BBA-206 Marketing Research

Unit I

Introduction of Marketing Research: Define Marketing Research, Aims and Objectives of Marketing Research. Applications of Marketing Research, Marketing Information System, Evaluation and Control of Marketing Research, Value of Information in Decision Making, Steps in Marketing Research.

Research Design: Formulating the Research Problem, Choice of Research Design, Types of Research Design, Sources of Experimental Errors.

Unit II

Sample and Sampling Design: Some basic terms, Advantages and Limitation of Sampling, Sampling process, Types of Sampling, Types of Sample Designs, Determining the Sample Size, Sampling Distribution of the Mean. Scaling Techniques: The concept of Attitude, Difficulty of Attitude Measurement, Types of Scales, Applications of Scaling in Marketing Research.

Unit III

Data Collection:: Secondary Data, Sources of Secondary Data, Primary Data, Collection of Primary Data, Methods of Data Collection- Observation, Questionnaire, Designing of Questionnaire. Data Processing and Tabulation: Editing, Coding and Tabulation.

Unit IV

Data Analysis: Testing of Hypothesis, Measurement of Central Tendency, Dispersion, Univariate Analysis, Multiple Regression, Factor Analysis, Cluster Analysis, Multidimensional Scaling, Conjoint Analysis; Interpretation and Report Writing, Types of Research Reports,

BBA(206) Marketing Research

Unit 1

Introduction of Marketing research

Marketing research is "the function that links the consumers, customers, and public to the marketer through information — information used to identify and define marketing opportunities and problems; generate, refine, and evaluate marketing actions; monitor marketing performance; and improve understanding of marketing as a process. Marketing research specifies the information required to address these issues, designs the method for collecting information, manages and implements the data collection process, analyzes the results, and communicates the findings and their implications."

It is the systematic gathering, recording, and analysis of qualitative and quantitative data about issues relating to marketing products and services. The goal of marketing research is to identify and assess how changing elements of the marketing mix impacts customer behavior. The term is commonly interchanged with market research; however, expert practitioners may wish to draw a distinction, in that *market* research is concerned specifically with markets, while *marketing* research is concerned specifically about marketing processes.

Aims And Objectives Of Marketing Research:

The aims of the marketing research and analysis may be stated as follows:

(1) To study the needs, wants and expectations of consumers.

(2) To find out reactions of consumers to the products of the company.

(3) To evaluate company's sales promotion measures for suitable adjustment and improvement.

(4) To study current marketing problems and opportunities for suitable follow-up actions.

(5) To suggest the introduction of new products, modifications of existing products and to discover new uses of existing products.

(6) To design and test appropriate packages of company's products and make packaging as attractive as possible

(7) To study existing pricing, channels of distribution and market competition for suitable changes, if necessary.

(8) To find out methods for making the products of the company popular and raising its goodwill and market reputation.

(9) To assess competitive strength and policies.

(10) To estimate potential buying-power in various areas

(11) To know the company's expected share of the market.

(12) To determine the dimensions of the marketing problems, facilitate evaluation of the alternative solutions of different problems and help in the selection of a right course of action.

(13) To define the probable market for a specialized product and to report on general market conditions and tendencies, buying habits, etc.

Application of Marketing Research

1. Competitive Advantage.

The notion that achieving superior performance requires a business to gain and hold an advantage competitors is central to contemporary strategic thinking.

Businesses seeking advantage are exhorted to develop distinctive competencies at the lowest delivered cost or to achieve differentiation through superior value.

The assessing competitive advantage can be done in number of ways. The methods can be broadly classified as market-based and process-based assessment.

Market-based assessment is direct comparison with a few target competitors, whereas process-based assessment is a comparison of the methods employed.

2. Brand Equity.

- Brand equity is defined as a set of assets and liabilities linked to a brand that add to or subtract from the value of a product or service to a company and/ or its customers.

- The assets or liabilities that underlie brand equity must be linked to the name and/or symbol of the brand.
- The assets and liabilities on which brand equity is based will differ from context to context. However, they can be usefully grouped into five categories

3. Customer satisfaction.

- The measurement of customer satisfaction and its link to product/ service attributes is the vehicle for developing a market-driven quality approach.
- This approach requires a sequential research design that uses the results from each research phase to build and enhance the value of subsequent efforts.
- During this process, it is imperative to study customers who were lost, to determine why they left. This issue must be addressed early in the system design.
- The steps involved in customer satisfaction is

4. Total quality management.

- TQM is a process of managing complex changes in the organization with the aim of improving quality.
- The power of measurements is clearly visible in applications of quality function deployment (QFD), a japanese import used to make product design better reflect customer requirements.
- In QFD, a multifunctional team measures and analyzes in great detail both customers attitudes and product attributes. Marketing research plays a crucial role at this stage of the process.
- Then the team creates a visual mtrix in order to find ways to modify product attributes (engineering characteristics) so as to improve the product on the customer-based measures of product performance. Along the way, the team must develop a series of measures of several different types.

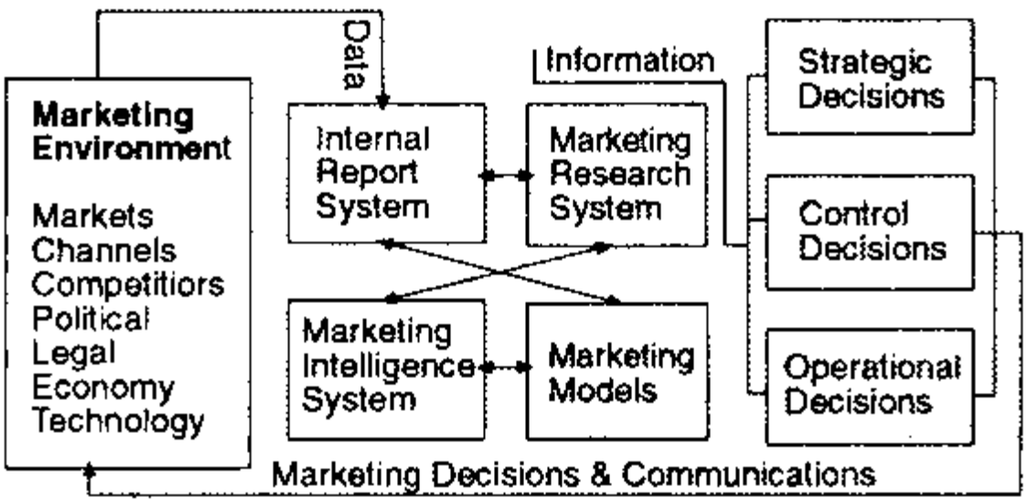
A marketing information system

A marketing information system (MIS) is intended to bring together disparate items of data into a coherent body of information. An MIS is, as will shortly be seen, more than raw data or information suitable for the purposes of decision making. An MIS also provides

methods for interpreting the information the MIS provides. Moreover, as Kotler's1 definition says, an MIS is more than a system of data collection or a set of information technologies:

"A marketing information system is a continuing and interacting structure of people, equipment and procedures to gather, sort, analyse, evaluate, and distribute pertinent, timely and accurate information for use by marketing decision makers to improve their marketing planning, implementation, and control".

Figure 9.1 The marketing information systems and its subsystems



The explanation of this model of an MIS begins with a description of each of its four main constituent parts: the internal reporting systems, marketing research system, marketing intelligence system and marketing models. It is suggested that whilst the MIS varies in its degree of sophistication - with many in the industrialised countries being computerised and few in the developing countries being so - a fully fledged MIS should have these components, the methods (and technologies) of collection, storing, retrieving and processing data notwithstanding.

Internal reporting systems: All enterprises which have been in operation for any period of time nave a wealth of information. However, this information often remains under-utilised because it is compartmentalised, either in the form of an individual entrepreneur or in the functional departments of larger businesses. That is, information is usually categorised according to its nature so that there are, for example, financial, production, manpower, marketing, stockholding and logistical data. Often the entrepreneur, or various personnel working in the functional departments holding these pieces of data, do not see how it could help decision makers in other functional areas. Similarly, decision makers can fail to appreciate how information from other functional areas might help them and therefore do not request it.

The internal records that are of immediate value to marketing decisions are: orders received, stockholdings and sales invoices. These are but a few of the internal records that can be used by marketing managers, but even this small set of records is capable of generating a great deal of information. Below, is a list of some of the information that can be derived from sales invoices.

- Product type, size and pack type by territory
  - · Product type, size and pack type by type of account
  - · Product type, size and pack type by industry
  - · Product type, size and pack type by customer
  - · Average value and/or volume of sale by territory
  - · Average value and/or volume of sale by type of account
  - · Average value and/or volume of sale by industry
  - · Average value and/or volume of sale by sales person

By comparing orders received with invoices an enterprise can establish the extent to which it is providing an acceptable level of customer service. In the same way, comparing stockholding records with orders received helps an enterprise ascertain whether its stocks are in line with current demand patterns.

Stages or Steps in Marketing Research Process

Marketing research exercise may take many forms but systematic enquiry is a feature common to all such forms. Being a systematic process. Though it is not necessary that all research processes would invariably follow a given sequence, yet marketing research aften follows a generalized pattern, which can be broken down and studied as sequential stages stages. The various stages or steps in the marketing research process may be discussed as follows:

1. Identification and Defining of the Problem The market research process begins with the identification of a problem faced by the company. The clear cut statement of problem may not be possible at the very outset of research process because often only the symptoms of the problems are apparent at that stage. Then, after some explanatory research, clear definition of the problem is of crucial importance in marketing research because such research is a costly process involving time, energy and money. Clear definition of the problem helps the researcher in all subsequent research efforts including setting of proper research objectives, the determination of the techniques to be used and the extent of information to be collected. It may be noted that the methods of explanatory research popularly in use are : survey of secondary data, experience survey or pilot studies i.e. studies of a small initial sample. All this is also known as preliminary investigation.

2. Statement of Research Objectives After identifying and defining the problem with or without explanatory research, the researcher must make a formal statement of researcher objectives. Such objectives may be stated in qualitative or quantitative terms and expressed as research questions, statement or hypothesis. For example, the research objective. "To find out the extent to which sales promotion schemes affected the sales volume" is a research objective expressed as a statement. On the other hand, a hypothesis is a statement that can be refuted or supported by empirical findings. The same research objective could be stated, "To test the proposition that sales are positively affected by the sales promotion schemes undertaken this winter." Example of another hypothesis may be. "The new packaging pattern has resulted in increase in sales and profit." Once the objective or the hypothesis are developed, the researcher is ready to choose the research design.

