BUSINESS RESEARCH METHODS

UNIT 3

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MEASUREMENT

Measurement is the process of observing and recording the observations that are collected as part of research. The recording of the observations may be in terms of numbers or other symbols to characteristics of objects according to certain prescribed rules. The respondent's, characteristics are feelings, attitudes, opinions etc. Measurement is a systematic way of assigning numbers or names to objects and their attributes. It is easy to assign numbers in respect of properties of some objects, properties like weight, height. For example, you may assign '1' for Male and '2' for Female respondents. In response to a question on whether he/she is using the ATM provided by a particular bank branch, the respondent may say 'yes' or 'no'. You may wish to assign the number '1' for the response yes and '2' for the response no.

We assign numbers to these characteristics for two reasons.

- First, the numbers facilitate further statistical analysis of data obtained.
- Second, numbers facilitate the communication of measurement rules and results.

The most important aspect of measurement is the specification of rules for assigning numbers to characteristics. The rules for assigning numbers should be standardised and applied uniformly. This must not change over time or objects.

The term scale of measurement is derived from two keywords in statistics, namely; measurement and scale. Measurement is the process of recording observations collected as part of the research. Scaling, on the other hand, is the assignment of objects to numbers or semantics. These two words merged together refer to the relationship among the assigned objects and the recorded observations.

SCALING

Scaling is the procedure of measuring and assigning the objects to the numbers according to the specified rules. In other words, the process of locating the measured objects on the continuum, a continuous sequence of numbers to which the objects are assigned is called as scaling. Scaling technique is a method of placing respondents in continuation of gradual change

in the pre-assigned values, symbols or numbers based on the features of a particular object as per the defined rules. All the scaling techniques are based on four pillars, i.e., order, description, distance and origin. The marketing research is highly dependable upon the scaling techniques, without which no market analysis can be performed.

Scaling Techniques

- **Rating Scale:** It means measuring an attribute by judgement in a continuum. For eg. Students are rated by their teachers. In rating three elements are taken into consideration namely judges, continuum and subjects. Judges must be impartial. Continuum must accommodate the attributes realistically. Subjects should be amenable to rating. Rating scales are generally used for measuring the attitudes and the intensity of attitudes.
- **Ranking Scales:** Ranking scales are identical to rating scales. In ranking scales, we make relative the score will place judgements against other similar objects. There are two generally used approaches of ranking scales namely.

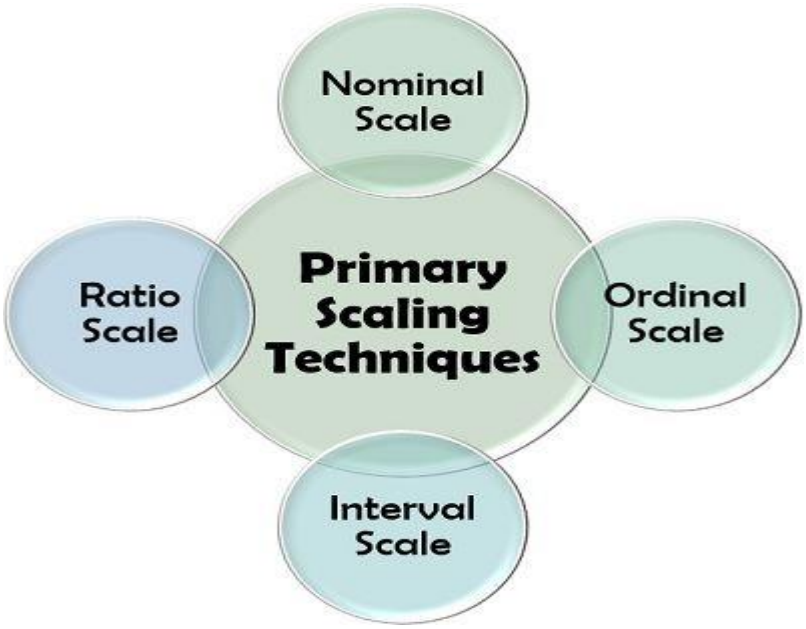
    1. Method of Paired Comparison where the respondent can express his attitude by making a choice between two objects.
    2. Method of Ranking Order where the respondents are asked to rank their choices.

