UNIT 13   CONJOINT ANALYSIS

Objectives

After going through this unit you should be able to :

- Understand the concept and need of conjoint analysis
- Explain the steps involved in conjoint analysis
- Apply conjoint analysis in different marketing needs.

Structure

13.1   INTRODUCTION

In marketing the need to understand consumer behaviour is paramount. Although consumer behaviour has to be understood in its many facets, the need to discover the attributes that the consumer considers important is quite common. After understanding these attributes the marketers attempt to understand consumers perceptions for the products or brands along these important attributes.

Many research and analytical techniques are available and often employed for these purposes. For discovering the salient attributes, one can ask the consumers directly or use analytical, techniques like Factor Analysis or Multi Dimensional Scaling (MDS). Simple techniques of Depth Interviewing or Focus Group Discussions are found to be quite effective for discovering these dimensions or attributes. Later, the scores of different products along these dimensions are obtained from the consumers directly on Likert type metric scales.

Factor Analysis (discussed in previous unit) is found to be quite powerful in analytically discovering the important attributes through a set of indirect and large number of questions. MDS is also found quite effective in similar situations. In fact, it is particularly effective when it is not considered desirable to probe consumers directly about the attributes. This may be true when breaking the products into attributes and seeking responses along them may be too artificial for the consumers. A more realistic way may be to ask the consumers to respond to the totality of the products or brands - something that they always do in real life purchase situations.

MDS (which would be discussed in subsequent unit in detail) is found to be superior to more traditional method of attributes wise data collection method because of its lesser demands on data scaling. It can work with metric as well as ranking data. This feature is also very consumer friendly as the constmers, in most cases, compare products in terms of "better" or "worse" instead of assigning absolute values to products or its attributes. For example, a shirt customer may consider the brand, material of the fabric, design, colour, texture of the cloth, price and stitching as important He shall consider all these attributes when he chooses the particular shirt for his purchase out of the set of shirts displayed to him in the shop. But, he many find it difficult to accurately provide his ratings for each of these attributes for each of the shirt displayed to him. With the help of above techniques, we can understand the significant attributes of products and obtain the plots of competing products or brands in the perceptual space of consumers. These information go a long way in helping us to take the product positioning decisions.

While it is very useful for the makerter to see the plots of existing products and visualise alternative positions together with their respective sizes, it is not sufficient for taking some of the important managerial decisions. For example, it does not help him in understanding

the trade-offs that the consumers make between different attributes. In fact, it is these trade-offs with which the marketer find his greatest opportunities to optimise his marketing efforts. Sometimes, he may not even find it feasible to exploit the precise opportunity that is suggested by the methods like MDS or direct plotting of consumers perceptual space. For example, the available technology to produce the product may allow some variant of the product instead of the ones thrown up by the traditional methods.

The marketer is also naturally interested in getting the answers to several "What if' kind of questions. What if I reduce one attribute? What if the competitor changes its brand position? What if the salience of one attribute changed through some consumer education efforts? Etc.

Conjoint Analysis technique has been developed to answer most of these questions and guide the marketer in optimizing his decisions. Yet , the data requirements on the consumers are minimized and anchored at a very natural level. This techniques was introduced to the marketers in 1970s and has gained tremendous popularity since then due to its great managerial relevance and simplicity.

13.2 WHAT IS CINJOINT ANALYSIS

Conjoint Analysis is basically a data decompositional technique which tries to plot the output data on the joint space of the importance of each attribute are the attribute. It seeks data from the consumers in the form of their overall response to the totality of products (or their descriptions) while the output is in terms of the scores that the consumer has implicitly assigned to each of the attribute and its levels.

The important thing to note is that the consumer is not asked to assign scores to different attributes separately. In fact, the consumer is presented the stimulus in the form of totality of the product like in the case of MD S. However, there is one difference between and Conjoint Analysis. In Conjoint Analysis, the stimuli are created by the researcher himself While in the case of PODS already existing products or brands are used.