3. Planning the Research Design or Designing the Research Study After defining the research problem and deciding the objectives, the research design must be developed. A research design is a master plan specifying the procedure for collecting and analyzing the needed information. It represents a framework for the research plan of action. The objectives of the study are included in the research design to ensure that data collected are relevant to the objectives. At this stage, the researcher should also determine the type of sources of information needed, the data collection method (e.g. survey or interview), the sampling methodology and the timing and possible costs of research.

4. Planning the Sample
Sampling involves procedures that use a small number of items or parts of the population (total items) to take conclusion regarding the population. Important questions in this regard are; who is to be sampled as a rightly representative lot? Which is the target – population? What should be the sample size – how large or how small? How to select the various units to make up the sample?

5. Data Collection
The collection of data relates to the gathering of facts to be used in solving the problem. Hence, methods of marketing research are essentially methods of data collection. Data can be secondary, i.e. collected from concerned reports, magazines and other periodicals, especially written articles,government publications, company publications, books etc. Data can be primary i.e. collected from the original base through empirical research by means of various tools. There can be broadly two types of sources – (i) Internal sources – existing within the firm itself, such as accounting data, salesmen's reports etc. (ii) External sources – outside the firm.

6. Data Processing and Analysis
Once data have been collected these have to be converted into a format that will suggest answer to

the initially identified and defined problem. Data processing begins with the editing of data and its coding. Editing involves inspecting the data collection – forms for omission, legibility and consistency in classification. Before tabulation, responses need to be classified into meaningful categories. The rules for categorizing, recording and transferring the data to "date storage media" are called codes. This coding process facilities the manual or computer tabulation. If computer analysis is being used the data can be key-product and verified.

7. Formulating Conclusions, Preparing and Processing the Report
The final stage in the marketing research process is that of interpreting the information and drawing conclusion for use in managerial decision. The research report should clearly and effectively communicate the research findings and need not include complicated statement about the technical aspect of the study and research methods. Often the management is not interested in details of research design and statistical analysis but instead in the concrete findings of the research. If need to the researcher may bring out his appropriate recommendation or suggestions in the matter. Researchers must make the presentation technically accurate, understandable and useful.

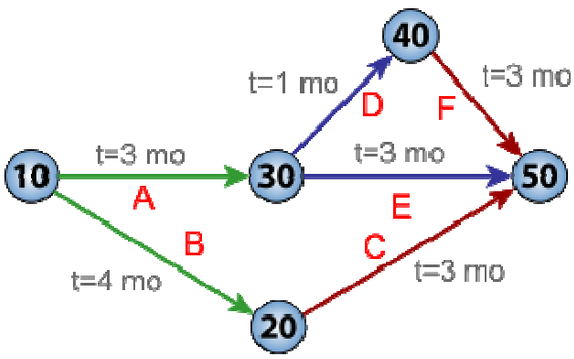
Evaluation and control of marketing research

A Gantt chart is a type of bar chart, developed by Henry Gantt in the 1910s, that illustrates a project schedule. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project. Terminal elements and summary elements comprise the work breakdown structure of the project. Some Gantt charts also show the dependency (i.e. precedence network) relationships between activities. Gantt charts can be used to show current schedule status using percent-complete shadings and a vertical "TODAY" line as shown here.

Although now regarded as a common charting technique, Gantt charts were considered revolutionary when first introduced.[1] In recognition of Henry Gantt's contributions, the Henry Laurence Gantt Medal is awarded for distinguished achievement in management and in community service. This chart is also used in information technology to represent data that has been collected

A checklist is a type of informational job aid used to reduce failure by compensating for potential limits of human memory and attention. It helps to ensure consistency and completeness in carrying out a task. A basic example is the "to do list." A more advanced checklist would be a schedule, which lays out tasks to be done according to time of day or other factors.

A **flowchart** is a type of diagram that represents an algorithm or process, showing the steps as boxes of various kinds, and their order by connecting them with arrows. This diagrammatic representation illustrates a solution to a given problem. Process operations are represented in these boxes, and arrows; rather, they are implied by the sequencing of operations. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields.



PERT network chart for a seven-month project with five milestones (10 through 50) and six activities (A through F).

The **Program** (or **Project**) **Evaluation and Review Technique**, commonly abbreviated **PERT**, is a statistical tool, used in project management, that is designed to analyze and represent the tasks involved in completing a given project. First developed by the United States Navy in the 1950s, it is commonly used in conjunction with the critical path method (**CPM**).

Value of information in decision making

1. Diversity: Varied cultures, age groups, gender, etc all add to the diversity of group which gives us varied perspectives and enhances the kind of ideas the group can come up with.

2. Varied experiences: There are difference in fields of experience and amount of experience and there differences in the life experiences and the kind of experiences people have had even with the same problem. This pool of experience can be a great advantage.

3. Enhanced memory for facts: An individual may forget a particular piece of information, but as there are a number of people involved here, there is the combined memory of all members to recollect data.

4. Greater Acceptability of decisions: As everyone has made some contribution to the decision, people tend to be more accepting of the decision. Also those who may not have contributed still support it as "the group" has come to this decision.

5. Error detection: When there are many people working together, mistakes and errors that may have accidentally gone unnoticed and had serious consequences are spotted by other team members.

6. collective understanding: The members together come to a decision after much deliberation and discussions and so everyone has a better understanding of the course of action to be followed.

7. Less influence of bias: Individual biases can be challenged and individuals may have to recognize and eliminate them.

8. More creative solutions: With so many people involved, more creative and innovative solutions to problems may emerge than an individual may have been able to develop.

9. shared responsibility: There are a number of people involved, so no one person has to shoulder the burden of work or of single-handedly making a decision.

10. motivational effect: The group decision making may even have a motivational effect on the team if the team is a successful one.

Steps in Marketing Research Process

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Research Design

A **research design** encompasses the methodology and procedures employed to conduct scientific research. The design of a study defines the study type (descriptive, correlational, semi-experimental, experimental, review, meta-analytic) and sub-type (e.g., descriptive-longitudinal case study), research question, hypotheses, independent and dependent variables, experimental design, and, if applicable, data collection methods and a statistical analysis plan.

Formulating a Research Problem

1. Identify a broad field or subject area of interest to your group
2. Dissect the broad area into sub-areas
3. Select what is of most interest to you
4. Raise possible research questions
5. Formulate objectives

6. Assess your objectives
7. Double-check

Choice and Types of Research Design

Action Research Design

The essentials of action research design follow a characteristic cycle whereby initially an exploratory stance is adopted, where an understanding of a problem is developed and plans are made for some form of interventionary strategy. Then the intervention is carried out (the action in Action Research) during which time, pertinent observations are collected in various forms. The new interventional strategies are carried out, and the cyclic process repeats, continuing until a sufficient understanding of (or implement able solution for) the problem is achieved. The protocol is iterative or cyclical in nature and is intended to foster deeper understanding of a given situation, starting with conceptualizing and particularizing the problem and moving through several interventions and evaluations

Case Study Design

A case study is an in-depth study of a particular research problem rather than a sweeping statistical survey. It is often used to narrow down a very broad field of research into one or a few easily researchable examples. The case study research design is also useful for testing whether a specific theory and model actually applies to phenomena in the real world. It is a useful design when not much is known about a phenomenon.

Causal Design

Causality studies may be thought of as understanding a phenomenon in terms of conditional statements in the form, "If X, then Y." This type of research is used to measure what impact a specific change will have on existing norms and assumptions. Most social scientists seek causal explanations that reflect tests of hypotheses. Causal effect (nomothetic perspective) occurs when variation in one phenomenon, an independent variable, leads to or results, on average, in variation in another phenomenon, the dependent variable.

Cross-Sectional Design

Cross-sectional research designs have three distinctive features: no time dimension, a reliance on existing differences rather than change following intervention; and, groups are selected based on existing differences rather than random allocation. The cross-sectional design can only measure diffrerences between or from among a variety of people, subjects, or phenomena rather than change. As such, researchers using this design can only employ a relative passive approach to making causal inferences based on findings.

Descriptive Design

Descriptive research designs help provide answers to the questions of who, what, when, where, and how associated with a particular research problem; a descriptive study cannot conclusively ascertain answers to why. Descriptive research is used to obtain information concerning the current status of the phenomena and to describe "what exists" with respect to variables or conditions in a situation

Experimental Design

A blueprint of the procedure that enables the researcher to maintain control over all factors that may affect the result of an experiment. In doing this, the researcher attempts to determine or predict what may occur. Experimental Research is often used where there is time priority in a causal relationship (cause precedes effect), there is consistency in a causal relationship (a cause will always lead to the same effect), and the magnitude of the correlation is great. The classic experimental design specifies an experimental group and a control group. The independent variable is administered to the experimental group and not to the control group, and both groups are measured on the same dependent variable. Subsequent experimental designs have used more groups and more measurements over longer periods. True experiments must have control, randomization, and manipulation.

Exploratory Design

An exploratory design is conducted about a research problem when there are few or no earlier studies to refer to. The focus is on gaining insights and familiarity for later investigation or undertaken when problems are in a preliminary stage of investigation.

Historical Design

The purpose of a historical research design is to collect, verify, and synthesize evidence from the past to establish facts that defend or refute your hypothesis. It uses secondary sources and a variety of primary documentary evidence, such as, logs, diaries, official records, reports, archives, and non-textual information [maps, pictures, audio and visual recordings]. The limitation is that the sources must be both authentic and valid.

Longitudinal Design

A longitudinal study follows the same sample over time and makes repeated observations. With longitudinal surveys, for example, the same group of people is interviewed at regular intervals, enabling researchers to track changes over time and to relate them to variables that might explain why the changes occur. Longitudinal research designs describe patterns of change and help establish the direction and magnitude of causal relationships. Measurements are taken on each variable over two or more distinct time periods. This allows the researcher to measure change in variables over time. It is a type of observational study and is sometimes referred to as a panel study.

Observational Design

This type of research design draws a conclusion by comparing subjects against a control group, in cases where the researcher has no control over the experiment. There are two general types of observational designs. In direct observations, people know that you are watching them. Unobtrusive measures involve any method for studying behavior where individuals do not know they are being observed. An observational study allows a useful insight into a phenomenon and avoids the ethical and practical difficulties of setting up a large and cumbersome research project.