- **Attitude Scales:** In this type of scale, the attitude of an individual towards a matter can be known from the score of his responses given on a questionnaire. The score will place him in a scale. He simply expresses his likes or dislikes, agreement or disagreement with the issue involved as given in the forms of questions. On the basis of reply, he is assigned a score which indicates his position. In the attitude scale some relevant statements are to be considered by the respondents. The statements are found in such a way as to be intimately related to the attribute which is sought to be measured.
- **Factor Scaling:** This is a type of scaling in which multi dimensions of a complex attitude is identified.

Types of Scaling Techniques

The researchers have identified many scaling techniques; today, we will discuss some of the most common scales used by business organizations, researchers, economists, experts, etc. These techniques can be classified as primary scaling techniques and other scaling techniques.

Primary Scaling Techniques



NOMINAL SCALE

Nominal scales are adopted for non-quantitative (containing no numerical implication) labelling variables which are unique and different from one another.

Types of Nominal Scales:

1. **Dichotomous**: A nominal scale that has only two labels is called 'dichotomous'; *f*or example, Yes/No.
2. **Nominal with Order**: The labels on a nominal scale arranged in an ascending or descending order is termed as 'nominal with order'; for example, Excellent, Good, Average, Poor, Worst.
3. **Nominal without Order**: Such nominal scale which has no sequence, is called 'nominal without order'; for example, Black, White.

ORDINAL SCALE

The ordinal scale functions on the concept of the relative position of the objects or labels based on the individual's choice or preference. For example, At Amazon.in, every product has a customer review section where the buyers rate the listed product according to their buying experience, product features, quality, usage, etc.

The ratings so provided are as follows:

- 5 Star – Excellent
- 4 Star – Good
- 3 Star – Average
- 2 Star – Poor
- 1 Star – Worst

INTERVAL SCALE

An interval scale is also called a cardinal scale which is the numerical labelling with the same difference among the consecutive measurement units. With the help of this scaling technique, researchers can obtain a better comparison between the objects. For example; A survey conducted by an automobile company to know the number of vehicles owned by the people living in a particular area who can be its prospective customers in future. It adopted the interval scaling technique for the purpose and provided the units as 1, 2, 3, 4, 5, 6 to select from. In the scale mentioned above, every unit has the same difference, i.e., 1, whether it is between 2 and 3 or between 4 and 5.

RATIO SCALE

One of the most superior measurement technique is the ratio scale. Similar to an interval scale, a ratio scale is an abstract number system. It allows measurement at proper intervals, order, categorization and distance, with an added property of originating from a fixed zero point. Here, the comparison can be made in terms of the acquired ratio. For example, A health product manufacturing company surveyed to identify the level of obesity in a particular locality. It released the following survey questionnaire:

Select a category to which your weight belongs to:

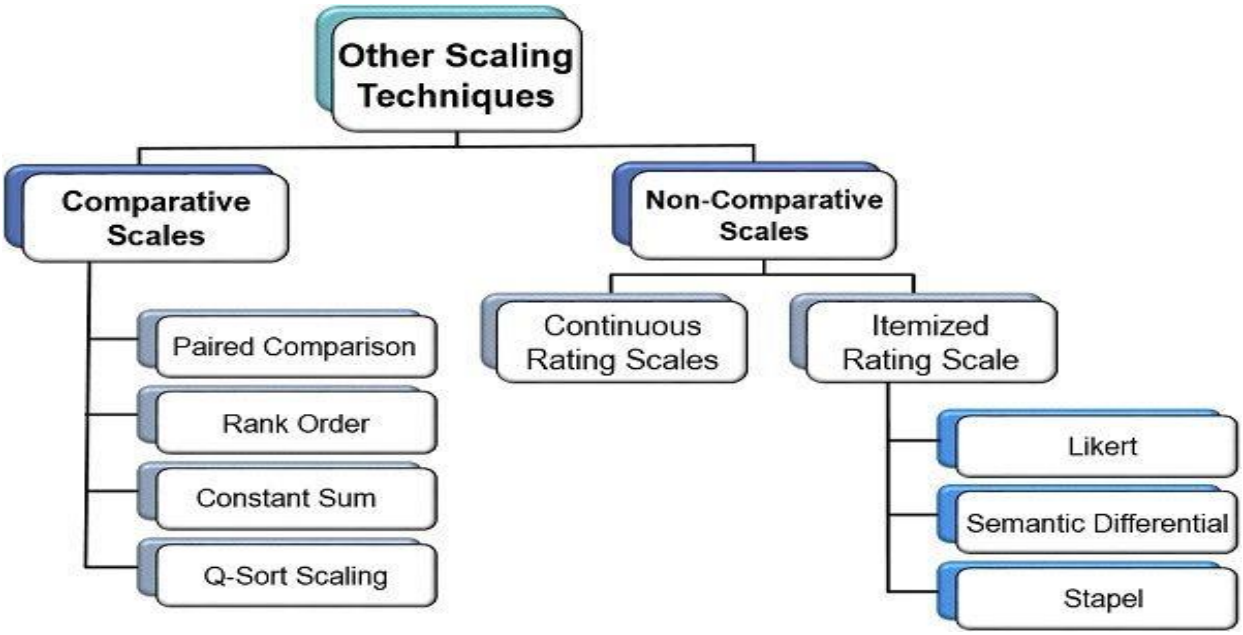
- Less than 40 kilograms
- 40-59 Kilograms
- 60-79 Kilograms
- 80-99 Kilograms
- 100-119 Kilograms
- 120 Kilograms and more

