	Frequency	Percent
Better than existing (+)	167	50.6	195	59.1
Same as existing (0)	54	16.4	66	20
Worse than existing (-)	109	33.0	69	20.9

Table 4.3: Respondents' opinion on design ideas in terms of ease of use

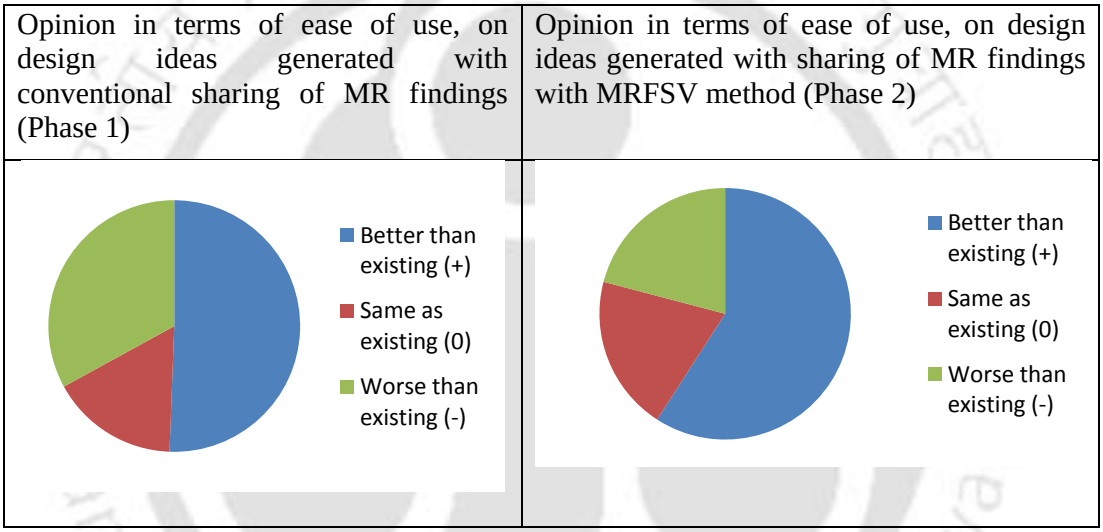


Figure 4.4: Respondents' opinion on design ideas in terms of ease of use

4.3.3 Evaluation of design ideas considering ergonomics

It has been observed that the design ideas generated in the second phase have improved in terms of ergonomic considerations. In the second phase 49.4% response was in favour of 'better than existing' over 47.6% that of the first phase. The response in favour of 'worse than exiting' has decreased to 19.1% in the second phase from 27.9% in the first phase.

Opinion on design ideas in terms of ergonomic considerations	Phase 1 (conventional sharing of MR findings)		Phase 2 (sharing of MR findings with MRFSV tool)	
	Frequency	Percent	Frequency	Percent
Better than existing (+)	157	47.6	163	49.4
Same as existing (0)	81	24.5	104	31.5
Worse than existing (-)	92	27.9	63	19.1

Table 4.4: Respondents' opinion on design ideas in terms of ergonomic consideration

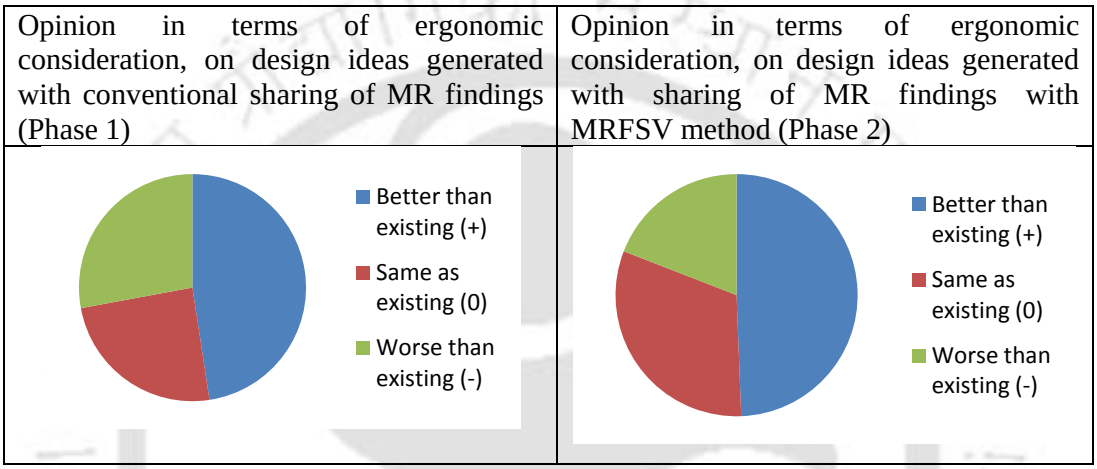


Figure 4.5: Respondents' opinion on design ideas in terms of ergonomic consideration

4.3.4 Evaluation of design ideas considering ease of manufacture and assembly

It has been observed that the design ideas generated in the second phase have just slightly improved in terms of ease of manufacture and assembly. The reason for this marginal improvement may be that marketing research findings did not much emphasise on ease of manufacture and assembly. However the response in favour of 'worse than exiting' has decreased to 38.2% in the second phase from 43.3% in the first phase.

Opinion on design ideas in terms of ease of manufacture and assembly	Phase 1 (conventional sharing of MR findings)		Phase 2 (sharing of MR findings with MRFSV tool)	
	Frequency	Percent	Frequency	Percent
Better than existing (+)	126	38.2	127	38.5
Same as existing (0)	61	18.5	77	23.3
Worse than existing (-)	143	43.3	126	38.2

Table 4.5: Respondents' opinion on design ideas in terms of ease of manufacture and assembly

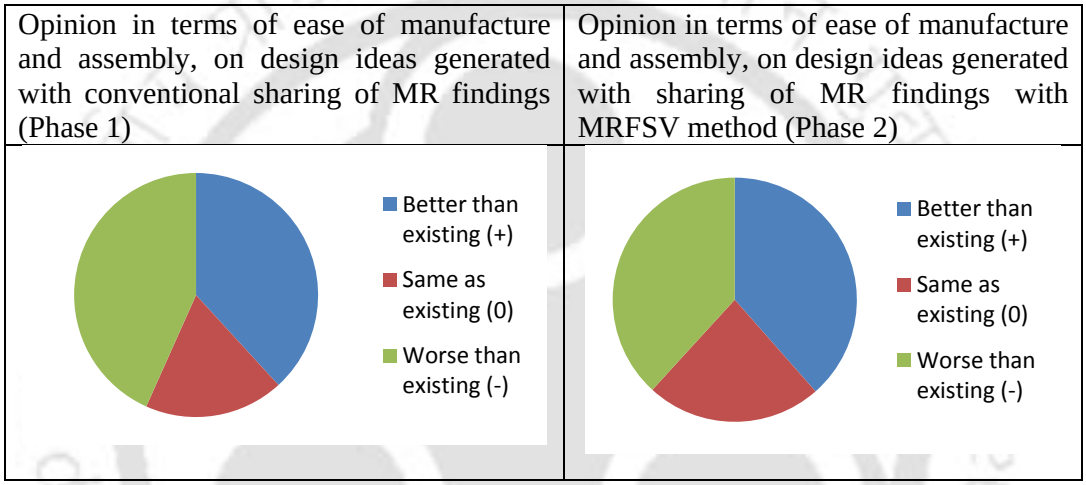


Figure 4.6: Respondents' opinion on design ideas in terms of ease of manufacture and assembly

4.3.5 Evaluation of design ideas considering aesthetic appeal/ design variety

It has been observed that the design ideas generated in the second phase have substantially improved in terms of aesthetic appeal and design variety. In the second phase 52.7% response was in favour of 'better than existing' over 46.7% that of the first phase. The response in favour of 'worse than exiting' has decreased to 23.0% in the second phase from 30.3% in the first phase.

Opinion on design ideas in terms of aesthetic appeal/ design variety	Phase 1 (conventional sharing of MR findings)		Phase 2 (sharing of MR findings with MRFSV tool)	
	Frequency	Percent	Frequency	Percent
Better than existing (+)	154	46.7	174	52.7
Same as existing (0)	76	23.0	80	24.2
Worse than existing (-)	100	30.3	76	23.0

Table 4.6: Respondents' opinion on design ideas in terms of aesthetic appeal/ design variety

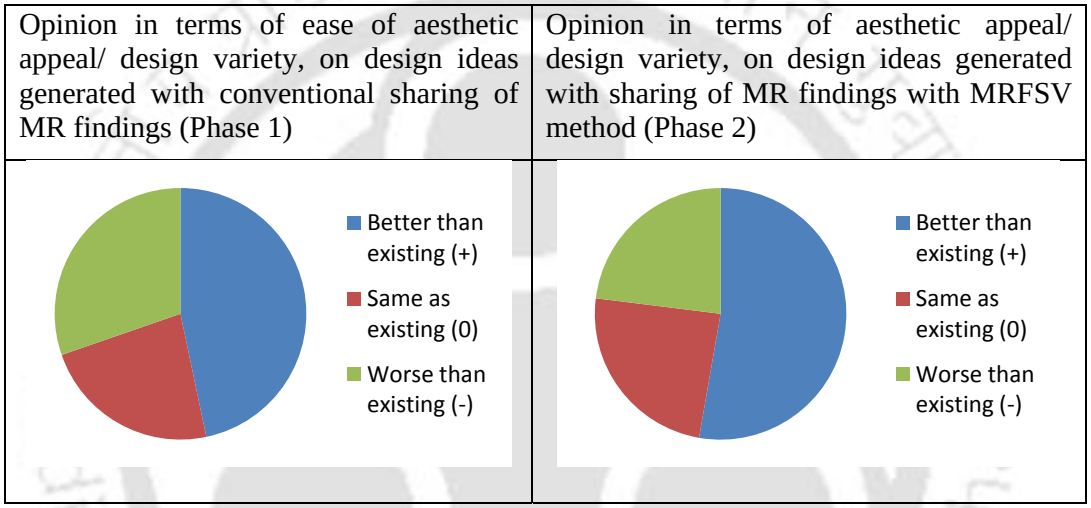


Figure 4.7: Respondents' opinion on design ideas in terms of aesthetic appeal/ design variety

4.3.6 Evaluation of design ideas considering economic and financial feasibility

It has been observed that the design ideas generated in the second phase have substantially improved in terms of economic and financial feasibility. In the second phase 36.4% response was in favour of 'better than existing' over 29.4% that of the first phase. The response in favour of 'worse than exiting' has decreased to 35.8% in the second phase from 48.8% in the first phase.

Opinion on design ideas in terms of economic and financial feasibility	Phase 1 (conventional sharing of MR findings)		Phase 2 (sharing of MR findings with MRFSV tool)	
	Frequency	Percent	Frequency	Percent
Better than existing (+)	97	29.4	120	36.4
Same as existing (0)	72	21.8	92	27.9
Worse than existing (-)	161	48.8	118	35.8

Table 4.7: Respondents' opinion on design ideas in terms of economic and financial feasibility

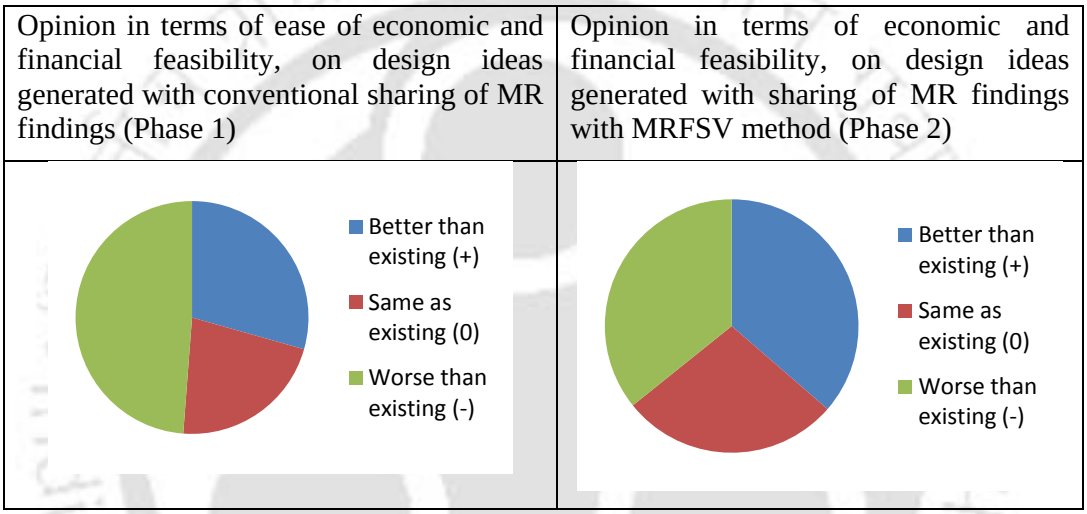


Figure 4.8: Respondents' opinion on design ideas in terms of economic and financial feasibility

4.3.7 Evaluation of design ideas considering environment friendliness

It has been observed that the design ideas generated in the second phase have substantially improved in terms of environment friendliness. In the second phase 45.5% response was in favour of 'better than existing' over 36.4% that of the first phase. The response in favour of 'worse than exiting' has substantially decreased to 15.8% in the second phase from 25.5% in the first phase.

Opinion on design ideas in terms of environment friendliness	Phase 1 (conventional sharing of MR findings)		Phase 2 (sharing of MR findings with MRFSV tool)	
	Frequency	Percent	Frequency	Percent
Better than existing (+)	120	36.4	150	45.5
Same as existing (0)	126	38.2	128	38.8
Worse than existing (-)	84	25.5	52	15.8

Table 4.8: Respondents' opinion on design ideas in terms of environment friendliness

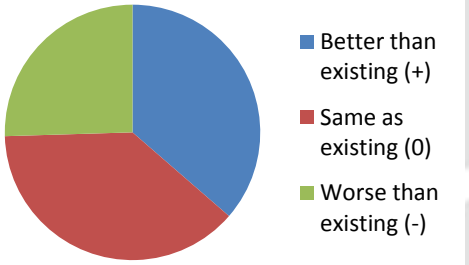
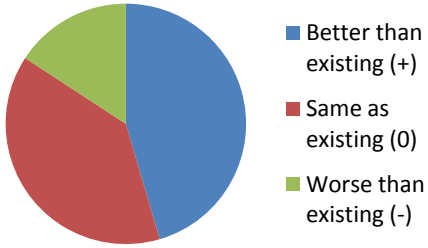
Opinion in terms of environment friendliness, on design ideas generated with conventional sharing of MR findings (Phase 1)	Opinion in terms of environment friendliness, on design ideas generated with sharing of MR findings with MRFSV method (Phase 2)
	

Figure 4.9: Respondents' opinion on design ideas in terms of environment friendliness

4.4 Relationship and variance in ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool)

A series of Pearson Chi square tests were conducted to observe the significance of variance in ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool), considering various attributes for design idea screening viz. Ease of dishwashing in Indian context, Ease of use, Ergonomic considerations, Ease of manufacture and assembly, Aesthetic appeal/ design variety, Economic and financial feasibility and Environment friendliness.

4.4.1 Cross tabulation of ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) considering ease of dishwashing in Indian context

Null hypothesis: There is no significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of ease of dishwashing in Indian context.

A Chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.019, Contingency Coefficient: 0.186) and concluded that there is a significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of ease of dishwashing in Indian context.

In terms of ease of dishwashing in Indian context, the study reveals that amongst the designs rated 'better than existing' in the 1st phase, altogether 66.2% design ideas were rated 'better than existing' in the 2nd phase. This means that MRFSV method do not hamper the originality of design thinking of the designers. Again amongst the designs rated 'better than existing' in the 2nd phase, 52.3% designs were rated 'better than existing', 11.1% designs were rated 'same as existing' and 36.7% designs were rated ' worse than existing' in the 1st phase. Amongst the designs rated 'worse than existing' in the 1st phase, altogether 55.3% design ideas were rated 'better than existing' in the 2nd phase. This shows a significant improvement in design ideas terms of ease of dishwashing in Indian context.

			Ranking of design ideas generated in the 2nd phase considering ease of dishwashing in Indian context			Total
			Better than existing (+)	Same as existing (0)	Worse than existing (-)	
Ranking of design ideas generated in the 1st phase, considering ease of dishwashing in Indian context	Better than existing (+)	Count	104	15	38	157
		% within Ease of dishwashing in Indian context: Phase 1	66.2%	9.6%	24.2%	100%
		% within Ease of dishwashing in Indian context: Phase 2	52.3%	26.8%	50.7%	47.6%
		% of Total	31.5%	4.5%	11.5%	47.6%
	Same as existing (0)	Count	22	10	9	41
		% within Ease of dishwashing in Indian context: Phase 1	53.7%	24.4%	22.0%	100%
		% within Ease of dishwashing in Indian context: Phase 2	11.1%	17.9%	12.0%	12.4%
		% of Total	6.7%	3.0%	2.7%	12.4%
	Worse than existing (-)	Count	73	31	28	132
		% within Ease of dishwashing in Indian context: Phase 1	55.3%	23.5%	21.2%	100%
		% within Ease of dishwashing in Indian context: Phase 2	36.7%	55.4%	37.3%	40.0%
		% of Total	22.1%	9.4%	8.5%	40.0%

Table 4.9: Cross tabulation of ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) considering ease of dishwashing in Indian context

4.4.2 Cross tabulation of ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) considering ease of use, ease of manufacture and assembly, economic and financial feasibility

Null hypothesis: There is no significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings)and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of ease of use.

A Chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.500, Contingency Coefficient: 0.100) and concluded that there is no significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of ease of use.

Null hypothesis: There is no significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of ergonomic consideration.

A Chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.327, Contingency Coefficient: 0.118) and concluded that there is no significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of ergonomic consideration.

Null hypothesis: There is no significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of ease of manufacture and assembly.

A Chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.899, Contingency Coefficient: 0.057) and concluded that there is no significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of ease of manufacture and assembly.

Null hypothesis: There is no significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of economic and financial feasibility.

A Chi square test was conducted for a significance level of 0.05. The null hypothesis was accepted (Sig: 0.491, Contingency Coefficient: 0.101) and concluded that there is no significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of economic and financial feasibility.

4.4.3 Cross tabulation of ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) considering aesthetic appeal and design variety

Null hypothesis: There is no significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of aesthetic appeal and design variety.

A Chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.004, Contingency Coefficient: 0.213) and concluded that there is a significant difference of raking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) in terms of aesthetic appeal and design variety.

The study reveals that amongst the designs rated ‘ better than existing’ in the 1st phase, altogether 57.1% design ideas were rated ‘better than existing’ and 25.3% ideas were rated ‘ same as existing’ in the 2nd phase. This means that MRFSV tool don not hamper the originality of design thinking of the designers as far as the aesthetic appeal and design variety is concerned. Again amongst the designs rated ‘ better than existing’ in the 2nd phase, 50.6% designs were rated ‘better than existing’, 22.4 % designs were rated ‘ same as existing’ and 27% designs were rated ‘ worse than existing’ in the 1st phase. Amongst the designs rated ‘worse than existing’ in the 1st phase, altogether 47% design ideas were rated ‘better than existing’ in the 2nd phase. This shows a significant improvement in design ideas in terms of ease of aesthetic appeal and design variety of the designs.

			Ranking of design ideas generated in the 2nd phase considering aesthetic appeal and design variety			Total
			Better than existing (+)	Same as existing (0)	Worse than existing (-)	
Ranking of design ideas generated in the 1st phase, considering aesthetic appeal and design variety	Better than existing (+)	Count	88	39	27	154
		% within Aesthetic appeal and design variety: Phase1	57.1%	25.3%	17.5%	100%
		% within Aesthetic appeal and design variety: Phase 2	50.6%	48.8%	35.5%	46.7%
		% of Total	26.7%	11.8%	8.2%	46.7%
	Same as existing (0)	Count	39	24	13	76
		% within Aesthetic appeal and design variety: Phase1	51.3%	31.6%	17.1%	100%
		% within Aesthetic appeal and design variety: Phase 2	22.4%	30.0%	17.1%	23.0%
		% of Total	11.8%	7.3%	3.9%	23.0%
	Worse than existing (-)	Count	47	17	36	100
		% within Aesthetic appeal and design variety: Phase 1	47.0%	17.0%	36.0%	100%
		% within Aesthetic appeal and design variety: Phase 2	27.0%	21.3%	47.4%	30.3%
		% of Total	14.2%	5.2%	10.9%	30.3%

Table 4.10: Cross tabulation of ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) considering aesthetic appeal and design variety

4.4.4 Cross tabulation of ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) considering environment friendliness of the designs

Null hypothesis: There is no significant difference of raking of design ideas generated in the 1st phase and 2nd phase in terms of environment friendliness of the designs.

A Chi square test was conducted for a significance level of 0.05. The null hypothesis was rejected (Sig: 0.002, Contingency Coefficient: 0.183) and concluded that there is a significant difference of raking of design ideas generated in the 1st phase and 2nd phase in terms of environment friendliness of the designs.

			Ranking of design ideas generated in the 2nd phase considering environment friendliness of the designs			Total
			Better than existing (+)	Same as existing (0)	Worse than existing (-)	
Ranking of design ideas generated in the 1st phase considering environment friendliness of the designs	Better than existing (+)	Count	65	33	22	120
		% within Environment friendliness: Phase1	54.2%	27.5%	18.3%	100%
		% within Environment friendliness: Phase 2	43.3%	25.8%	42.3%	36.4%
		% of Total	19.7%	10.0%	6.7%	36.4%
	Same as existing (0)	Count	47	60	19	126
		% within Environment friendliness: Phase1	37.3%	47.6%	15.1%	100%
		% within Environment friendliness: Phase 2	31.3%	46.9%	36.5%	38.2%
		% of Total	14.2%	18.2%	5.8%	38.2%
	Worse than existing (-)	Count	38	35	11	84
		% within Environment friendliness: Phase1	45.2%	41.7%	13.1%	100%
		% within Environment friendliness: Phase 2	25.3%	27.3%	21.2%	25.5%
		% of Total	11.5%	10.6%	3.3%	25.5%

Table 4.11: Cross tabulation of ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) considering environment friendliness of the designs

The study reveals that amongst the designs rated ‘ better than existing’ in the 1st phase, altogether 54.2% design ideas were rated ‘better than existing’ and 27.5% ideas were rated ‘ same as existing’ in the 2nd phase. This means that MRFSV tool don not hamper the originality of design thinking of the designers as far as the environment friendliness of the designs is concerned. Again amongst the designs rated ‘ better than existing’ in the 2nd phase, 43.3% designs were rated ‘better than existing’, 31.3 % designs were rated ‘ same as existing’ and 25.3% designs were rated ‘ worse than existing’ in the 1st phase. Amongst the designs rated ‘worse than existing’ in the 1st phase, altogether 45.2% design ideas were rated ‘better than existing’ and 41.7% designs were rated ‘ same as existing’ in the 2nd phase. This shows a significant improvement in design ideas in terms of environment friendliness of the designs.

4.4.5 Comprehensive summery of the relationships and variances in ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool)

Following table shows the results of the chi- square tests conducted to observe the relationships and variances in ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool) considering various attributes for design idea screening.

Attributes for design idea screening	Sig (2 sided)	Contingency coefficient
Ease of dishwashing in Indian context	0.019	0.186
Ease of use	0.500	0.100
Ergonomic consideration	0.327	0.118
Ease of manufacture and assembly	0.899	0.057
Aesthetic appeal/ design variety	0.004	0.213
Economic and financial feasibility	0.491	0.101
Environment friendliness	0.002	0.183

Table 4.12: Comprehensive summery of the relationships and variances in ranking of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV tool)

It has been observed that for a significance level of 0.05; there is a significance difference of rankings on ease of dishwashing in Indian context, aesthetic appeal/ design variety, environment friendliness for the design ideas generated in 1st phase and 2nd phase. For other variables variance is not significant. However contingency coefficients are low. This is because the MR findings have focused mainly on the issues related to dishwashing in Indian context, aesthetic appeal/ design variety and environment friendliness etc. The consideration of issues related to ease of use, ergonomics, ease of manufacture and assembly, economic and financial feasibility is very fundamental in design ideation. The above analysis establishes that the MRFSV method has a significant impact in transforming marketing research findings to design ideation.

4.5 Comparison of total scores of design ideas generated in the 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with MRFSV method)

A paired sample t-test was conducted to observe the significance of variance in scores of design ideas generated in the 1st phase and 2nd phase.

Null hypothesis: There is no significant difference of scores of design ideas generated in the 1st phase (conventional sharing of MR findings) and 2nd phase (sharing of MR findings with MRFSV method).

The null hypothesis was rejected for a significance level of 0.05 and concluded that the total and average scores of design ideas generated in the 1st phase (conventional sharing of MR findings) and 2nd phase (sharing of MR findings with MRFSV method) varies significantly.

The total and average scores of the design ideas generated in the 2nd phase (sharing of MR findings with MRFSV method) observed significant improvement over scores of the 1st phase (conventional sharing of MR findings).

Scores	1st phase (Conventional sharing of MR findings)	2nd phase (Sharing of MR findings with MRFSV method)
Total score	15.39	49.91
Average score	1.03	3.33

Table 4.13: Scores of 1st phase (conventional sharing of marketing research findings) and 2nd phase (sharing of marketing research findings with the MRFSV method)

4.6 Ranks of the Marketing Research (MR) findings in meeting the design objective

Designers were asked to give weightages to each MR findings out of a total score of 100. Weighted scores represent the usefulness of MR findings in meeting design objective. Following table shows the ranks of the MR findings in order to meet the design objective of design for development. These weightages should be considered in the brainstorming session for the final design ideation.