Sequential Design

Sequential research is that which is carried out in a deliberate, staged approach [i.e. serially] where one stage will be completed, followed by another, then another, and so on, with the aim that each stage will build upon the previous one until enough data is gathered over an interval of time to test your hypothesis. The sample size is not predetermined. After each sample is analyzed, the researcher can accept the null hypothesis, accept the alternative hypothesis, or select another pool of

subjects and conduct the study once again. This means the researcher can obtain a limitless number of subjects before finally making a decision whether to accept the null or alternative hypothesis. Using a quantitative framework, a sequential study generally utilizes sampling techniques to gather data and applying statistical methods to analze the data. Using a qualitative framework, sequential studies generally utilize samples of individuals or groups of individuals [cohorts] and use qualitative methods, such as interviews or observations, to gather information from each sample.

Formulate the Research Problem

1. Specify the Research Objectives

A clear statement of objectives will help you develop **effective research.** It will help the decision makers evaluate your project. **It's critical** that you have manageable objectives. (Two or three clear goals will help to keep your research project focused and relevant.)

2. Review the Environment or Context of the Research Problem

As a marketing researcher, you must work closely with your team. This will help you determine whether the findings of your project will produce enough information to be worth the cost. In order to do this, you have to identify the environmental variables that will affect the research project.

3. Explore the Nature of the Problem

Research problems range from simple to complex, depending on the number of variables and the nature of their relationship. If you understand the nature of the **problem as a researcher**, you will be able to better develop a solution for the problem.

To help you understand all dimensions, you might want to consider focus groups of consumers, sales people, managers, or professionals to provide what is sometimes much needed insight.

4. Define the Variable Relationships

Marketing plans often focus on creating a sequence of behaviors that occur over time, as in the adoption of a new package design, or the introduction of a new product.

Such programs create a commitment to follow some behavioral pattern in the future.

Studying such a process involves:

- Determining which variables affect the solution to the problem.
- Determining the degree to which each variable can be controlled.
- Determining the functional relationships between the variables and which variables are critical to the solution of the problem.

During the **problem formulation** stage, you will want to generate and consider as many courses of action and variable relationships as possible.

5. The Consequences of Alternative Courses of Action

There are always consequences to any course of action. Anticipating and communicating the possible outcomes of various courses of action is a primary responsibility in the research process.

Sources of Experimental Error (Uncertainty)

1. Personal Careless Error

- Introduced by experimenter.

- Simply put, usually due to 'sloppiness.'

2. Determinate (Systematic) Error

- Uncertainty that is inherent in the measurement devices (hard to read scales, etc.)

- Usually caused by poorly or miscalibrated instruments.

- There are usually ways to determine or estimate.

- Cannot reduce by repeated measurements, but can account for in some way.

3. Indeterminate (Random) Errors

- Natural variations in measurements.

- May be result of operator bias, variation in experimental conditions, or other factors not easily accounted for.

- May be minimized by repeated measurement and using an average value.

Unit 2

Sampling

Signal sampling representation. The continuous signal is represented with a green colored line while the discrete samples are indicated by the blue vertical lines.

In signal processing, **sampling** is the reduction of a continuous signal to a discrete signal. A common example is the conversion of a sound wave (a continuous signal) to a sequence of samples (a discrete-time signal).

A **sample** refers to a value or set of values at a point in time and/or space.

A **sampler** is a subsystem or operation that extracts samples from a continuous signal.

A theoretical **ideal sampler** produces samples equivalent to the instantaneous value of the **continuous signal at the desired points.**

Sample

A portion selected from a larger quantity of material General term used for a unit taken from the total amount of foodSampling protocol A predetermined procedure for the selection, withdrawal,preservation and preparation of the sample Sometimes called a sampling plan Characteristic The property or constituent that is to be measured or noted Description of the food, nutrient and other analyses

Homogeneity

The extent to which a property or constituent is uniformly distributed

Sampling error

The part of the total error associated with using only a fraction of the total population of food and extrapolating it to the whole population. This arises from the heterogeneity of the population Sometimes called a sampling plan Because of the heterogeneous nature of foods, replicate Samples must be taken when estimating

Batch

A quantity of food that is known, or assumed, to be produced under uniform conditions Batch numbers should always be noted when sampling foods

Unit

Each of the discrete, identifiable units of food that are suitable for removal from the population as samples and that can be individually described, analyzed or combined These units form the basis of most food analysis work (e.g. an apple, a bunch of bananas, a can of beans, a prepared dish)

Advantages and Limitation of Sampling

Advantages of sampling

1. Very accurate.
2. Economical in nature.
3. Very reliable.
4. High suitability ratio towards the different surveys.
5. Takes less time.
6. In cases, when the universe is very large, then the sampling method is the only practical method for collecting the data.

Limitation of sampling

1. Inadequacy of the samples.
2. Chances for bias.
3. Problems of accuracy.
4. Difficulty of getting the representative sample.
5. Untrained manpower.
6. Absence of the informants.
7. Chances of committing the errors in sampling.

Steps in Sampling Process

It is the procedure required right from defining a population to the actual selection of sample elements. There are seven steps involved in this process.

Step 1: **Define the population**

It is the aggregate of all the elements defined prior to selection of the sample. It is necessary to define population in terms of

(i) Elements

(ii) Sampling units

(iii) Extent

(iv) Time.

Step 2 : Identify the sampling frame

Identifying the sampling frame, which could be a telephone directory, a list of blocks and localities of a city, a map or any other list consisting of all the sampling units. It may be pointed out that if the frame is incomplete or otherwise defective, sampling will not be able to overcome these shortcomings

3: Specify the sampling unit

The sampling unit is the basic unit containing the elements of the target population. The sampling unit may be different from the element. For example, if one wanted a sample of housewives, it might be possible to have access to such a sample directly. However, it is easier to select households as the sampling unit and then interview housewives in each of the households.

Step 4: Specify the sampling method

It indicates how the sample units are selected. One of the most important decisions in this regard is to determine which of the two—probability and non-probability sample—is to be chosen.

Step 5: Determine the sample size

In other words, one has to decide how many elements of the target population are to be chosen.

Step 6: Specify the sampling plan

This means that one should indicate how decisions made so far are to be implemented. For example, if a survey of households is to be conducted, a sampling plan should define a household, contain instructions to the interviewer as to how he should take a systematic sample of households, advise him on what he should do when no one is available on his visit to the household, and so on. These are some pertinent issues in a sampling survey to which a sampling plan should provide answers.

Step 7: Select the sample

This is the final step in the sampling process. A good deal of office and fieldwork is involved in the actual selection of the sampling elements. Most of the problems in this stage are faced by the interviewer while contacting the sample-respondents.

Types of sampling

Probability Sampling:

Simple Random Sampling: A simple random sample (SRS) of size *n* is produced by a scheme which ensures that each subgroup of the population of size *n* has an equal probability of being chosen as the sample.

Stratified Random Sampling: Divide the population into "strata". There can be any number of these. Then choose a simple random sample from each stratum. Combine those into the overall sample. That is a stratified random sample. (Example: Church A has 600 women and 400 women as members. One way to get a stratified random sample of size 30 is to take a SRS of 18 women from the 600 women and another SRS of 12 men from the 400 men.)

Multi-Stage Sampling: Sometimes the population is too large and scattered for it to be practical to make a list of the entire population from which to draw a SRS. For instance, when the a polling organization samples US voters, they do not do a SRS. Since voter lists are compiled by counties, they might first do a sample of the counties and then sample within the selected counties. This illustrates two stages. In some instances, they might use even more stages. At each stage, they might do a stratified random sample on sex, race, income level, or any other useful variable on which they could get information before sampling.

Non-probability sampling schemes

These include voluntary response sampling, judgement sampling, convenience sampling, and maybe others.

In the early part of the 20th century, many important samples were done that weren't based on probability sampling schemes. They led to some memorable mistakes. Look in an introductory statistics text at the discussion of sampling for some interesting examples. The introductory statistics books I usually teach from are *Basic Practice of Statistics* by David Moore, Freeman, and *Introduction to the Practice of Statistics* by Moore and McCabe, also from Freeman. A particularly good book for a discussion of the problems of non-probability sampling is *Statistics* by Freedman, Pisani, and Purves. The detail is fascinating. Or, ask a statistics teacher to lunch and have them tell you the stories they tell in class. Most of us like to talk about these! Someday when I have time, maybe I'll write some of them here.

Mathematically, the important thing to recognize is that the discipline of statistics is based on the mathematics of probability. That's about random variables. All of our formulas in statistics are based on probabilities in sampling distributions of estimators. To create a sampling distribution of an estimator for a sample size of 30, we must be able to consider all possible samples of size 30 and base our analysis on how likely each individual result is.

Types of sampling design

Snowball Sample. A snowball sample is appropriate to use in research when the members of a population are difficult to locate, such as homeless individuals, migrant workers, or undocumented immigrants. A snowball sample is one in which the researcher collects data on the few members of the target population he or she can locate, then asks those individuals to provide information needed to locate other members of that population whom they know. For example, if a researcher wishes to interview undocumented immigrants from Mexico, he or she might interview a few undocumented individuals that he or she knows or can locate and would then rely on those subjects to help locate more undocumented individuals. This process continues until the researcher has all the interviews he or she needs or until all contacts have been exhausted.

Quota Sample. A quota sample is one in which units are selected into a sample on the basis of pre-specified characteristics so that the total sample has the same distribution of characteristics assumed to exist in the population being studied. For example, if you a researcher conducting a national quota sample, you might need to know what proportion of the population is male and what proportion is

female as well as what proportions of each gender fall into different age categories, race or ethnic categories, educational categories, etc. The researcher would then collect a sample with the same proportions as the national population.

Probability Sampling Techniques

Probability sampling is a sampling technique where the samples are gathered in a process that gives all the individuals in the population equal chances of being selected.

Simple Random Sample. The simple random sample is the basic sampling method assumed in statistical methods and computations. To collect a simple random sample, each unit of the target population is assigned a number. A set of random numbers is then generated and the units having those numbers are included in the sample. For example, let's say you have a population of 1,000 people and you wish to choose a simple random sample of 50 people. First, each person is numbered 1 through 1,000. Then, you generate a list of 50 random numbers (typically with a computer program) and those individuals assigned those numbers are the ones you include in the sample.