The following table will better clarify the difference between all the four primary scaling techniques:

PARTICULAR	NOMINAL SCALE	ORDINAL SCALE	INTERVAL SCALE	RATIO SCALE
Characteristics	Description	Order	Distance	Description, Order, Distance and Origin
Sequential Arrangement	Not Applicable	Applicable	Applicable	Applicable
Fixed Zero Point	Not Applicable	Not Applicable	Not Applicable	Applicable
Multiplication and Division	Not Applicable	Not Applicable	Not Applicable	Applicable
Addition and Subtraction	Not Applicable	Not Applicable	Applicable	Applicable
Difference between Variables	Non-Measurable	Non-Measurable	Measurable	Measurable
Mean	Not Applicable	Not Applicable	Applicable	Applicable
Median	Not Applicable	Applicable	Applicable	Applicable
Mode	Applicable	Applicable	Applicable	Applicable

Other Scaling Techniques

Scaling of objects can be used for a comparative study between more than one objects (products, services, brands, events, etc.). Or can be individually carried out to understand the consumer's behaviour and response towards a particular object. Following are the two categories under which other scaling techniques are placed based on their comparability:



A. Comparative Scales

For comparing two or more variables, a comparative scale is used by the respondents. Following are the different types of comparative scaling techniques:

Paired Comparison

A paired comparison symbolizes two variables from which the respondent needs to select one. This technique is mainly used at the time of product testing, to facilitate the consumers with a comparative analysis of the two major products in the market. To compare more than two objects say comparing P, Q and R, one can first compare P with Q and then the superior one (i.e., one with a higher percentage) with R.

For example, A market survey was conducted to find out consumer's preference for the network service provider brands, A and B. The outcome of the survey was as follows:
Brand 'A' = 57%
Brand 'B' = 43%
Thus, it is visible that the consumers prefer brand 'A', over brand 'B'.

Rank Order

In rank order scaling the respondent needs to rank or arrange the given objects according to his or her preference. For example, A soap manufacturing company conducted a rank order scaling

to find out the orderly preference of the consumers. It asked the respondents to rank the following brands in the sequence of their choice:

SOAP BRANDS	RANK
Brand V	4
Brand X	2
Brand Y	1
Brand Z	3

The above scaling shows that soap ‘Y’ is the most preferred brand, followed by soap ‘X’, then soap ‘Z’ and the least preferred one is the soap ‘V’.

Constant Sum

It is a scaling technique where a continual sum of units like dollars, points, chits, chips, etc. is given to the features, attributes and importance of a particular product or service by the respondents. For example, The respondents belonging to 3 different segments were asked to allocate 50 points to the following attributes of a cosmetic product ‘P’:

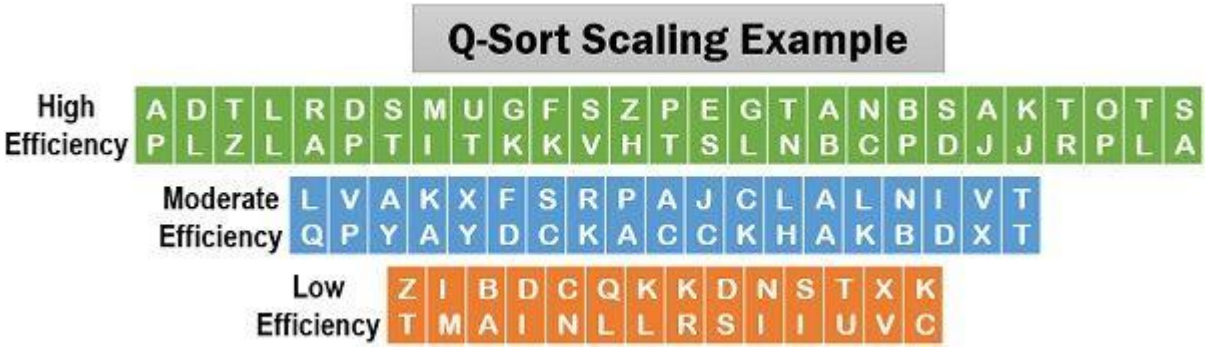
ATTRIBUTES	SEGMENT 1	SEGMENT 2	SEGMENT 3
Finish	11	8	9
Skin Friendly	11	12	12
Fragrance	7	11	8
Packaging	9	8	10
Price	12	11	11