Marketing Research Findings	Weightage in meeting design objective (Average Score)	Rank
MR Finding 1 Various attributes viz. design and aesthetic look, additional features, safety considerations and ability to save energy effect the purchase decision of kitchenware products. Customer would be happy to have their cultural tradition reflected in the kitchenware products they use.	8.941176471	1st Rank
MR Finding 2 It was observed that respondents prefer serving utensils/ crockery made of Steel, Bell Metal, Brass and Glass. (Indian traditional designs)	6.411764706	5th Rank
MR Finding 3 Majority of the urban respondents prefer nonstick cookware followed by steel made cookware. A large number of respondents also prefer cookware made of Cast Iron, Brass, Bell Metal and Copper (Indian traditional designs)	6.470588235	4th Rank
MR Finding 4 It has been observed that 'Ease of Use' is the foremost important attribute in case of utensils/kitchenware.	6.882352941	3rd Rank
MR Finding 5 Consumers are not using modern sophisticated kitchenware because of the following reasons: 1. People find it complex to use especially when the job has to be done by domestic help 2. Operation process does not match with the traditional/ conventional way. 3. Power failures.	6.411764706	5th Rank

MR Finding 6 Occupation and education plays a crucial role in purchasing decision in this context; as they create awareness and the need of an efficient time saving kitchenware.	5.176470588	8th Rank
MR Finding 7 The current condition of dishwashing process is not satisfactory from the point of view of Hygiene, Environment and Productivity.	5.088235294	9th Rank
MR Finding 8 In the kitchens of the urban household, dishwashing is normally done in standing position. They need to continuously bend while doing the dish washing activity.	6.411764706	5th Rank
MR Finding 9 The scrubbing process requires more force in fingers, wrist and palm and therefore stress develops in the entire hand specifically in fingers, palm and the wrist. The scrubbing process comparatively takes a lot of time in the dishwashing process. The continuous bending in this posture while applying pressure with fingers results in back pain, neck pain and fatigue.	7.764705882	2nd Rank
MR Finding 10 In urban areas, dishwashing activity is being performed by the domestic help, who belong to the underprivileged; their voice is seldom heard of. The participation of the domestic help in the kitchenware design and the design of the integrated kitchen is abysmally low.	4.5	12th Rank
MR Finding 11 Domestic helps face problems in holding the scrubber in right position, because due to soap solution, it tends to slip out from the finger grip. Their fingers get eroded due to constant rubbing of utensils and cookware in	4.117647059	13th Rank

presence of soap solution.		
MR Finding 12 Interestingly it was found that many of the domestic helps use the thin metallic foils of used medicine tablets as scrubber instead of iron wire mesh. On being asked about the reason, they revealed that the thin metallic foils of used tablets work better than iron wire mesh scrubber or any other hard scrubber available in the market.	3.764705882	15th Rank
MR Finding 13 The continuous spitting of water makes the person wet mainly in the lower chest area	3.647058824	16th Rank
MR Finding 14 In rural areas the dependence on domestic help for dishwashing activity is very less. They perform the dishwashing activity in sitting and squatting body posture. They mostly use charcoal, ash and powder detergent for dishwashing. It was observed that most of them use natural coir as scrubber. The place for dishwashing is normally at a distance from the kitchen and is near to the main water source of the household like a well or a tube well.	5.764705882	6th Rank
MR Finding 15 Improvement in productivity and health & hygiene condition with proper design intervention in the dishwashing problem may largely benefit the poor.	4.588235294	11th Rank
MR Finding 16 On being asked to the urban respondents whether they thought that a dishwasher or a washing machine could be a substitute of domestic help; 90% respondents strongly disagreed and 10% of them disagreed.	3.941176471	14th Rank

MR Finding 17 The analysis of the urban respondents on use of various scrubbers reveals that majority of the respondents (83%) use coir scrubber followed by 15% for plastic scrubber. Again satisfaction level for steel scrubber is moderately low for 82% of the respondents. The satisfaction level for coir scrubber is the highest (85%) followed by plastic scrubber.	5.411764706	7th Rank
MR Finding 18 Amongst the rural respondents 72.5% prefer coir scrubber over 27.5% for plastic scrubber. It has been observed that the satisfaction level on steel scrubber and plastic scrubber is low. The satisfaction level on coir scrubber is the highest (72.5%)	4.941176471	10th Rank

Table 4.14: Ranks of the Marketing Research (MR) findings in meeting the design objective

5.0 Conclusion, Recommendations and Suggestions

5.1 Conclusion

It is important to effectively transform the marketing research findings for idea generation for product design. Companies may decide to do marketing research in house or may outsource the marketing research project to some other consultancy organization. In the both the cases the research is conducted by professionals from the marketing domain. They use several management tools and techniques for data collection and analysis. They normally use different sophisticated statistical tools and techniques for quantitative research. Secondary research also plays a major role in the marketing research projects. In marketing research projects researcher defines the project aim and objectives. The aim and objectives of the marketing research project may not be necessarily for product design. The objective of the marketing research project may be to study the market dynamics, market potential, demand estimation, overall consumer behavior, advertising, product communication, satisfaction level, needs and expectation of consumer, social impact and so on. But though the project objective may not be directly related to product design, the findings of the marketing research projects may be very much useful for product design. The extensive qualitative and quantitative analysis of the data collected in the marketing research projects give an insight to the overall consumer behavior. Marketing research projects are documented keeping in mind the aims and objectives of the project. As far as linking product design with marketing research is concerned one of the major challenges is extracting the 'specific' information needed by the designers from the marketing research project. If the designers are provided with the entire marketing research report, they may find it difficult to understand and interpret it, as they may not be familiar with the tools and techniques used by the management professionals. In this situation the designers may not find relevance of the marketing research findings for product design. Therefore the key is to 'structure' the marketing research findings from the point of view of product design. This doctoral study has evolved a method termed Marketing-Research- Finding Sensitive Visualisation (MRFSV) to structure marketing research findings for product designers. The product designers will get 'specific' information for product design with the help of this method. The MRFSV method stimulates the idea generation for product design to cater to the exact needs and expectations of consumers.

The study reveals that, conventional communication of consumer behavior to the designers may move away the designers from the design objective. Designers tend to enclose their preconceived thought about the consumer behavior in their design ideas. The MRFSV method helps the designers in defining design problems. This method helps in establishing a direct relationship of defined design problem to designer's design solution. The synthesis of all the marketing research finding sensitive visualizations generates wonderful design ideas, which ultimately lead to a complete design solution to meet the design objective.

5.2 Recommendation and suggestion

A great idea for product design is only as good as its potential to be successfully executed. The enterprises must develop their ability to innovate in understanding consumer needs and expectations, developing futuristic concepts and bring life to innovations in product design. An idea of a product design cannot be a just a great thought or a great concept on papers unless it fully has the ability to be executed; so that its worth can be gauged and proven among people in its value chain, amid market forces and among competing forces. Enterprises have now realized that execution is an intrinsic part of the innovation concept. At the end of the day good innovations are measured when the consumer is willing to invest in it. Therefore enterprises need to be very methodical about understanding consumer behaviour and effective transformation of consumer need and expectation to new idea for product design. Otherwise the idea may result in to a failure during execution. For example, when Parachute oil maker Marico entered the baby care segment (Sparsh baby oil and soap), it was considered a great idea. But the firm soon realized that it was a difficult segment, which it underestimated. Mothers are not the ones to experiment with new product on their babies. When Marico went back to the drawing board stage, it realized how execution had failed an excellent idea.

Marketing is going to be about being mobile, about location, about the consumer, his network of friends, likes and dislikes. Social media is changing the entire scenario of groups and clusters in the society. Now people have friends all over the world and with the help of social networking sites they are creating a global village of their friends. As the world becomes more global, people feel more rootless and social networking sites help people create their own personal village. Therefore marketing research would also take a new turn in this complex environment. Product designers need to closely observe this development. Marketing research team may take extensive help of web based tools

for primary data collection especially through social networking sites. The product designers may also extensively use web based tools, especially social networking sites for evaluation of their design ideas, product concepts or a prototype.

The MRFSV method discussed in this doctoral study is likely to bridge the gap between marketing team and the product design team in enterprises. It is expected to help the product designers to closely work with the marketing research team. As a result, probability of failure of the design ideas during execution will be minimized. A case study of dishwashing was considered for this study. Future research may be conducted considering other design related problems to revalidate and improve the method. Researcher may choose any other consumer durable or fast moving consumer goods to do a marketing research project. After that they may apply the MRFSV tool to transform marketing research findings to product design and do further analysis on this method. The research was conducted only in Indian context. The researcher may do similar research in other geographic and cultural segment. It is recommended to consider comparatively larger sample size of respondents in order to avoid errors in testing of hypotheses in quantitative analysis in marketing research.

MRFSV deals with the idea generation for product design at all levels of the design process viz. community, systems, product and component. Future research may be conducted to observe the efficiency of the tool at all the four levels. Further research may also be conducted to review the new method from three points of view, (i) that of creativity i.e designer as black boxes, (ii) that of rationality i.e. designer as glass boxes (iii) that of control over the design process i.e designer as a self organizing system. MRFSV method is suitable for splittable design problems, which are design problems can be split up or decomposed in to separate pieces that can be solved in series or in parallel (Jones Christopher C, 1982).

Future research may be conducted to evaluate the MRFSV method in the context of product life cycle management. In the present business environment product life cycle is becoming shorter. Research may be conducted to study the efficiency of MRFSV method to meet the challenges of short product life cycle.

Product designers may further refine the design ideas generated in this study and develop prototype for testing and validation. Focus groups may be formed for this. The focus group members may be given similar questionnaires as discussed in this study to record their specific responses on the prototype. Quantitative analysis may be conducted on the recorded data for further interpretation and refinement of the design. The method

suggested in this study may be applied for grass root level innovations keeping in mind the philosophy behind design for development.

MRFSV method deals with the idea generation for product design at all levels of the design process viz. community, systems, product and component (Jones Christopher C, 1982). Future research may be conducted to observe the efficiency of the tool at all the four levels. Further research may also be conducted to review the new method from three points of view, (1) that of creativity i.e designer as black boxes, (2) that of rationality i.e. designer as glass boxes (3) that of control over the design process i.e designer as a self organizing system. MRFSV method is suitable for splittable design problems, that is design problems can be split up or decomposed in to separate pieces that can be solved in series or in parallel. As far as the input-output chart suggested by Christopher C. Jones for selecting design method is concerned, MRFSV will lie in column 3 of the chart, which is 'transformation'. Further research may be conducted to identity the exact location of MRFSV in the input- output chart shown in the following page.

Input → Output ↓	**1** Design situation explored	**2** Problem structure perceived or transformed	**3** Boundaries located, Sub solutions described and conflicts identified	**4** Sub solutions combined in to alternative designs	**5** Alternative design evaluated and final design selected
1 Brief Issued					
2Design situation explored	DIVERGENCE	TRANSFORMATION		CONVERGENCE	
3Problem structure perceived or transformed					
4Boundaries located, Sub solutions described and conflicts identified					
5Sub solutions combined in to alternative designs					
6Alternative design evaluated and final design selected					

Figure 5.1: The input-output chart of design methods

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Author Index

Appendix 1

Questionnaire for the study of consumer behaviour related to cookware, crockery and utensils (Module I)

Dear Sir/Madam,

I am conducting a survey to study the consumer behaviour in case of kitchenware. I would be grateful to you for your kind cooperation in filling up this questionnaire.

1. On an average what type of food do you have? (You can tick in more than one box)

Breakfast		Lunch/Dinner	
a) Paratha/luchi	☐	a) Rice/chapatti	☐
b) Bread/loaf/sandwich	☐	b) Dosa	☐
c) Idli	☐	c) Chicken/fish/paneer item	☐
d)Rice	☐	d) Tandoor items	☐
e) any other (specify)……		e) any other (specify)……	

Snacks		Festivals/Occasional	
a) Biscuits/cake/pizza	☐	a) Pulao/Biryani	☐
b) Pakora	☐	b) Sweets	☐
c) Roll/Chow	☐	c) Pitha	☐
d) Upma	☐	d)Any other spececify)……..	
e) Any other (specify)……			

2. By which processes do you cook your meal? (You can tick more than one box)

a) Heating and frying☐b) Steaming☐c) Baking☐d) Roasting☐e) Grilling☐f)any other(specify_____)

3. Do you own a Microwave Oven/ OTG etc? If yes, which brand do you have?

a) Yes ☐ b) No ☐

4. How important is the variety of product features in a cookware for you

a)Most important ☐ b) Important ☐c) Not so important ☐ d) Least important ☐

5. How satisfied are you with your Microwave Oven/ OTG? (Please tick within 1 to 5, 1-highly satisfied, 5-highly dissatisfied)

	……	……	……	……	……	…….
(Highly satisfied)	1	2	3	4	5	(Highly dissatisfied)

6. Did you ever feel the need to upgrade your MWO for your cooking needs?

a) Yes ☐ b) No ☐

7. What are the reasons for not buying a modern sophisticated kitchenware like Microwave Oven/OTG

a) Price☐ b) Electricity ☐c) Taste variation☐d) Safety matters☐
e) Any other (please specify)…….

8. Give your preference ratings on following material for cookware

	Least preferred									Most preferred
Cast Iron	1	2	3	4	5	6	7	8	9	10
Brass	1	2	3	4	5	6	7	8	9	10
Bell Metal	1	2	3	4	5	6	7	8	9	10
Copper	1	2	3	4	5	6	7	8	9	10
Non Stick	1	2	3	4	5	6	7	8	9	10
Steel	1	2	3	4	5	6	7	8	9	10
Ceramic	1	2	3	4	5	6	7	8	9	10
Melamine	1	2	3	4	5	6	7	8	9	10

9. Give your preference ratings on following material for utensils

	Least preferred									Most preferred
Cast Iron	1	2	3	4	5	6	7	8	9	10
Brass	1	2	3	4	5	6	7	8	9	10
Bell Metal	1	2	3	4	5	6	7	8	9	10
Copper	1	2	3	4	5	6	7	8	9	10
Plastic	1	2	3	4	5	6	7	8	9	10
Wood/Cane Banboo	1	2	3	4	5	6	7	8	9	10
Steel	1	2	3	4	5	6	7	8	9	10
Ceramic	1	2	3	4	5	6	7	8	9	10
China Clay	1	2	3	4	5	6	7	8	9	10
Melamine	1	2	3	4	5	6	7	8	9	10
Glass	1	2	3	4	5	6	7	8	9	10

10. Give your importance level on the following attributes of cookware

	Least Important						Most Important
Ease of use	1	2	3	4	5	6	7
Aesthetic look	1	2	3	4	5	6	7
Traditional design	1	2	3	4	5	6	7
Taste of food	1	2	3	4	5	6	7
Ease for washing	1	2	3	4	5	6	7
Durability/ Robustness	1	2	3	4	5	6	7

Variety in design	1	2	3	4	5	6	7
Brand name	1	2	3	4	5	6	7
Hygiene	1	2	3	4	5	6	7
Weight	1	2	3	4	5	6	7
Status symbol	1	2	3	4	5	6	7

11. Give your importance level on the following attributes of crockery

	Least Important						Most Important
Ease of use	1	2	3	4	5	6	7
Aesthetic look	1	2	3	4	5	6	7
Traditional design	1	2	3	4	5	6	7
Taste of food	1	2	3	4	5	6	7
Ease for washing	1	2	3	4	5	6	7
Durability/ Robustness	1	2	3	4	5	6	7
Variety in design	1	2	3	4	5	6	7
Brand name	1	2	3	4	5	6	7
Hygiene	1	2	3	4	5	6	7
Weight	1	2	3	4	5	6	7
Status symbol	1	2	3	4	5	6	7

12. Give your importance level on the following attributes of utensils

	Least Important						Most Important
Ease of use	1	2	3	4	5	6	7
Aesthetic look	1	2	3	4	5	6	7
Traditional design	1	2	3	4	5	6	7
Taste of food	1	2	3	4	5	6	7
Ease for washing	1	2	3	4	5	6	7
Durability/ Robustness	1	2	3	4	5	6	7
Variety in design	1	2	3	4	5	6	7
Brand name	1	2	3	4	5	6	7
Hygiene	1	2	3	4	5	6	7
Weight	1	2	3	4	5	6	7
Status symbol	1	2	3	4	5	6	7

ABOUT YOU

1. Name:_____

2. Agegroup (in years):

a) below 25 ☐
b) 26---35 ☐
c) 36---45 ☐
d) above 45 ☐

3.Gender:
a) Male ☐ b) Female ☐

4. Education:
a) Matriculation ☐ b) Higher secondary ☐ c) Graduate ☐
d) Post graduate ☐ e) others☐

Occupation:
a) Student ☐ b) Housewife ☐ c) Govt. employee ☐ d)Corporate executive☐e) Businessman☐ f)Any other (specify)……..

Number of family members in the household:
2 to 4 ☐ b) 5 to 7 c)8 to 10 d)Above 10

Your monthly household income (in Rupees):

a) Below 10,000 ☐ c) 25,001---35,000 ☐
b) 10,001—25,000 ☐ d) Above 35,000 ☐

Appendix 2

Questionnaire for the study of dishwashing related consumer behaviour (Module II)

Dear respondent,

I am a PhD Research scholar of Indian Institute of Technology, Guwahati. I am doing a consumer survey to understand the dishwashing behavior. It would take you only a few minutes to answer the questions. I solicit your help and cooperation.

Uban☐ Rural☐

Do you have any male/ maid domestic help in your house? Kindly mark (√)

Yes ( )No ( )

Your domestic help is a man or maid? Man ( ) Maid ( ) Kindly mark(√)

You have engaged your domestic help in full time basis or part-time basis?

Part Time ( ) Full Time ( ) Kindly mark(√)

For which activity you depend on the domestic help the most? Kindly mark (√).

(a) Cooking ( )
(b) Dishwashing ( )
(c) Taking care of kids ( )
(d) Cloth washing ( )
(e) Dishwashing and Cloth washing ( )

For above workings how much do you pay him/ her per month? Kindly mark(√)

Rs. 300 – Rs. 500 ( )
Rs. 501 - Rs. 700 ( )
Rs. 701 – Rs.900 ( )
Rs. 901 – Rs. 1100 ( )
Above Rs. 1100 ( )

Your part-time domestic help works in how many households? Kindly mark(√)

(a) 2 households ( )
(b)3 households ( )
(c) 4 households ( )
(d) 5 to 6 households ( )
(d) I have full time domestic help ( )

Please give your preference of part time / full time domestic help for the following activities. Kindly mark (√)

a) Dishwashing-----full time/part-time
b) Cooking-----full time/part-time

c) Taking care of kids-----full time/part-time
d) Cloth washing/ cleaning-----full time/part-time

Do you have a dishwasher? Kindly mark(√) Yes ( ) No ( )

Do you have a cloth washing machine? Kindly mark(√) Yes ( ) No ( )

Please give your opinion on the following statement in rating : 'A cloth washing machine or a dishwasher can substitute a domestic help'

Strongly agree I--------I--------I--------I--------I-------I Strongly disagree

Please rate the following activity which like you most and dislike you most while cooking? (1= dislike most, 5= like most)

	1	2	3	4	5
(a) Only cooking itself	I--------I--------I--------I--------I				
(b) Washing the utensils	I--------I--------I--------I--------I				
(C) Preparing the raw food ingredients	I--------I--------I--------I--------I				

What type of scriber do you use for washing your utensils? Kindly mark (√).

(a) Sponz scrubber ( )
(b) Steel Scrubber ( )
(c) Plastic Scrubber ( )
(d) Coir Scrubber ( )

Please rate the satisfaction level of the scriber that you are using daily for washing the utensils? (5= highest, 1= lowest)

	1	2	3	4	5
(a) Sponz scrubbers	I--------I--------I--------I--------I				
(b) Steel Scrubbers	I--------I--------I--------I--------I				
(c) Plastic Scrubbers	I--------I--------I--------I--------I				
(d) Coir Scrubbers	I--------I--------I--------I--------I				

What type of dishwashing detergent do you use for removing the stains from the utensils? Kindly mark (√)

(a) Bar detergent ( )
(b) Liquid detergent ( )
(c)Powder detergent ( )

Please rank the following detergent according to your preference. (1= lowest, 3=highest).

(a) Bar detergent ( )
(b) Liquid detergent ( )
(c)Powder detergent ( )

About yourself

Name of the household head: _____

Number of Family members: Kindly mark (√)

2 members( )
3 to 4 members ( )
5 to 6 members ( )
7 to 8 members ( )
More than 8 members ( )

Annual Income: Kindly mark (√)

[ ] Less than Rs. 100,000
[ ] Between Rs. (100,000 – 150,000)
[ ] Between Rs. (150,000 – 200,000)
[ ] Between Rs. (200,000 – 250,000)
[ ] Between Rs. (250,000 – 300,000)
[ ] Above Rs. 300,000

Appendix 3

Questionnaire for visual data analysis

Please give your opinion the following issues:

1. Do you think that the present scenario is acceptable to a progressive society?

Highly Acceptable	Acceptable	Cannot say	Not Acceptable	Not at all acceptable

2. Do you think that with certain improvement in the present condition of dishwashing, the productivity of the people can be substantially increased?

Strongly agree	Agree	Cannot say	Disagree	Strongly disagree

3. Is the process environment friendly?

Strongly agree	Agree	Cannot say	Disagree	Strongly disagree

4. Can the present process ensure the better health and hygiene of person?

Strongly agree	Agree	Cannot say	Disagree	Strongly disagree

5. Do you think that the existing dishwashing process is benefiting the poor?

Strongly agree	Agree	Cannot say	Disagree	Strongly disagree

6. Do you think that the dishwashing problem needs immediate attention from designers, technologists and social scientists?

Strongly agree	Agree	Cannot say	Disagree	Strongly disagree

Appendix 4

Questionnaire for Concept Screening

Dear Friends,

I am a PhD Research Scholar of Indian Institute of Technology, Guwahati. It was found from my previous research that '**Dishwashing'** is the **most disliked** activity amongst all the activities a person performs related to cooking and eating in his/her daily life. Some designers have generated some new design ideas to solve the '**dishwashing problem'**. Kindly help me in the concept screening process of the design ideas.

Please rate the concepts against the criterion in the following concept screening matrix. Reference concept is the existing products/ solutions for the dishwashing problem.
The codes are: '+' for better than existing, '0' for same as existing, '-' for worse than existing

Selection Criteria	Concept 1	Concept 2	Concept 3	Concept 4	Concept 5
Ease of dishwashing in Indian context					
Ease of use					
Ergonomic considerations					
Ease of manufacture and assembly					
Aesthetic appeal/ design variety					
Economic and financial feasibility					
Environment friendliness					

Selection Criteria	Concept 6	Concept 7	Concept 8	Concept 9	Concept 10
Ease of dishwashing in Indian context					
Ease of use					
Ergonomic considerations					
Ease of manufacture and assembly					
Aesthetic appeal/ design variety					
Economic and financial feasibility					
Environment friendliness					

Selection Criteria	Concept 11	Concept 12	Concept 13	Concept 14	Concept 15
Ease of dishwashing in Indian context					
Ease of use					
Ergonomic considerations					
Ease of manufacture and assembly					
Aesthetic appeal/ design variety					
Economic and financial feasibility					
Environment friendliness					

Appendix 5

Questionnaire for Marketing-Research-Findings Sensitive Visualization (MRFSV)

Dear friends:

A Marketing Research study was conducted to understand the consumer behavior related to the **'dishwashing'** activity in Indian context. Following table (column 1) contains the major findings of the study. The design objective is to solve the dishwashing problem in order to improve quality of life. The broad objective is 'Design for Development'.

Marketing Research Findings	Weightage in meeting design objective *(Divide total score 100 amongst the eighteen marketing research findings)*	Define Design Problem *(How would you like to define the design problem from the corresponding MR Findings?)*	Marketing Research Findings Specific Visualization (MRFSV) *(Description of Designer's design solution for the design problem)*
MR Finding 1 Various attributes viz. design and aesthetic look, additional features, safety considerations and ability to save energy effect the purchase decision of kitchenware products. Customer would be happy to have their cultural tradition reflected in the kitchenware products they use.			
MR Finding 2 It was observed that respondents prefer serving utensils/ crockery made of Steel, Bell Metal, Brass and Glass. (Indian traditional designs)			

MR Finding 3 Majority of the urban respondents prefer nonstick cookware followed by steel made cookware. A large number of respondents also prefer cookware made of Cast Iron, Brass, Bell Metal and Copper (Indian traditional designs)			
MR Finding 4 It has been observed that 'Ease of Use' is the foremost important attribute in case of utensils/kitchenware.			
MR Finding 5 Consumers are not using modern sophisticated kitchenware because of the following reasons: 1. People find it complex to use especially when the job has to be done by domestic help 2. Operation process does not match with the traditional/ conventional way. 3. Power failures.			
MR Finding 6 Occupation and Education plays a crucial role in purchasing decision in this context; as they create awareness and the need of an efficient time saving kitchenware.			

MR Finding 7 The current condition of dishwashing process is not satisfactory from the point of view of Hygiene, Environment and Productivity.			
MR Finding 8 In the kitchens of the urban household, dishwashing is normally done in standing position. They need to continuously bend while doing the dish washing activity.			
MR Finding 9 The scrubbing process requires more force in fingers, wrist and palm and therefore stress develops in the entire hand specifically in fingers, palm and the wrist. The scrubbing process comparatively takes a lot of time in the dishwashing process. The continuous bending in this posture while applying pressure with fingers results in back pain, neck pain and fatigue.			
MR Finding 10 In urban areas, dishwashing activity is being performed by the domestic help, who belong to the underprivileged; their voice is seldom heard of. The			

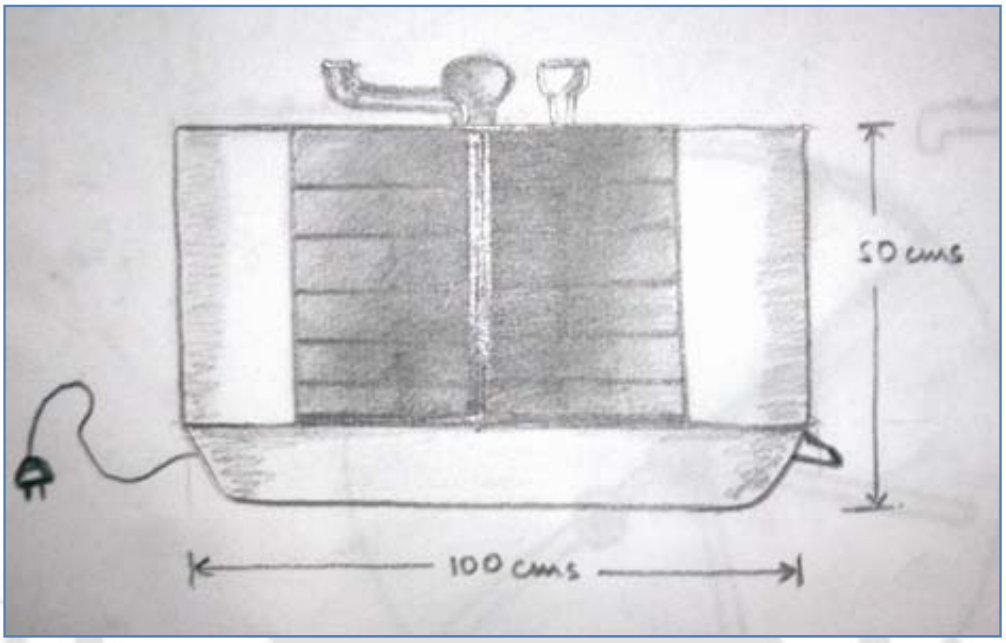
participation of the domestic help in the kitchenware design and the design of the integrated kitchen is abysmally low.			
MR Finding 11 Domestic helps face problems in holding the scrubber in right position, because due to soap solution, it tends to slip out from the finger grip. Their fingers get eroded due to constant rubbing of utensils and cookware in presence of soap solution.			
MR Finding 12 Interestingly it was found that many of the domestic helps use the thin metallic foils of used medicine tablets as scrubber instead of iron wire mesh. On being asked about the reason, they revealed that the thin metallic foils of used tablets work better than iron wire mesh scrubber or any other hard scrubber available in the market.			
MR Finding 13 The continuous spitting of water makes the person wet mainly in the lower chest area			
MR Finding 14 In rural areas the dependence on domestic help for dishwashing activity is very less. They perform the			

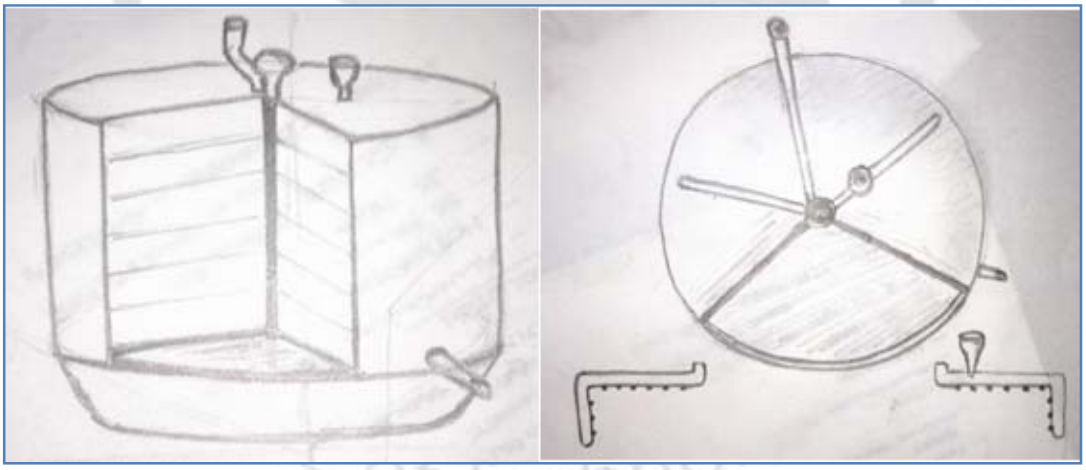
dishwashing activity in sitting and squatting body posture. They mostly use charcoal, ash and powder detergent for dishwashing. It was observed that most of them use natural coir as scrubber. The place for dishwashing is normally at a distance from the kitchen and is near to the main water source of the household like a well or a tube well.			
MR Finding 15 Improvement in productivity and health & hygiene condition with proper design intervention in the dishwashing problem may largely benefit the poor.			
MR Finding 16 On being asked to the urban respondents whether they thought that a dishwasher or a washing machine could be a substitute of domestic help; 90% of the respondents strongly disagreed and 10% of them disagreed.			
MR Finding 17 The analysis of the urban respondents on use of various scrubbers reveals that majority of the respondents (83%) use coir scrubber followed by 15% for			

plastic scrubber. Again satisfaction level for steel scrubber is moderately low for 82% of the respondents. The satisfaction level for coir scrubber is the highest (85%) followed by plastic scrubber.			
MR Finding 18 Amongst the rural respondents 72.5% prefer coir scrubber over 27.5%for plastic scrubber. It has been observed that the satisfaction level on steel scrubber and plastic scrubber is low. The satisfaction level on coir scrubber is the highest (72.5%)			