Conjoint Analysis derives the importance weights (called "part worth utilities") assigned by each consumer to respective levels of attributes in such a way that they are directly comparable. This feature of the technique allows to determine the trade-offs that the consumers make in their minds. The relative importance of the attributes can also be derived from the output of "part worth utilities". Thus, starting with a very simple input data (just the ranking of some predesigned product alternatives) Conjoint Analysis provides the part worth utilities for each of the product attributes levels for every consumer individually

13.3 STEPS IN THE APPLICATION OF CONJOINT ANALYSIS

The main steps involved in the application of Conjoint Analysis are following:

1. Determination of the salient attributes for the given product from the points of view of the consumers

2. Assigning a set of discrete levels or a range of continuous values to each of the attributes.

3. Utilising Fractional Factorial Design of Experiment for designing the stimuli for experiment.

4. Physically designing the stimuli

5. Ranking or Rating data collection

6. Conjoint analysis and determination of part worth utilities.

7. Applying conjoint analysis output for different marketing decisions

We shall now describe each of these steps in some details.

1. Identification of Salient Attributes

Unlike MDS or Factor Analysis, Conjoint Analysis requires the salient attributes to be given. These attributes can be selected based on the marketer's experience, depth interviewing or Focussed group discussions. In some cases Factor Analysis or MDS may also be used for labelling the salient factors. Only those attributes should be selected here around which differences do exist among brands or through which future differentiations can be achieved. For, if it is not possible to differentiate products along any particular attribute, the managerial value of that attribute becomes very low.

2. Assignment of levels to selected attributes

The real products can be described as specific combinations of the attributes where each attribute can take different values. Sometimes the attribute can take only discrete values. Examples of such attributes may be brand name , colour of the product or the nature of technology used. Out of the entire range of values that may be theoretically possible, the marketer may choose only a few for his active consideration. For example, a soap can technically be produced in all colours. But, some colours, like dark black, may be ruled out.

Some attributes, like price or life of the product, may take continuous values. Conjoint Analysis can treat them or like that also. Some range of values may be specified for them or the range may be kept open ended.

3. Fractional Factorial Design of Experiment

In Conjoint Analysis the profile of different products are presented to the consumers for their responses. These profiles are generated by varying the levels of its attributes. For example, suppose we are conducting a Conjoint Analysis based study of dish washers. Let us assume that the most important attributes considered by its customers are Brand, Price, Washing Capacity, Colour and Shape. Let us further assume that the following levels of attributes are considered relevant and interesting by the marketer for the study:

	Attribute		Levels
1.	Brand		Kitchen Master Elegant Torrent Evermaid
2.	Price		Rs. 15,000/- Rs. 20,000/- Rs. 25,000/-
3.	Washing Capacity		High Medium Low
4.	Colour		Steel grey White Light Blue Pink
5.	Shape		Cylindrical Box Type

Since the 5 attributes can take 4, 3, 3, 4 and 2 levels, the total number of possible product concepts that can be generated by configuring these attributes is 4x3x3x4x2 = 288. In order to determine the part worth utilities of each of the levels, of all these attributes, we shall have to take 288 different product concepts for getting his responses. This number is certainly too large for any,consumer. Therefore, we resort to the method of Fractional Factorial Design of Experiment to make it manageable.

29

The statistical technique of Fractional Factorial Design of Experiment finds out the minimum number of product designs which are necessary to use in the study and yet provide us all the information that we originally sought. These designs are also mutually independent (orthogonal) to avoid any redundancy in the data and allow the representation of each of the attributes and their respective levels in an unbiased manner.

In the example of dish washer considered here, this technique has given us only 16 designs out of the 288 possible dish washers. However, it should be noted that such reduction in number of product designs is possible only after making certain assumptions. For example, we had assumed that none of the attributes interact among themselves. Or in other words, the attributes are considered to be independent of each other. Only under this assumption we got the number of product concepts as 16. At the other end, if we would have allowed all the attributes to interact with each other the required number of product concepts would have remained as 288. With different types of assumptions the number of concepts required would be in between these extremes.

The 16 product concepts found through this method are not unique. Many other sets of 16 cards would have also been, equally good. However, all of these sets would have to be independent and represent all the attributes and their respective levels in an unbiased manner. We are illustrating below one such set of 16 cards representing the product concepts of dish washers using Fractional Factorial Design of Experiment.

Table 1: Description of Product Concept Cards.