Systematic Sample. In a systematic sample, the elements of the population are put into a list and then every kth element in the list is chosen (systematically) for inclusion in the sample. For example, if the population of study contained 2,000 students at a high school and the researcher wanted a sample of 100 students, the students would be put into list form and then every 20th student would be selected for inclusion in the sample. To ensure against any possible human bias in this method, the researcher should select the first individual at random. This is technically called a systematic sample with a random start.

Stratified Sample. A stratified sample is a sampling technique in which the researcher divided the entire target population into different subgroups, or strata, and then randomly selects the final subjects proportionally from the different strata. This type of sampling is used when the researcher wants to highlight specific subgroups within the population. For example, to obtain a stratified sample of university students, the researcher would first organize the population by college class and then select appropriate numbers of freshmen, sophomores, juniors, and seniors. This ensures that the researcher has adequate amounts of subjects from each class in the final sample.

Cluster Sample. Cluster sampling may be used when it is either impossible or impractical to compile an exhaustive list of the elements that make up the target population. Usually, however, the population elements are already grouped into subpopulations and lists of those subpopulations

already exist or can be created. For example, let's say the target population in a study was church members in the United States. There is no list of all church members in the country. The researcher could, however, create a list of churches in the United States, choose a sample of churches, and then obtain lists of members from those churches.

Determining a Sample-Size

An appropriate sample size is based on a number of accuracy factors that you must consider. Together

They comprise a five step process:

1. Determine Goals

2. Determine desired Precision of results

3. Determine Confidence level

4. Estimate the degree of Variability

5. Estimate the Response Rate

Step One: Determine Goals

• First, know the size of the population with which you're dealing. If your population is small (200 people or less), it may be preferable to do a census of everyone in the population, rather than a sample. For a marginally higher cost than a 134-person sample, you can survey the entire population and gain a 0% sampling error. However, if the population from which you want to gather information is larger, it makes sense to do a sample.
• Second, decide the methods and design of the sample you're going to draw and the specific attributes or concepts you're trying to measure.
• Third, know what kind of resources you have available, as they could be a limitation on other steps below such as your level of precision. Once you have this information in-hand, you're ready to go on to the next step.
Step Two: Determine the Desired Precision of Results
The level of precision is the closeness with which the sample predicts where the true values in the population lie. The difference between the sample and the real population is called the sampling

error.If the sampling error is ±3%, this means we add or subtract 3 percentage points from the value in the survey to find out the actual value in the population. For example, if the value in a survey says that 65% of farmers use a particular pesticide, and the sampling error is ±3%, we know that in the real-world population, between 62% and 68% are likely to use this pesticide. This range is also commonly referred to as the margin of error.The level of precision you accept depends on balancing accuracy and resources. High levels of precision require larger sample sizes and higher costs to achieve those samples, but high margins of error can leave you with results that aren't a whole lot more meaningful than human estimation. The tables in Appendices 1 and 2 at the end of the Tipsheet provide sample sizes for precision levels
of 5% and 3% respectively.

Step Three: Determine the Confidence Level

The confidence level involves the **risk** you're willing to accept that your sample is within the average or "bell curve" of the population. A confidence level of 90% means that, were the population sampled 100 times in the same manner, 90 of these samples would have the true population value within the **range of precision** specified earlier, and 10 would be unrepresentative samples. Higher confidence levels require larger sample sizes. *The tables at the end of this Tipsheet assume a 95% confidence level.* This level is standard for most social-science applications, though higher levels can be used. If the confidence level that is chosen is
too low, results will be "statistically insignificant".

Step Four: Estimate the Degree of Variability

Variability is the degree to which the attributes or concepts being measured in the questions are distributed throughout the population. A heterogeneous population, divided more or less 50%-50% on
an attribute or a concept, will be harder to measure precisely than a homogeneous population, divided say 80%-20%. Therefore, the higher the degree of variability you expect the distribution of a concept to be in your target audience, the larger the sample size must be to obtain the same level of precision. To come up with an estimate of variability, simply take a reasonable guess of the size of the smaller attribute or concept you're trying to measure, rounding **up** if necessary. If you estimate that 25% of the population in your county farms organically and 75% does not, then your variability would be .25 (which rounds up to 30% on the table provided at the end of this Tipsheet). If variability is too difficult to estimate, it is best to use the conservative figure of 50%. Note: when the population is *extremely* heterogeneous (i.e., greater than 90-10), a larger sample may be needed for an accurate result, because the population with the minority attribute is so low.At this point, using the **level of precision** and **estimate of variability** you've selected, you can use either the table

or the equation provided at the bottom of this Tipsheet to determine the **base sample size** for your project.

Step Five: Estimate the Response Rate

The base sample size is the number of responses you must get back when you conduct your survey.However, since not everyone will respond, you will need to increase your sample size, and perhaps the number of contacts you attempt to account for these non-responses. To estimate response rate that you are likely to get, you should take into consideration the method of your survey and the population involved. Direct contact and multiple contacts increase response, as does a population which is interested in the issues, involved, or connected to the institution doing the surveying, or, limited or specialized in character. You can also look at the rates of response that may have occurred in similar, previous surveys.

Sampling Distribution of the Mean

The *sampling distribution* of the mean was defined in the section introducing sampling distributions. This section reviews some important properties of the sampling distribution of the mean, which were introduced in the demonstrations in this chapter.

MEAN

The mean of the sampling distribution of the mean is the mean of the population from which the scores were sampled. Therefore, if a population has a mean μ, then the mean of the sampling distribution of the mean is also μ. The symbol μ_M is used to refer to the mean of the sampling distribution of the mean. Therefore, the formula for the mean of the sampling distribution of the mean can be written as:

$$\mu_M = \mu$$

VARIANCE

The variance of the sampling distribution of the mean is computed as follows:

$$\sigma_M^2 = \frac{\sigma^2}{N}$$

That is, the variance of the sampling distribution of the mean is the population variance divided by N, the sample size (the number of scores used to compute a mean). Thus, the larger the sample size, the smaller the variance of the sampling distribution of the mean.

(optional) This expression can be derived very easily from the variance sum law. Let's begin by computing the variance of the sampling distribution of the sum of three numbers sampled from a population with variance σ^2. The variance of the sum would be $\sigma^2 + \sigma^2 + \sigma^2$. For N numbers, the variance would be $N\sigma^2$. Since the mean is 1/N times the sum, the variance of the sampling distribution of the mean would be $1/N^2$ times the variance of the sum, which equals σ^2/N.

The standard error of the mean is the standard deviation of the sampling distribution of the mean. It is therefore the square root of the variance of the sampling distribution of the mean and can be written as:

$$\sigma_M = \frac{\sigma}{\sqrt{N}}$$

The *standard error* is represented by a σ because it is a standard deviation. The subscript (M) indicates that the standard error in question is the standard error of the mean

Definitions of Attitude

An attitude can be defined as a positive or negative evaluation of people, objects, event, activities, ideas, or just about anything in your environment, but there is debate about precise definitions. Eagly and Chaiken, for example, define an attitude "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor."[3] Though it is sometimes common to define an attitude as affect toward an object, affect (i.e., discrete emotions or overall arousal) is generally understood to be distinct from attitude as a measure of favorability.

This definition of attitude allows for one's evaluation of an attitude object to vary from extremely negative to extremely positive, but also admits that people can also be conflicted or ambivalent toward an object meaning that they might at different times express both positive and negative attitude toward the same object. This has led to some discussion of whether individual can hold multiple attitudes toward the same object.

Whether attitudes are explicit (i.e., deliberately formed) versus implicit (i.e., subconscious) has been a topic of considerable research. Research on implicit attitudes, which are generally unacknowledged or outside of awareness, uses sophisticated methods involving people's response times to stimuli to show that implicit attitudes exist (perhaps in tandem with explicit attitudes of the

same object). Implicit and explicit attitudes seem to affect people's behavior, though in different ways. They tend not to be strongly associated with each other, although in some cases they are. The relationship between them is poorly understood.

Difficulty of attitude measurement

The central problem is how to be certain that interpretations of respondents attitudes are more or less reliable and valid measurements of their actual thoughts and feelings, as opposed to measurements of hypothetical constructs that do not mirror in any way at all the conceptual world of the respondents I will then look at two specific examples of contemporary attitude research, and look at possible flaws of validity and reliability in the construction of a few questionnaire items within these pieces of research. I will examine techniques for avoiding pitfalls associated with reliability and validity, and point out why these can never overcome the classical problems of interpretation of subjective

Types of scale

Pairwise comparison scale – a respondent is presented with two items at a time and asked to select one (example : Do you prefer Pepsi or Coke?). This is an ordinal level technique when a measurement model is not applied. Krus and Kennedy (1977) elaborated the paired comparison scaling within their domain-referenced model. The Bradley–Terry–Luce (BTL) model (Bradley and Terry, 1952; Luce, 1959) can be applied in order to derive measurements provided the data derived from paired comparisons possess an appropriate structure. Thurstone's Law of comparative judgment can also be applied in such contexts.

Rasch model scaling – respondents interact with items and comparisons are inferred between items from the responses to obtain scale values. Respondents are subsequently also scaled based on their responses to items given the item scale values. The Rasch model has a close relation to the BTL model.

Rank-ordering – a respondent is presented with several items simultaneously and asked to rank them (example : Rate the following advertisements from 1 to 10.). This is an ordinal level technique.

Social distance scale – measures the degree to which a person is willing to associate with a class or type of people. It asks how willing the respondent is to make various associations. The results are reduced to a single score on a scale. There are also non-comparative versions of this scale.

Q-Sort – Up to 140 items are sorted into groups based a rank-order procedure.

Guttman scale – This is a procedure to determine whether a set of items can be rank-ordered on a unidimensional scale. It utilizes the intensity structure among several indicators of a given variable. Statements are listed in order of importance. The rating is scaled by summing all responses until the first negative response in the list. The Guttman scale is related to Rasch measurement; specifically, Rasch models bring the Guttman approach within a probabilistic framework.

Constant sum scale – a respondent is given a constant sum of money, script, credits, or points and asked to allocate these to various items (example : If you had 100 Yen to spend on food products, how much would you spend on product A, on product B, on product C, etc.). This is an ordinal level technique.

Magnitude estimation scale – In a psychophysics procedure invented by S. S. Stevens people simply assign numbers to the dimension of judgment. The geometric mean of those numbers usually produces a power law with a characteristic exponent. In cross-modality matching instead of assigning numbers, people manipulate another dimension, such as loudness or brightness to match the items. Typically the exponent of the psychometric function can be predicted from the magnitude estimation exponents of each dimension.