Appendix 6

Design ideas generated with conventional sharing of marketing research findings (1st phase)

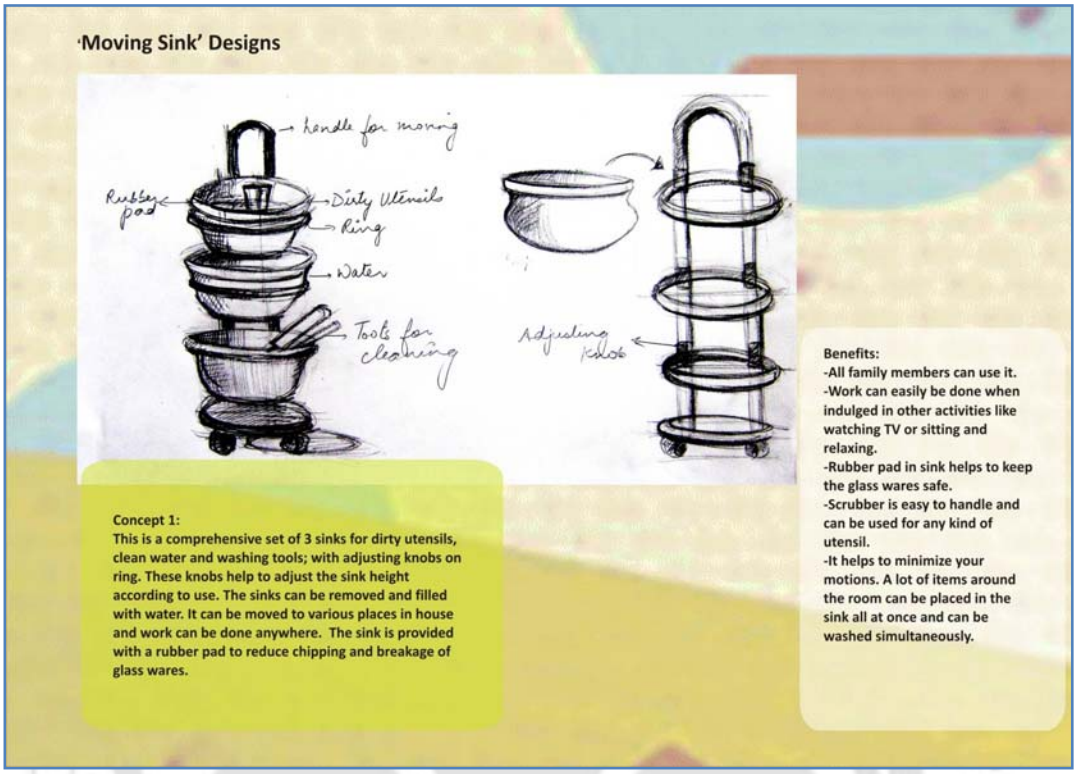




Concept 1

Appendix 6

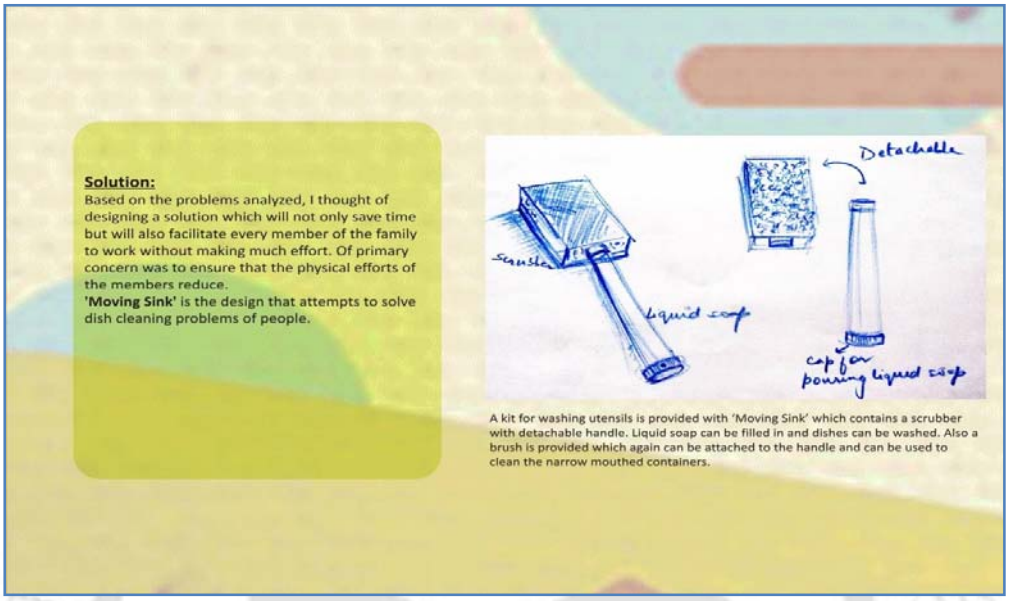
Design ideas generated with conventional sharing of marketing research findings (1st phase)

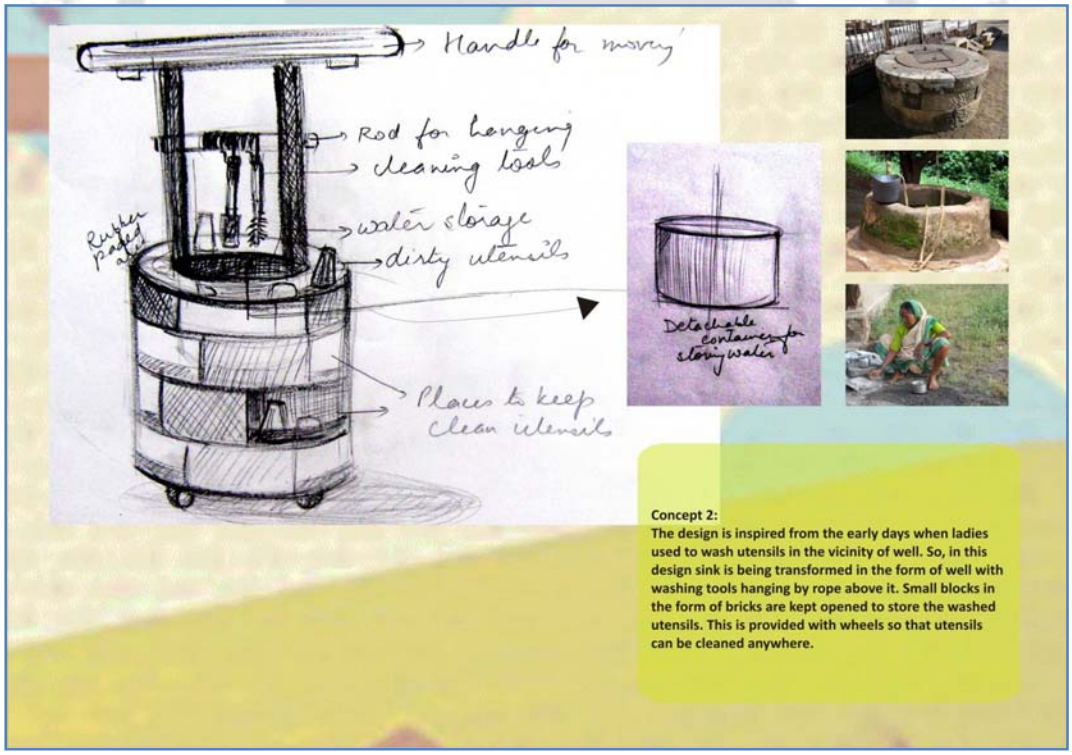


Concept 2

Appendix 6

Design ideas generated with conventional sharing of marketing research findings (1st phase)

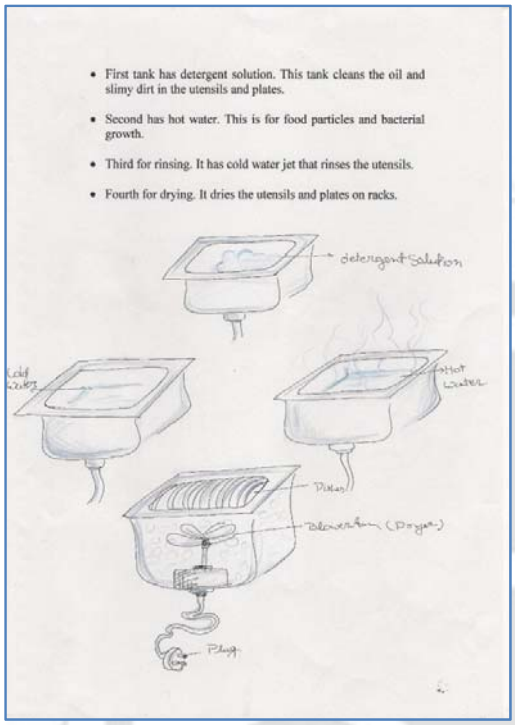




Concept 3

Appendix 6

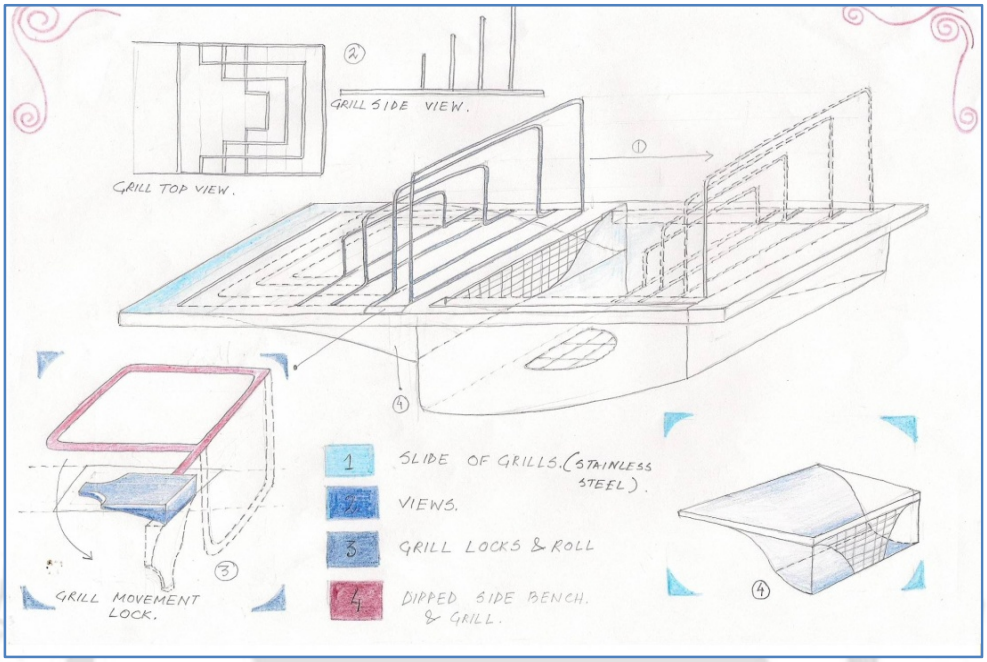
Design ideas generated with conventional sharing of marketing research findings (1st phase)

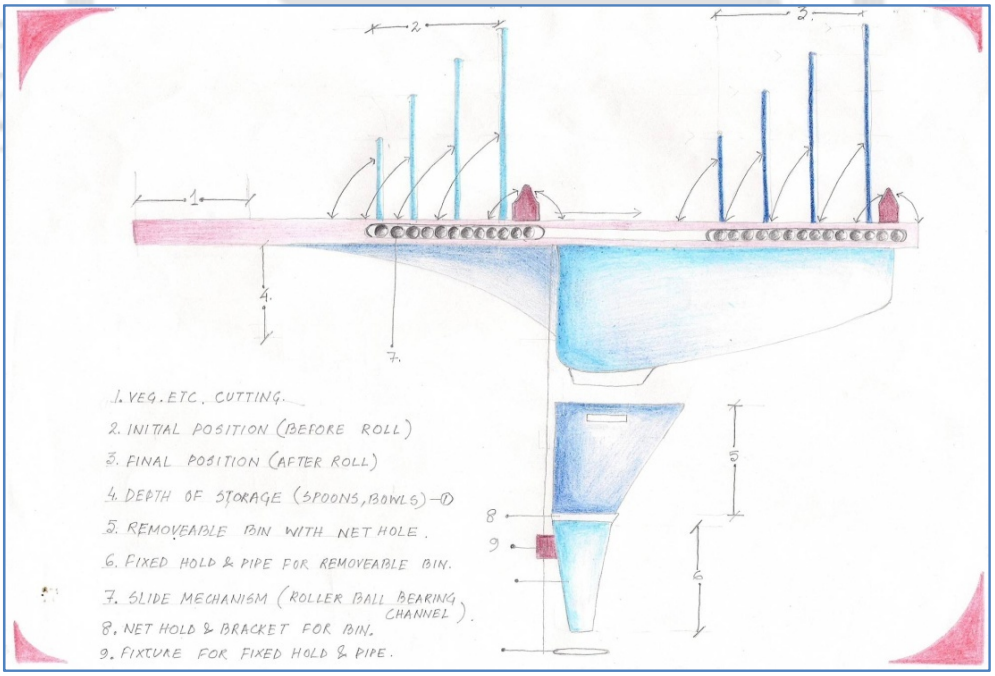


Concept 4

Appendix 6

Design ideas generated with conventional sharing of marketing research findings (1st phase)

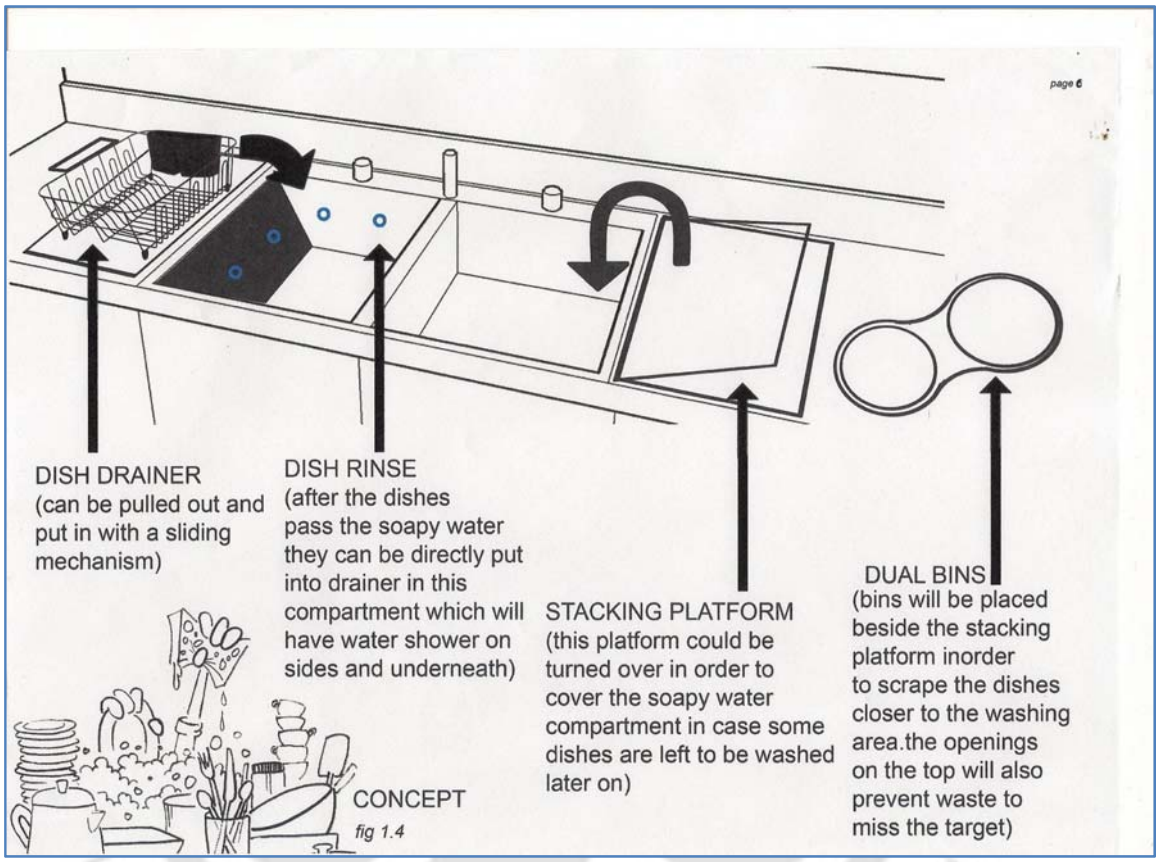




Concept 5

Appendix 6

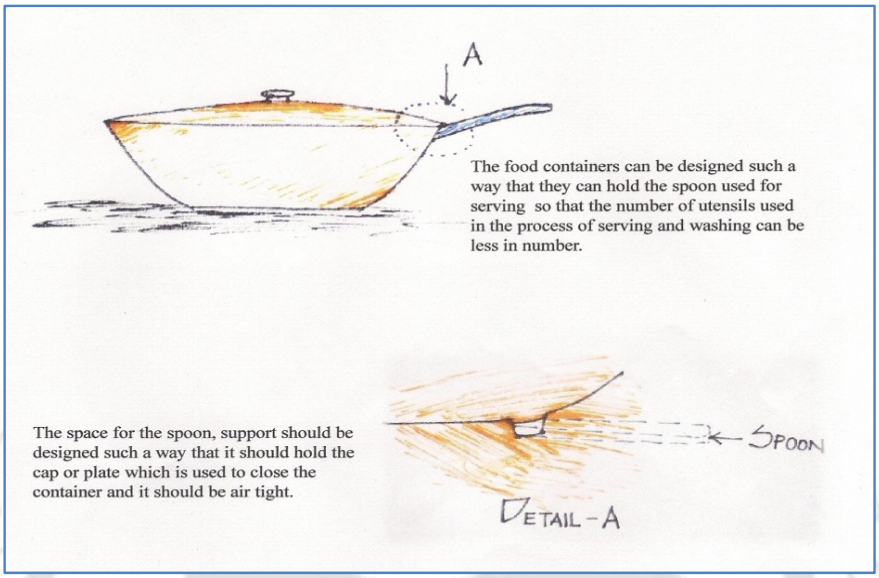
Design ideas generated with conventional sharing of marketing research findings (1st phase)

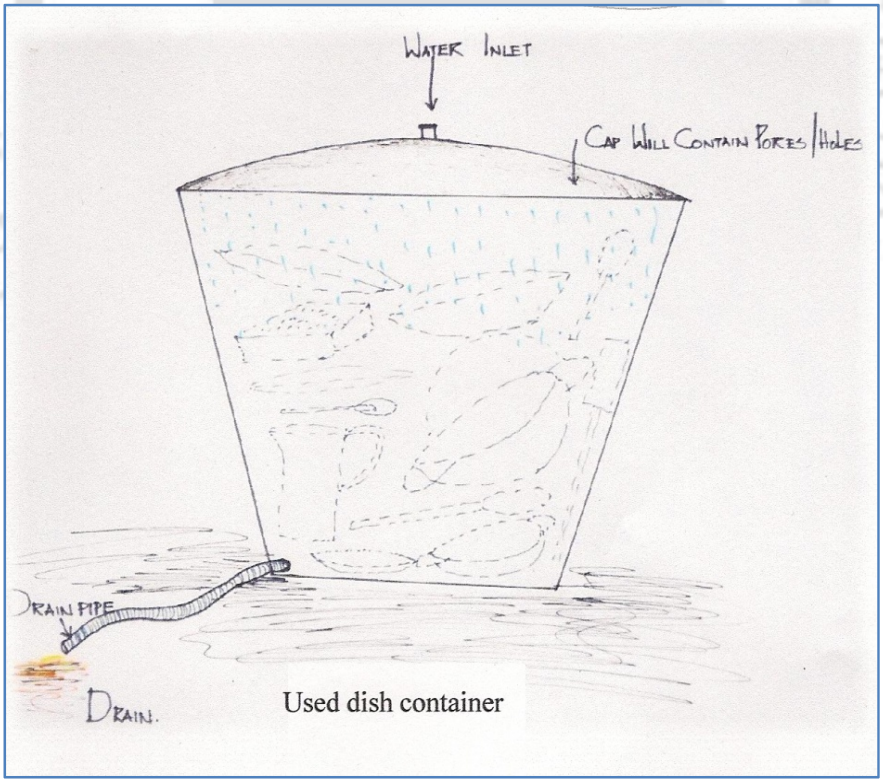


Concept 6

Appendix 6

Design ideas generated with conventional sharing of marketing research findings (1st phase)

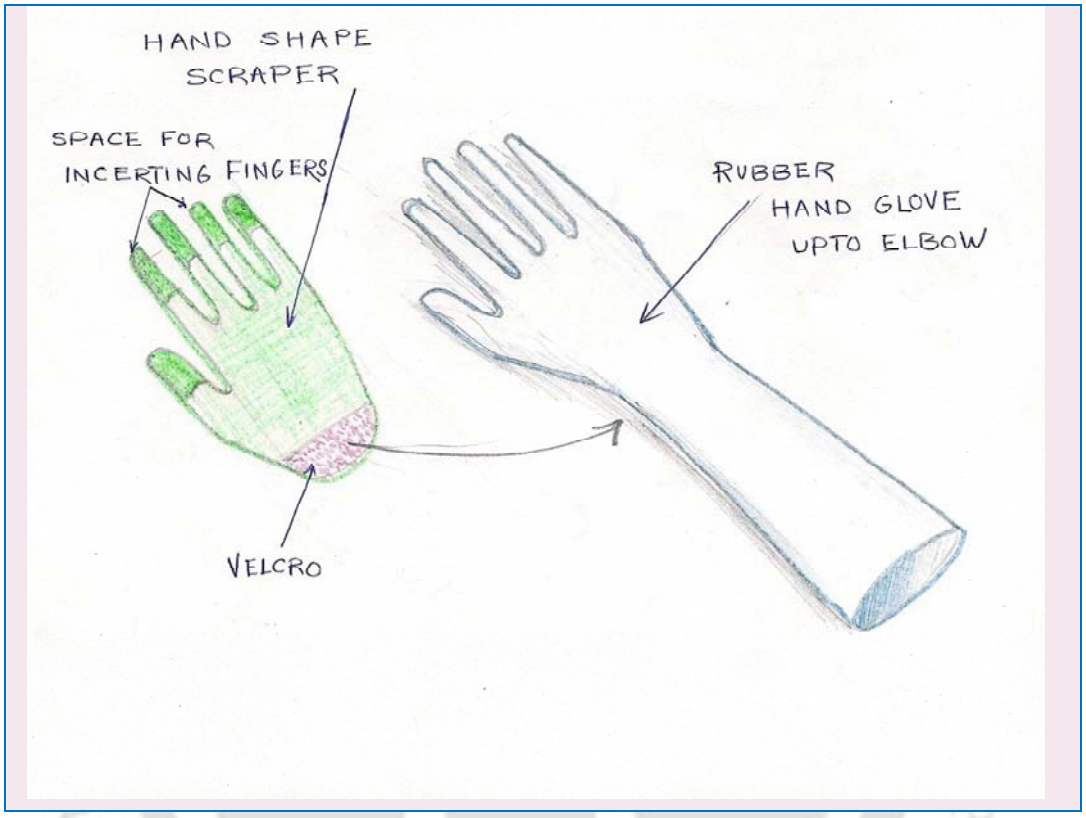




Concept 7

Appendix 6

Design ideas generated with conventional sharing of marketing research findings (1st phase)



Concept 8

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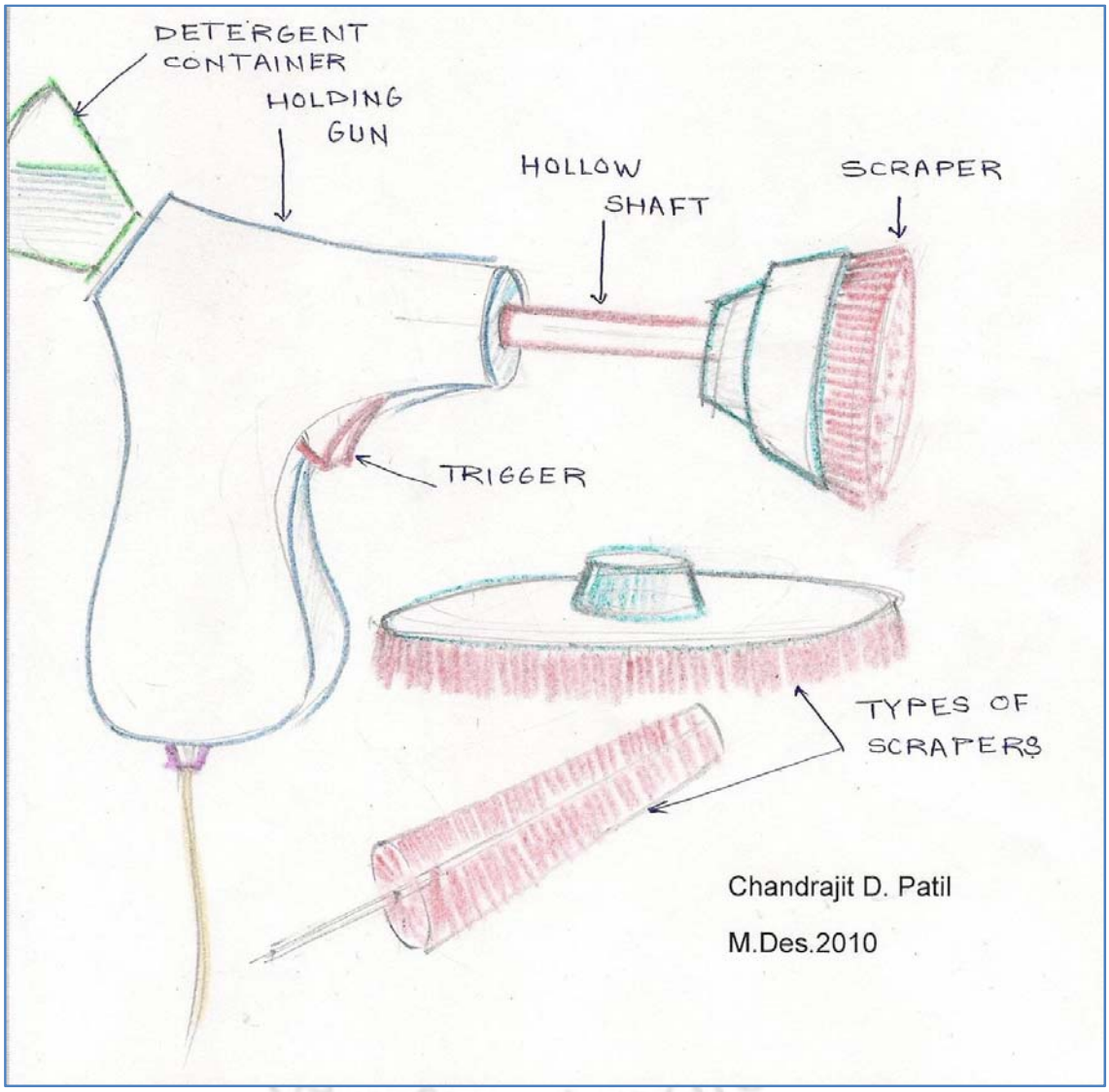