From the above constant sum scaling analysis, we can see that:

- Segment 1 considers product ‘P’ due to its competitive price as a major factor.
- But segment 2 and segment 3, prefers the product because it is skin-friendly.

Q-Sort Scaling

Q-sort scaling is a technique used for sorting the most appropriate objects out of a large number of given variables. It emphasizes on the ranking of the given objects in a descending order to form similar piles based on specific attributes. It is suitable in the case where the number of objects is not less than 60 and more than 140, the most appropriate of all ranging between 60 to 90. For example, The marketing manager of a garment manufacturing company sorts the most efficient marketing executives based on their past performance, sales revenue generation, dedication and growth. The Q-sort scaling was performed on 60 executives, and the marketing head creates three piles based on their efficiency as follows:



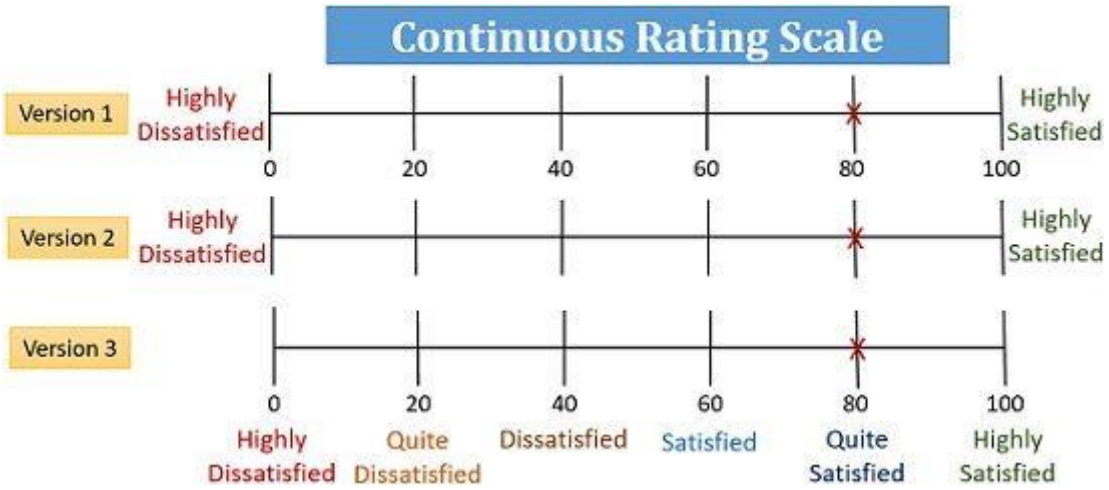
In the above diagram, the initials of the employees are used to denote their names.

B. Non-Comparative Scales

A non-comparative scale is used to analyse the performance of an individual product or object on different parameters. Following are some of its most common types:

Continuous Rating Scales

It is a graphical rating scale where the respondents are free to place the object at a position of their choice. It is done by selecting and marking a point along the vertical or horizontal line which ranges between two extreme criteria. For example, A mattress manufacturing company used a continuous rating scale to find out the level of customer satisfaction for its new comfy bedding. The response can be taken in the following different ways:



The above diagram shows a non-comparative analysis of one particular product, i.e. comfy bedding. Thus, making it very clear that the customers are quite satisfied with the product and its features.

Itemized Rating Scale

Itemized scale is another essential technique under the non-comparative scales. It emphasizes on choosing a particular category among the various given categories by the respondents. Each class is briefly defined by the researchers to facilitate such selection.