Non-comparative scaling techniques

Continuous rating scale (also called the graphic rating scale) – respondents rate items by placing a mark on a line. The line is usually labeled at each end. There are sometimes a series of numbers, called scale points, (say, from zero to 100) under the line. Scoring and codification is difficult.

Likert scale – Respondents are asked to indicate the amount of agreement or disagreement (from strongly agree to strongly disagree) on a five- to nine-point scale. The same format is used for multiple questions. This categorical scaling procedure can easily be extended to a magnitude estimation procedure that uses the full scale of numbers rather than verbal categories.

Phrase completion scales – Respondents are asked to complete a phrase on an 11-point response scale in which 0 represents the absence of the theoretical construct and 10 represents the theorized maximum amount of the construct being measured. The same basic format is used for multiple questions.

Semantic differential scale – Respondents are asked to rate on a 7 point scale an item on various attributes. Each attribute requires a scale with bipolar terminal labels.

Stapel scale – This is a unipolar ten-point rating scale. It ranges from +5 to –5 and has no neutral zero point.

Thurstone scale – This is a scaling technique that incorporates the intensity structure among indicators.

Mathematically derived scale – Researchers infer respondents' evaluations mathematically. Two examples are multi dimensional scaling and conjoint analysis.

Applications of scaling

1. Scientific visualization
2. Data mining
3. Cognitive science
4. Information science,
5. Psychophysics,
6. Psychometrics,
7. Marketing and
8. Ecology.

Unit 3

Secondary data

Secondary data, is data collected by someone other than the user. Common sources of secondary data for social science include censuses, organisational records and data collected through qualitative methodologies or qualitative research. Primary data, by contrast, are collected by the investigator conducting the research.

Secondary data analysis saves time that would otherwise be spent collecting data and, particularly in the case of quantitative data, provides larger and higher-quality databases that would be unfeasible for any individual researcher to collect on their own. In addition, analysts of social and economic change consider secondary data essential, since it is impossible to conduct a new survey that can adequately capture past change and/or developments.

Sources of secondary data

As is the case in primary research, secondary data can be obtained from two different research strands:

- Quantitative: Census, housing, social security as well as electoral statistics and other related databases.
- Qualitative: Semi-structured and structured interviews, focus groups transcripts, field notes, observation records and other personal, research-related documents.

A clear benefit of using secondary data is that much of the background work needed has already been carried out, for example: literature reviews, case studies might have been carried out, published texts and statistics could have been already used elsewhere, media promotion and personal contacts have also been utilized.

This wealth of background work means that secondary data generally have a pre-established degree of validity and reliability which need not be re-examined by the researcher who is re-using such data.

Furthermore, secondary data can also be helpful in the research design of subsequent primary research and can provide a baseline with which the collected primary data results can be compared to. Therefore, it is always wise to begin any research activity with a review of the secondary data.

Primary Data:

Data that has been collected from first-hand-experience is known as primary data. Primary data has not been published yet and is more reliable, authentic and objective. Primary data has not been changed or altered by human beings, therefore its validity is greater than secondary data.

Importance of Primary Data:

Importance of Primary data cannot be neglected. A research can be conducted without secondary data but a research based on only secondary data is least reliable and may have biases because secondary data has already been manipulated by human beings. In statistical surveys it is necessary to get information from primary sources and work on primary data: for example, the statistical records of female population in a country cannot be based on newspaper, magazine and other printed sources. One such sources are old and secondly they contain limited information as well as they can be misleading and biased.

Validity: Validity is one of the major concerns in a research. Validity is the quality of a research that makes it trustworthy and scientific. Validity is the use of scientific methods in research to make it logical and acceptable. Using primary data in research can improves the validity of research. First hand information obtained from a sample that is representative of the target population will yield data that will be valid for the entire target population.

Authenticity: Authenticity is the genuineness of the research. Authenticity can be at stake if the researcher invests personal biases or uses misleading information int he research. Primary research tools and data can become more authentic if the methods chosen to analyze and interpret data are valid and reasonably suitable for the data type. . Primary sources are more authentic because the facts have not been overdone. Primary source can be less authentic if the source hides information or alters facts due to some personal reasons. Their are methods that can be employed to ensure factual yielding of data from the source.

Reliability: Reliability is the certainty that the research is enough true to be trusted on. For example, if a research study concludes that junk food consumption does not increase the risk of cancer and heart diseases. This conclusion should have to be drawn from a sample whose size, sampling

technique and variability is not questionable. Reliability improves with using primary data. In the similar research mentioned above if the researcher uses experimental method and questionnaires the results will be highly reliable. On the other hand, if he relies on the data available in books and on internet he will collect information that does not represent the real facts.

Sources of Primary Data:

Sources for primary data are limited and at times it becomes difficult to obtain data from primary source because of either scarcity of population or lack of cooperation. Regardless of any difficulty one can face in collecting primary data; it is the most authentic and reliable data source. Following are some of the sources of primary data.

Experiments: Experiments require an artificial or natural setting in which to perform logical study to collect data. Experiments are more suitable for medicine, psychological studies, nutrition and for other scientific studies. In experiments the experimenter has to keep control over the influence of any extraneous variable on the results.

Survey: Survey is most commonly used method in social sciences, management, marketing and psychology to some extent. Surveys can be conducted in different methods.

- Questionnaire: is the most commonly used method in survey. Questionnaires are a list of questions either open-ended or close -ended for which the respondent give answers. Questionnaire can be conducted via telephone, mail, live in a public area, or in an institute, through electronic mail or through fax and other methods.
- Interview: Interview is a face-to-face conversation with the respondent. In interview the main problem arises when the respondent deliberately hides information otherwise it is an in depth source of information. The interviewer can not only record the statements the interviewee speaks but he can observe the body language, expressions and other reactions to the questions too. This enables the interviewer to draw conclusions easily.
- Observations: Observation can be done while letting the observing person know that he is being observed or without letting him know. Observations can also be made in natural settings as well as in artificially created environment.

DATA COLLECTION METHODS

Questionnaires

In contrast with interviews, where an enumerator poses questions directly, questionnaires refer to forms filled in by respondents alone. Questionnaires can be handed out or sent by mail and later collected or returned by stamped addressed envelope. This method can be adopted for the entire population or sampled sectors.

Questionnaires may be used to collect regular or infrequent routine data, and data for specialised studies. While the information in this section applies to questionnaires for all these uses, examples will concern only routine data, whether regular or infrequent. Some of the data often obtained through questionnaires include demographic characteristics, fishing practices, opinions of stakeholders on fisheries issues or management, general information on fishers and household food budgets.

A questionnaire requires respondents to fill out the form themselves, and so requires a high level of literacy. Where multiple languages are common, questionnaires should be prepared using the major languages of the target group. Special care needs to be taken in these cases to ensure accurate translations.

Questionnaires, like interviews, can contain either structured questions with blanks to be filled in, multiple choice questions, or they can contain open-ended questions where the respondent is encouraged to reply at length and choose their own focus to some extent.

Interviews

In interviews information is obtained through inquiry and recorded by enumerators. Structured interviews are performed by using survey forms, whereas open interviews are notes taken while talking with respondents. The notes are subsequently structured (interpreted) for further analysis. Open-ended interviews, which need to be interpreted and analysed even during the interview, have to be carried out by well-trained observers and/or enumerators.

Although structured interviews can be used to obtain almost any information, as with questionnaires, information is based on personal opinion. Data on variables such as catch or effort are potentially subject to large errors, due to poor estimates or intentional errors of sensitive information.

Open-ended interviews

Open-ended interviews cover a variety of data-gathering activities, including a number of social science research methods.

Focus groups are small (5-15 individuals) and composed of representative members of a group whose beliefs, practises or opinions are sought. By asking initial questions and structuring the subsequent discussion, the facilitator/interviewer can obtain, for example, information on common gear use practices, responses to management regulations or opinions about fishing.

Panel surveys involve the random selection of a small number of representative individuals from a group, who agree to be available over an extended period - often one to three years. During that period, they serve as a stratified random sample of people from whom data can be elicited on a variety of topics.

Structured interview

Generally, structured interviews are conducted with a well-designed form already established. Forms are filled in by researchers, instead of respondents, and in that it differs from questionnaires. While this approach is more expensive, more complicated questions can be asked and data can be validated as it is collected, improving data quality. Interviews can be undertaken with variety of data sources (fishers to consumers), and through alternative media, such as by telephone or in person.

Structured interviews form the basis for much of the data collection in small-scale fisheries.

In an **interview approach for boat/gear activities,** the enumerators work according to a schedule of homeport visits to record data on boat/gear activities. Enumerators can be mobile (that is homeports are visited on a rotational basis) or resident at a specific sampling site. In either case, their job is to determine the total number of fishing units (and if feasible, fishing gears) for all boat/gear types based at that homeport and number of those that have been fishing during the sampling day.

Direct observations

Observers

Observers can make direct measurements on the fishing vessels, at landing sites, processing plants, or in markets. The variables that enumerators can collect include catch (landing and discards), effort, vessel/gears, operations, environmental variables (e.g. sea state, temperature), biological variables (e.g. length, weight, age), the values and quantities of landings and sales.

In practice, observers do not only make direct measurements (observations), but also conduct interviews and surveys using questionnaires. They might also be involved in data processing and analysis. The tasks of an observer are difficult and adequate training and supervision are therefore essential.

the batch number of raw materials, which can sometimes be traced back to fishing vessels. These data if collected can be used to validate landing data.

Inspectors

Inspectors are a kind of enumerator involved in law enforcement and surveillance (for fishing regulations, sanitary inspections, labour control, etc.). They may work at sea on surveillance vessels, at landing sites on shore, at processing factories and at markets. In general, scientific data are better collected by enumerators who are not directly involved in law enforcement. Nevertheless, many variables collected by the inspectors are very useful, and include landings, operational information, effort, landing price, processing procedure and values of product to the market and processors. Inspectors are also useful in collecting employment data.

Inspectors may play an important role in verification. In many cases, reports can be physically checked with observations. For example, random samples of boxes can be taken to check box contents (species, product type and size grade) against box identification marks. Inspectors need to be skilled in such sampling strategies.

As with enumerators/observers, inspector data should be treated with caution because of the high chance of sampling bias. This potential bias of data collected by law-enforcement officers should be considered in analyses.