Concept 9

Appendix 6

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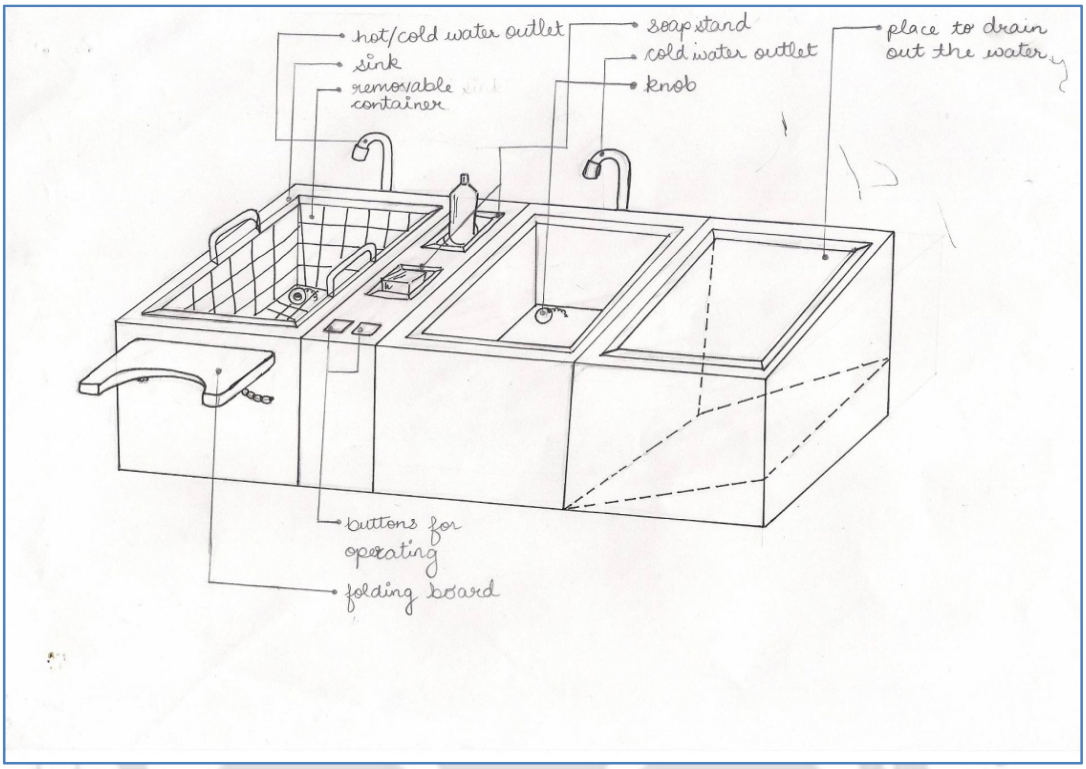
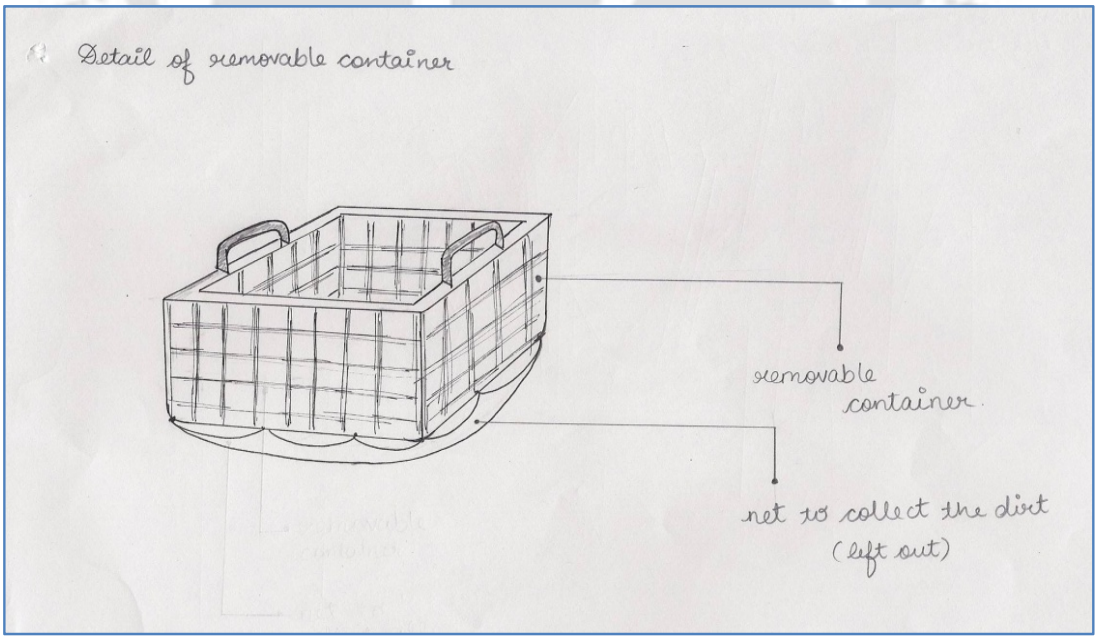
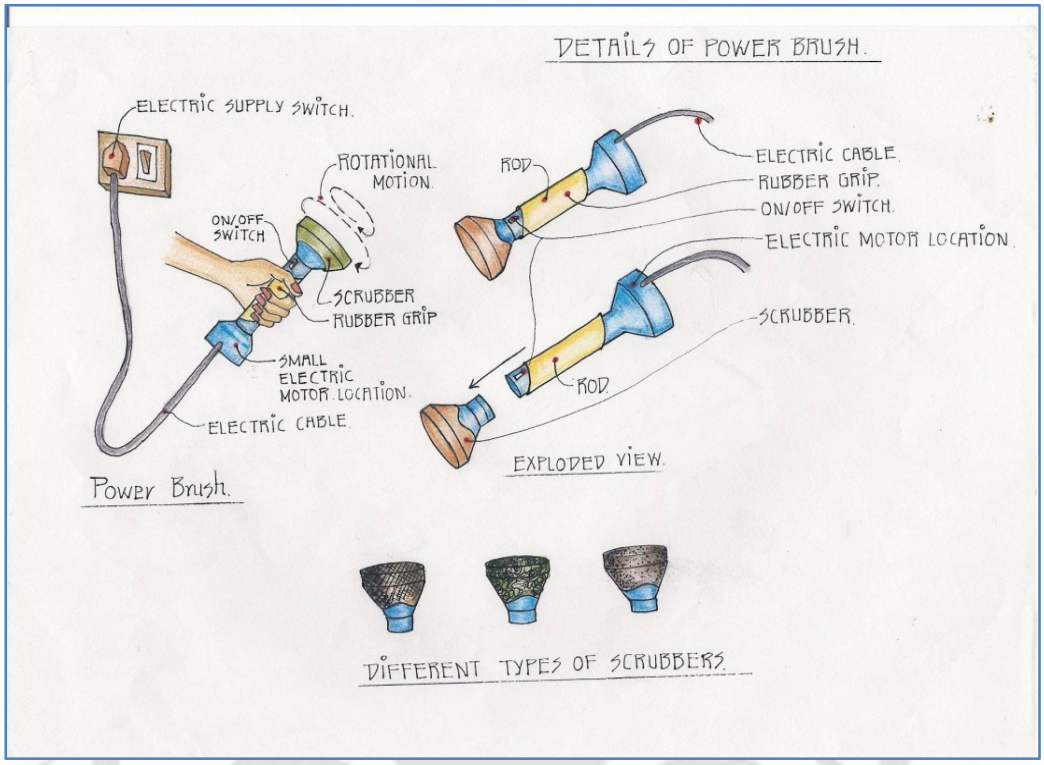


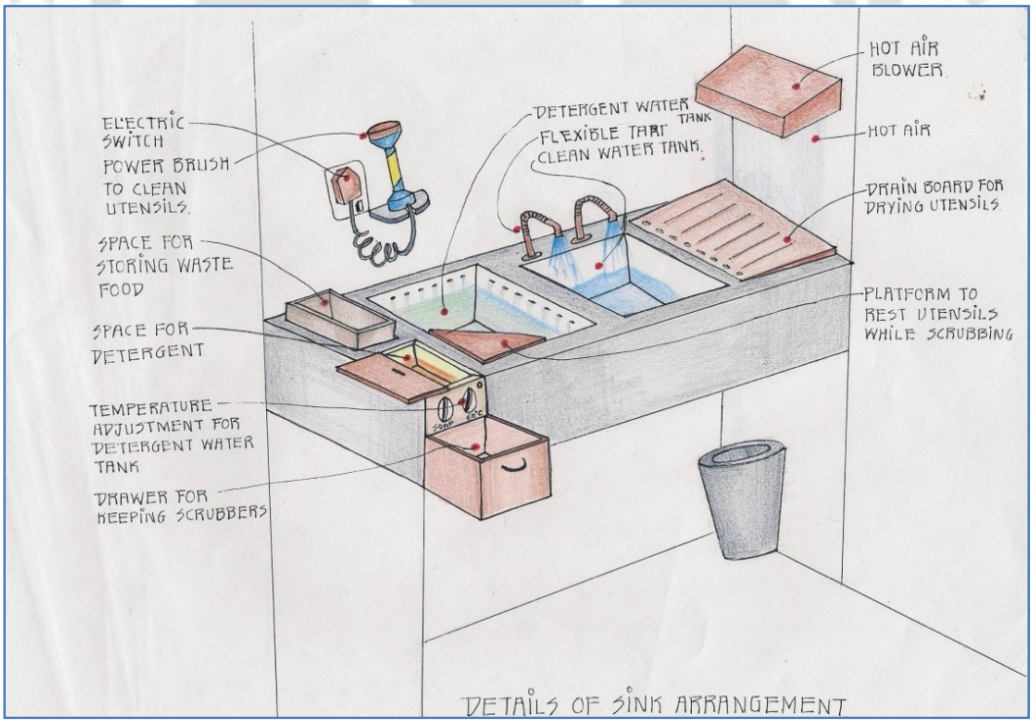


Concept 10

Appendix 6

Design ideas generated with conventional sharing of marketing research findings (1st phase)

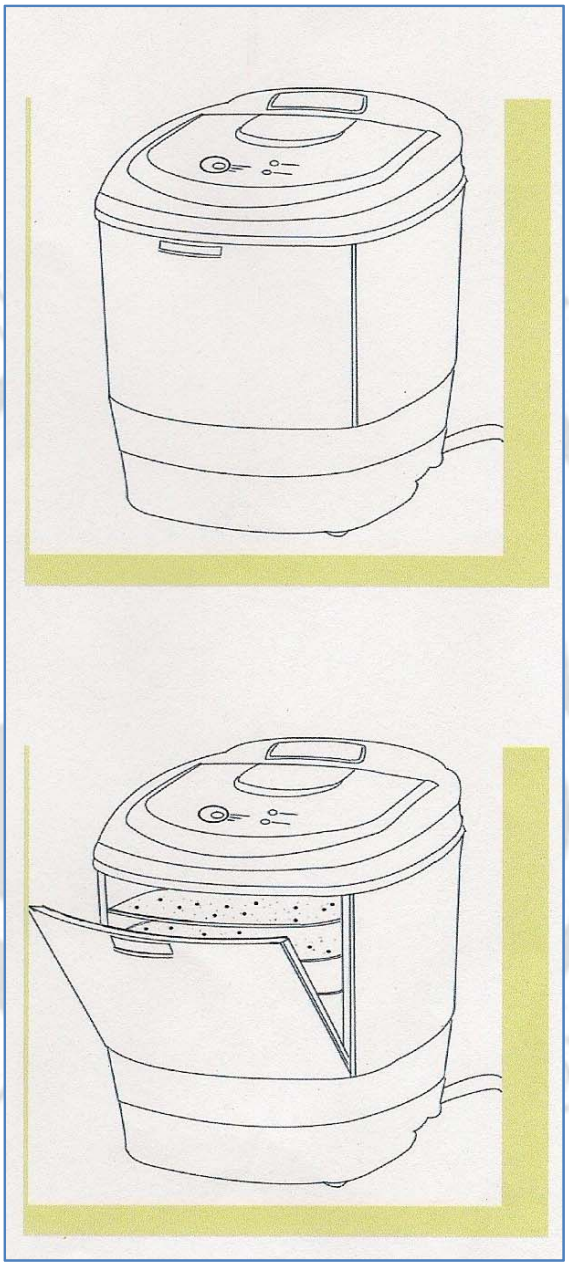




Concept 11

Appendix 6

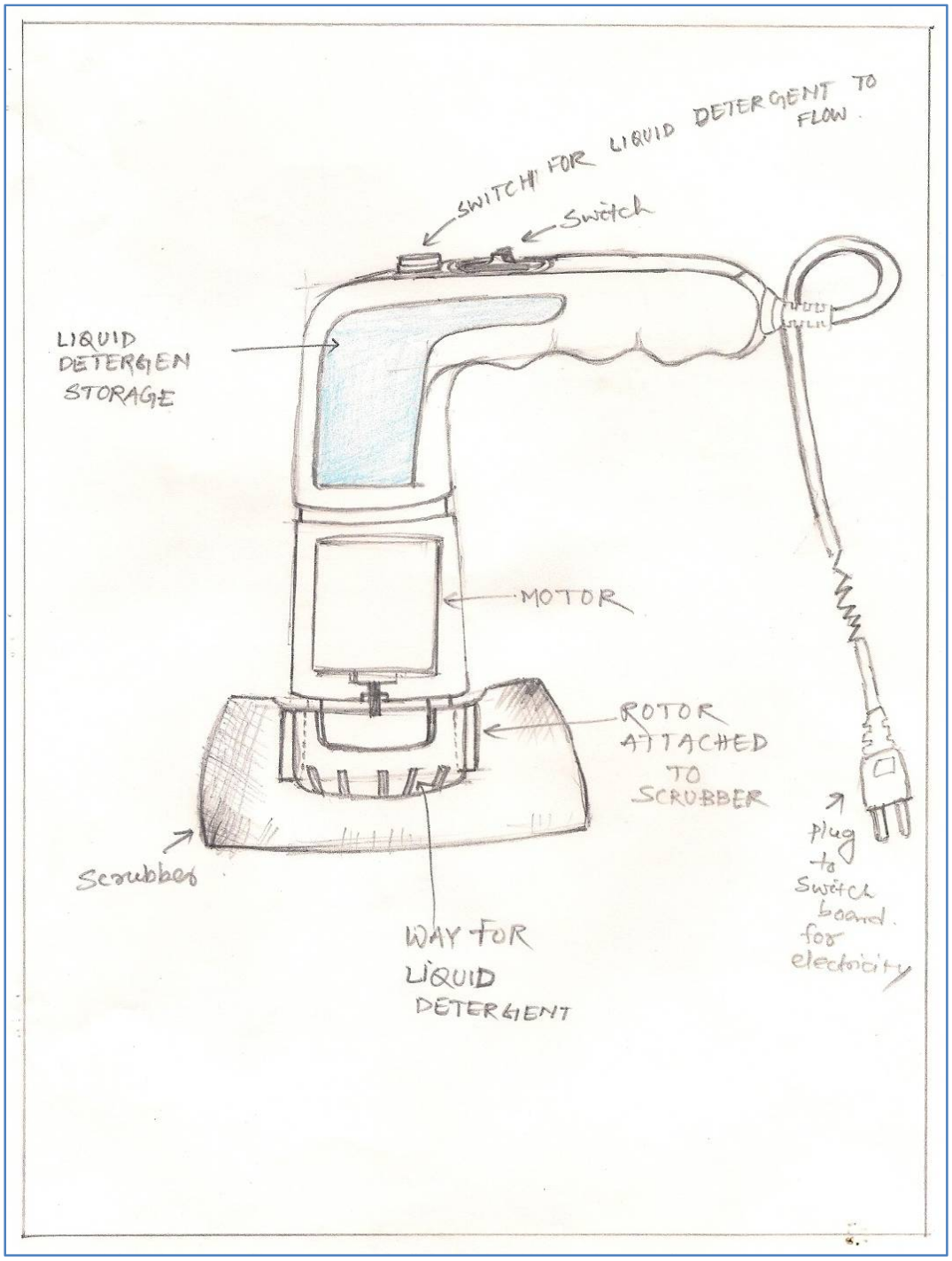
Design ideas generated with conventional sharing of marketing research findings (1st phase)



Concept 12

Appendix 6

Design ideas generated with conventional sharing of marketing research findings (1st phase)



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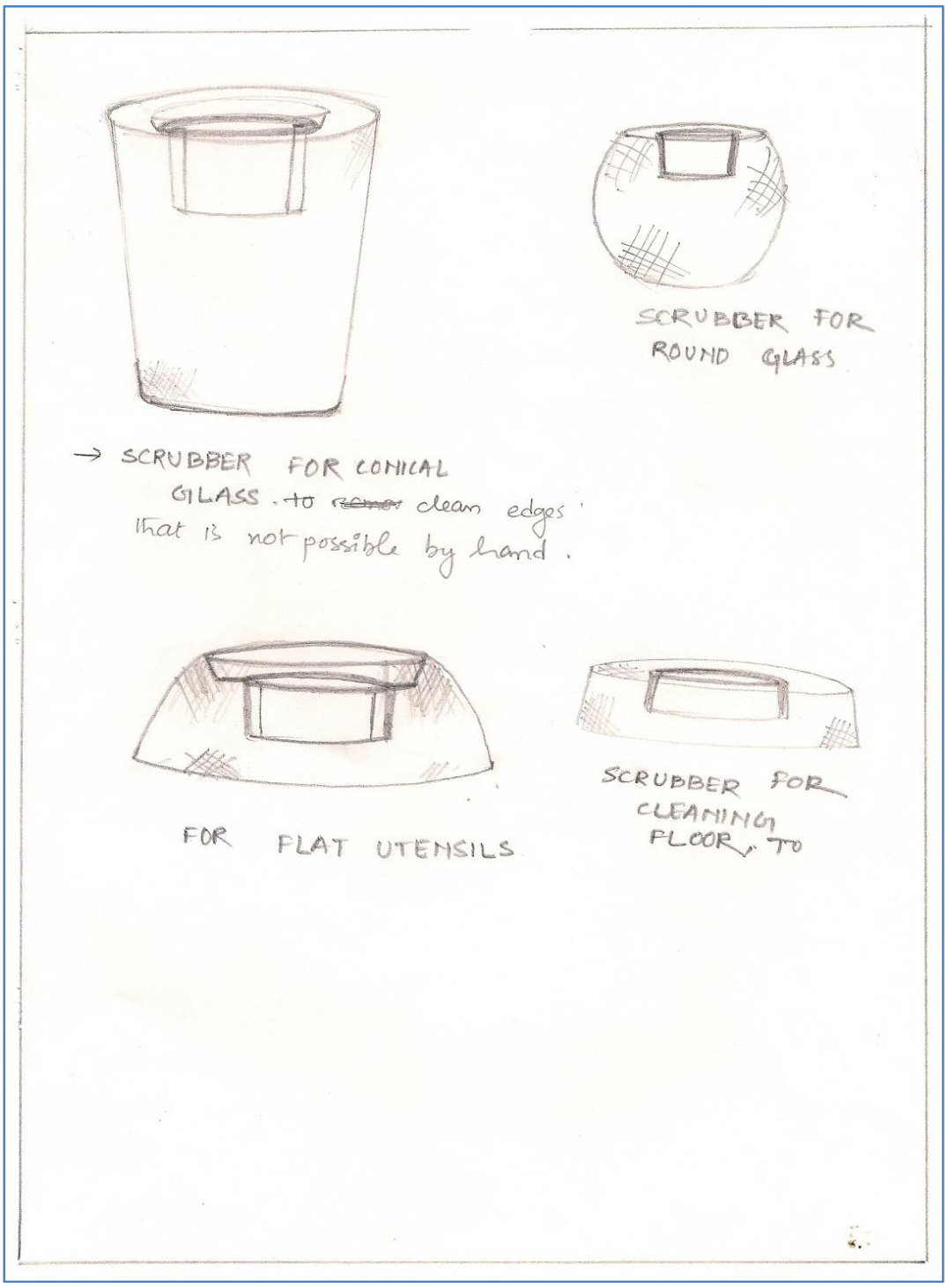
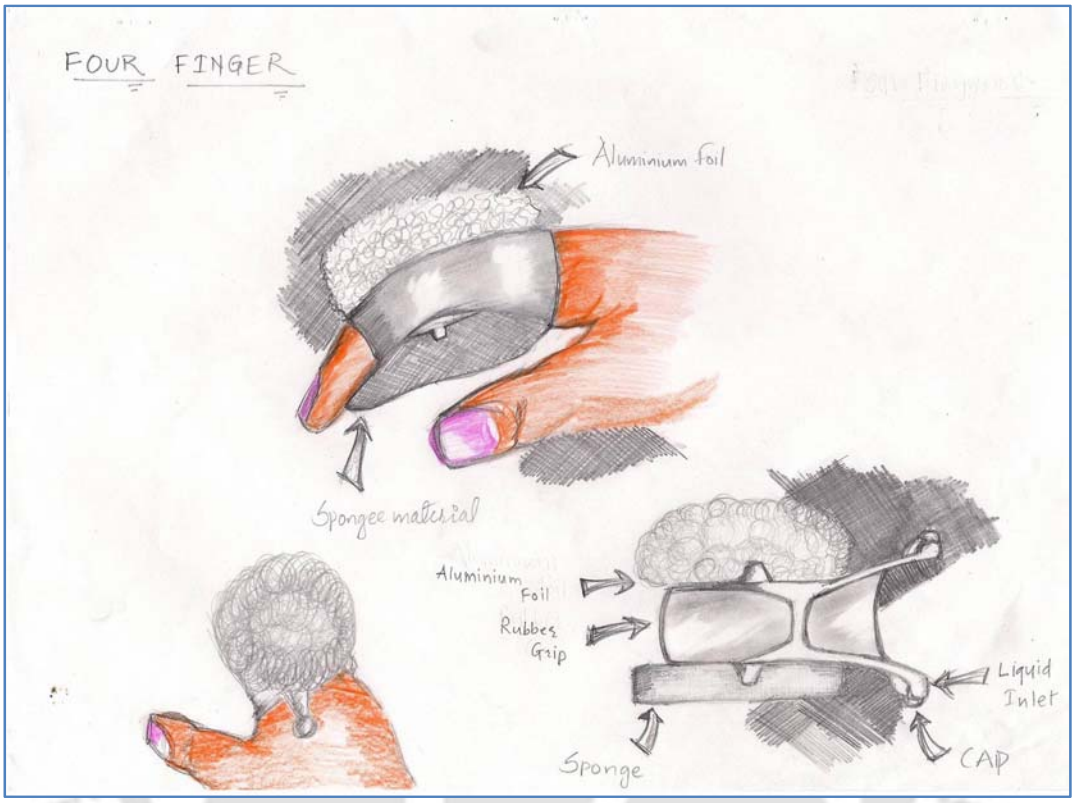
Design ideas generated with conventional sharing of marketing research findings (1st phase)



Concept 14

Appendix 6

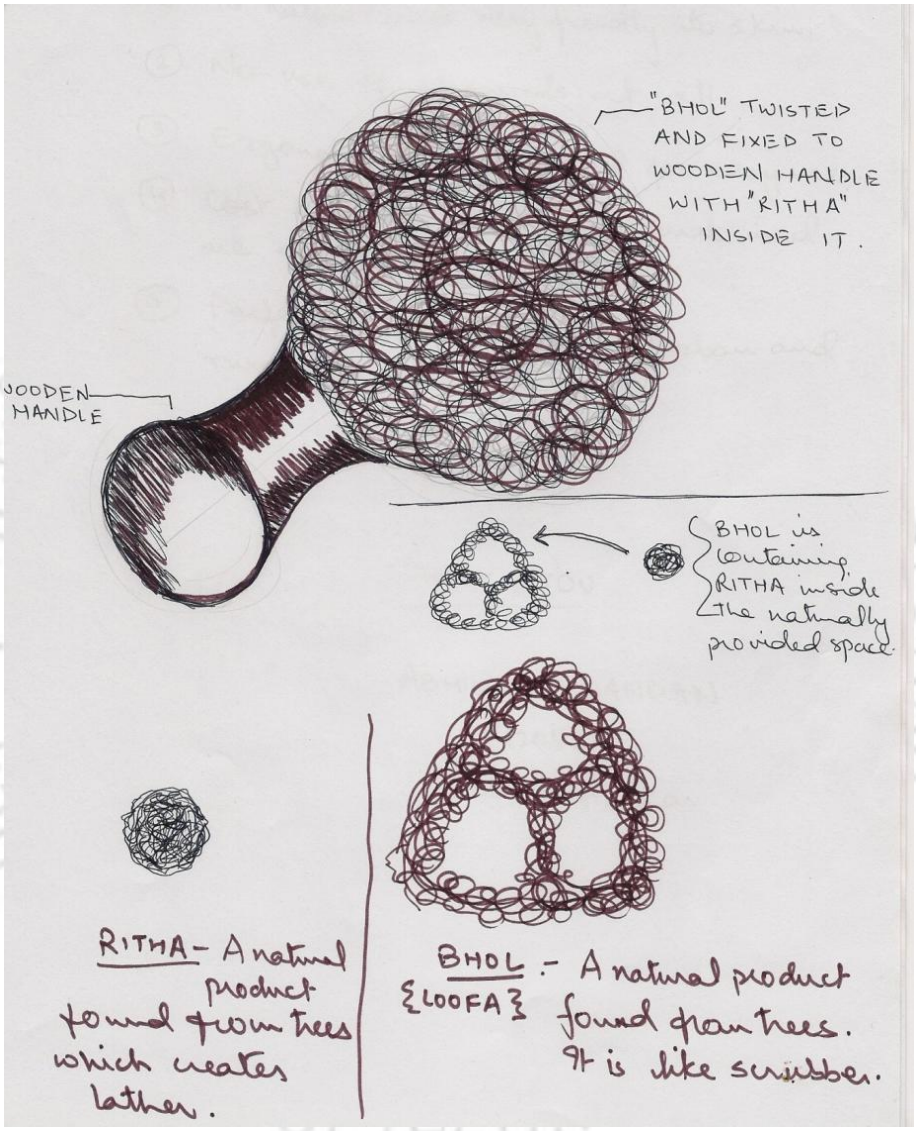
Design ideas generated with conventional sharing of marketing research findings (1st phase)



Concept 15

Appendix 7

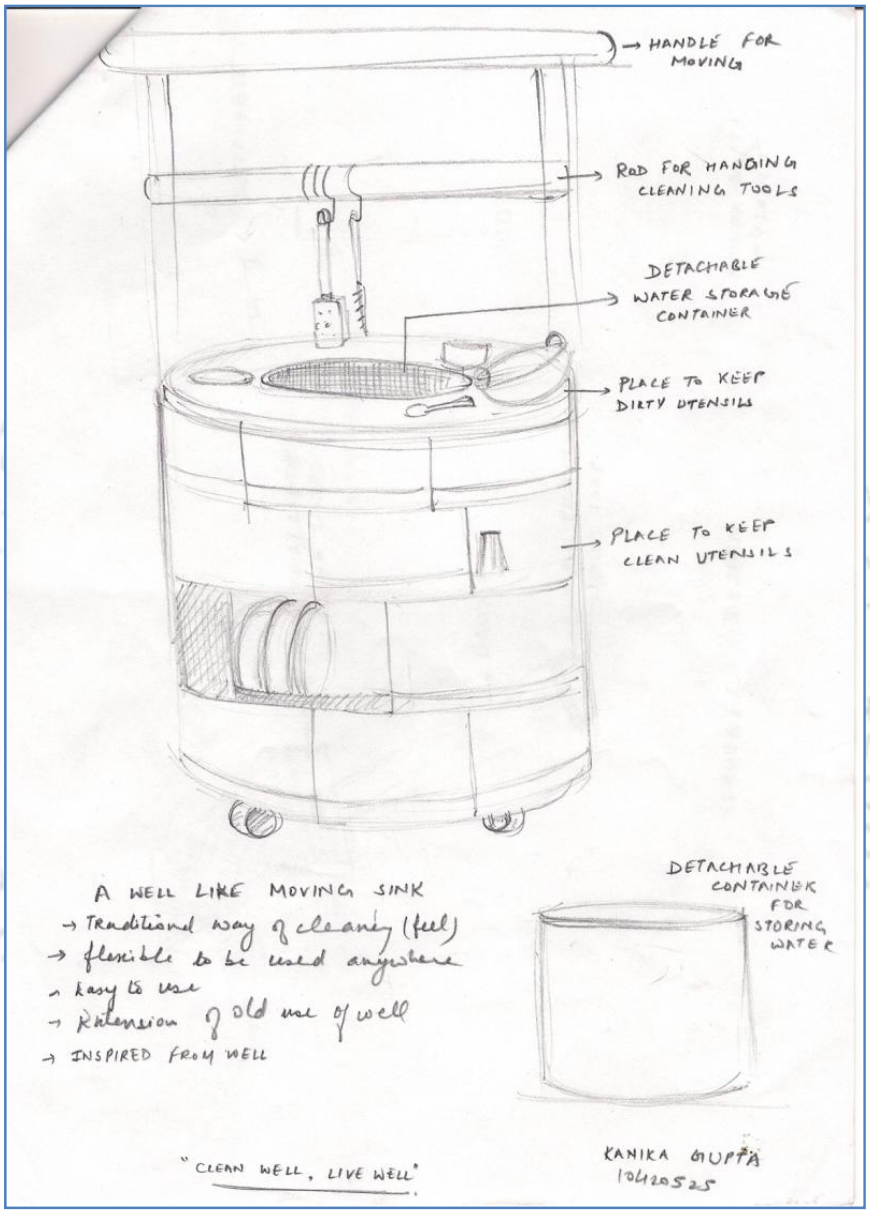
Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design (2nd phase)