Card #	Brand	Price	Cap.	Colour	Shape
Card 1	Kit Master	Rs. 15,000	High	St. Grey	Cylinder
Card 2	Elegant	Rs.25,000	Medium	St. Grey	Box Type
Card 3	Torrent	Rs.20,000	Medium	St. Grey	Box Type
Card 4	Ever Maid	Rs.20,000	Low	St. Grey	Cylinder
Card 5	Kit Master	Rs.20,000	Medium	White	Box Type
Card 6	Elegant	Rs.20,000	Low	White	Cylinder
Card 7	Torrent	Rs.25,000	High	White	Cylinder
Card 8	Ever Maid	Rs. 15,000	Medium	White	Box Type
Card 9	Kit Master	Rs.25,000	Low	Light B1	Box Type
Card 10	Elegant	Rs. 15,000	Medium	Lighlt B1	Cylinder.
Card 11	Torrent	Rs.20,000	Medium	Light Bl	Cylinder
Card 12	Ever Maid	Rs.20,000	High	Light B1	Box Type
Card 13	Kit Master	Rs.20,000	Medium	Pink	Cylinder
Card 14	Elegant	R&20,000	High	Pink	Box Type
Card 15	Torrent	Rs.15,000	Low	Pink	Box Type
Card 16	Ever Maid	Rs.25,000	Medium	Pink	Cylinder

4. Physical design of stimuli

After selecting the product concepts required for the Conjoint Analysis study, they need to be exposed to the consumers as stimuli. This may be done in a variety of ways mainly depending on the demands of the situation and the convenience of the researcher. Of course, it would be most desirable to present real life prototypes of the products according to the product concepts specified. These, may be given to the consumers for their usage or trials. But, such extreme ways of presenting the products may not always be possible or even necessary. In such cases, product models, diagrams or even verbal descriptions may be adopted. In our example of dish washers, it may not be possible to produce the 16 prototypes and take them to the consumers. Just their models or pictures may be sufficient.

5. Data Collection

Ease of data collection is a key feature of Conjoint Analysis. The consumers are asked only to assign rating scores to each ^{o}f the product stimuli or even rank the 'different concepts presented to them. This is quite, a realistic task and is close to the shopping experiences where the customer merely makes choices. He does not have to respond to each of the attributes separately.

This feature of conjoint analysis is possible due to the use of Fractional Factorial Design of Experiment before collection of data and the use of Conjoint Analysis after collecting the data. In other words, the use of the technique eases the burden of the respondents.

6. Determination of part worth utilities

The rating or ranking data obtained from the consumers are analysed next. Two methods are more popular for this purpose. In one method, the part worth utilities for each of the levels of each attributes are arbitrarily assigned. Based on these assumed values, consumers overall rating or ranking (as the case may be) are estimated. These estimated responses may, understandably, be quite different from the actual data. After a few iterations convergence is achieved so that the part worth utilities found approximate the estimate responses to the actual data best.

In the alternative method, the part worth utilities are derived in one step. Here, an error function describing the difference between the estimated and actual data is defined. This function is then minimised.

After using any of the available method, the output is obtained for each of the respondent separately. This is quite significant as the disagregate data can be combined in any of the desired way. But, if the output was only at the aggregate level then disaggregation might not have been possible.
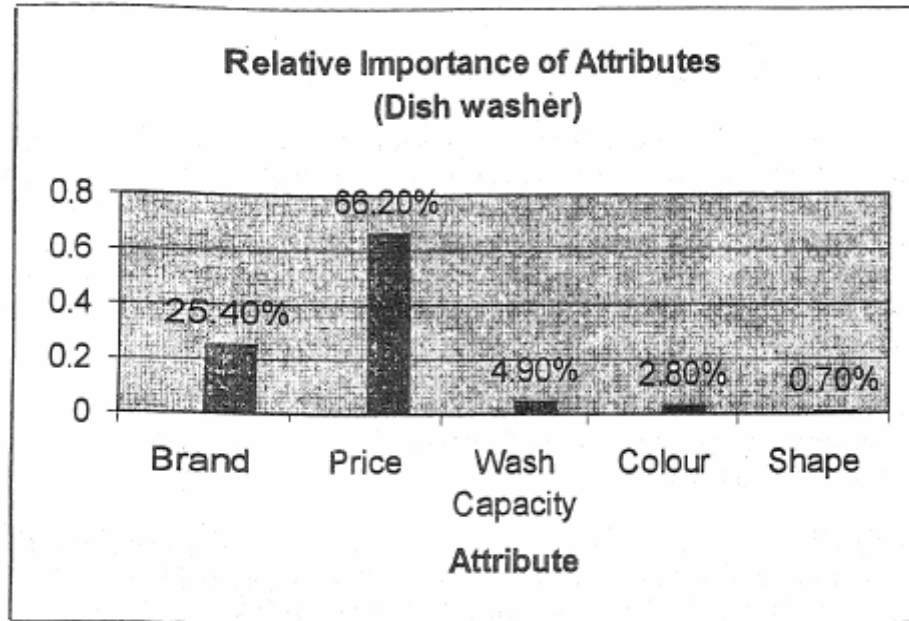
In our example of dish washer, the part worth utilities may be found for each of the attributes and their levels as following:

	Attribute	Levels	Part Worth Utility
1.	Brand (25.4%)	Kitchen Master	2.2
		Elegant	-2.3
		Torrent	-0.8
		Evermaid	0.9
2.	Price- (66.2%)	Rs. 15,000/-	5.9
		Rs. 20;000/-	-0.1
		Rs. 25,000/-	-5.8
3.	Washing Capacity (4.9%)	High	0.0
		Medium	0.1
		Low	-0.1
4.	Colour (2:8%)	Steel Grey	-0.3
		White	-0.1
		Light Blue	0.1
		Pink	0.2
5.	Shape (0.7%)	Cylindrical	-0.1
		Box Type	0.1

From the above table, we find that price plays most important role (66.2%) in the minds of customers. This is followed by Brand (25.4%) Washing Capacity (4.9%), Colour (2.8%) and Shape (0.7%): These relative importance values for the attributes have been found by finding the difference between the maximum and minimum values of the part worth utilities of the respective. attributes.

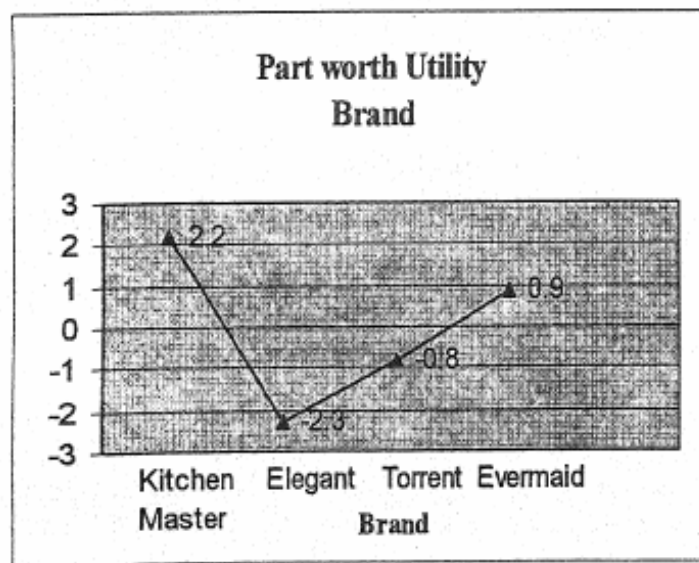The relative importance of different attributes has been shown in figure 1 below.

Figure 1: Relative importance assigned by the customers by the customers to attributes of dish washer
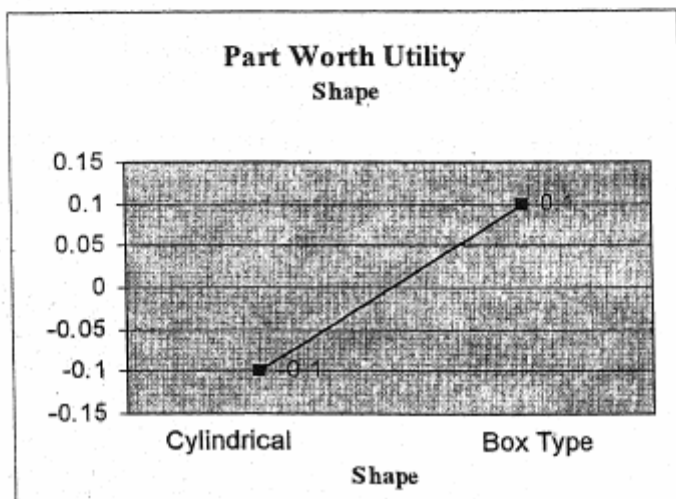

