BRM UNIT 3
Measurement & Data

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3.1 Concept of Measurement: what is measured? Problems in measurement in management research - Validity and Reliability. Levels of measurement - Nominal, Ordinal, Interval, Ratio.


3.3 Types of Data - Secondary Data: Definition, Sources, Characteristics, Searching World Wide Web for data, Issues to be considered for secondary data, sufficiency, adequacy, reliability, consistency.

3.4 Types of Data - Primary Data: Definition, Advantages and disadvantages over secondary data,

3.5 Questionnaire Method: Questionnaire Construction - Personal Interviews, Telephonic survey Interviewing, Email/Internet survey, online survey sites, their utility, constraints
Concept of Measurement

- Measurement is the assignment of a number to a characteristic of an object or event, which can be compared with other objects or events.

**Definition by Kerlinger:** “Measurement is the assignment of numerical to objects or events according to the rules”.

**Problems in measurement in management research**

- Measurement should be precise and unambiguous in an ideal research study.
<table>
<thead>
<tr>
<th>Problems</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondent</td>
<td>At times the respondent may be reluctant to express strong negative feelings or it is just possible that he may have very little knowledge but may not admit his ignorance.</td>
</tr>
<tr>
<td>Situation</td>
<td>Situational factors may also come in the way of correct measurement. Any condition which places a strain on interview can have serious effects on the interviewer-respondent rapport.</td>
</tr>
<tr>
<td>Problems</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Measurer</td>
<td>The interviewer can distort responses by rewording or reordering questions. His behavior, style and looks may encourage or discourage certain replies from respondents. Careless mechanical processing may distort the findings.</td>
</tr>
<tr>
<td>Instrument</td>
<td>Error may arise because of the defective measuring instrument. The use of complex words, beyond the comprehension of the respondent, ambiguous meanings, poor printing, inadequate space for replies, response choice omissions, etc. are a few things that make the measuring instrument defective and may result in measurement errors. Another type of instrument deficiency is the poor sampling of the universe of items of concern.</td>
</tr>
</tbody>
</table>
Reliability

- Reliability is the overall consistency of a measure.
- A measure is said to have a high reliability if it produces similar results under consistent conditions.
- It is the characteristic of a set of test scores that relates to the amount of random error from the measurement process that might be embedded in the scores.
- Scores that are highly reliable are accurate, reproducible, and consistent from one testing occasion to another.
- That is, if the testing process were repeated with a group of test takers, essentially the same results would be obtained.
- Various kinds of reliability coefficients, with values ranging between 0.00 (much error) and 1.00 (no error), are usually used to indicate the amount of error in the scores.
- For example, measurements of people's height and weight are often extremely reliable
Validity

Validity is the extent to which a concept, conclusion or measurement is well-founded and corresponds accurately to the real world.

The validity of a measurement tool (for example, a test in education) is considered to be the degree to which the tool measures what it claims to measure; in this case, the validity is an equivalent to accuracy.

Validity is important because it can help determine what types of tests to use, and help to make sure researchers are using methods that are not only ethical, and cost-effective, but also a method that truly measures the idea or construct in question.
Levels of Measurement

- It is a classification that describes the nature of information within the numbers assigned to variables. The classification with four levels, or scales, of measurement: Nominal, Ordinal, Interval, Ratio
Levels of Measurement

- Nominal
- Ordinal
- Interval
- Ratio
Nominal Scale

- The nominal type differentiates between items or subjects based only on their names or categories and other qualitative classifications they belong to; thus dichotomous data involves the construction of classification as well as the classification of items.
- From the Statistical point of view it is the lowest measurement level. Nominal Scale is assigned to items that is divided into categories without having any order or structure.
Nominal Scale

- Example: What is your favorite color?
  Red 2) Blue 3) Orange 4) Green 5) Yellow

- Colors do not have any assigned order; we could number them 1 to 5 or 5 - 1 or number them in a mix, here the numbers are assigned to color just for the purpose of identification, and ordering them Ascending or Descending doesn’t mean that Colors have an Order.

- The number gives us the identity of the category assigned. The only mathematical operation we can perform with nominal data is to count.

- Another example from research activities is a YES/NO scale, which is nominal. It has no order and there is no distance between YES and NO.
Ordinal Scale

- Ordinal Scale variables have the property of Identity and Magnitude.
- The numbers represent a quality being measured (identity) and can tell us whether a case has more of the quality measured or less of the quality measured than another case (magnitude). The distance between scale points is not equal. Ranked preferences are presented as an example of ordinal scales encountered in everyday life.
- Example: Swimmers at the end of the race at the position 1, 2 and 3.
Ordinal Scale

Not these are rank and the time distance between 1 and 2 may well not be the same as between 2 and 3, so the distance between points is not the same but there is an order present, when responses have an order but the distance between the response is not necessarily same, the items are regarded or put into the Ordinal Scale.

Therefore an ordinal scale lets the researcher interpret gross order and not the relative positional distances.