Concept 1

Appendix 7

Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design (2nd phase)



Concept 2

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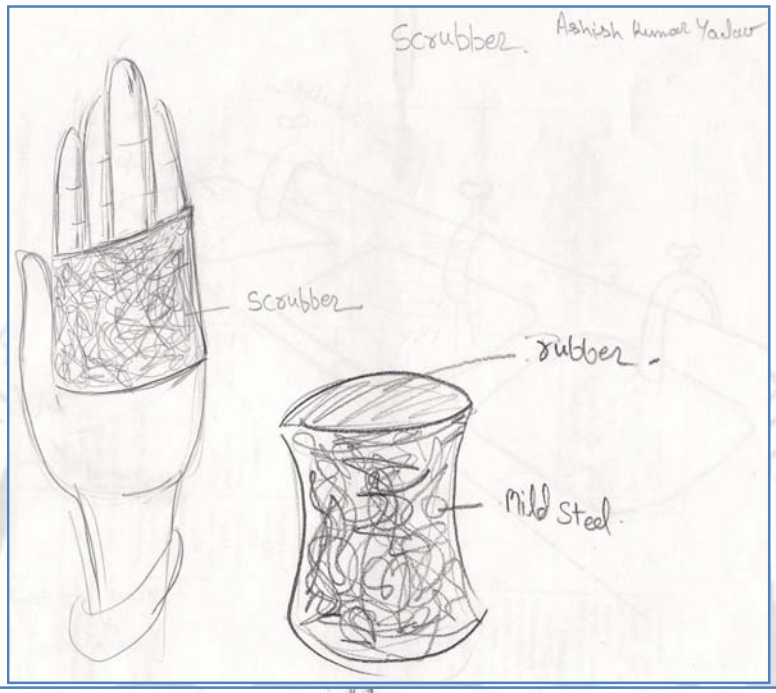
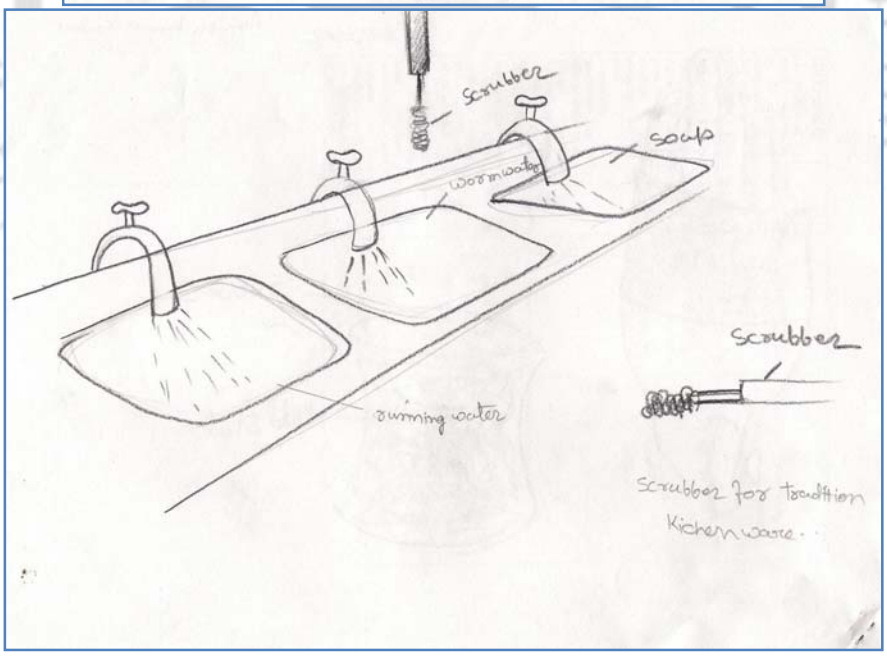
Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design
(2nd phase)

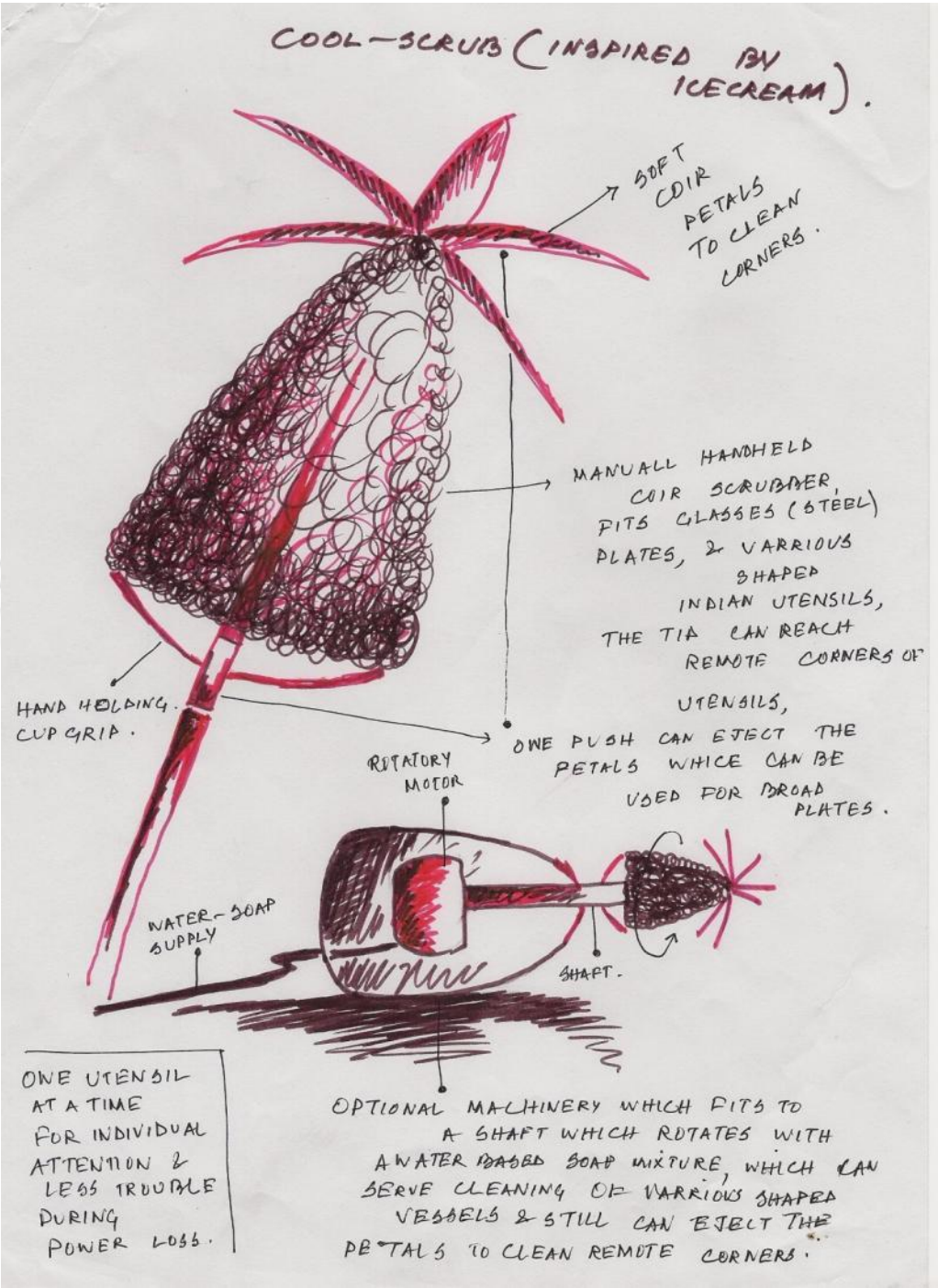




Concept 3

Appendix 7

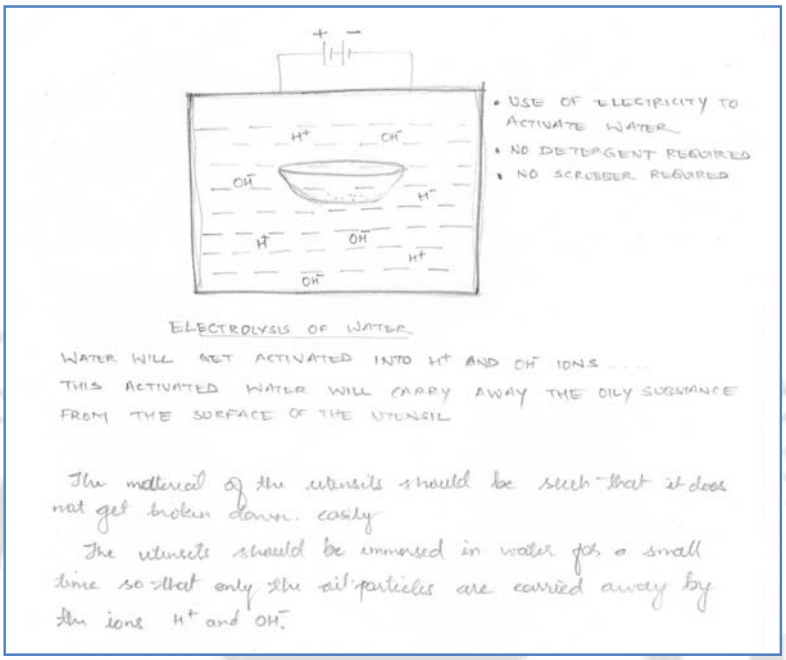
Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design (2nd phase)

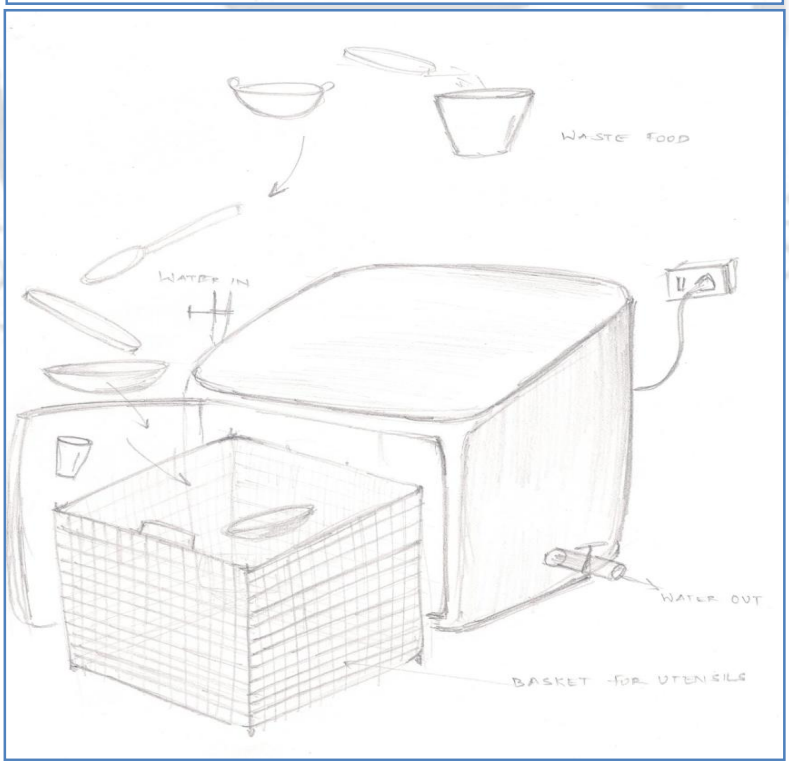


Concept 4

Appendix 7

Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design (2nd phase)





Concept 5

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Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design
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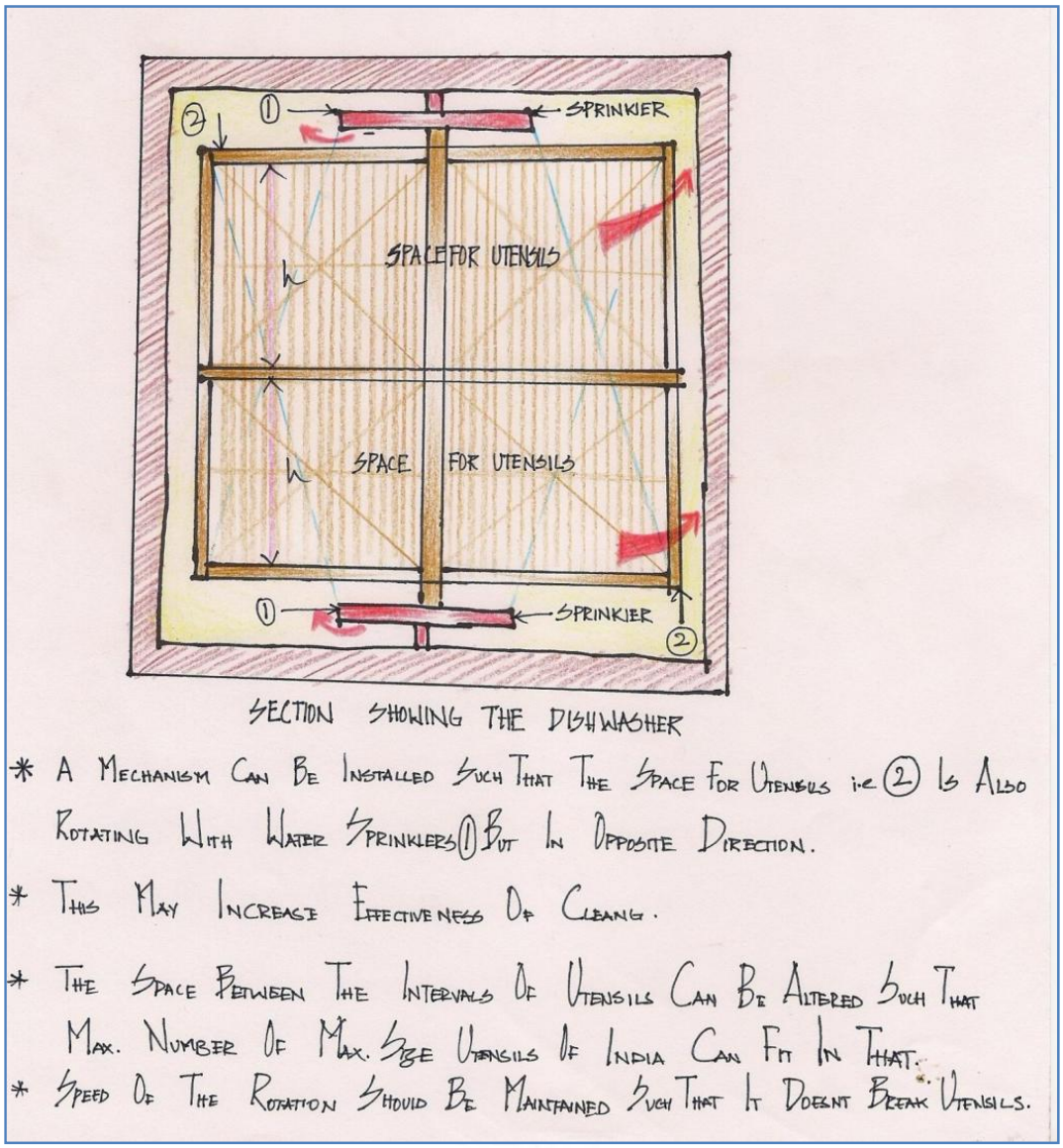

Concept 6

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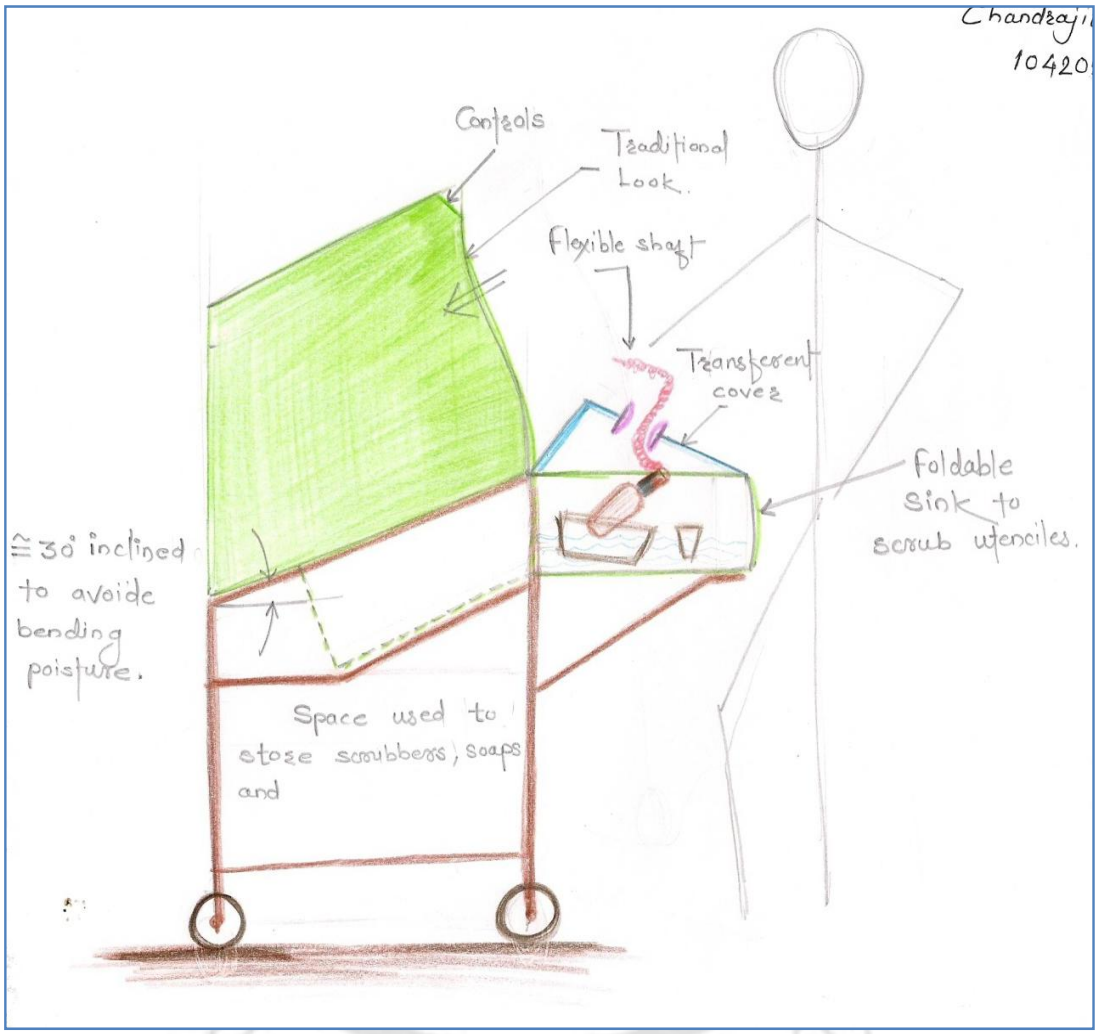
Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design
(2nd phase)



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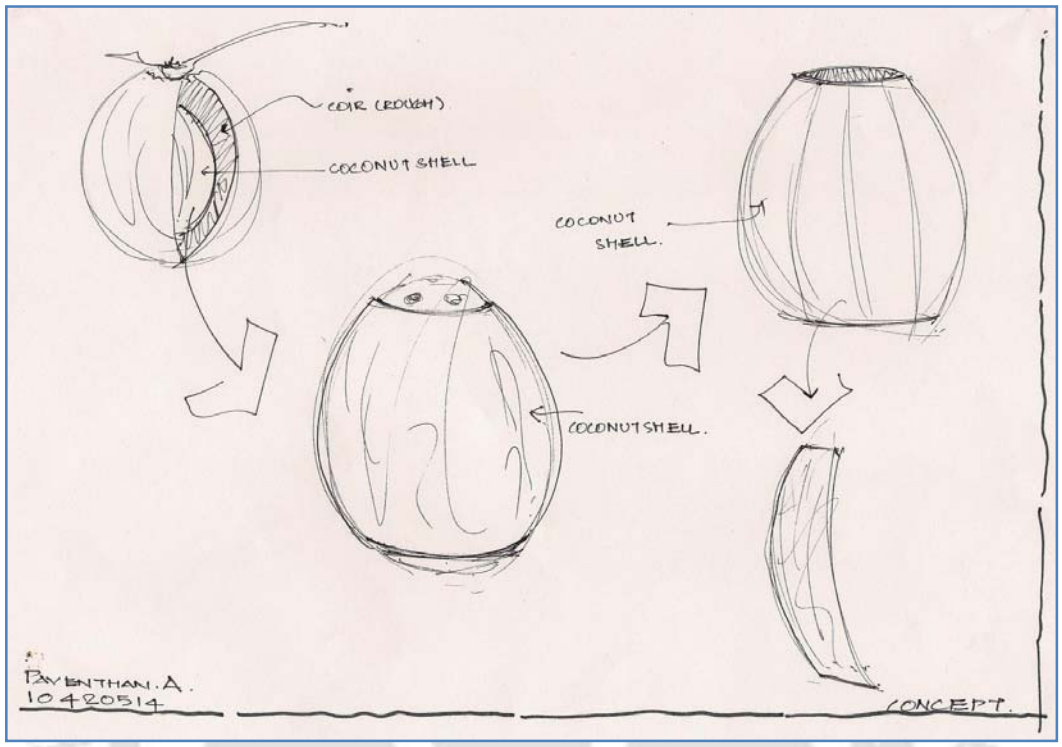
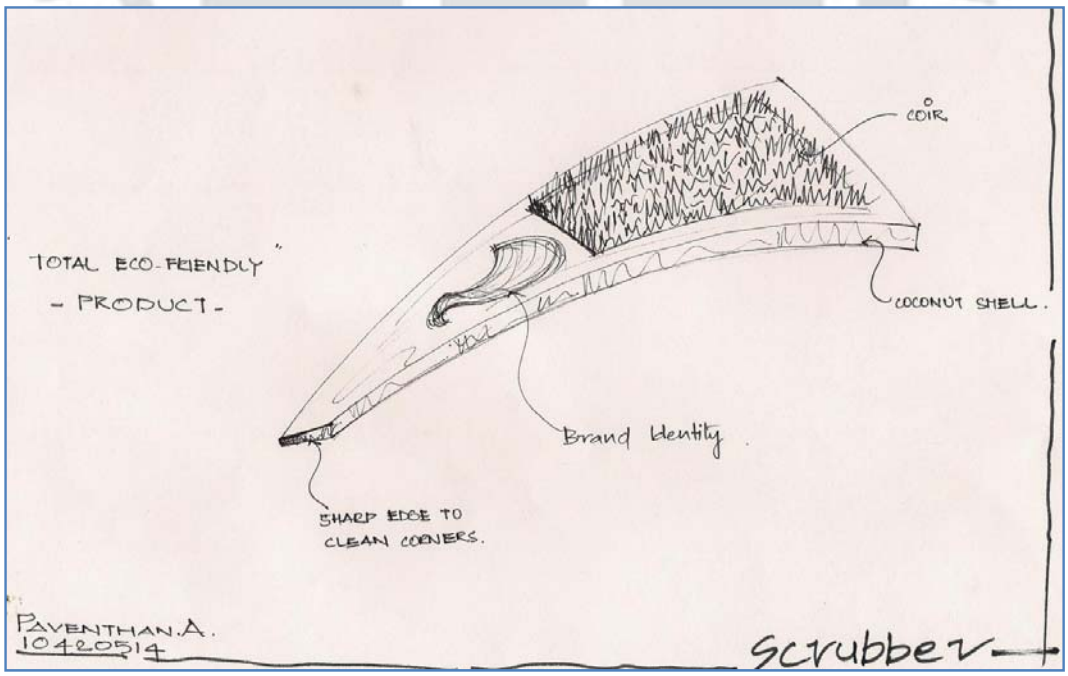
Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design
(2nd phase)





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Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design
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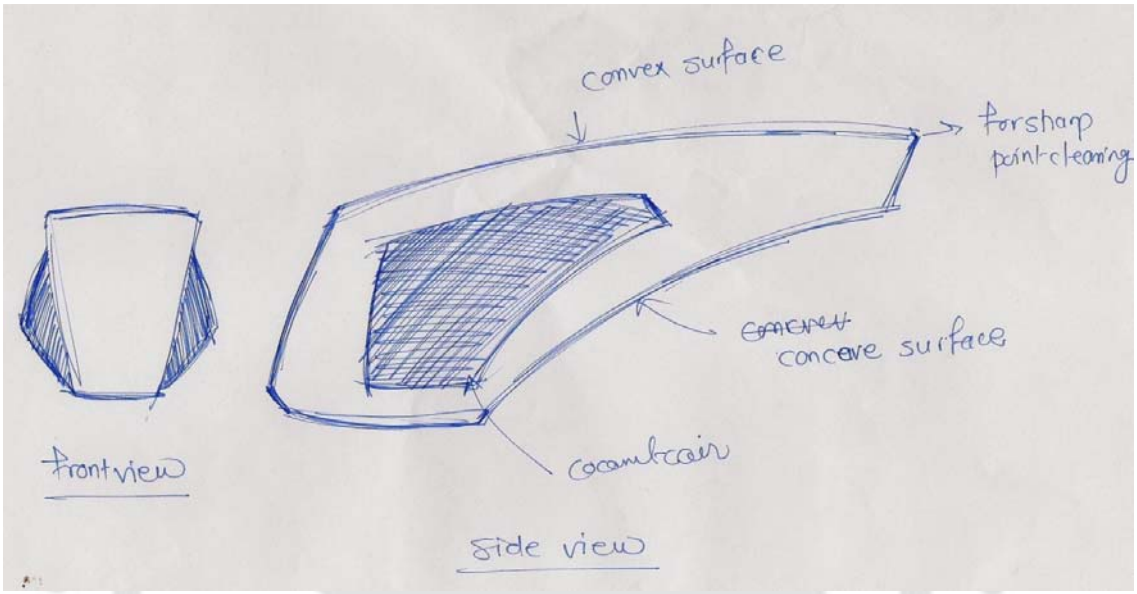

Concept 9

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Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design
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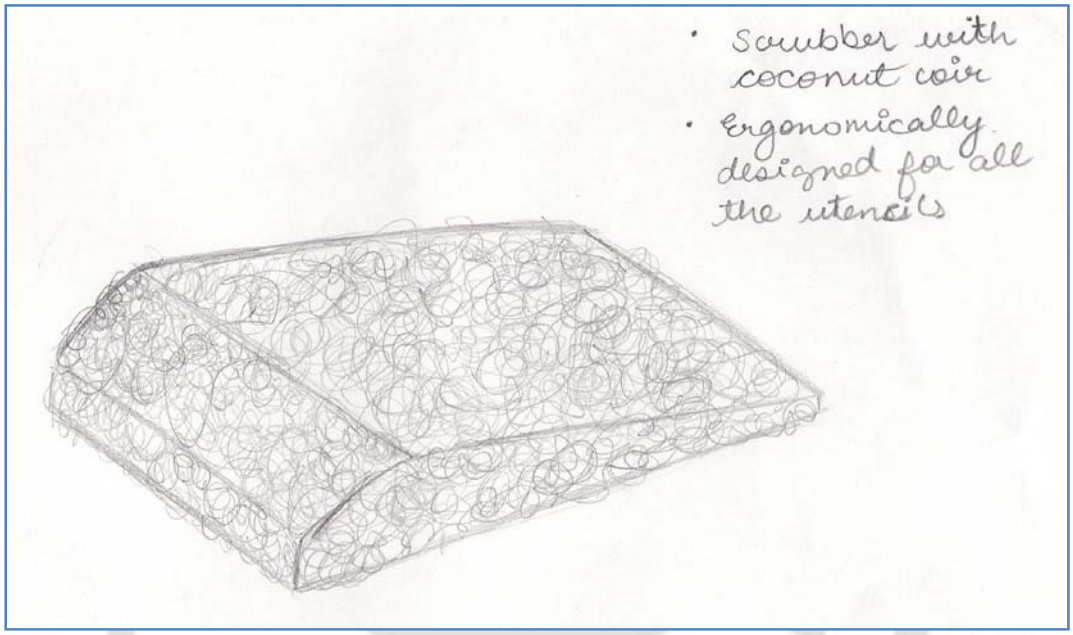