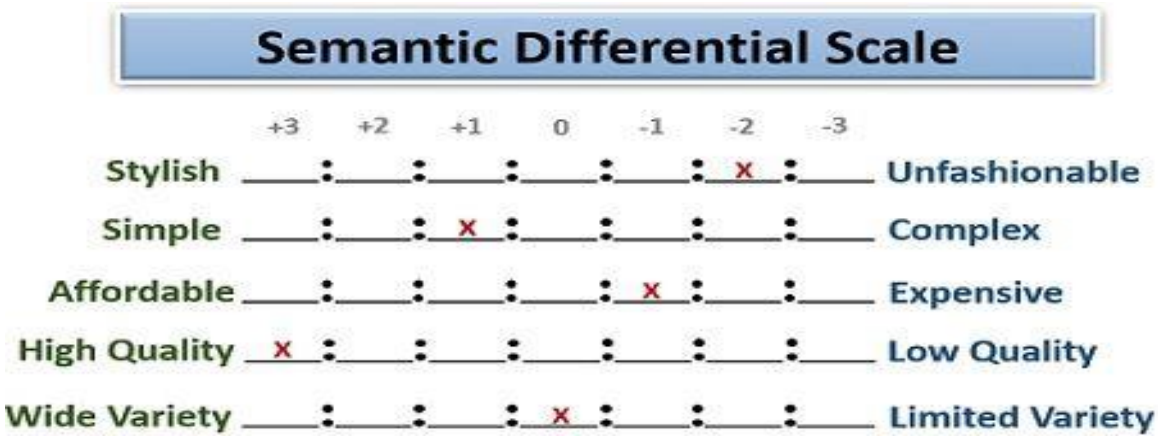
The three most commonly used itemized rating scales are as follows:

- **Likert Scale**: In the Likert scale, the researcher provides some statements and ask the respondents to mark their level of agreement or disagreement over these statements by selecting any one of the options from the five given alternatives. For example, a shoes manufacturing company adopted the Likert scale technique for its new sports shoe range named Z sports shoes. The purpose is to know the agreement or disagreement of the respondents. For this, the researcher asked the respondents to circle a number representing the most suitable answer according to them, in the following representation:
    - 1 – Strongly Disagree
    - 2 – Disagree
    - 3 – Neither Agree Nor Disagree
    - 4 – Agree
    - 5 – Strongly Agree

STATEMENT	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
Z sports shoes are very light weight	1	2	3	4	5
Z sports shoes are extremely comfortable	1	2	3	4	5
Z sports shoes look too trendy	1	2	3	4	5
I will definitely recommend Z sports shoes to friends, family and colleagues	1	2	3	4	5

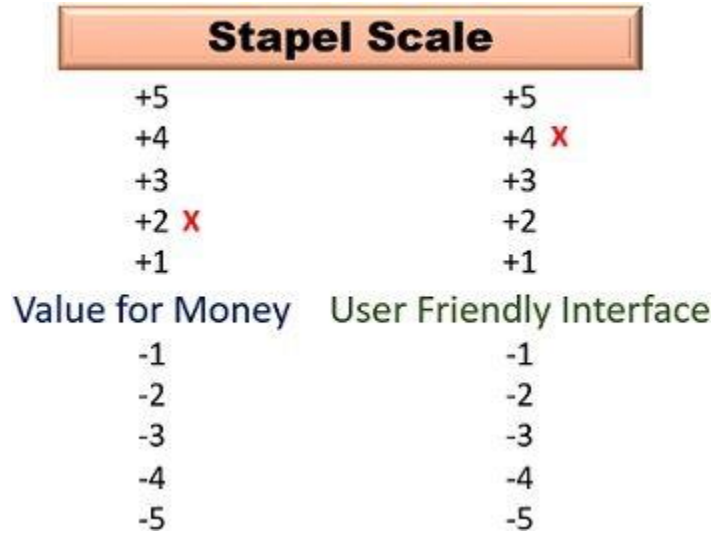
The above illustration will help the company to understand what the customers think about its products. Also, whether there is any need for improvement or not.

- **Semantic Differential Scale**: A bi-polar seven-point non-comparative rating scale is where the respondent can mark on any of the seven points for each given attribute of the object as per personal choice. Thus, depicting the respondent's attitude or perception towards the object. For example, A well-known brand for watches, carried out semantic differential scaling to understand the customer's attitude towards its product. The pictorial representation of this technique is as follows:



From the above diagram, we can analyze that the customer finds the product of superior quality; however, the brand needs to focus more on the styling of its watches.