Example: Option form filling for MBA admissions, where student give preference to the institutes like 1,2,3… and so on.
Interval Scale

- The interval type allows for the *degree of difference* between items, but not the ratio between them.

- A normal survey rating scale is an interval scale for instance when asked to rate satisfaction with a training on a 5 point scale, from Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree, an interval scale is being used.
Interval Scale

- It is an interval scale because it is assumed to have equal distance between each of the scale elements i.e. the Magnitude between Strongly Agree and Agree is assumed to be the same as Agree and Strongly Agree.

- This means that we can interpret differences in the distance along the scale. We contrast this to an ordinal scale where we can only talk about differences in order, not differences in the degree of order i.e. the distance between responses.
A Ratio Scale is at the top level of Measurement. The factor which clearly defines a ratio scale is that it has a true zero point. The simplest example of a ratio scale is the measurement of length (disregarding any philosophical points about defining how we can identify zero length) or money.

Having zero length or zero money means that there is no length and no money but zero temperature is not an absolute zero, as it certainly has its effect.

Ratio scales of measurement have all of the properties of the abstract number system.
<table>
<thead>
<tr>
<th>Incremental Progress</th>
<th>Measure Property</th>
<th>Mathematical Operators</th>
<th>Advanced Operations</th>
<th>Central Tendency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nominal</strong></td>
<td>Classification, Membership</td>
<td>=, !=</td>
<td>Grouping</td>
<td>Mode</td>
</tr>
<tr>
<td><strong>Ordinal</strong></td>
<td>Comparison, Level</td>
<td>&gt;, &lt;</td>
<td>Sorting</td>
<td>Median</td>
</tr>
<tr>
<td><strong>Interval</strong></td>
<td>Difference, Affinity</td>
<td>+, -</td>
<td>Yardstick</td>
<td>Mean, Deviation</td>
</tr>
<tr>
<td><strong>Ratio</strong></td>
<td>Magnitude, Amount</td>
<td>*, /</td>
<td>Ratio</td>
<td>Geometric Mean, Coefficient of Variation</td>
</tr>
</tbody>
</table>
Attitude Scaling Techniques

“Scaling is an extension of measurement.”

- **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.
A) Likert Scale

- A **Likert Scale** is a scale used to measure the attitude wherein the respondents are asked to indicate the level of agreement or disagreement with the statements related to the stimulus objects.

The Likert Scale was named after its developer, **Rensis Likert**.

- It is typically a five response category scale ranging from “**strongly disagree**” to “**strongly agree**”. Scale can be 1 to 3, 1 to 5 or a to 7 etc.

- The purpose of a Likert scale is to identify the attitude of people towards the given stimulus objects by asking them the extent to which they agree or disagree with them.
Examples: Likert Scale (1 to 5)

<table>
<thead>
<tr>
<th>Likert Scale</th>
<th>Not Applicable</th>
<th>Not Very Important</th>
<th>Somewhat Important</th>
<th>Important</th>
<th>Very Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Assigned</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Statement: Please rate the importance of the communication skills.

Statement: I like the BRM book by DAAS Publication.

A. Strongly agree
B. Agree
C. Neutral
D. Disagree
E. Strongly disagree
B) Semantic Differential Scales

- It has 2 poles
- Both poles show exact opposite characteristics
- Fix scale of ‘7’
- Mean is captured after response
Example

Rate the current student representative on each of the following dimensions:

-3  -2  -1  0  1  2  3

Strong: ___________________________________________ Weak

Decisive: ___________________________________________ Indecisive

Good: ___________________________________________ Bad

Intelligent: ___________________________________________ Dumb

Active: ___________________________________________ Passive

Lazy: ___________________________________________ Industrious
C) Constant Sum Scales

- Here, relative weights are assigned as per importance of the parameter.
- Total weights are 100 points
- Here equal importance of attributes can be indicated through equal weights.
- Useful for study of attitude & behavior patterns of the respondent
Example

Consider SERVQUAL gap analysis study. Weights are assigned to SERVQUAL attributes as follows:

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Importance weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangible</td>
<td>10</td>
</tr>
<tr>
<td>Reliability</td>
<td>30</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>30</td>
</tr>
<tr>
<td>Assurance</td>
<td>20</td>
</tr>
<tr>
<td>Empathy</td>
<td>10</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
D) Graphic Rating Scales

- Graphical or pictorial representation
- Respondents tick, circle or shade the appropriate response
- Less time is required to develop these scales
<table>
<thead>
<tr>
<th>Response</th>
<th>😊</th>
<th>😐</th>
<th>😞</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you satisfied with after sales services provided by this company?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are you satisfied with after quality of the product?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
E) Ranking Scales

Direct comparison between two or more attributes

- Compare A with B

If A = 70 % & B = 30%, then obviously A is better than B.

- Thus with the help of comparison, ranks are given or assign.
Example: Rank the following, Rank 1 (highest) to 4 (Lowest)

What you like most about the film?