Concept 10

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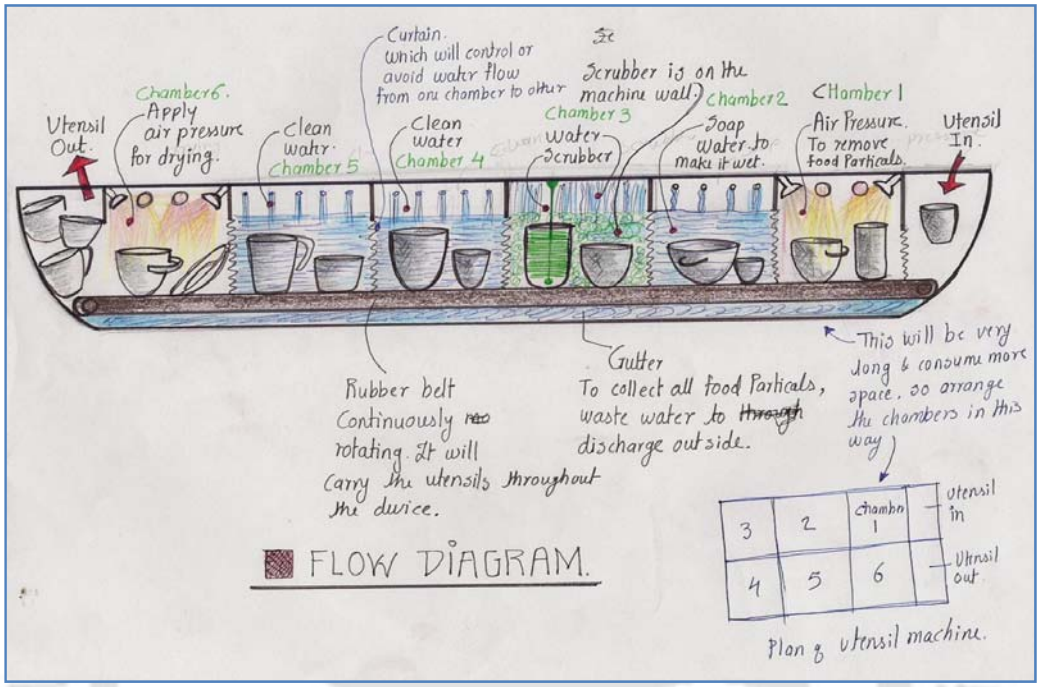
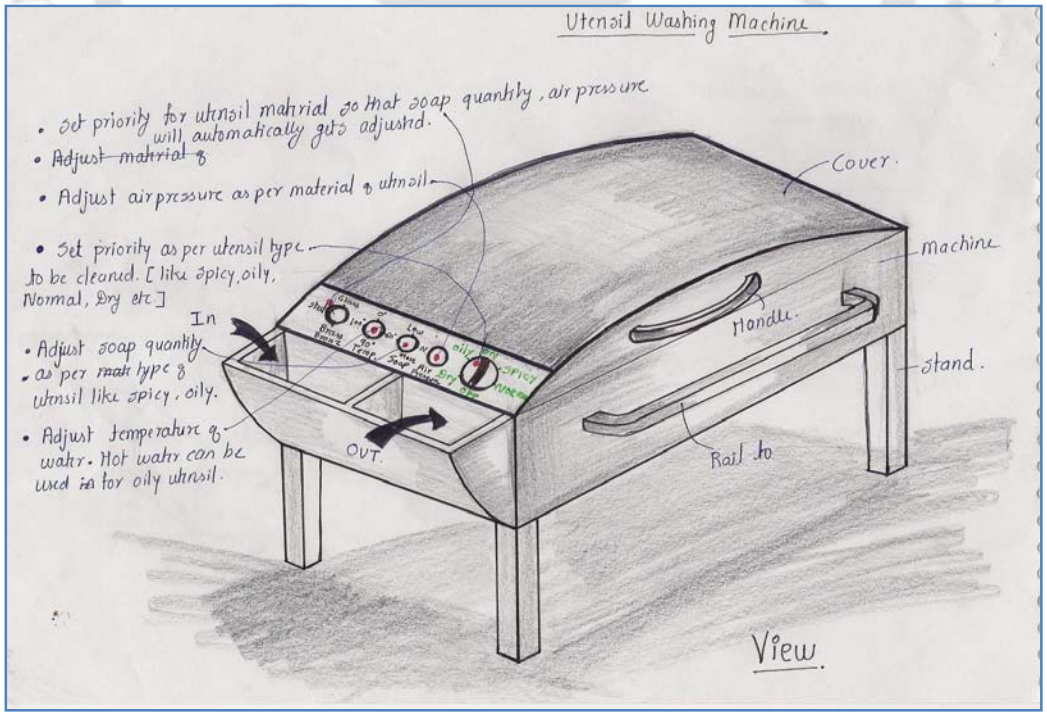
Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design
(2nd phase)





Concept 11

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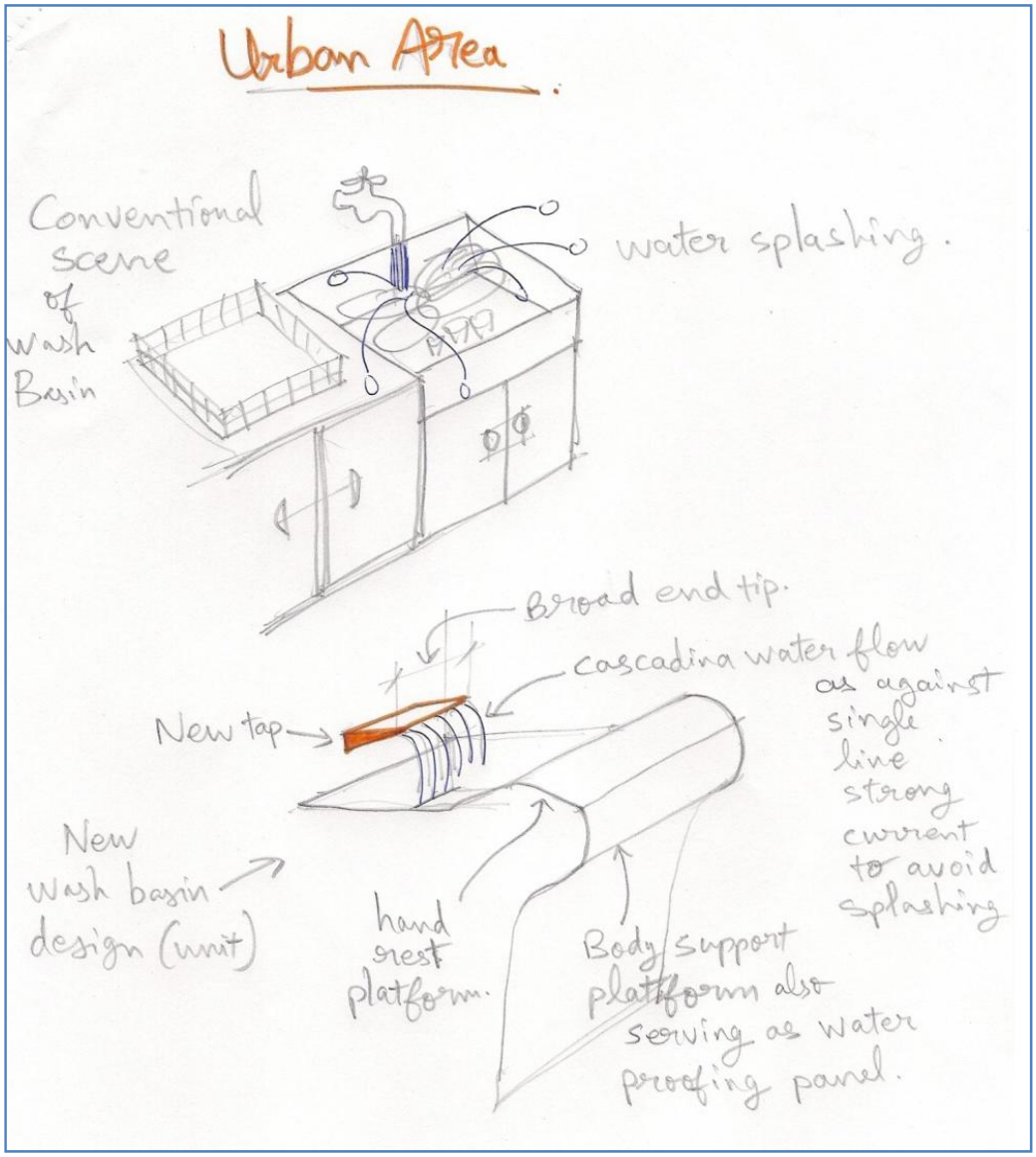
Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design
(2nd phase)



Concept 12

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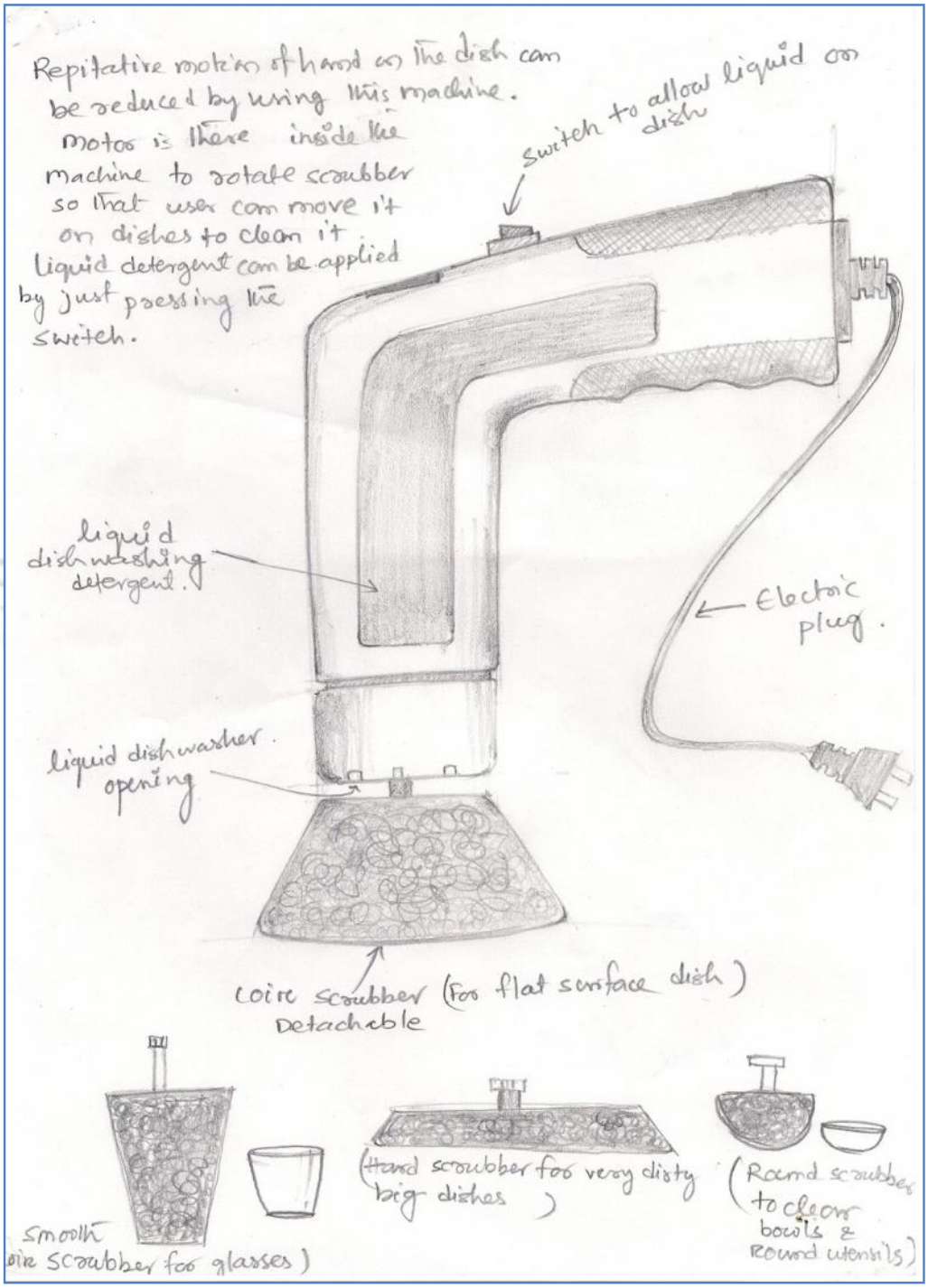
Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design (2nd phase)



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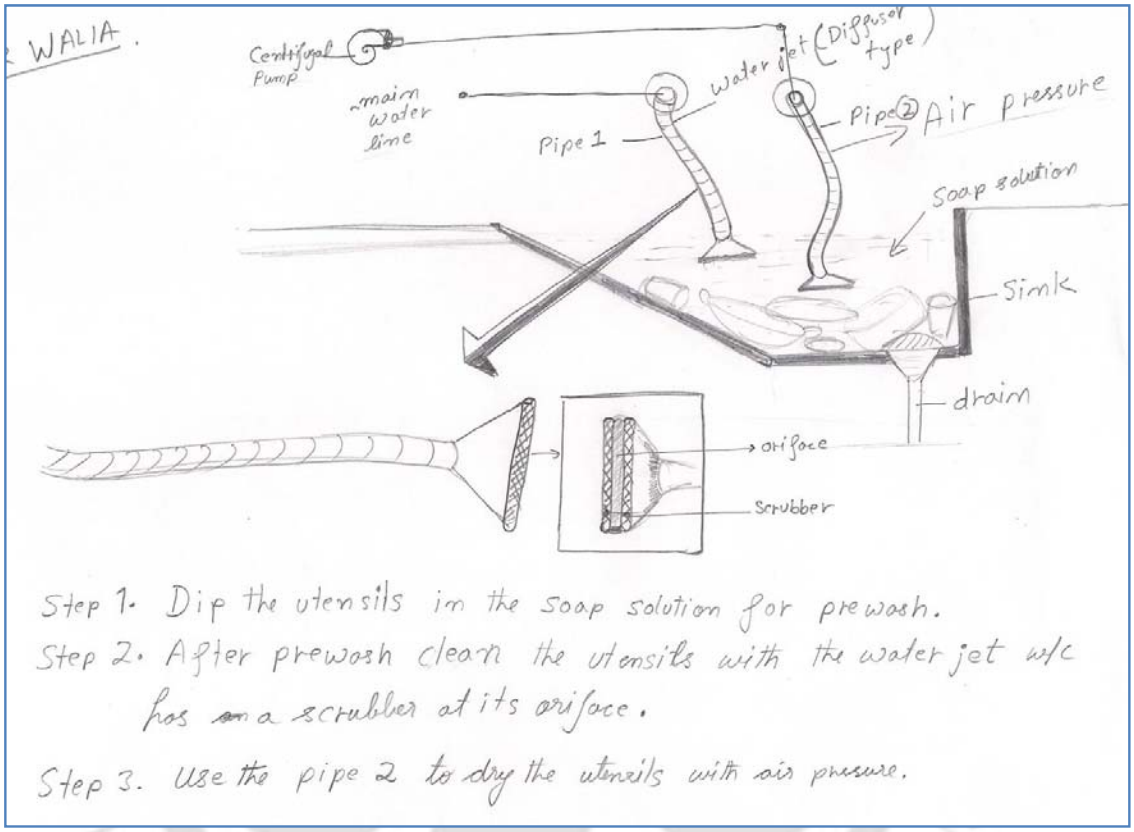
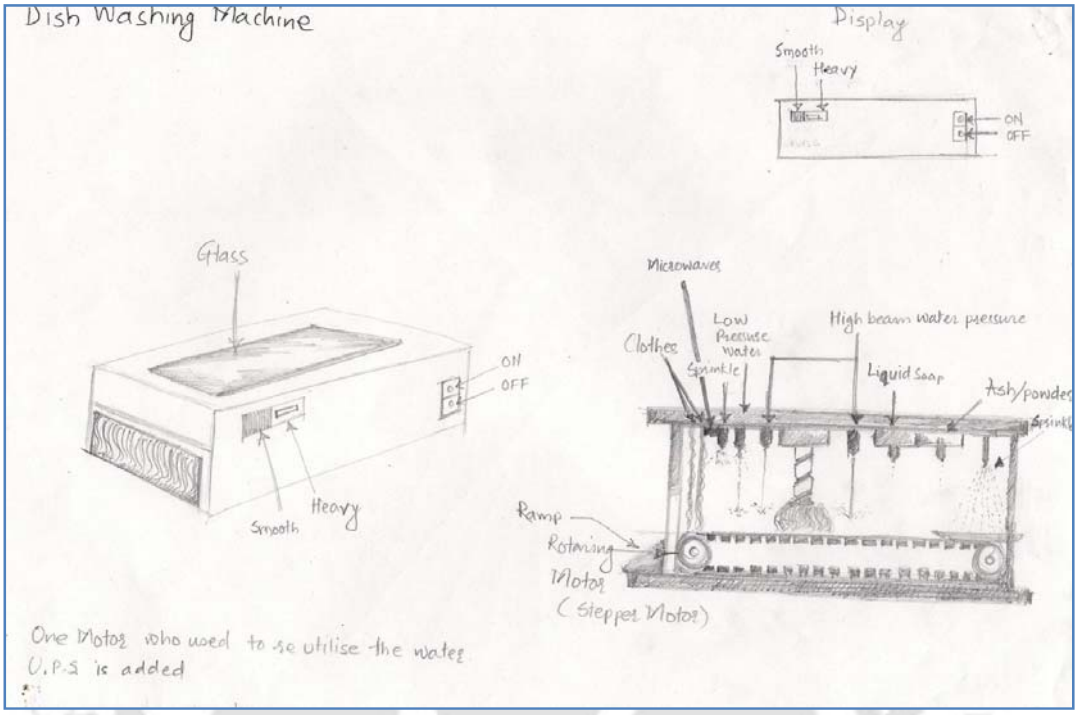
(2nd phase)



Concept 14

Appendix 7

Design ideas generated with Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design
(2nd phase)



Concept 15

Appendix 8

List of Publications and Proceedings Generated from the thesis

Sl. No	Title of the paper	Name of the conference and date	Organised by	Publication and Remark
1	Identification of Design strategy for cookware products in Indian multi cultural context	Tools and Methods of Competitive Engineering (TMCE 2008) conference, held in Izmir, Turkey on April 21-25, 2008.	TU Delft, Delft, The Netherlands	Paper presented and published in the conference proceedings
2	The use of visual research method in the study of dishwashing process to identify the design need and idea generation	Design Principles and Practices 2010 conference heldat the University of Illinois, Chicago, USA, from 13th to 15th February 2010	CG Publishers, University of Illinois, Urbana-Champaign, USA	Paper presented and published in the international journal, Design Principles and Practices, Volume 4, Issue 2, pp.83-94
3	Application of MRFSV tool to study effectiveness of marketing research findings in product design	Engineering and Product Design Education (E&PDE 2011) conference held at the City University, London, on 9th-10th September 2011	Institution of Engineering Designers, Wiltshire, UK, Design Society, Glasgow, UK and City University, London.	Paper presented and published in the conference proceedings

1.1 Product Design

Product design plays an important role in achieving competitive advantage in the business world. In the twenty first century, one of the principal focuses of the organization remains in the design of product manufactured by the organization. In Paleolithic and Neolithic age people designed things without being much conscious of the design effort. Product design was driven by the need of survival. Products were created without anyone actually designing them. Product design has taken altogether different shape with the growth of technology and industry. Historically it has been observed that designers are the first to respond to the seductive call of new technology. The socio economic situation and the prevalent philosophy of a particular time period get reflected in the product design. Product design is sensitive to culture, demographic, geographic and psychographic segments of people. At the same time society is also sensitive with product design. The design for development community has emerged with the mission to improve the quality of life of the people with design intervention. The thought leaders like Victor Papanek (1985), Victor Margolin(2006), Amartya Sen(1999), C.K Prahlad (2003) have contributed a lot in this context. John Thackara, in his book 'In the bubble, designing in a complex world' (2005) has discussed about designing for 'preferred situation' and 'desired goals' with a focus more on people and less on devices. He has critically analysed the complexities of the factors influencing design at the present context. He termed these factors viz. lightness, speed, mobility, locality, situation, conviviality, learning, literacy smartness and flow. He has urged the designers to control things around us though proper design intervention rather than allowing things just to happen and thus be controlled. Therefore along with internal and external business environment it is important for the product designers to understand social, cultural and economic environment of people (Mital Anil et.al 2009). The product design and marketing function of an organization is interdependent and mutually exclusive for each other in meeting aims and objectives of an organization (Rafinejad Dariush, 2009).

1.2 Marketing and Product Design

The foundations for long term success in any type of operation can be established only on the basis of a synergistic relationship between the marketing, design and operations functions of the organization. Good integration and effective communication between these groups is essential to organization to grow in a sustainable basis. Product development should be an iterative process. A team comprising of representative from all

the groups viz. customer, marketing, sales, product design, purchasing, supply, operations and production should be formed. This team work together and develop new products that can be produced economically and meet customer expectations and need. Following shows a traditional sequential product development process (Muhlemann Alen et al, 1994).

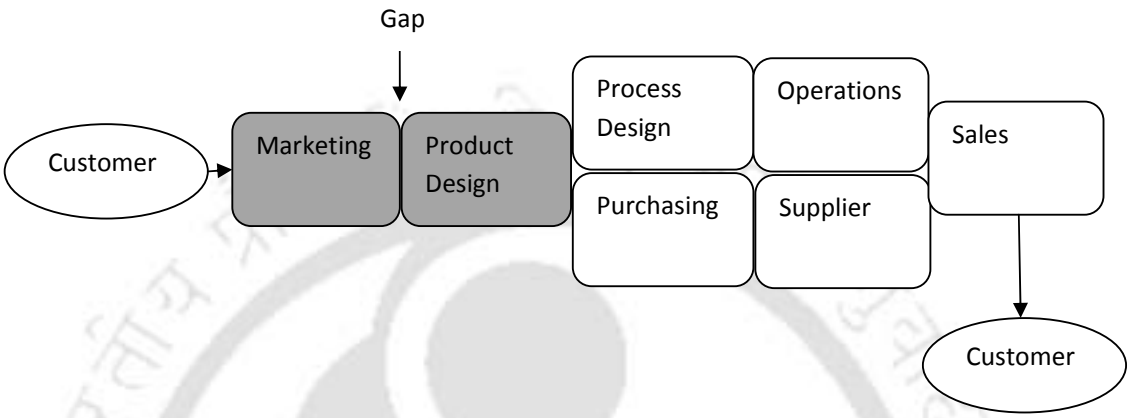


Figure 1.1: Sequential product development process

- Marketing passes the customer requirements to the product designers
- The designers believe the requirements are unrealistic with regard to the available technology or resources, alter the requirements and design a product to meet the corrected market analysis.
- The designers pass the product design to the process designers and purchasing
- The process designers believe the product designers do not understand the real world. They find design flaws, correct the product design so they think it can be produced
- The process designers pass the new product and process design to operations and production.
- Purchasing interacts with suppliers, who indicate problems with the design and they work with the suppliers to correct it.
- The suppliers are contracted to produce what will meet the requirements of the new designs economically.
- Operations receive the process design and the purchased materials which all have to be corrected before anything can be sensibly produced.
- Operations change the market analysis and product design and have to rush to production while still designing the product.
- Production pass the few products to sales.

- Sales receive a suggested selling price and a forecast from the marketing team but they are not happy with selling what the customer does not want – 'sub standard' product.

A traditional product development process used in industries involves barriers between pairs of functions. These barriers exist because of ineffective communication between the functions. There is a need to conduct extensive research to minimize theses barriers in order to design products that meet customer expectations. This research attempts to minimize the gap between marketing and the product design functions.

1.3 Product Development Decision framework

Product development framework is interdisciplinary in nature. Different academic communities look in to this from different perspectives. For example marketing community looks a product as a bundle of attributes; and the organizations look a product as an artifact resulting from an organizational process. At the same time, Engineering design community looks product as a complex assembly of interacting components; and the operations management community looks a product as a sequence of development and production process steps. The challenge is to bring a consensus among these varied communities participating in the product design and development process.

Following is a comparison of these varied perspectives of product development framework (Krishnan V. et al 2001).

	Marketing	Organizations	Engineering Design	Operations Management
Perspective on Product	A product is a bundle of attributes	A product is an artifact resulting from an organizational process	A product is a complex assembly of interacting components	A product is a sequence of development and/or production process steps
Typical performance matrices	'Fit with market' *Market share *Consumer utility * Profit	'Project Success' *Mileage achieved from the new product development *Positioning of the organization	'Form and function' Technical performance innovativeness	Efficiency *On time completion of the project *Cost optimization for the product development *Capacity utilization
Dominant representational paradigm	* Customer utility as a function of product attributes *Customer satisfaction *Product attribute levels *Value delivery propositions	*Organizational structure of the product development team *Organizational network sometimes used	*Geometric models *Parametric models of technical performance *Product size, shape, configuration, function, dimensions	*Process flow diagram. *Parametric models of process flow diagram *Development process sequence and schedule *Point of differentiation in production process
Critical success factors	*Product positioning and pricing *Collecting and meeting customer needs	*Organizational alignment *Team characteristics	*Creative concept and configuration *Performance optimization	*Supplier and material selection * Design of production sequence *Project Management

Table 1.1: Comparison of perspectives of the academic communities in Marketing, Organizations, Engineering Design and Operations management

1.4 New Product Development and Marketing Interface: Product performance and Time-to –market

New products are consumer or industrial offerings for the first time. It has been observed in the past research that many of the so called new products are not new to the world, but just copies or one-off imitations of existing products. These new products are developed

only with slight changes from the existing products. These new products normally result from sales maximization programs of the business houses. In a long run it does not seem to be profitable. Customers are not satisfied in such situations. Therefore it is always important to question the newness of the product (John E Ettlie, 2006). As far as the new product development (NPD) process is concerned we need to take in to consideration of customer needs and expectations at the initial stages of the NPD process. Customer need identification through marketing research has to be exhaustive. It is a time staking process. Research findings reveal that there is a trade-off between time to market, quality and product performance. In the context of product development and marketing interface, Morris A. Cohen and Jehoshua Eliashberg (1996) of the Wharton School, University of Pennsylvania has suggested a model of new product development process. Some of the most interesting conclusions of their research are:

- Allocation of uniformly distributed effort at all the stages of the new product development process is not suggested. More emphasis on efforts on the most productive stages of the new product development process is required. This may vary by firm by firm and product to product. In the case of product development for dishwashing more effort was given in the understanding consumer behaviour and its related issues.
- In case of low competitive performance there is little or no point in developing an ambitious new product.
- Concentrating on time-to-market alone and minimizing this time period tends to lead to incremental product improvement but not in a sustainable basis. This approach is driven by sales maximization, not marketing where customer satisfaction is to be considered in the first and foremost. In this case product performance suffers.
- New products with superior performance effectively act as an entry barrier for the competitors- both time wise and performance wise.
- Replacing existing products always delays the time-to-market and performance target for the new product vis-à-vis introducing the first generation of new products.
- The optimal strategy is to use faster speed of improvement to develop a *better* product rather than to develop a product *faster*. This doctoral study critically considers this issue. The effort of this doctoral study is to evolve a design method to develop a *better product* satisfying *customer needs* and expectations *minimizing*

the time for development. This was achieved through a very structured method of communicating marketing research findings to the designers. With the help of this new method, designers generated design ideas without losing focus on design objectives. This helps in putting more emphasis on significant product improvement over incremental product improvement. The aforesaid design strategy is a better competitive weapon (Bytheway Charles W, 2009).