- **Stapel Scale**: A Stapel scale is that itemized rating scale which measures the response, perception or attitude of the respondents for a particular object through a unipolar rating. The range of a Stapel scale is between -5 to +5 eliminating 0, thus confining to 10 units. For example, A tours and travel company asked the respondent to rank their holiday package in terms of value for money and user-friendly interface as follows:



With the help of the above scale, we can say that the company needs to improve its package in terms of value for money. However, the decisive point is that the interface is quite user-friendly for the customers.

DATA ANALYSIS

Data analysis is defined as a process of cleaning, transforming, and modelling data to discover useful information for business decision-making. The purpose of Data Analysis is to extract useful information from data and taking the decision based upon the data analysis. A simple example of Data analysis is whenever we take any decision in our day-to-day life is by thinking about what happened last time or what will happen by choosing that particular decision. This is nothing but analyzing our past or future and making decisions based on it. For that, we gather memories of our past or dreams of our future. So that is nothing but data analysis. Now same thing analyst does for business purposes, is called Data Analysis.

Types of Data Analysis: Techniques and Methods

There are several types of Data Analysis techniques that exist based on business and technology. However, the major Data Analysis methods are:

Text Analysis

Text Analysis is also referred to as Data Mining. It is one of the methods of data analysis to discover a pattern in large data sets using databases or data mining tools. It used to transform raw data into business information. Business Intelligence tools are present in the market which is used to take strategic business decisions. Overall it offers a way to extract and examine data and deriving patterns and finally interpretation of the data.

Statistical Analysis

Statistical Analysis shows "What happen?" by using past data in the form of dashboards. Statistical Analysis includes collection, Analysis, interpretation, presentation, and modelling of data. It analyses a set of data or a sample of data.

There are two categories of this type of Analysis – Descriptive Analysis and Inferential Analysis.

- **Descriptive Analysis:** analyses complete data or a sample of summarized numerical data. It shows mean and deviation for continuous data whereas percentage and frequency for categorical data.
- **Inferential Analysis:** analyses sample from complete data. In this type of Analysis, you can find different conclusions from the same data by selecting different samples.

Diagnostic Analysis

Diagnostic Analysis shows "Why did it happen?" by finding the cause from the insight found in Statistical Analysis. This Analysis is useful to identify behaviour patterns of data. If a new problem arrives in your business process, then you can look into this Analysis to find similar patterns of that problem. And it may have chances to use similar prescriptions for the new problems.

Predictive Analysis

Predictive Analysis shows "what is likely to happen" by using previous data. The simplest data analysis example is like if last year I bought two dresses based on my savings and if this year my salary is increasing double then I can buy four dresses. But of course it's not easy like this because you have to think about other circumstances like chances of prices of clothes is increased this year or maybe instead of dresses you want to buy a new bike, or you need to buy a house! So here, this Analysis makes predictions about future outcomes based on current or past data. Forecasting is just an estimate. Its accuracy is based on how much detailed information you have and how much you dig in it.

Prescriptive Analysis

Prescriptive Analysis combines the insight from all previous Analysis to determine which action to take in a current problem or decision. Most data-driven companies are utilizing Prescriptive Analysis because predictive and descriptive Analysis are not enough to improve data performance. Based on current situations and problems, they analyze the data and make decisions.

DATA ANALYSIS PROCESS

The **Data Analysis Process** is nothing but gathering information by using a proper application or tool which allows you to explore the data and find a pattern in it. Based on that information and data, you can make decisions, or you can get ultimate conclusions.

Data Analysis consists of the following phases:

1. Data Requirement Gathering

First of all, you have to think about why do you want to do this data analysis? All you need to find out the purpose or aim of doing the Analysis of data. You have to decide which type of data analysis you wanted to do! In this phase, you have to decide what to analyze and how to measure it, you have to understand why you are investigating and what measures you have to use to do this Analysis.

2. Data Collection

After requirement gathering, you will get a clear idea about what things you have to measure and what should be your findings. Now it's time to collect your data based on requirements. Once you collect your data, remember that the collected data must be processed or organized for Analysis. As you collected data from various sources, you must have to keep a log with a collection date and source of the data.

3. Data Cleaning

Now whatever data is collected may not be useful or irrelevant to your aim of Analysis, hence it should be cleaned. The data which is collected may contain duplicate records, white spaces or errors. The data should be cleaned and error free. This phase must be done before Analysis because based on data cleaning, your output of Analysis will be closer to your expected outcome.