Scientific research

Ecological research methods can be undertaken independent of commercial fishing operations to measure variables related to fish populations or the environment. Such research can be carried out by institutional research vessels or by industry or institutions using commercial fishing vessels. The objective is to obtain observations on biological (e.g. stock abundance or spatial distribution and fish size, maturity and spawning activities) and environmental (e.g. salinity and temperature) variables. It is important that this type of research is carried out periodically in order to obtain time sequential data.

Similarly, socio-cultural research methods can be used to obtain specific information useful to management. Although these methods may not often be considered routine, they provide important data and should be considered for infrequent data collection where possible.

Key informants are individuals with specialised knowledge on a particular topic. They may include academic specialists, community leaders, or especially skilled fishers. Interviews are usually begun with a set of baseline questions, but the interviewer expects to elicit new and perhaps unexpected information by requesting that the key informant expand on his or her answers to these initial

questions. This method is ideal for obtaining in-depth descriptive data on beliefs and practices, including historical practices.

Participant-observation is a technique whereby the researcher spends an extended period of time (from weeks to years, depending on the objective and the context) living with a target community, both observing their behaviour and participating in their practices. During this time, the researcher will be conducting formal and informal open-ended interviewing on a variety of topics. This is a good method for learning about the actual processes of decision-making, as opposed to the formal procedures. Cultural and institutional rules are rarely followed to the letter, and there are usually informal standards for an acceptable leeway. However, information on these standards can often only be obtained through participant-observation.

Data logging

Automatic Location Communicators (ALC) automatically log data through positioning and communications technology. They allow remote observation through recording of fishing activities at sea, and could replace logbooks and observers/inspectors on the bridges of fishing vessels. However, ALCs will be deficient in one simple respect: entry of data on the catch remains the responsibility of the captain.

Many data on fishing operations can be automatically recorded from bridge instrumentation. Position, speed, heading, deployment of gear through links to electronic instruments are likely to become more common in future. Once gathered, such data may be automatically transmitted to databases through satellite or ground communications.

Reporting

In most complete enumeration approaches, fisheries staff do not directly undertake data collection, but use external data sources. Most commonly, these sources are data forms completed by the fishing companies themselves, middle persons, market operators, processors and even trading companies and custom offices. Such methods are almost exclusively used for semi-industrial and industrial fisheries and institutions.

Fishing companies are often a good source of information regarding basic data on catches and fishing effort. Regular submission of basic data is a part of the fishing licensing process. Data submitted by companies are often in the form of logbooks or landings declarations. Logbooks should contain detailed information on individual fishing operations, including fishing grounds, type and duration of operation, catch by species and other types of data relating to weather and sea

conditions. Landings declarations usually deal with grouped data presented as summaries of fishing trips and catch by species.

The advantage of using reports is that data are compiled by agents other than fisheries staff and sometimes can be made available in pre-processed computerised format directly from the company's records, thereby reducing administration costs. Confidentiality of information (such as fishing grounds and catch rates) should be part of the agreement for data submission, and statistical outputs of the survey should not contain information related to individual fishing vessels or companies. However, there are also risks of under-reporting or of deliberate distortion of data, especially fishing ground, catch and revenue related information.

Harvest

The collection of data from all vessels within a fishery sector is sometimes needed usually from large-scale fisheries. Normally each vessel will be required to record their catch and effort data for every trip on a specially designed logbook. Because it is a painstaking task, usually only essential data are required. For various reasons, the data collected by this method could be inaccurate and thus validation from time to time by inspectors is important.

Post harvest

Data from post harvest operations are often used for obtaining information on landings, biology, markets, costs and earnings. Where logsheets, landings records and market reports are not available, reliable information can often only be obtained from processing factories. Reports by the processors generally include quantities and value of fish received and the resulting products. Additional information may include the origin of catch (fishing and transport vessels) and size categories of fish.

Monitoring off-loading catch in processed or whole round form requires considerable attention to detail and much depends on the relationship between the fishery authority and vessel captains or companies. It may be that sufficient trust has been developed to allow vessel or company off-loading records to be used directly, perhaps with random spot checks.

Sale

Market transaction records may form a feasible way of collecting landings with complete enumeration, particularly in large fleets of small-scale vessels that land in central locations. All invoices, sales slips or sales tallies should be designed with care as to content, style and availability to ensure completeness of coverage. Given the potential volume of paper work, simplicity and brevity will often be the most important criteria.

The primary identifier on records should be the name of the vessel (including all carrier vessels unloading from more distant fleets) that sold the catch, and the date or trip number, since vessels may make more than one sale from one landing. Total weight by species or commercial group, and price should be collected.

Trade

Trade data refers to information from customs or similar sources on trade. These data are used in socio-economic indicators and, in some exceptional cases, support landings data.

Information on exports and imports is published in most countries. It is particularly important where export or import taxes are payable, or export incentives given.

Design a Questionnaire

1. What are you trying to find out?

A good questionnaire is designed so that your results will tell you what you want to find out.

Start by writing down what you are trying to do in a few clear sentences, and design your questionnaire around this.

2. How are you going to use the information?

There is no point conducting research if the results aren't going to be used – make sure you know why you are asking the questions in the first place.

Make sure you cover everything you will need when it come to analysing the answers. e.g. maybe you want to compare answers given by men and women. You can only do this if you've remembered to record the gender of each respondent on each questionnaire.

3. Telephone, Postal, Web, Face-to-Face?

There are many methods used to ask questions, and each has its good and bad points. For example, postal surveys can be cheap but responses can be low and can take a long time to receive, face-to-face can be expensive but will generate the fullest responses, web surveys can be cost-effective but hit and miss on response rates, and telephone can be costly, but will often generate high response rates, give fast turnaround and will allow for probing.

4. Qualitative or Quantitative?

Do you want to focus on the number e.g. 87% of respondents thought this, or are you more interested in interpreting feedback from respondents to bring out common themes?

The method used will generally be determined by the subject matter you are researching and the types of respondents you will be contacting.

5. Keep it short. In fact, quite often the shorter the better.

We are all busy, and as a general rule people are less likely to answer a long questionnaire than a short one.

If you are going to be asking your customers to answer your questionnaire in-store, make sure the interview is no longer than 10 minutes maximum (this will be about 10 to 15 questions).

If your questionnaire is too long, try to remove some questions. Read each question and ask, "How am I going to use this information?" If you don't know, don't include it!

6. Use simple and direct language.

The questions must be clearly understood by the respondent. The wording of a question should be simple and to the point. Do not use uncommon words or long sentences.

7. Start with something general.

Respondents will be put-off and may even refuse to complete your questionnaire if you ask questions that are too personal at the start (e.g. questions about financial matters, age, even whether or not they are married).

8. Place the most important questions in the first half of the questionnaire.

Respondents sometimes only complete part of a questionnaire. By putting the most important items near the beginning, the partially completed questionnaires will still contain important information.

9. Leave enough space to record the answers.

If you are going to include questions which may require a long answer e.g. ask someone why they do a particular thing, then make sure you leave enough room to write in the possible answers. It sounds obvious, but it's so often overlooked!

10. Test your questionnaire on your colleagues.

No matter how much time and effort you put into designing your questionnaire, there is no substitute for testing it. Complete some interviews with your colleagues BEFORE you ask the real respondents. This will allow you to time your questionnaire, make any final changes, and get feedback from your colleagues.

Data Processing and Tabulation:

EDITING: The process of checking and adjusting responses in the completed questionnaires for omissions, legibility, and consistency and readying them for coding and storage.

Purpose of Editing For consistency between and among responses. For completeness in responses– to reduce effects of item non-response. To better utilize questions answered out of order. To facilitate the coding process.

Types of Editing: 1. Field Editing Preliminary editing by a field supervisor on the same day as the interview to catch technical omissions, check legibility of handwriting, and clarify responses that are logically or conceptually inconsistent.

2. Editing performed by a central office staff; often done more rigorously than field editing.

CODING The process of identifying and classifying each answer with a numerical score or other character symbol. The numerical score or symbol is called a code, and serves as a rule for interpreting, classifying, and recording data. Identifying responses with codes is necessary if data is to be processed by computer.

TABULATION Tabulation is the process of summarizing raw data and displaying the same in compact form (i.e., in the form of statistical table) for further analysis When mass data has been

assembled, it becomes necessary for the researcher to arrange the same in some kind of concise logical order, which may be called tabulation.

Advantages of Tabulation: :

1. It simplifies complex data.

2. It facilitates comparison.

3. It facilitates computation.

4. It presents facts in minimum possible space.

5. Tabulated data are good for references and they make it easier to present the information in the form of graphs and diagrams.

Unit 4

Hypothesis Testing

Hypothesis testing allows us to use a sample to decide between two statements made about a Population characteristic. Population Characteristics are things like " The mean of a population" or " the proportion of the population who have a particular property". These two statements are called the Null Hypothesis and the Alternative Hypothesis.

Definitions *H0:*

The Null Hypothesis This is the hypothesis or claim that is initially assumed to be true.

HA: The Alternative Hypothesis This is the hypothesis or claim which we initially assume to be false but which we may decide to accept if there is sufficient evidence.

Type I error

A **type I error**, also known as an **error of the first kind**, occurs when the null hypothesis (H_0) is true, but is rejected. It is **asserting something that is absent**, a **false hit**. A type I error may be compared with a so-called *false positive* (a result that indicates that a given condition is present when it actually is not present) in tests where a single condition is tested for. Type I errors are philosophically a focus of skepticism and Occam's razor. A Type I error occurs when we believe a falsehood.[4] In terms of folk tales, an investigator may be "crying wolf" without a wolf in sight (raising a false alarm) (H_0: no wolf).

The rate of the type I error is called the *size* of the test and denoted by the Greek letter α (alpha). It usually equals the significance level of a test. In the case of a simple null hypothesis α is the probability of a type I error. If the null hypothesis is composite, α is the maximum (supremum) of the possible probabilities of a type I error.

False positive error

A **false positive error**, commonly called a "**false alarm**" is a result that indicates a given condition has been fulfilled, when it actually has not been fulfilled. In the case of "crying wolf" – the condition tested for was "is there a wolf near the herd?", the actual result was that there had not been a wolf near the herd. The shepherd wrongly indicated there was one, by calling "Wolf, wolf!".

A false positive error is a Type I error where the test is checking a single condition, and results in an affirmative or negative decision usually designated as "true or false".