1.5 The R&D- Marketing Interface in New Product Development process

Understanding the relationship between R&D and Marketing in the new product development process is important. The study of Morris A. Cohen and Jehoshua Eliashberg (1996) reveals that an integrated approach to the new product development process is required. Balanced sourcing of ideas, that is giving equal weight to R&D and Marketing in idea generation for new product can improve the odds of new product commercial success by 30 percent. The success of development process in R&D depends on the two step flow of communication: first, to or from the team leader in the lab (referred as technological gatekeeper), and then to or from team members in the R&D groups. Marketing Research and service managers use a different one step communication process. These are all discipline based sources of new product information (Ettlie J.E, 1997).The effective communication of new product strategy in the business unit has a significant impact on the new product development process. This strategy must be clearly communicated and must contain new product goals for the business unit (Ettlie, 2006). The areas of focus must be well defined and effectively communicated to the design team. The role of the new product in the long term plan should be well understood by all the members of the new product development team. This aspect is discussed in the working paper by entitled Idea Reservoirs and new product commercialization by Ettlie J.E and Elsanbach J, College of Business, Rochester Institute of Technology, April 2004. There are subtle constraints on incorporating the 'voice of customer' in any organization. Though everyone in the organization agrees with the idea that customers are important, the voice of customer is often overlooked. Enlisting the aid of lead users or application of Quality Function Deployment (QFD) helps convert voice of customers in to product ideas. But this conversion process is difficult and takes time (Hippel Von E, 1998).The Quality Function Deployment (QFD) (Akao Yoji), Kano method, conjoint analysis etc are very specialized product development tools and are normally used by the product development team in an organization(Pullman, Moore

William L. et al, 1999, Otto Kelvin N. et al 1993, Qianli Xu et al, 2009). But the marketing research team generally conducts consumer behaviour study using structured questionnaires or other qualitative and quantitative methods. The effort of this study is to maximize the benefits of these marketing research findings to the product development team.

1.6 Effectiveness of the Marketing research findings: Practice and contradiction

The American Marketing Association has defined Marketing Research as the function that links the consumer, customer and public to the marketer through information-information used to identify and define marketing opportunities; generate, refine, and evaluate marketing actions; monitor marketing performance; and improve the understanding of marketing process (Bennet P.D ,Ed., 1995).The American Marketing Association definition of Marketing Research tells us that the information provided by marketing research should represent the consumer. The AMA definition is normative; that is it tells us how marketing research should be used to ensure the firm is consumer oriented (Malhotra Naresh K et al, 2011). But what should be done is not always followed. Clancy and Krieg (2000) in their book *Counterintuitive marketing: Achieve great results using uncommon sense* argue that many failures can be attributed to managers just making 'intuitive' decisions. They implore managers to use marketing research in order to make better decisions. This well known authors make a good argument for studying marketing research.

Sometimes marketing research studies lead to wrong decisions. In some cases marketing research predicted failure but turned out to be success. On the other hand in some cases marketing research predicted success but turned out to be a failure. Following are the some of the cases studies in support of the above.

Case studies of Marketing research that predicted failure but turned out to be success.

Case Study1

The story behind Sony's market research is legendary. The Sony walkman is today counted among those products of the twentieth century that changed the definition of what a new product meant to the consumers and to the manufacturers. In the dictionary of new product development, it is treated as a classic example of what 'discontinuous' innovation means. It changed forever the way consumers listed to music and extended the definition of privacy mobility and convenience in the context of listening to music. When

Akio Morita initially conducted marketing research on walkman he received a very negative feedback on the need of walkman. But Sony planed to lead the public with new products rather than ask them what kind of product they wanted. Therefore instead of doing a lot of marketing research they refined their thinking on the product and its use and tried to create a market for it by educating and communicating with the public. It was quite interesting to see how one convinces the public they need a product that they've never owned or seen. Marketing research seems to have no role to play in the development and marketing of walkman (Easwaran Sunanda, 2006).

Case Study 2

The Marketing Research results had shown that Stella Artois beer ad would be a failure but the ad turned out to be very successful (Marketing, May 8, 2003). Stella Artois beer appealed primary to people in urban areas. The company's ad agency developed an ad showing a peasant selling flowers in rural setting. The ad was 60 seconds long and marketing research results showed the ad to be a failure, citing below average brand awareness and the fact that the ad positioned the beer away from the group to which it primarily appealed. Management at Stella Artois however believed that the ad was good and the marketing research was flawed. The ad was so successful that it is credited with helping in turn the company's product from a niche beer one of the top selling grocery-store beer brands in the UK.

Case study 3

Marketing research findings had predicted that Jerry Seinfeld's popular TV program, Seinfeld would be a failure (Tracy K.,1998). The marketing research that was conducted on the plot for the Jerry Seinfeld TV show stated that the show was so bad that the executive gave up on the idea. It was six months before another manager questioned the accuracy of the research and resurrected the show, which became of the most successful shows in the television history.

Case study 4

Marketing Research findings had predicted that the hair styling mousse and answering machine would be a failure (Marconi J.,1998; Zangwill W.1993). The product turned out to be very successful after the launch.

Case studies of Marketing research that predicted successful outcome but turned out to be failure

Case study 1

The fire extinguishers for cars designed by ceasefire industries limited, India predicted an overwhelming success. But it could not capture market as desired.

Case study 2

Sainsbury's the UK's grocery chain had an ad tested favorably in MR but negative result was recorded from the consumers and staff when the ad ran (Marketing, May 8, 2003). Sainsbury changed their ad agency.

Case study 3

Grand kids, a toy store targeting grandparents failed (Hise P, 1998). The owner relied on local school data and statistics from a company soliciting advertising for her marketing research. Had she conducted better research, such as examining the most recent census data, she would have discovered that there were only 3219 families in the whole town and those 50 and over made up only 31% of town residents. There simply were not enough grandparents to support her store.

Case study 4

Tata Motors had predicted a sales of 2,50,000 per annum of Tata Nano during its design stage and actual sales after introduction was found to be hardly 60,000 per year (The economic times,2010).

Likewise there are several instances that question the effectiveness of marketing research

1.7 Marketing Research in Product Design

One of the interesting examples of use of marketing research to develop new products is: Gillette develops new products by watching consumers shave not actually by standing in their bathrooms but by watching videos from micro cameras that have been attached to razors (Forelle Charles, 2003). Again, development and commercialization of a whole product can be a source of competitive advantage (Trout J 2000). The devise that a company sells may not be particularly superior to the devise of the competition, but if the whole product is better overall, no competitor can effectively challenge it. To position

against competition, comparing whole products, not only generic products, is important. Consumers are increasingly purchasing goods not only for their practical functions, but also for their meanings (Ravasi Davide et al, 2007). Acts of purchase and consumption reflect proactive efforts to claim a position in the system of social relationships by changing the characteristics of the artifacts that surround, support, and often mediate human interactions. As far as the organizational transformation required with-in the organization, to encourage design innovation in concerned, the product design and marketing functions must work closely and must assign a clear owner with discernable accountability for each function (Srivastava et al,1999; Homburg C et al, 2000; Moorman C et al, 1999; Lehmann D R et al 1997; Paul Sherlock P 1991; Lehman R.W, 1997; Trout J,2000; Leonard D et al,1997; Christensen CM,1997; Iansiti M, 1995). Design and designers can contribute to corporate strategic renewal. For producers of traditional or high-tech consumer durables seeking to differentiate themselves from their competitors, the role of the product designer is increasingly taking a key role (Ravasi Davide et al, 2005). A product idea starts at the intersection of new technology capability and perceived market opportunity. A product idea takes shape during marketing research and the definition of market requirement specification (Rafinejad Dariush, 2009, Armstrong Stephen C, 2001). It is crucial to get close to customers and to intimately understand a customer's operative environment and how the customer solves his/ her problems. Only through such a deep dive in to customers business can a supplier perceive opportunity to add value to the customer by making his business easier, less costly and faster by enabling the customer to do more new things and by improving customer's competitive advantage (Leonard D, 1997, Annacchino Marc. A, 2006, Lehmann Donald R et al, 2005). Design solutions identified with this approach may be helpful in increasing the capability (Sen Amartya, 1999) of the customer. Again, customers may be using the innovative product in a way that the designers did not originally intend the product to be used. A supplier must stay close to the customer and observe if product capabilities are exceeding the user's need (Christensen C.M, 1997). Yet still a subtle but interesting argument persists about the overall nature of the innovation process: is it a top-down process in which a master concept is discovered or created and then applied to the details of a project; (Owen Charles L, 2009) or is it a bottom-up process in which many threads are followed to build ideas toward a master concept As far as the idea generation process in this context is concerned, the power to abstract is very fundamental. When ideas are

scarce, a fresh viewpoint makes all the difference (Owen Charles L, 2007, Youngchan Kim, 2008)

A need is felt to review the marketing research process and critically examine the various factors contributing the effectiveness of marketing research in formulating design solution.

1.8 Identifying customer needs

The process of identifying customer needs is a continuous process for enterprises inspired by innovation. In his book 'The Design of Everyday Things', Donald A. Norman(1990), critically examines various issues of consumer behavior and design of everyday things. While discussing the hidden frustrations of everyday things, he argues that while everyday things viz. computers, mobile phones, kitchenware etc. are most intended to make our lives easier and pleasant; but it may end up with unpleasing and uncomfortable experience. He urges the designers to study people, to take their needs and expectations in to account. He has illustrated how the best trained and best motivated designers can go wrong when they listen to their instincts instead of listening to the users and testing their ideas on actual users.

The process of identifying customer need is an integral part of the larger product development process and is most closely related to processes viz. concept generation, concept selection, competitive benchmarking and establishment of product specification. Identifying customer need is itself a process. Karl T. Ulrich (2009) has presented a five step method.

- Gather raw data from customers
- Interpret the raw data in terms of customer needs
- Organize the needs to a hierarchy of primary, secondary and (if necessary) tertiary needs
- Establish the relative importance of needs
- Reflect on the results and the process.

In this study the customer need identification was done with collection of raw data gathered through structured questionnaire. Visual research technique was also used. Extensive quantitative and qualitative analysis was done to understand the consumer behaviour. For arrangement of customer needs in hierarchy, and to establish relative importance of needs; marketing research findings were ranked in terms of meeting the design objective.

1.9 The effect of product novelty on the tools used for new product development

Previous research has identified the usage and usefulness of different tools adopted for high novelty and low novelty new product development projects. The research suggested that different managerial processes, structures and tools are appropriate for routine and novel development projects.

The study revealed that in terms of frequency of use ,the most common methods used for high novelty projects are segmentation, prototyping, market experimentation and industry experts where as for less novel projects the most common methods are partnering customers, trend exploration and segmentation. In terms of usefulness, there are statistically significant differences in the ratings for segmentation, prototyping, industry experts, market surveys and latent need analysis. Segmentation is the only method more effective for routine development projects followed by prototyping. For novel development projects the most effective tool is surveys and focus groups. The other effective tools for novel development projects are prototyping, market experimentation, trend exploration, partnering customers, user developers and role playing. The new product development project considered in this study (design solution to the dishwashing problem) is of high novelty. Therefore the major tool adopted for this doctoral study was 'surveys and focus groups'. Visual prototype and market experimentation tools were also adopted for design evaluation.

Following table shows the effect of product novelty on the tools used for new product and service development (Tidd Joe et al 2008).

Tools	High Novelty		Low Novelty	
	Usage (%)	Usefulness (Rating 1-5)	Usage (%)	Usefulness (Rating 1-5)
Segmentation*	89	3.42	42	4.50
Prototyping*	79	4.33	63	4.08
Market experimentation	63	4.00	53	3.70
Industry experts*	63	3.83	37	3.71
Surveys/focus groups*	52	4.50	37	4.00
Trend exploration	47	4.00	47	3.44
Latent need analysis*	47	3.89	32	3.67
User practice observation	47	3.67	42	3.50
Partnering customers	37	4.43	58	3.67
User-developers	32	4.33	37	3.57
Scenario development	21	3.75	26	2.80
Role playing	5	4.00	11	1.00

* Denotes difference in usefulness rating is statistically significant at 5% level (n=50)

Table 1.2: The effect of product novelty on the tools used for new product and service development

1.10 Concept Development

At the concept development stage there are five basic decisions to be made:

- What are the target values of the product attributes?
- What will the product concept be?
- What variants of the product will be offered?
- What is the product architecture?
- What will be the overall physical form and industrial design of the product?

A product may be represented as a combination of many attributes. For example in the case of dishwashing scrubber the attributes may be such as ability to clean utensils, ability to protect hand, ability to prevent any damage to the utensils, environment friendliness, fitness for variety of designs of utensils/cookware, aesthetic appeal etc. These product attributes refer to both customer needs (also referred to as customer

attributes or customer requirements) and product specifications (also referred to as engineering characteristics or technical performance matrices). The attribute based models such as Quality Function Deployment (QFD), Kano method and conjoint analysis are in practice. These structured methods determine the target values of product attributes and help in defining product specifications. These attribute based models have limitations in their ability to represent the whole product (Pullman, Moore William L. et al, 1999, Otto Kelvin N et al 1993, Qianli Xu et al, 2009). These models are more confined to generic product development concepts (Krishnan V et al 2001). Therefore the overall appeal of the product and customer needs and expectations may not be adequately represented. Much of the research with these models have focus on maximization of customer satisfaction or market share but overall profitability and social impact is seldom considered.

The generic concept development process generally contains many interrelated activities ordered roughly as shown in the figure 1.2 (Ulrich Karl. T, 2009, Annacchino, 2006)

Identifying customer needs: The goal of this activity is to understand customer's needs and to effectively communicate them to the development team.

Establishing target specification: Specification are the translation of the customer needs in to technical terms. Target specifications are set to represent the hopes of the product development team. These specifications are later refined by the product development team.

Concept Generation: Concept generation includes a mix of external and internal search. The process includes creative problem solving activity within the design team and a synthesis of various design solutions the team generates

Concept Selection: In this process the various product concepts are analysed and sequentially eliminated to indentify the best product concepts to meet the customer need.

Concept testing: One or more product concepts are then tested to verify that the customer needs have been met and assess the shortcomings.

Setting final specification: The target specifications set earlier are then revised.

Project Planning: The team creates a detail development schedule, devises a strategy to minimize the development time and identifies the resources required for the product development project.

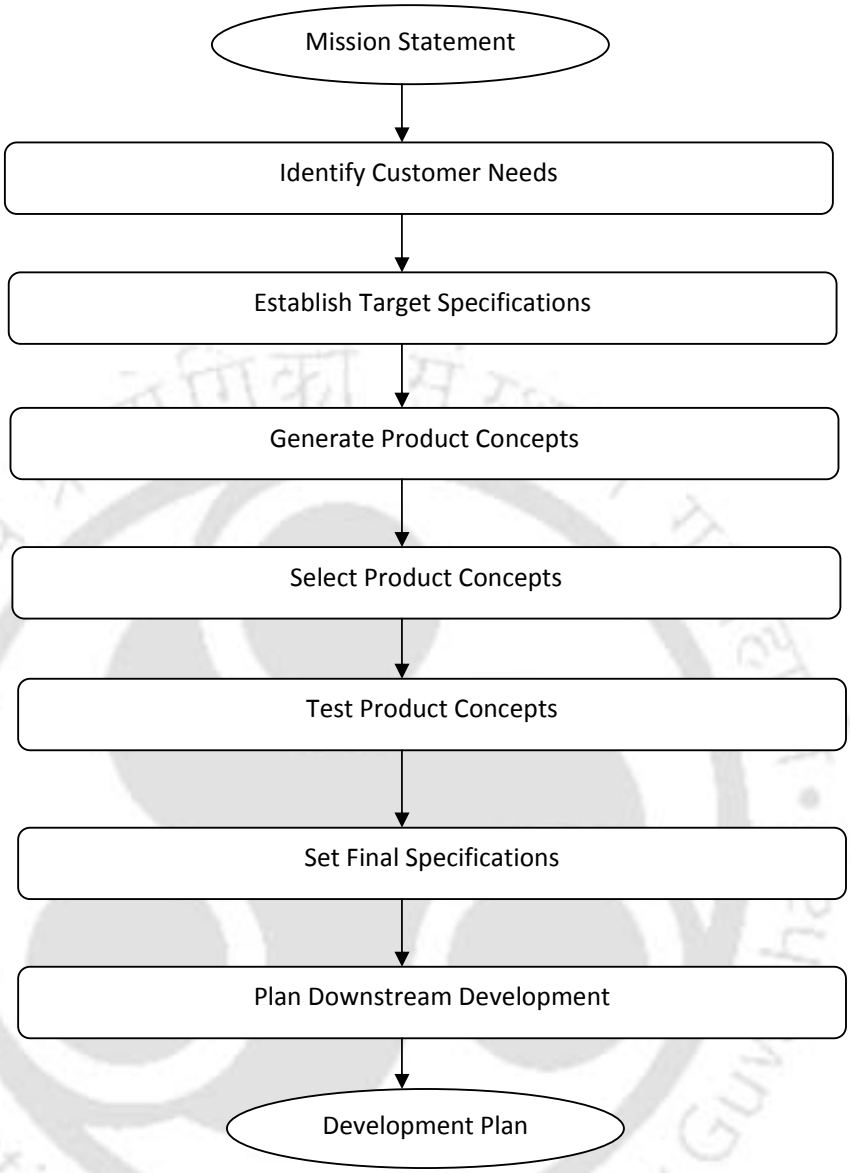


Figure 1.2: The generic concept development process

1.11 Key issues in Innovation

Innovation is driven by the ability to see connections between different entities in the society and marketplace, thereby identifying market opportunities. Innovation is not just opening up new markets–it can also offer new ways of serving established and mature ones. Innovation contributes in several ways. Several researches suggest that there exists a strong correlation between market performance and new products (Cogliandro John A, 2009). Marketers cannot achieve competitive sales growth from low price strategy alone but also from design, customization and quality. Therefore a need is felt to do a research

in the interdisciplinary field of marketing research and product design (Tidd Joe et al, 2008).

1.11.1 The '4Ps' of innovation

Types of Innovation can be categorized as follows-

- Product Innovation – Changes in the things (product/ services) which an organization offers
- Process Innovation – Changes in the ways in which they are created and delivered.
- Position Innovation – Changes in the context in which the products/services are introduced.
- Paradigm Innovation – Changes in the underlying mental models which frame what the organization does.

This study critically examines the effect of marketing research findings, especially consumer behavior in product innovation, process innovation and position innovation.

1.11.2 Dimensions of Innovation

Innovation may take place in the both component level and system level. The 'change' a particular innovation brings about may lie between incremental to radical. A case study of dishwashing was considered for this doctoral study. The design ideas generated in this study results in the innovation in both component level and system level. Some of the design ideas generated during the study may be attributed for bringing about incremental changes in the existing dishwashing process; while radical changes in the existing dishwashing process were expected from a few design ideas generated during the study.

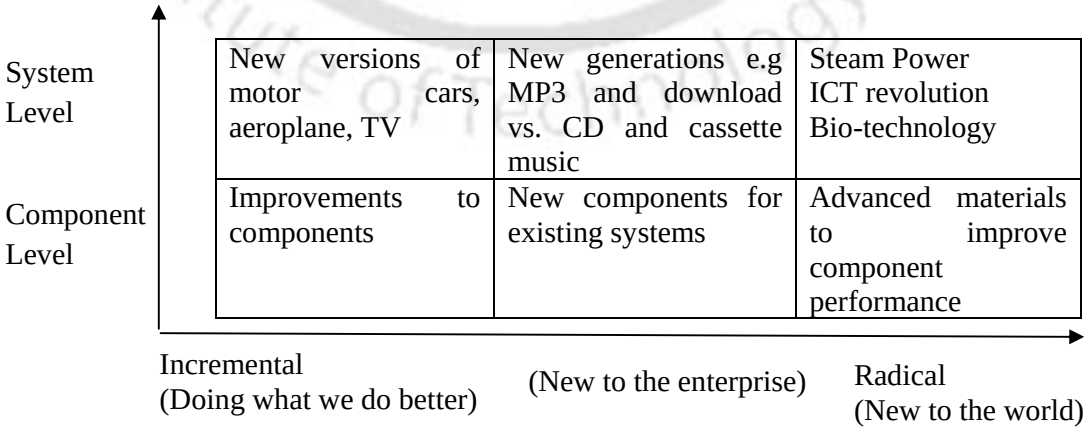


Figure 1.3: Dimensions of Innovation

1.11.3 Innovation Space

Each of the 4Ps of Innovation can take place along an axis running from incremental through to radical change. The area indicated by the circle is the potential innovation space. Whether it actually explores and exploits all the space is a question of innovation strategy. The new model evolved (MRFSV: Marketing Research Finding Sensitive Visualization) attempts to explore all the areas of potential innovation space while formulating innovation strategy

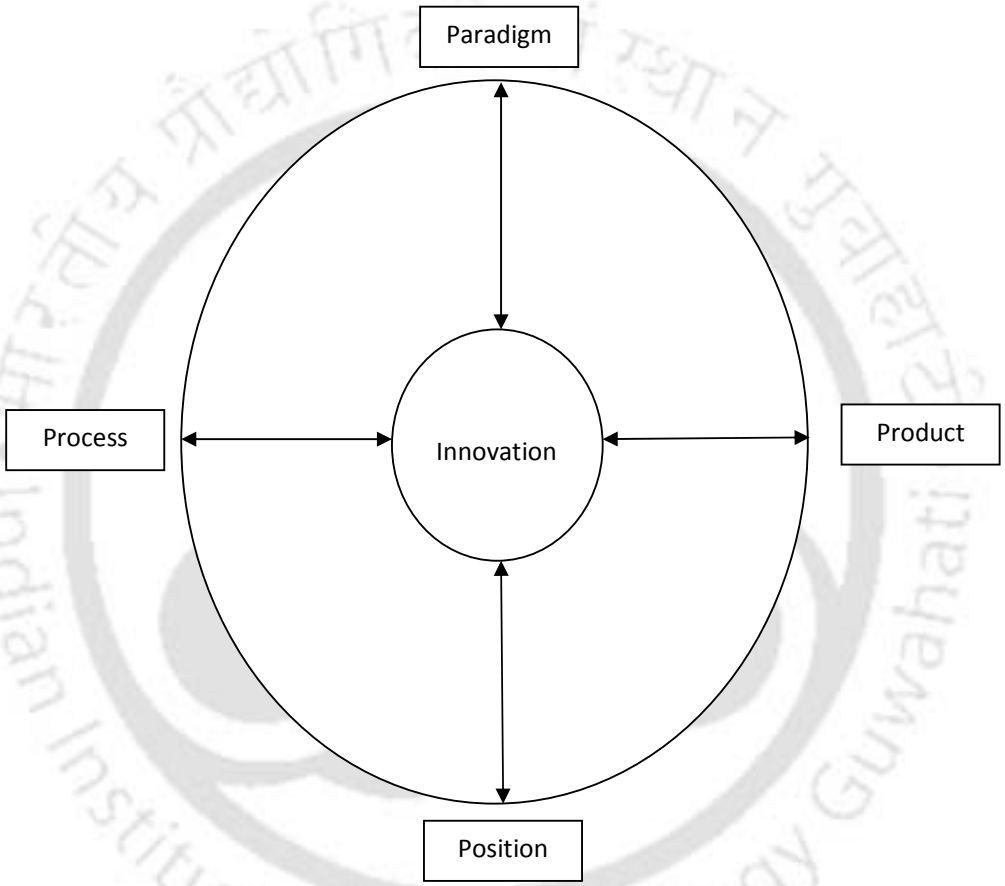


Figure 1.4: Innovation space

1.12 Contextual Background: Need Recognized

While American Marketing Association definition of marketing research (Bennet P.D, 1995) makes the point that marketing research links the firm to the consumer; Marketing Research activity involves information collection on entities other than consumer viz. distribution channel, employees, environment, competitors etc. That means to make marketing research findings effective the research initiative has to go beyond typical consumer behaviour study. It has to take in to consideration of the other factors effecting

the internal and external business environment. The factors may be social, cultural, economic, environmental, supply chain and so on (Malhotra Naresh K. et al, 2011, Burns Alvin C. et al, 2007, Marcus J. Schmidt et al,2007, Aaker David A et al 2007, Churchill Jr Gilbert A et al,2008). The issues of participatory design and capability approach (Sen Amartya, 1999) find its relevance in the context of design for development. Victor Papanek (1985) pointed out the designers' responsibilities with respect to major social and environmental needs. It is true that a small group of designers was proposing interesting, albeit isolated, design contributions for the solution of social or environmental problems, but the logic of economic rationalism seemed unbreakable, and it did not contribute to any exploration of the middle ground between pure market-based industrial logic and socially responsible design (Morelli Nicola, 2007). The 'capability approach' (Sen Amartya, 1999) may be suggested towards designing for society, and particularly, the world's poor. Central in this approach are human capabilities; the effective opportunities that people have to live the lives that they have reason to value. Again, C.K. Prahlad(2003) argues that poor people know that what keeps them poor is lack of competitiveness and knowledge. In the bottom of the pyramid what is required is both market development and creating technology solutions. Margolin (2006) notes the lack of interest of development organizations in design. Margolin emphasizes a different and less known path in the history of design for development and urged for a more complex involvement of designers in different stages of industrial development. The relationship between industry and customers should be such that the customer is no longer a passive receiver (a consumer) of the output of industrial production, but rather an active co-producer of his/her own values (Normann Richard, 2001, 1994; Ramirez Rafael, 1999). Interestingly, Frediani (2008), in exploring the connections between the capability approach and participatory methods more broadly, notices something similar. In practice, participatory methods used in developmental cooperation often do not meet the expectations, being sometimes used merely as a tool for achieving preset objectives and not as a process for true empowerment and improvement of people's lives. He argues that participatory methods need to be complemented by a theory that explores the nature of people's lives and the relations between the many dimensions of well-being. This theory, he says, should be comprehensive, but flexible and able to capture complex linkages between (aspects of) poverty, intervention, participation, and empowerment. He feels that the capability approach is able to offer exactly that. The capability approach may be able to offer the same revival to the ideals of participatory design. Research should address

issues ranging from design methods to the social and ethical dilemmas that the designer will encounter along the way.

In the context of need for new design methods Christopher C. Jones cited that the new methods that have appeared so far are only partial solutions to the modern design problems. We can identify the strengths and weaknesses of traditional design methods by posing and answering four critical questions:

i. How do traditional designers cope with complexity?
ii. In what ways are the modern design problems more complicated than traditional one?
iii. What are the interpersonal obstacles to solve modern design problems?
iv. Why are the new types of complexities outside the scope of the traditional design process?

Considering the above queries Jones has urged for quest of new design methods to design products in order to meet the needs and expectations of people in the complex business environment.

As far as the research initiatives in the design academia is concerned is has been observed that academic fraternity has extensively taken up several issues of design research in different time period. A need has been felt to conduct a research to address to the issues that needed attention in order to contribute to the design academia. This study addresses several issues relating to design methodology, design management, ergonomics, cultural identity etc in the context of product design.