4. Data Analysis

Once the data is collected, cleaned, and processed, it is ready for Analysis. As you manipulate data, you may find you have the exact information you need, or you might need to collect more

data. During this phase, you can use data analysis tools and software which will help you to understand, interpret, and derive conclusions based on the requirements.

5. Data Interpretation

After analyzing your data, it's finally time to interpret your results. You can choose the way to express or communicate your data analysis either you can use simply in words or maybe a table or chart. Then use the results of your data analysis process to decide your best course of action.

6. Data Visualization

Data visualization is very common in your day to day life; they often appear in the form of charts and graphs. In other words, data shown graphically so that it will be easier for the human brain to understand and process it. Data visualization often used to discover unknown facts and trends. By observing relationships and comparing datasets, you can find a way to find out meaningful information.

EDITING

"Editing is a step where by researchers eliminate errors or points of confusion in the raw data". "Editing detects the errors, correct them when possible and certifies that minimum data quality standards have been achieved".

Objectives of Editing

The purpose of editing is to guarantee that the data are-

1. Accurate
2. Complete
3. Uniformly entered
4. Consistent with intent of questions
5. Arranged to simplify coding and tabulation.

Need for Editing

1. Parts of the questionnaire may be incomplete
2. The pattern of responses may indicate that the respondent did not understood or follow the instructions
3. The responses show little variance
4. One or more pages are missing
5. The questionnaire is answered by someone who does not qualify for participation

CODING

"Coding means assigning a code, usually a number, to each possible response to each question. "Coding involves assigning numbers or other symbols to answer so the responses can be grouped in to a limited number of classes or categories". Example 1 Male 2 Female

Rules of Coding

1. Appropriateness- categories should be appropriate to research problem and objectives.

2. Exhaustiveness- there should be a class for every data item. The researcher often uses "other" option.

3. Mutually exclusivity- specific answers should be placed in one and only one category. Ex- In an occupation survey non-mutually exclusive classification may be-

a) Professional

b) Managerial

c) Sales

d) Clerical

e) Craft

f) Operative

g) Unemployed

Coding close-ended questions

• Dichotomous or multiple choice questions have response category.

• While coding such questions numerical codes are provided to each response category. Response category Codes Yes 1 Male 1 Do not know 2 Female 2 No 3 14 Dr. Amitabh Mishra

Coding open-ended questions

• Researcher should review each open question and establish meaning full category. Ex- How many cup of coffee/ tea you drink in a day? If respondents answered Response category Code More than 5 cups/day Heavy consumer 1 Between 2-5 cups/day Moderate consumer 2 Less than 2 cups/ day Light consumer 3 O cups/day Non consumer 4 15 Dr. Amitabh Mishra

TABULATION OF DATA

"A table is a systematic arrangement of statistical data in column and rows".

"Tabulation is a process whereby raw data on completed questionnaire are transformed in to the "list of needed information".

The purpose of table is to simplify the presentation and facilitate comparison.

Significance of Tabulation

1. It simplifies the complex data

2. It facilitates comparison
3. It gives identity to the data
4. It reveals pattern

Parts of Table

1. Table number
2. Title of table
3. Caption
4. Stub
5. Body of table
6. Head notes
7. Foot notes

Types of Tabulation

Univariate Tabulation

- "Uni-variate tabulation counts one questions answer"
- Such a tabulation results in frequency distribution of answers. As- – No. of people who answered in first response category – No. of people who answered in first

Bi-variate Tabulation or Multivariate tabulation

- In Bi-variate Tabulation or Multivariate tabulation the researcher simultaneously tabulate the responses of two or more questions.

EXAMPLE

1. What is your gender? a) Male b) Female

2. How often you use credit cards when purchasing PIZZA at Dominos. a) Regularly b) Occasionally c) Never

Uses of credit cards for purchase of Dominos Pizza Usages rate Male Female Number Percent (%) Number Percent (%) Regularly 20 10 100 50 Occasionally 60 30 80 40 Never 120 60 20 10 Total 200 100% 200 100%

CROSS TABULATIONS

Cross tabulation is a method to quantitatively analyze the relationship between multiple variables. Also known as contingency tables or cross tabs, cross tabulation groups variables to understand the correlation between different variables. It also shows how correlations change from one variable grouping to another. It is usually used in statistical analysis to find patterns, trends, and probabilities within raw data.