Type II error[edit]

A **type II error**, also known as an **error of the second kind**, occurs when the null hypothesis is false, but erroneously fails to be rejected. It is **failing to assert what is present**, a **miss**. A type II error may be compared with a so-called *false negative* (where an actual 'hit' was disregarded by the test and seen as a 'miss') in a test checking for a single condition with a definitive result of true or false. A Type II error is committed when we fail to believe a truth.[4] In terms of folk tales, an investigator may fail to see the wolf ("failing to raise an alarm"). Again, H_0: no wolf.

The rate of the type II error is denoted by the Greek letter β (beta) and related to the power of a test (which equals 1-β).

What we actually call type I or type II error depends directly on the null hypothesis. Negation of the null hypothesis causes type I and type II errors to switch roles.

The goal of the test is to determine if the null hypothesis can be rejected. A statistical test can either reject (prove false) or fail to reject (fail to prove false) a null hypothesis, but never prove it true (i.e., failing to reject a null hypothesis does not prove it true).

False negative error

A **false negative error** is where a test result indicates that a condition failed, while it actually was successful. A common example is a guilty prisoner freed from jail. The condition: "*Is the prisoner*

guilty?" actually had a positive result (yes, he is guilty). But the test failed to realize this, and wrongly decided the prisoner was not guilty.

A false negative error is a type II error occurring in test steps where a single condition is checked for and the result can either be positive or negative.

Example

As it is conjectured that adding fluoride to toothpaste protects against cavities, the null hypothesis of no effect is tested. When the null hypothesis is true (i.e., there is indeed no effect), but the data give rise to rejection of this hypothesis, falsely suggesting that adding fluoride is effective against cavities, a type I error has occurred.

A type II error occurs when the null hypothesis is false (i.e., adding fluoride is actually effective against cavities), but the data are such that the null hypothesis cannot be rejected, failing to prove the existing effect.

In colloquial usage type I error can be thought of as "convicting an innocent person" and type II error "letting a guilty person go free".

Tabularised relations between truth/falseness of the null hypothesis and outcomes of the test:

	Null hypothesis (H_0) is true	**Null hypothesis (H_0) is false**
Reject null hypothesis	Type I error False positive	Correct outcome True positive
Fail to reject null hypothesis	Correct outcome True negative	Type II error False negative

Measurement ofCentral Tendency

Converting Data to Information: The goal of a six sigma project is not to produce an overwhelming amount of data that ends up intimidating the concerned people. The goal is to find out as much data as possible and convert it into meaningful information that can be used by the concerned personnel to make meaningful decisions about the process. However for that one needs to learn how to statistically deal with huge amounts of data.

Data primarily needs to be understood for its two characteristics viz central tendency and dispersion. Data tends to be centred around a point known as average. The degree to which it is spread out from that point is also important because it has an important bearing on the probability. It is for this reason that we use the following characteristics to make sense of the data involved:

Measures of Central Tendency: Different types of data need different measures of central tendency. Some of the important measures, commonly used are as follows:

- **Mean:** This is most probably the arithmetic mean or simply the average of the data points involved. It could also be the geometric or harmonic mean however that is unusual. This is the most popular measure of central tendency. Many statistical techniques have evolved that use the mean as the primary measure to understand the centrality of a given set of data points.
- **Median:** If all the data points given in a particular data set were arranged in ascending or descending order, the value in the centre is called the median. In case where data sets have an odd number of elements like 7, the median is the 4th item because it has 3 data points on each side. In case the number is even like 8, then the median is the average of 4th and 5th data point. Median is used where there are outliers i.e. big numbers that impact the mean giving a false picture of the data involved.
- **Mode:** This is the value of the most frequently occurring item in the data set. This is the value of the most expected number to occur.

Dispersion

Measures of Dispersion: The degree of spread determines the probability and the level of confidence that one can have on the results obtained from the measures of central tendency. Common measures of dispersion are as follows:

- **Range:** The two endpoints between which all the values of a data set fall is called a range. It is important because it exhaustively includes all the possibilities.
- **Quartiles:** The data set is divided into 4 sets and the number of elements is each set is studied to give us data about quartiles. Similar measures include the deciles and the percentiles. However quartiles remain most widely used.
- **Standard Deviation:** A complex formula is used to work out standard deviation of a given set of data. However standard deviation is like the mean, it is the most important measure of dispersion and is used exhaustively in almost every statistical technique.

Univariate analysis

Univariate analysis is the simplest form of quantitative (statistical) analysis. The analysis is carried out with the description of a single variable in terms of the applicable unit of analysis. For example, if the variable "age" was the subject of the analysis, the researcher would look at how many subjects fall into given age attribute categories.

Univariate analysis contrasts with bivariate analysis – the analysis of two variables simultaneously – or multivariate analysis – the analysis of multiple variables simultaneously. Univariate analysis is commonly used in the first, descriptive stages of research, before being supplemented by more advanced, inferential bivariate or multivariate analysis.

Methods

A basic way of presenting univariate data is to create a frequency distribution of the individual cases, which involves presenting the number of cases in the sample that fall into each category of values of the variable. This can be done in a table format or with a bar chart or a similar form of graphical representation. A sample distribution table is presented below, showing the frequency distribution for a variable "age".

Age range	Number of cases	Percent
under 18	10	5
18–29	50	25
29–45	40	20
45–65	40	20
over 65	60	30
Valid cases: 200 Missing cases: 0		

In addition to frequency distribution, univariate analysis commonly involves reporting measures of central tendency (location). This involves describing the way in which quantitative data tend to cluster around some value. In univariate analysis, the measure of central tendency is an average of a

set of measurements, the word "average" being variously construed as (arithmetic) mean, median, mode or another measure of location, depending on the context. For a categorical variable, such as preferred brand of cereal, only the mode can serve this purpose. For a variable measured on an interval scale, such as temperature in Centigrade, or on a ratio scale, such as temperature on the Kelvin scale, the median or mean can also be used.

Another set of measures used in univariate analysis, complementing the study of the central tendency, involves statistical dispersion. These measures look at how the values are distributed around the central tendency. The most common dispersion measures are the range, interquartile range, and the standard deviation.

Further descriptors include the variable's skewness and kurtosis.

In the case of time series, which can be ordered along a time scale, univariate analysis can also involve time series analysis such as autoregression, moving average, autoregressive moving average, or autoregressive integrated moving average models. These models describe the relation between the current value of the variable and its various past values.

Multiple Regression Analysis using SPSS

Introduction

Multiple regression is an extension of simple linear regression. It is used when we want to predict the value of a variable based on the value of two or more other variables. The variable we want to predict is called the dependent variable (or sometimes, the outcome, target or criterion variable). The variables we are using to predict the value of the dependent variable are called the independent variables (or sometimes, the predictor, explanatory or regressor variables).

For example, you could use multiple regression to understand whether exam performance can be predicted based on revision time, test anxiety, lecture attendence, and gender. Alternately, you could use multiple regression to understand whether daily cigarette consumption can be predicted based on smoking duration, age when started smoking, smoker type, income, and gender

R, R Square, Adjusted R Square

R is a measure of the correlation between the observed value and the predicted value of the criterion variable. In our example this would be the correlation between the levels of job satisfaction reported by our participants and the levels predicted for them by our predictor variables. R Square (R2) is the

square of this measure of correlation and indicates the proportion of the variance in the criterion variable which is accounted for by our model – in our example the proportion of the
variance in the job satisfaction scores accounted for by our set of predictor variables (salary, etc.). In essence, this is a measure of how good a prediction of the criterion variable we can make by knowing the predictor variables. However, R square tends to somewhat over-estimate the success of the model when applied to the real world, so an Adjusted R Square value is calculated which takes into account the number of variables in the model and the number of observations (participants) our model is based on. This Adjusted R Square value gives the most useful measure of the success of our model. If, for example we have an Adjusted R Square value of 0.75 we can say that our model has accounted for 75% of the variance in the criterion variable.

Section 2: Performing a multiple regression on SPSS

EXAMPLE STUDY

In an investigation of children's spelling, a colleague of ours, Corriene Reed, decided to look at the importance of several psycholinguistic variables on spelling performance. Previous research has shown that age of acquisition has an effect on children's reading and also on object naming. A total of 64 children, aged between 7 and 9 years, completed standardised reading and spelling tests and were then asked to spell 48 words that varied systematically according to certain features such as age of acquisition, word frequency, word length, and imageability. Word length and age of acquisition emerged as significant predictors of whether the word waslikely to be spelt correctly.

Factor analysis

Factor analysis is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors. In other words, it is possible, for example, that variations in three or four observed variables mainly reflect the variations in fewer unobserved variables. Factor analysis searches for such joint variations in response to unobserved latent variables. The observed variables are modelled as linear combinations of the potential factors, plus "error" terms. The information gained about the interdependencies between observed variables can be used later to reduce the set of variables in a dataset. Computationally this technique is equivalent to low rank approximation of the matrix of observed variables. Factor analysis originated in psychometrics, and is used in behavioral sciences, social sciences, marketing, product management, operations research, and other applied sciences that deal with large quantities of data.

Factor analysis is related to principal component analysis (PCA), but the two are not identical. Latent variable models, including factor analysis, use regression modelling techniques to test hypotheses producing error terms, while PCA is a descriptive statistical technique. There has been

significant controversy in the field over the equivalence or otherwise of the two techniques (see exploratory factor analysis versus principal components analysis)

Cluster analysis (in marketing)

Cluster analysis is a class of statistical techniques that can be applied to data that exhibit "natural" groupings. Cluster analysis sorts through the raw data and groups them into clusters. A **cluster** is a group of relatively homogeneous cases or observations. Objects in a cluster are similar to each other.

Examples

The diagram below illustrates the results of a survey that studied drinkers' perceptions of spirits (alcohol). Each point represents the results from one respondent. The research indicates there are four clusters in this market. The axes represent two traits of the market. In more complex cluster analyses you may have more than that number.