Following shows a hypothetical timeline of design research discourse. (Bonsiepe Gui, Design Research Now, 2007)

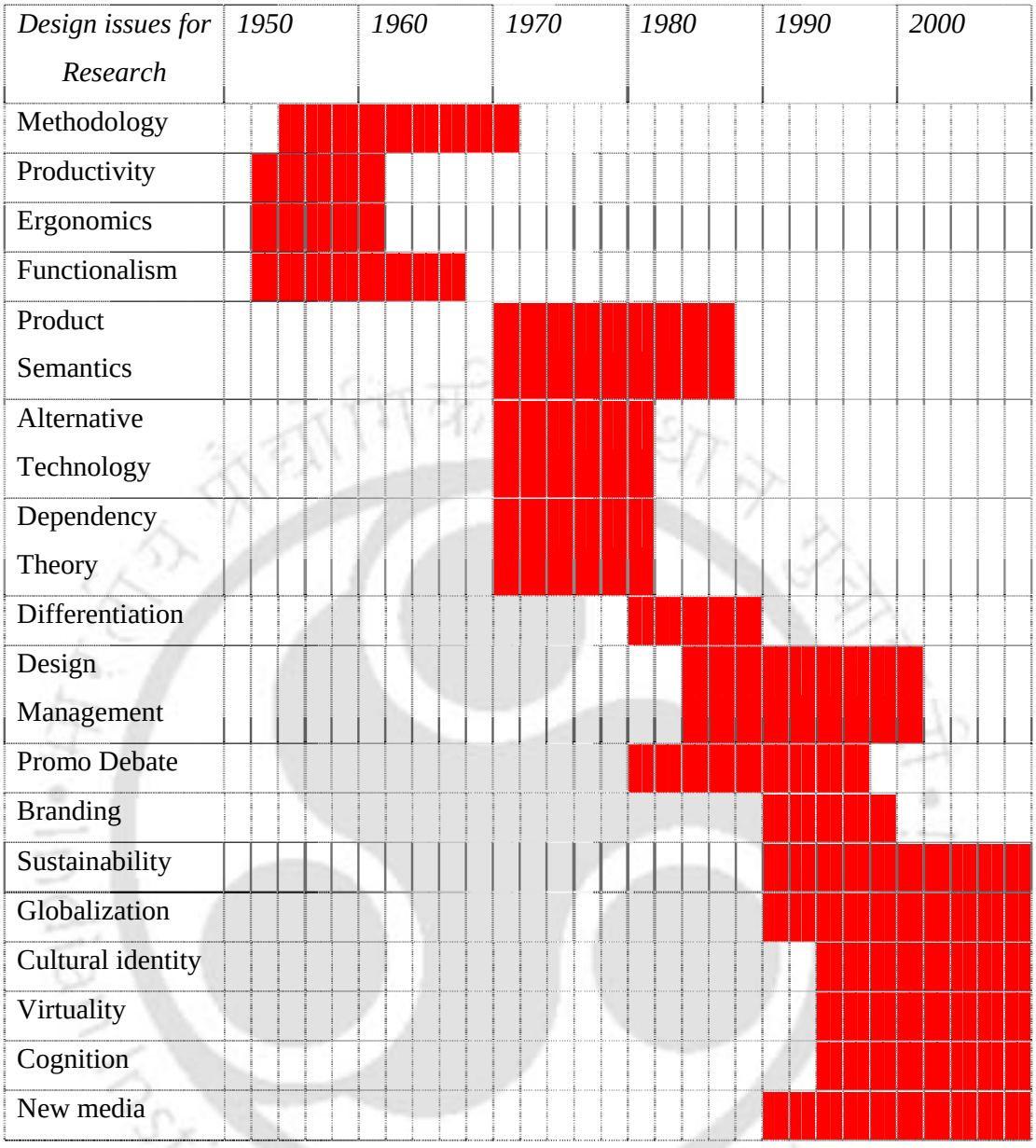


Figure 1.5: Hypothetical timeline of design research discourse

1.12.1 Domestic dishwashing in Indian context

To validate the idea that marketing research needs to consider actual user behaviour and integrate the same for design ideation, a case study of 'domestic dishwashing in Indian context' has been considered. This is because of the fact that even though various modern gadgets like washing machine, gas stoves, exhaust chimney, mixer grinder, OTG, microwave oven have made their impact in the Indian society, dishwashing machines have not made its impact in this class/segment. But the marketing research data has projected a favorable market for dishwasher in India based on purchasing power and sales data of consumer durable goods (Snapshots India Dishwashers, 2009). The idea is to

study reasons for the same and connection between marketing research and design solution.

People enjoy some of the activities in their daily life and for them some activities are irritating. Physical efforts required to perform these different activities are significantly different (Sidhu M. et. al, 2005). The household work now a day has become very strenuous and consumes 2700 k.cal to 2800 k.cal. of energy in every day and it can be compared with any type of hard occupation outside the home in terms of energy costs and time utilization. (Grandjean,1971). The study conducted in rural areas by M. Sidhu, R. Bakshi and P. Sandhu of Punjab Agriculture University, Ludhiana, India reveals that most of the women in the rural areas carry out the dishwashing activity in squatting posture (Sidhu M. et al, 2005). When heights of work surface are involved and when specific posture need to be followed, excessive bending of legs and abdominal muscles take place, which may increase oxygen consumption, resulting in increased energy expenditure (Park and Rodbard, 1962). Finding of Dhillon (1982), Oberoi et al (1983) are also in the same line. In another study conducted for grip assessment of rural women performing dishwashing activity (Khatoon Jahida et al., 2009) reveals that majority of the rural respondents (60%) adopted bending posture for bringing utensils from kitchen to the cleaning area and 75% of the respondents adopted sitting with bending posture for scrubbing utensils.

Therefore a need was felt to study the dishwashing problem in Indian context and generate design ideas to solve the dishwashing problem. This study critically analyses the dishwashing problem and evolves a new methodology for effective integration of marketing research findings for product design.

1.13.0 Aim and objectives

1.13.1 Broad aim and objectives

The aim of the study is to develop a methodology for design ideation by effective communication of marketing research findings to the designers; thereby bridging the gap between marketing research function and product design function. The aim is to study the method in solving the design problem of domestic dishwashing in Indian context.

The entire study has been carried out in three modules. Following are the objectives of each module:

1.13.2 Research objectives of the study of consumer behaviour related to cookware, crockery and utensils (Module I)

- To study the relationship of demographic and psychographic factors influencing the consumer behaviour related to cookware, utensils and crockery in Indian multicultural context.
- To study the consumer behavior related to various product attributes of cookware, utensils and crockery.
- To study the factors influencing the consumer behavior in using modern sophisticated kitchenware in Indian context.
- To study the level of disliking for activities performed in kitchen in Indian context.
- To identify the needs and expectations of consumers in case of cookware, utensils and crockery.

1.13.3 Research objectives of the study of dishwashing related consumer behaviour (Module II)

- To understand the dishwashing process in details
- To critically examine various factors related to domestic help and dishwashing.
- To study the perceived value of various solutions available for the dishwashing problem and consumer's preference level.
- To study the 'design for development' aspect in the context of dishwashing.

1.13.4 Research objectives of the study of transformation of marketing research findings for design ideation (Module III)

- To study the transformation process of marketing research findings to design ideas.
- To study and evaluate the design ideas from the point of view of ability to meet basic design objectives incorporating consumer behaviour.
- To evolve a method for effective communication of marketing research findings to product designers.

- To study the improvement in ideation after applying the Marketing-Research-Finding Sensitive Visualization (MRFSV) method for product design.

1.14.0 Research Methodology

Conclusive research design was adopted for this study. For the study of consumer behaviour related to cookware, crockery and utensils, a multiple cross sectional design was adopted. The respondents from both rural and urban areas were included. Longitudinal research design was adopted in idea generation process. Ideas were generated by the same group of designers before and after application of Marketing-Research-Finding Sensitive Visualisation (MRFSV) method. The ideas were evaluated by focus groups. The members of the focus group have fair idea about consumer behaviour and product design. Following is the schematic representation of the research methodology adopted.

The entire study was done in three modules. In module I and module II, consumer behavior data was collected by using structured questionnaires, personal interview and ethnography. Primary data was analysed using various quantitative and qualitative tools with extensive use of various descriptive and inferential statistical tools. Statistical Package for Social Science (SPSS) was extensively used for quantitative analysis. The marketing research findings were documented. The module III has two phases. In the first phase of module III, designers were asked to generate design ideas for the dishwashing problem on the basis of information obtained from conventional sharing of marketing research findings. In the second phase of module III, a new method termed 'Marketing-Research-Finding Sensitive Visualisation (MRFSV)' was adopted to transform marketing research findings for design ideation. This doctoral study has evolved the MRFSV method. Eui-Chul Jung, Sam Sung Kwan and Keiichi Sato (2010) developed a method named Context Sensitive Visualization (CSV) for mapping internal contexts in to visualization mechanisms. This method was used for system design. The MRFSV method has been developed from the basic idea of Context Sensitive Visualization (CSV). This method helps the designers for ideation in the context of marketing research findings. The ideas generated in both the phases of module III were evaluated with the help of focus group's response on the idea screening matrix (Pugh Stuart, 1990).

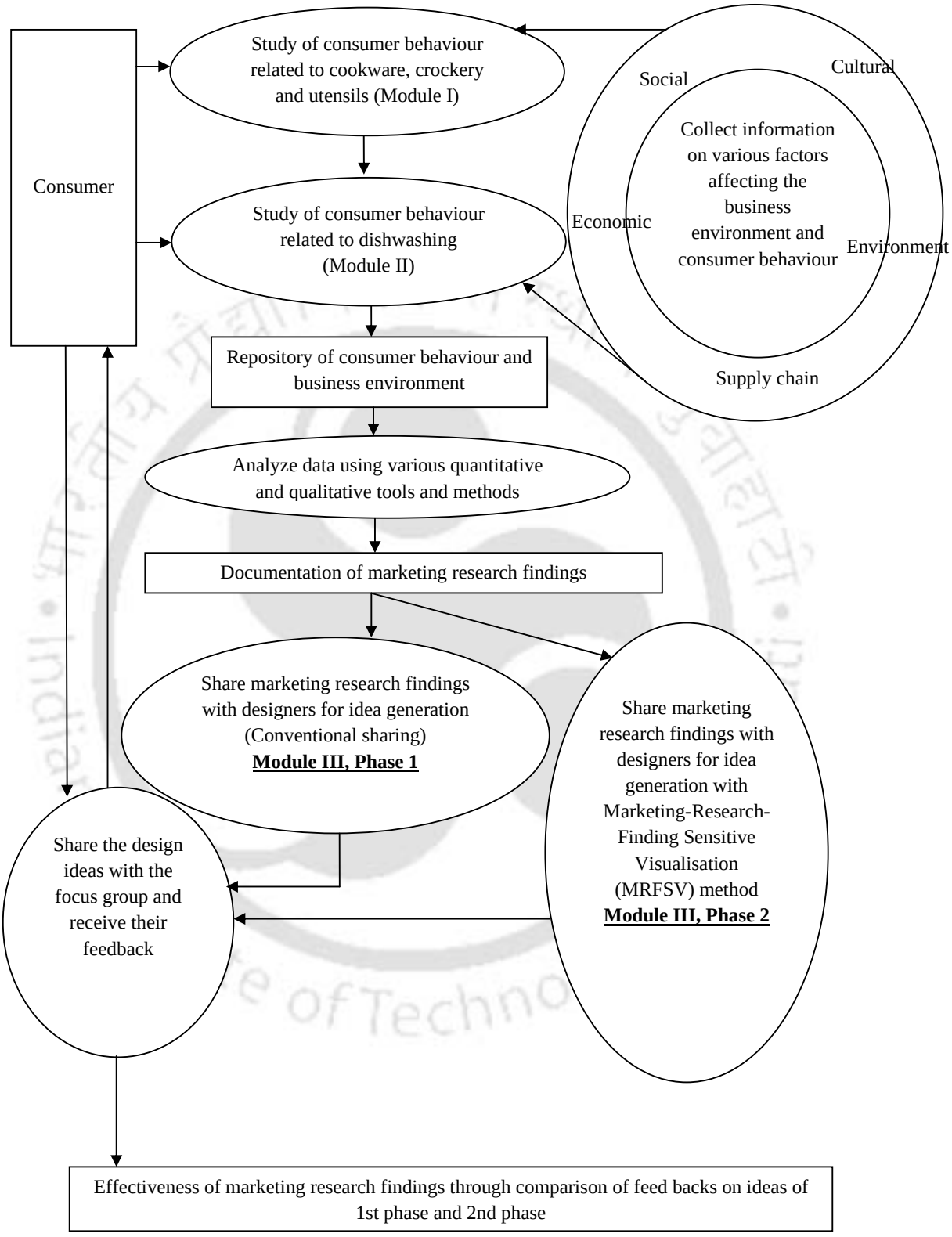


Figure1.6: Schematic representation of the research methodology

1.14.1 Research design for the study of consumer behaviour related to cookware, crockery and utensils (Module I)

A market survey was conducted to assess factors influencing the consumer behavior related to cookware, utensils, crockery and modern kitchenwares viz. Oven Toaster Grill (OTG), microwave oven etc. A sample size of 200; with 150 females and 50 males were considered. Data was collected through structured questionnaires. Simple random sampling method was followed. The questionnaire comprised of questions to study the food habit of consumer and their preference of different types of cookware, utensils and crockery. Specific questions were asked to collect the demographic profile of the respondent. Respondents were asked about their preferred food in breakfast. Data was collected through a question in nominal scale. The options given were (a) Paratha/luchi (b) Bread/loaf/sandwich (c) Idli (d) Rice (e) Any other. Respondents were also asked about their preferred food in lunch and dinner. Data was collected through a question in nominal scale. The options given were (a) Rice/ chapatti (b) Dosa (c) Chicken/fish/paneer (d) Tandoor items and (e) Any other. Respondents were allowed to go for multiple choices of options. Structured questions were asked to study the factors influencing consumer behaviour in case of modern sophisticated kitchenware viz. Oven Toaster Grill (OTG), microwave oven etc. Specific questions were asked to know consumers' preferred process of cooking viz. heating, steaming, roasting and baking. The reasons for low preference of modern sophisticated kitchenwares like microwave oven, OTG etc were explored. The factors considered for this purpose were price, electricity, taste variation, safety issues, and any other factors. Respondents were asked to provide ratings on activities in kitchen they dislike most. The activities considered were, preparing raw food ingredients, cooking and dish washing. The ratings were taken in a five point semantic differential scale; 1 being the 'dislike most' and 5 being the 'like most'. Respondents were asked to provide ratings on their preference of materials of cookware, utensils and crockery. Altogether twelve materials were considered viz. cast iron, brass, bell metal, copper, non-stick, plastic, wood, steel, ceramic, clay, melamine and glass. The ratings were taken in a ten point semantic differential scale; 1being the least preferred and 10 being the most preferred. Respondents were also asked to give their ratings of importance on various attributes of cookware, crockery and utensils. A seven point semantic differential rating scale was considered; 1 being the least important and 7 being the most important. The attributes under consideration for cookware, crockery and utensils were ease of use, aesthetic look, traditional design, taste of food, ease for

washing, durability / robustness, variety in design, brand name, hygiene, weight and associated status symbol. The data collected through structured questionnaire was tabulated in the Statistical Package for Social Science (SPSS). Descriptive statistical analysis was conducted to analyse data. Various inferential statistical analysis viz. Analysis of Variance (ANOVA), co-relations, chi-square test etc. were conducted.

1.14.2 Research design for the study of dishwashing related consumer behaviour (Module II)

The study of module II has considered respondents from both urban area and rural areas. The sample size for urban area is 100 and sample size for the rural area is 40. Simple random sampling method was followed. Questionnaires were distributed to a hundred post graduate students of business management. They have adequate knowledge of data collection for marketing research projects. They acted as enumerator for this study. They were asked to fill up the questionnaire after interviewing their individual household heads. The respondents were asked questions related to payment, duration of work of domestic help, most disliked activity in kitchen etc. The questions related to scrubber and detergents were asked to the domestic helps in case the family employs domestic help for dishwashing. Otherwise these questions were asked to the person who performs the task of dishwashing. Some of these enumerators were sent to rural areas in and around the Guwahati city and as well as other parts of Assam to collect data by using the same questionnaire. The enumerators were asked to capture still and video images of the dishwashing activity in their respective house. Enumerators extensively used the digital cameras attached to their mobile phones. Digital cameras were provided to those who did not have mobile phones with digital camera. While visiting the rural areas, along with the questionnaire, the enumerators collected still and video images of the dishwashing process. Visual ethnographic narrative technique was used to analyze the images (Harper Douglas, 1987; Collier John, 1987). Designers keep and organize visual material in their workplace as a means to stimulate their creativity. Normally designers keep two collections, a physical and a digital collection, each with different goals, uses and values (Keller et al, 2006). In this study, only the digital images were considered due to unavailability of sufficient number of relevant physical images for the study. The vital comments against each photograph were tabulated. After that all the comments were summarized to formulate the final findings on the dishwashing process. This qualitative data was also used to validate data collected for quantitative analysis. Altogether three

focus groups were formed. Two focus groups had altogether fourteen numbers of members in each; and one focus group was comprised of twelve members. Therefore there were altogether forty records for statistical analysis. The respondents were selected randomly from different spheres of life. It consists of students, lawyers, doctors, engineers, businessman, academicians, traders, teachers etc. They were shown the images and the footages in random slides in a power point presentation. The organization of images was done randomly to avoid any kind of biasness (Pasman G, 2003). After that they were asked to give their individual ratings in a five point ordinal scale on the following questions. For question (i) the options were, highly acceptable, acceptable, cannot say, not acceptable and not at all acceptable. For questions (ii), (iii), (iv), (v) and (vi) the options were strongly agree, agree, cannot say, disagree and strongly disagree.

i. Do you think that the present scenario is acceptable to a progressive society?
ii. Do you think that with certain improvement in the present condition of dishwashing, the productivity of the people can be substantially increased
iii. Is the process environment friendly?
iv. Can the present process ensure the better health and hygiene of person?
v. Do you think that the existing dishwashing process is benefiting the poor?
vi. Do you think that the dishwashing problem needs immediate attention from designers, technologists and social scientists?

The forty records were tabulated and statistical analysis was conducted. The data collected through structured questionnaire was tabulated in Statistical Package for Social Science (SPSS). Descriptive statistical analysis was conducted to analyse data. Various inferential statistical analysis viz. Analysis of Variance (ANOVA), chi-square test etc. were also conducted.

1.14.3 Research design for the study of transformation of marketing research findings for design ideation (Module III)

The study of module III has two phases. In the first phase of module III, designers were asked to generate design ideas for the dishwashing problem with conventional sharing of marketing research findings. In the second phase of module III, a new method termed Marketing-Research-Finding Sensitive Visualisation (MRFSV) was adopted to communicate the marketing research findings in a structured way to the design students of IIT Guwahati.

In the first phase altogether eighteen ideas were generated. Out of these fifteen ideas were considered for ranking in the idea screening process. In the second phase altogether seventeen ideas were generated and all were considered for the idea screening process. The ideas of the last two ranks were eliminated for further inferential and descriptive statistical analysis.

The ideas generated in both the phases of module III were evaluated with the help of focus group's response on the idea screening matrix. Two focus groups were formed comprising of eleven members in the each group. The focus group members are the final trimester students of post graduate programme of management with specialization in marketing and product design. The members of the focus groups also represented consumers.

The idea screening matrix was formulated considering the criteria viz. Ease of dishwashing in Indian context, Ease of use, Ergonomic considerations, Ease of manufacture and assembly, Aesthetic appeal/ design variety, Economic and financial feasibility and Environment friendliness. The codes used are: '+' for better than existing, '0' for same as existing, '-' for worse than existing (Pugh Stuart, 1990). The response of the focus group was further analysed using quantitative techniques.

1.14.3.1 The Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design

This study has evolved the Marketing-Research-Finding Sensitive Visualisation (MRFSV) method for product design. The idea of MRFSV has originated from the abstract thinking of Context Sensitive Visualisation (CSV) method. With the help of Context Sensitive Visualisation (CSV) method developed by Eui-Chul Jung, Sam Sung Kwan, Keiichi Sato (2010), designers could effectively generate user interface design of a car navigation system considering user's internal mapping. The Context-Sensitive Visualization methodology proposes visualization schemes and mechanisms that are mapped on users' internal models of external context. Its core ideas were demonstrated through a case study in which the design of a car navigation system was completed and assessed. The case study provided not only validation for the method, but also some useful insights for refining the current design and methodology. Since the positive results from the case study do not mean that the proposed methodology would work well for any type of product or system, multiple case studies need to be conducted in future research in order to further develop the CSV methodology. By verifying the methodology across

various types of products and systems, it will be possible to develop a more elaborate and generalized methodology. Following is the schematic representation of the mechanism of Context Sensitive Visualisation (CSV) method.

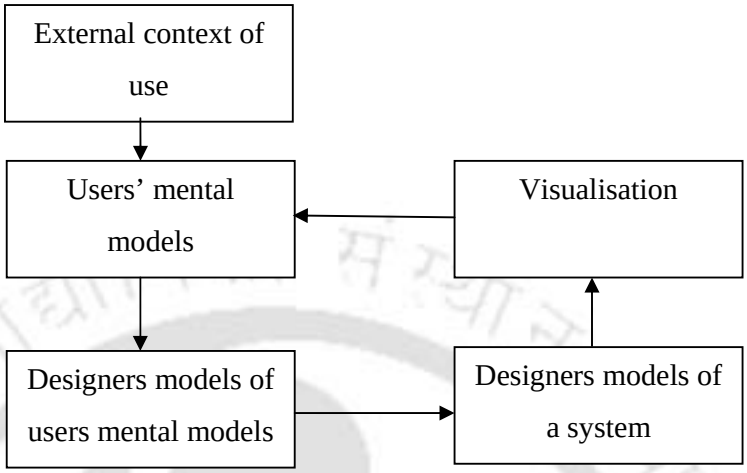


Figure1.7: Mechanism of Context Sensitive Visualisation (CSV) method

In the Context Sensitive Visualisation (CSV) method, the initial input comes from the context of use. The designers study users' metal models, and then interpret user's mental models. Designers develop models of the system followed by the generation of visualizations. Following is the schematic representation of the mechanism of Marketing-Research-Finding Sensitive Visualisation (MRFSV) method.

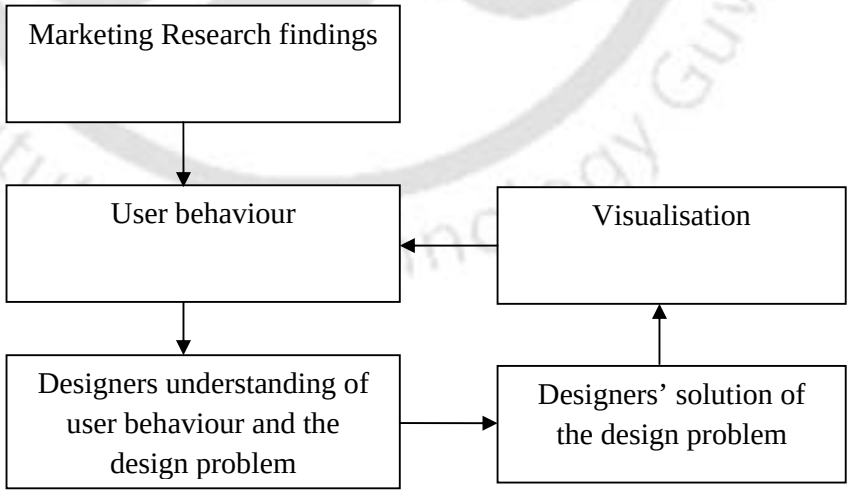


Figure1.8: Mechanism of Marketing-Research-Finding Sensitive Visualisation (MRFSV) method

In the MRFSV method developed in this study, the 'context' is the 'Marketing-Research-Findings'. In the MRFSV method, the designers are required to understand user requirements and its association with the design problem. Designers are required to define user requirements and specific design problems in a structured way. In the context of the specific user requirements designers are required to visualize design solutions for the specific design problems related to user requirements. Then designers develop the final model after synthesizing all the visualizations of design solutions.

In the first column entitled Marketing-Research-Findings, Marketing Research (MR) findings are written in brief. The other three columns are left blank for the individual designers' responses. Designers first read all the marketing research findings from the first column. Then in the 2nd column they give weightages to each MR findings out of a total score of 100. The design objective should be well defined to the designers prior to the exercise. Weighted scores represent the usefulness of MR findings in meeting design objective. In the 3rd column designers define the design problems specific to the MR findings. It creates an opportunity for the designers to very minutely observe each and every MR findings and understand the specific design problems. In the 4th column the designers give their ideas as a solution for the specific design problems identified. Adequate paper space is provided in the 4th column. The design ideas are expressed in texts and renderings. Designers may use additional papers for renderings where descriptions of the specific MR findings are to be mentioned properly. The designers arrive at the final design ideas after analysis and synthesis of all the Marketing-Research-Finding Sensitive Visualisations obtained from the exercise. The ideas and visualisations are prioritized on the basis of the weighted scores in meeting design objectives. All the designers may sit together to discuss their results and design ideas and thereby arrive at the final design solution. Following exhibit shows the MRFSV method

Marketing-Research-Findings	**Weightage in meeting design objective** (Divide total score 100 amongst the marketing research findings)	**Define Design Problem** (How would you like to define the design problem from the corresponding MR Findings?)	**Marketing Research Findings Sensitive Visualization (MRFSV)** (Description of Designer's design solution for the design problem)
MR Finding 1 Respondents prefer utensils/cookware made of steel, bell metal, brass, copper and Glass	15	Dishwashing kit should be able to clean utensils made of bell metal, brass, copper along with steel and glass.	Inspiration from Indian traditional designs. Use coir for scrubbing.
MR Finding 2			
MR Finding 3….			

Table 1.3: The MRFSV method

As far as the similar practices in industries are concerned, Alcatel Lucent transforms the consumer requirements through analytics (Strategic white paper, Alcatel-Lucent, 2011). Analytics is defined as a method of logical analysis. In the context of communications services, analytics is the logical analysis of data that corresponds to consumers and consumer behavior, as well as data that corresponds to service provider infrastructures and service delivery capabilities. In the MRFSV method evolved in this doctoral study addresses these issues in the context of product design. In MRFSV method, the logical analysis of consumer behaviour takes place in assigning weighted scores to each marketing research findings and defining the design problem related to the marketing research findings. The product designers get an opportunity to do the logical analysis of the designs corresponding to the specific design problems. Alcatel Lucent refers to the marketing research findings as 'user story' and the prioritized list of the marketing research findings as 'product back log'. The matrix is to some extent similar to that of MRFSV. The product manager prepares the product back log on the basis of inputs from consumer requirement and consumer behaviour. The implicit requirements are also identified. The product architect takes the input from the product manager and system design is evolved.

The method of Alcatel Lucent is basically for system design. In this method the design problems are not defined on the basis of specific marketing research findings (User story). The method is mainly used for identification of product specification; not for idea generation for product design. No visualisation of the design solution takes place in this method. In this method weightages are given on the basis of customer requirement priority. But in MRFSV weightages are given to each marketing research findings on the basis of ability to meet the design objectives set by the marketing team.

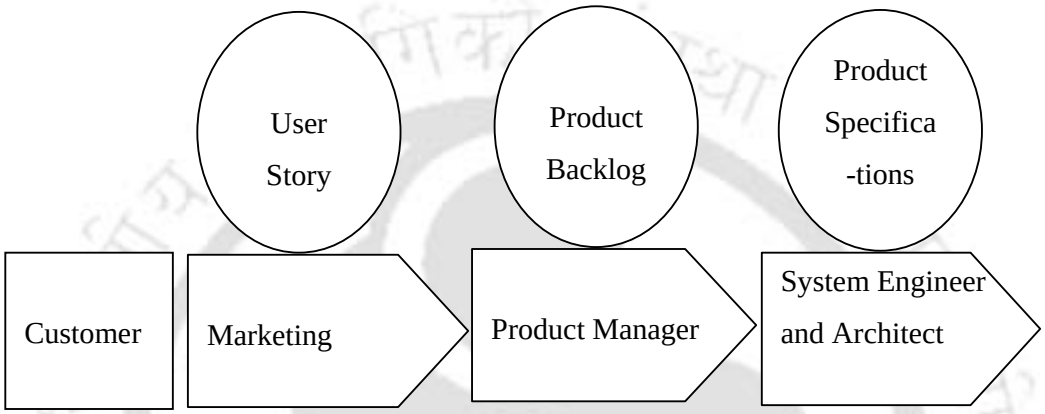


Figure: 1.9: Alcatel Lucent's method of transforming customer requirements to product specifications

The Marketing-Research-Finding Sensitive Visualisation (MRFSV) method has been evolved considering the basic concept of Context Sensitive Visualisation method and the industry practices of similar method is as described above.

MARKETING-RESEARCH-FINDING SENSITIVE VISUALISATION (MRFSV) METHOD FOR PRODUCT DESIGN WITH SPECIAL REFERENCE TO DOMESTIC DISHWASHING IN INDIAN CONTEXT

Chapter 1

Product Design and Marketing Research Interface

MARKETING-RESEARCH-FINDING SENSITIVE VISUALISATION (MRFSV) METHOD FOR PRODUCT DESIGN WITH SPECIAL REFERENCE TO DOMESTIC DISHWASHING IN INDIAN CONTEXT

Chapter 2

Consumer Behaviour Related to Cookware, Crockery and Utensils

MARKETING-RESEARCH-FINDING SENSITIVE VISUALISATION (MRFSV) METHOD FOR PRODUCT DESIGN WITH SPECIAL REFERENCE TO DOMESTIC DISHWASHING IN INDIAN CONTEXT

Chapter 3

Consumer Behaviour Related to Dishwashing

MARKETING-RESEARCH-FINDING SENSITIVE VISUALISATION (MRFSV) METHOD FOR PRODUCT DESIGN WITH SPECIAL REFERENCE TO DOMESTIC DISHWASHING IN INDIAN CONTEXT

Chapter 4

The transformation of marketing research findings for design ideation

MARKETING-RESEARCH-FINDING SENSITIVE VISUALISATION (MRFSV) METHOD FOR PRODUCT DESIGN WITH SPECIAL REFERENCE TO DOMESTIC DISHWASHING IN INDIAN CONTEXT

Chapter 5

Conclusion, Recommendations and Suggestions