Understanding cross-tabulation with example

Cross-tab is a popular choice for statistical data analysis. Since it is a reporting/ analyzing tool, it can be used with any data level: ordinal or nominal. It treats all data as nominal data (nominal data is not measured. It is categorized). For example, you can analyze the relation between two categorical variables like age and purchase of electronic gadgets.

There are two questions asked here:

- What is your age?
- What electronic gadget are you likely to buy in the next six months?

Age	Laptop	Phone	Tablet	Digital Camera
20-25	38%	29%	31%	12%
25-30	19%	15%	24%	17%
30-35	23%	19%	11%	27%
35-40	19%	12%	9%	30%
above 40	12%	17%	5%	31%

You can see the distinctive connection between age and the purchase of electronic gadgets in this example. It is not surprising but exciting to see the correlation between the two variables through the data collected. In survey research, crosstab allows us to deep dive and analyze the prospective data, making it simpler to spot trends and opportunities without getting overwhelmed with all the data gathered from the responses.

RELIABILITY AND VALIDITY

Reliability and validity are concepts used to evaluate the quality of research. They indicate how well a method, technique or test measures something. Reliability is about the consistency of a measure, and validity is about the accuracy of a measure. It's important to consider reliability and validity when you are creating your research design, planning your methods, and writing up your results, especially in quantitative research.

Reliability vs validity		
	Reliability	**Validity**
What does it tell you?	The extent to which the results can be reproduced when the research is repeated under the same conditions.	The extent to which the results really measure what they are supposed to measure.

Reliability vs validity		
	Reliability	**Validity**
How is it assessed?	By checking the consistency of results across time, across different observers, and across parts of the test itself.	By checking how well the results correspond to established theories and other measures of the same concept.
How do they relate?	A reliable measurement is not always valid: the results might be reproducible, but they're not necessarily correct.	A valid measurement is generally reliable: if a test produces accurate results, they should be reproducible.

What is reliability?

Reliability refers to how consistently a method measures something. If the same result can be consistently achieved by using the same methods under the same circumstances, the measurement is considered reliable.

What is validity?

Validity refers to how accurately a method measures what it is intended to measure. If research has high validity that means it produces results that correspond to real properties, characteristics, and variations in the physical or social world. High reliability is one indicator that a measurement is valid. If a method is not reliable, it probably isn't valid.

How are reliability and validity assessed?

Reliability can be estimated by comparing different versions of the same measurement. Validity is harder to assess, but it can be estimated by comparing the results to other relevant data or theory. Methods of estimating reliability and validity are usually split up into different types.

Types of reliability

Different types of reliability can be estimated through various statistical methods.

Types of reliability		
Type of reliability	**What does it assess?**	**Example**
Test-retest	The consistency of a measure across time: do you get the same results when you repeat the measurement?	A group of participants complete a questionnaire designed to measure personality traits. If they repeat the questionnaire days, weeks or months apart and give the same answers, this indicates high test-retest reliability.
Interrater	The consistency of a measure across raters or observers: do you get the same results when different people conduct the same measurement?	Based on an assessment criteria checklist, five examiners submit substantially different results for the same student project. This indicates that the assessment checklist has low inter-rater reliability (for example, because the criteria are too subjective).
Internal consistency	The consistency of the measurement itself: do you get the same results from different parts of a test that are designed to measure the same thing?	You design a questionnaire to measure self-esteem. If you randomly split the results into two halves, there should be a strong correlation between the two sets of results. If the two results are very different, this indicates low internal consistency.

Types of validity

The validity of a measurement can be estimated based on three main types of evidence. Each type can be evaluated through expert judgement or statistical methods.

Types of validity		
Type of validity	**What does it assess?**	**Example**
Construct	The adherence of a measure to existing theory and knowledge of the concept being measured.	A self-esteem questionnaire could be assessed by measuring other traits known or assumed to be related to the concept of self-esteem (such as social skills and optimism). Strong correlation between the scores for self-esteem and associated traits would indicate high construct validity.
Content	The extent to which the measurement covers all aspects of the concept being measured.	A test that aims to measure a class of students' level of Spanish contains reading, writing and speaking components, but no listening component. Experts agree that listening comprehension is an essential aspect of language ability, so the test lacks content validity for measuring the overall level of ability in Spanish.
Criterion	The extent to which the result of a measure corresponds to other valid measures of the same concept.	A survey is conducted to measure the political opinions of voters in a region. If the results accurately predict the later outcome of an election in that region, this indicates that the survey has high criterion validity.