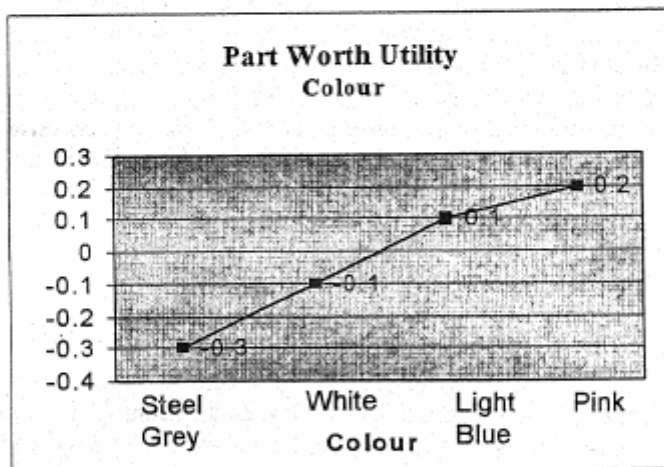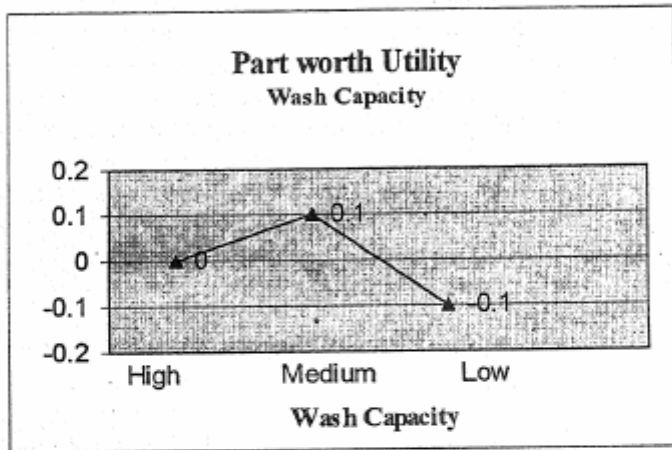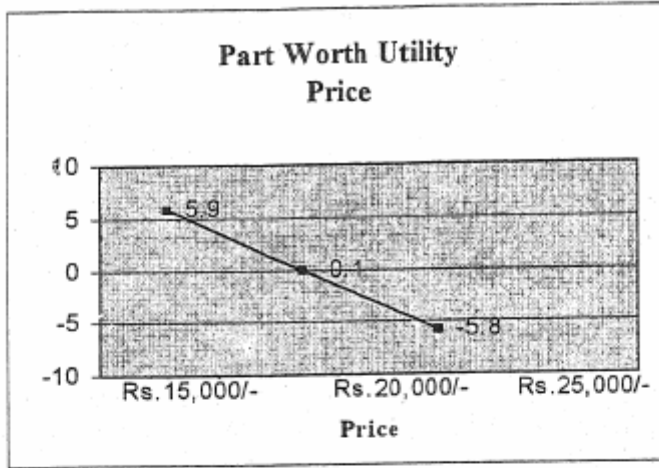**Relative Importance of Attributes (Dish washer)**

Customers respond quite predictably towards different price levels. They prefer lesser price to the higher ones. Among brands, we find that Kitchen Master is the most liked brand and Elegant is the least liked one. However, they do not prefer the "High" capacity most. They prefer "Medium" size most. In terms of the colour, they prefer Pink colour most. Between the two shapes, box type dish washers are preferred more. But, the importance scores for the wash capacity, colour and shape themselves are quite low.

The part worth utilities of conjoint analysis can be represented graphically as shown in the figure 2.

Figure 2: Part worth utilities assignment by the customers to different attributes levels of dish washer

Part worth Utility
Brand

Part Worth Utility
Price

Part worth Utility
Wash Capacity

Part Worth Utility
Colour

Part Worth Utility
Shape

In the above figure, the part worth utilities for different attributes and their respective levels have been shown along the common Y-axis. As a result, the part worth utilities become comparable within as well as across different attributes: This way we can understand the trade-offs that the consumers make.