<table>
<thead>
<tr>
<th></th>
<th>Story</th>
<th>Acting</th>
<th>Music</th>
<th>Dialogs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
F) Paired Comparison

- Ranking becomes more reliable and easier under the paired comparison method. Each worker is compared with all other employees in the group; for every trait the worker is compared with all other employees.

- Example

- There are five employees to be compared, then A's performance is compared with that of B's and decision is arrived at as to whose is the better or worse. Next, B is also compared with all others.
**Trait of comparison: ‘Quantity of work’**

<table>
<thead>
<tr>
<th>Comparison With</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>-</td>
<td></td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>C</td>
<td>+</td>
<td>-</td>
<td></td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>D</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>E</td>
<td>+</td>
<td>-</td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
Types of Data

Methods of data collection

- Secondary
- Primary
Secondary Data

Secondary data means data that was collected by someone other than the user or researcher.

Common sources of secondary data

- Census
- Information collected by government departments,
- Organizational records
- Data available on websites (official websites only)
- References books
- Periodicals and referred Journals
- Data that was originally collected for other research purposes
Characteristics of Secondary Data

- It is a summary of a book or a set of records
- Collection of Secondary data is less time consuming
- It provides a larger database of information
- The data cannot be personally checked and verified
- In some cases that data is not reliable
Issues to be considered for secondary data

Adequacy
Reliability
Consistency
Primary Data

Definition

- “Primary data is data originated for the first time by the researcher through direct efforts and experience, for the purpose of specific investigation.”
- Primary data is the data collected from a source by researcher himself/herself in a raw form.
- The data is derived from a new or original research study and collected at the source.
<table>
<thead>
<tr>
<th>Primary Data</th>
<th>Secondary Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Data is that data which is collected by the investigator or researcher himself. It is an original form of data collection</strong></td>
<td>Secondary Data refers to that data which is collected through other sources</td>
</tr>
<tr>
<td><strong>Primary data is always original as it is collected by the investigator</strong></td>
<td>Secondary data lacks originality. The investigator makes use of the data collected by other agencies</td>
</tr>
<tr>
<td><strong>Suitability of the primary data is positive because it is systematically collected</strong></td>
<td>Secondary data may or may not suit the objects of enquiry</td>
</tr>
<tr>
<td><strong>Primary data is expensive and time consuming</strong></td>
<td>Secondary data are relatively cheaper</td>
</tr>
<tr>
<td>Primary Data</td>
<td>Secondary Data</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Extra precautions are not required</td>
<td>It is used with great care and caution</td>
</tr>
<tr>
<td>Primary data is in the shape of raw material.</td>
<td>Secondary data is usually in the shape of readymade products.</td>
</tr>
<tr>
<td>Extra precautions are not required</td>
<td>Possibility of lesser degree of personal prejudice</td>
</tr>
<tr>
<td>Possibility of personal prejudice exists</td>
<td>Possibility of lesser degree of personal prejudice</td>
</tr>
<tr>
<td>Primary data is in the shape of raw material</td>
<td>Secondary data is usually in the shape of readymade products</td>
</tr>
<tr>
<td>Primary Data</td>
<td>Secondary Data</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Investigating agency collects the data</td>
<td>Some other investigating agency collects it for its own use</td>
</tr>
<tr>
<td>Requires long time for collection</td>
<td>Requires less time for collection</td>
</tr>
<tr>
<td>More reliable and suitable to the enquiry because the investigator himself collects it</td>
<td>Less reliable and suitable as someone else has done that job of collection which may not serve the purpose</td>
</tr>
<tr>
<td>Requires elaborate organization</td>
<td>Needs comparatively less funds</td>
</tr>
</tbody>
</table>
Questionnaire Method

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents.
Questionnaire Construction (Types)

- Open Ended
- Close Ended
  - Dichotomous
  - Multiple Response
  - Scales
I) Open Ended types:
1) What is your age? ______________.
2) What is your opinion about GST? ______________________________________
3) I like this hotel because ____________________________________________

Close Ended questions are further divided into following types:

II) Dichotomous type (Only 2 options for answers)
1) Are you a student?  Yes □  No □
2) Do you like travelling?  Yes □  No □
3) Access to library without I card?  Permit □  Forbid □
III) Multiple Response type

Q) Name of the department you are working:
   A. Operations
   B. Facility
   C. ERC
   D. Transport
   E. HR

Q) What is your position in the department?
   A. Trainee
   B. Supervisor
   C. Manager
   D. Senior Manager

Q) Since how long you are working with this company?
   A. Less than 1 Year
   B. 1 to 3 Years
   C. More than 3 Years
IV) Scales types (Likert Scale etc)

Q) I feel, because of training task performance will enhance.

A. Strongly agree
B. Agree
C. Neutral
D. Disagree
E. Strongly disagree

Q) How do you rate your competency in the work you perform?

A. Very High
B. High
C. Neutral
D. Low
E. Very Low
Personal Interviews

Telephonic survey

Interviewing

Email/Internet survey
Thank You