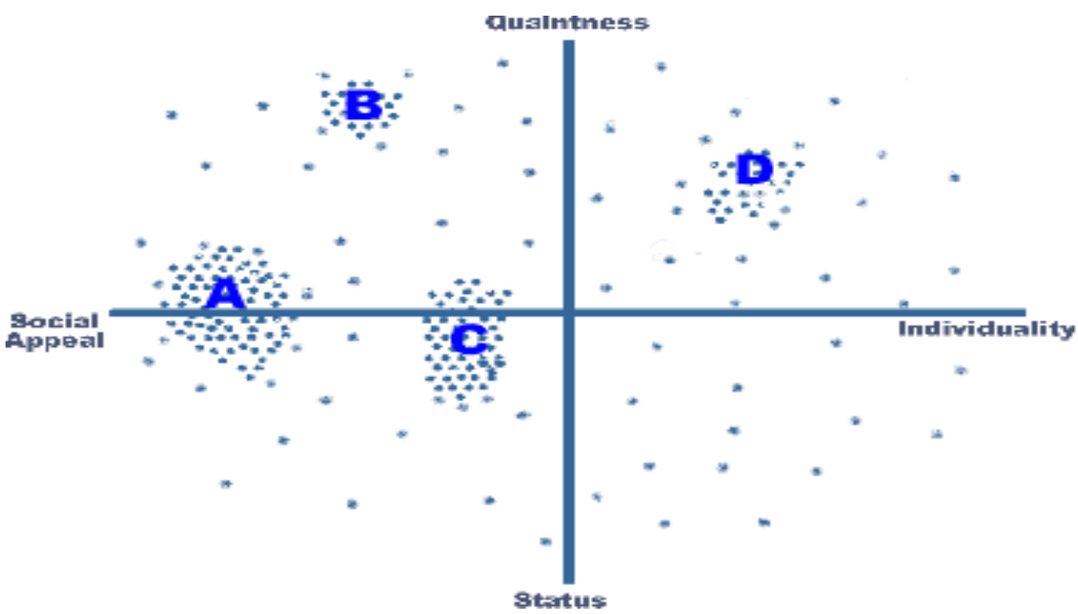

Illustration of clusters

Another example is the vacation travel market. Recent research has identified three clusters or market segments. They are the: 1) The demanders - they want exceptional service and expect to be

pampered; 2) The escapists - they want to get away and just relax; 3) The educationalist - they want to see new things, go to museums, go on a safari, or experience new cultures.

Cluster analysis, like factor analysis and multi-dimensional scaling, is an interdependence technique: it makes no distinction between dependent and independent variables. The entire set of interdependent relationships is examined. It is similar to multi-dimensional scaling in that both examine inter-object similarity by examining the complete set of interdependent relationships. The difference is that multi-dimensional scaling identifies underlying dimensions, while cluster analysis identifies clusters. Cluster analysis is the obverse of factor analysis. Whereas factor analysis reduces the number of variables by grouping them into a smaller set of factors, cluster analysis reduces the number of observations or cases by grouping them into a smaller set of clusters.

Multidimensional Scaling

Multidimensional scaling (MDS) is a series of techniques that helps the analyst to identify key dimensions underlying respondents' evaluations of objects. It is often used in Marketing to identify key dimensions underlying customer evaluations of products, services or companies.

Once the data is in hand, multidimensional scaling can help determine:

• what dimensions respondents use when evaluating objects
• how many dimensions they may use in a particular situation
• the relative importance of each dimension, and
• how the objects are related perceptually

The purpose of MDS is to transform consumer judgments of similarity or preference (eg. preference for stores or brands) into distances represented in multidimensional space. The resulting **perceptual maps** show the relative positioning of all objects. Multidimensional scaling is based on the comparison of **objects**. Any object (product, service, image, etc.) can be thought of as having both perceived and objective dimensions. For example, a firm may see their new model of lawnmower as having two color options (red versus green) and a 24-inch blade. These are the **objective dimensions**. Customers may or may not see theseattributes. Customers may also perceive the lawnmower as expensive-looking or fragile, and these are the **perceived dimensions**.

Objectives Of Multidimensional Scaling

1. As an exploratory technique to identify unrecognized
dimensions affecting behavior

2. As a means of obtaining comparative evaluations of objects when the specific bases of comparison are unknown or undefinable.

Conjoint analysis

Conjoint analysis is a statistical technique used in market research to determine how people value different features that make up an individual product or service.

The objective of conjoint analysis is to determine what combination of a limited number of attributes is most influential on respondent choice or decision making. A controlled set of potential products or services is shown to respondents and by analyzing how they make preferences between these products, the implicit valuation of the individual elements making up the product or service can be determined. These implicit valuations (utilities or part-worths) can be used to create market models that estimate market share, revenue and even profitability of new designs.

Report

Definition : A report may be defined as a formal document based on collection of facts, events and opinion and usually expresses a summarized and interpretative value of information. It can be defined as communication in which a person, who is assigned the work of report making, gives information to some individual or organization because it is his or her responsibility to do so. The word 'report' is derived from the Latin word – 'reportare' – means to bring back.

Types of Reports

Types of Reports : Reports can be classified as follows :

(1) Formal and Informal Repots

(2) Routine and special Reports

(3) Oral and written reports

(4) Informational and Analytical Reports

Formal Report	**Informal Report**
A formal report is prepared in a prescribed form.	**An informal report is generally in the form of a person to person communication.**
It is lengthy reports with length of hundred pages.	It is brief report of a specific business.
Annual Reports, reports of companies, project reports and thesis are examples of formal reports.	**Laboratory reports, daily production reports, trip reports are informal reports.**

Routine Report	**Special Report**
Routine reports are prepared and presented at regular intervals.	**Special reports is prepared and presented to convey special information related to an individual, occasion or problem.**
They may be submitted annually, semi-annually, quarterly, monthly, weekly and daily.	
Sales and production report, cost report are examples.	**Enquiry report, research reports, thesis, dissertation are special reports.**

Oral Report	Written Report
It is presentation of data in the form of face to face to communication Reports of accidents, sales production, joining are example of oral reports.	It is presentation of data/information in written form. They can be kept as permanent record / can be edited, reviewed and stored.
Informational Reports	**Analytical Reports**
It is presentation of data/information without any analysis or interpretation or recommendations. Conference report, seminar report and trip report are example.	It is presentation of data/information with analysis or interpretation or recommendations. Project reports, Feasibility reports, market research report are examples.

Guidelines for report writing

1. Know your purpose

This is the major aim: the reason you're writing the report in the first place. Because it

determines the *kind* of report you write, it's a critical (and often neglected) first step.

Give it a think. Are you writing a factual, instructional or leading report? Remember:

- Factual reports aim to inform.
- Instructional reports aim to explain.
- Leading reports aim to persuade.

Once your major aim has been defined this way, your subsidiary aims will fall into place - you inform in order to *explain*, and inform and explain in order to *persuade*. This starting point gives you vital focus, and drives absolutely everything else.

2. Know your readers

Before you start writing your report, consider its audience. Why? Because you can't hit the nail on the head if you can't see the bleedin' nail. In short, to be successful, a report must ensure that its target readers can:

- Read it without delay;
- Understand everything in it without much effort;
- Accept its facts, findings, conclusions and recommendations; and
- Decide to take the action recommended.

3. Know your objective

By matching the purpose to the reader, you are ready to set your objective. In other words, what

do you want the reader to think and do after reading your report? (People are not brainiacs - often, you have to make it explicit. 'Do *this*...!')

4. Choose an approach

I recommend a top-down approach to writing a report. This starts with the thesis statement (pretentiously also called the "terms of reference"), follows with the information-gathering and continues into three stages of ongoing refinement.

- **Thesis** - the thesis of a report is a guiding statement used to define the scope of the research or investigation. This helps you to communicate your information clearly and to be selective when collecting it.

- **Info-gathering** - there are a number of questions to ask at this stage:
    - What information do I need?
    - How much do I need?
    - Where will I find it?
    - How will I collect it?
- **Refinement** - there are three stages in the refinement process; namely:
    - Write the section-level outline.
    - Write the subsection-level outline.
    - Write the paragraph-level outline.

    Tip: The paragraph-level outline is like a presentation with bulleted points. It incorporates the flow of ideas. Once you have the paragraph-level flow of ideas, you can convert it into a full report by writing out the flow of ideas in full sentences. Like I said, hardly rocket science. But sometimes you just need someone to show you...

5. Decide on structure

Here are 11 basic elements of a standard report. I'm not a masochist, so this structure does not need to be rigidly adhered to. Instead, bring your own circumstances, needs and creativity to the mix, and use whatever's appropriate.

1. Title page
2. Index (or Contents)
3. Thesis (or Terms of Reference or Abstract)
4. Introduction (or Executive Summary)
5. Background
6. Procedure
7. Implications (or Issues)
8. Solutions (or Recommendations)
9. Conclusion
10. Appendices
11. Bibliography (or References)

6. Use the right style

Use hard facts and figures, evidence and justification. Use efficient language - big reports with too many words are awful. The best reports are simple and quick to read because the writer has interpreted the data and developed viable recommendations.

Here are some tips:

1. Write as you speak.
2. Avoid empty words.
3. Use descending order of importance.
4. Use the active voice.
5. Keep sentences short.
6. Don't try to impress; write to express.

7. Get facts 100% right.
8. Be unbiased and open.

7. Consider layout

- *Fonts*

  Remember that reports are conservative and often formal documents, so your font choices should not be cutesy, clever or sexy. For the body of the document, choose a serif font such as Times Roman or Cambria with a point size of 11 or 12. You can use a sans serif font such as Arial or Calibri for bolded headings to complement the body text.

- *Visuals*

  Spend time thinking about the pictures. Wherever necessary, explain all aspects of a visual and don't leave the reader wondering about the connection between the figure and the text. Write good captions, and choose *the type of visual* with careful consideration. (Bar graphs, pie charts and tables do different things, for example.)

8. Leave time to refine

No report is perfect, and definitely not when it's still Draft 1. Unfortunately, well-written reports are those that have gone through the mill a couple of times, either with your gimlet eye or under the skeptical gaze of someone else. Leave as much time as you can afford to check, check and double-check, and then ask yourself:

1. Overall, does the report fulfill its purpose?

2. Does it do what I was asked to do?
3. Does it do what I said I'd do in my introduction?
4. And bottom line: Am I pleased with it?

Evaluation of a Research Report

- TITLE [in a memorandum, the subject]
- ABSTRACT [in a memorandum, the first paragraph]
- 1. INTRODUCTION
- 1.1 Background
- 1.2 Outline of the problem and its context
- 1.3 Previous related work
- 2. PURPOSE
- 2.1 Hypothesis or hypotheses
- 2.2 Definitions
- 2.3 Assumptions
- 3. METHODS
- 3.1 What are the data that were used?
- 3.2 How were they collected?
- 3.3 How were they analyzed?
- 4. RESULTS
- 5. CONCLUSIONS
- 6. RECOMMENDATIONS
- 7. SUMMARY AND ACKNOWLEDGMENTS
- APPENDIX OR APPENDICES

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