The part worth utilities can now be added to determine the total utility for each of the possible product concepts. This allows us to scan the consumer preference pattern for all of the 288 product concepts although he has been exposed to only 16 of them. We can now also rank all of these 288 product concepts.

7   Conjoint Analysis applications

Calculation of the part worth utilities becomes just the starting point for many interesting applications of conjoint analysis: The important ones among them are described next:

i   Optimum Product Design: Since all possible product concepts can be compared after adding their respective attribute levels part worth utilities, it is possible to determine the demand for different products out of any given set of available products in the marketplace. The demand levels can be converted into profit figures as cost of producing and marketing can also be calculated. These cost calculations are possible as the volume of operations and the features of the products are now known. Thus, the optimum product can be chosen from the profits point of view (or any of the other given management's objective). Customers differential rates of purchase of products are also duly considered at this stage.

Quite often, a manager may like to know the effects of slight change in any of the attribute by his own company or the competitor's. Conjoint Analysis allows this kind of "What if' analysis very easily with the data base of part worth utilities. In fact, different kinds of scenarios can be simulated and the manager can optimise not only the product but other aspects of his marketing strategy. Similarly, whenever there is any change in competitor's actions or in the environment a fresh scenario can be-drawn for simulation. Of course, the simulation shall be limited to the attributes considered in the analysis. This feature does also help in increasing the shelf life of the conjoint analysis output:

ii   Market segmentation: Since the Conjoint Analysis is done at the individual customer level, the individual customer's identity can be retained throughout the analysis. Thus, consumers can be segmented according to their sensitivities to different product attributes.

It is also possible to identify the customers segments which would be attracted most for the proposed product position. This helps in having a focussed matching between the chosen product position and the target customer segment. It can also help in identifying that part of competitor's market which needs to be. poached for snatching market share from them. Similarly, the same type of analysis can be done to identify the most vulnerable section of one's own market segment.

Sometimes, an additional product offer appears to be quite attractive. But, this may be at the cost of cannibalisation. Conjoint Analysis can help in estimating the effects of cannibalisation as well. Thus, it helps in maximising net profits of the organisation.

iii   SWOT Analysis: First of all, the part worth utility of the brand itself can tell about the relative brand strength. Similarly by looking at the other features of one's own and competitor's offers Conjoint Analysis enables the marketers to conduct his detailed SWOT analysis.

iv   **Estimating Customer Level Brand Equity:** Conjoint Analysis is a good Conjoint Analysis bridge between the consumer level perceptions and the financial worth of the offers. This can be used for estimating the important parameter of brand equity at the consumers level. There is scope of differentiating the "Loyal", "Acceptors" and "Switchers" for more accurate calculations of brand equity.

13.4   SUMMARY

In this unit we have discussed about Conjoint Analysis, which is a multivariate analysis technique introduced to the marketers in 1970's. Conjoint Analysis is basically a data decompositional technique which tries to plot the output data on the joint space of the importance of each attribute. The important point to note is that the consumer is not asked to assign scores to different attribute separately. The main steps involved in using conjoint analysis include determination of the salient attributes for the given product from the points of view of the consumer, assigning a set of discrete levels or a range of continuous values to each of the attributes, utilising Traction factorial design of experiment for designing the stimuli for experiment, physically designing the stimuli, data collection, conjoint analysis and determination of part worth utilities. The possible application, of conjoint analysis include product design, market segmentation, swot analysis etc.

13.5   SELF-ASSESSMENT EXERCISES

1.   Define conjoint analysis and state its potientail applications.

2.   Describe some marketing research problems that you feel may be amenable to conjoint analysis and explain how you would use conjoint analysis in these situation.

3.   What are the steps involved in conjoint analysis? Explain with the help of examples.

13.6   FURTHER READINGS

Green, Paul E., Tull, S. and Albaum, G - *"Research for Marketing Decisions",* PHI, N.Delhi.

Parasuraman, A. - "Marketing Research", *Addision-Wesley Publishing Company, U.S.A.*