

Research Methodology

(Text & Cases)

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(Text & Cases)

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PREFACE

We have great pleasure in presenting the first edition “*Research Methodology*” written for students of PG courses. The subject matter is written in a simple and easily understandable language with sufficient support from real business world information.

The language of the book is simple and the coverage of various unit is exhaustive with examples. This work is prepared as a basic material for the learners to know fully about advance research methodology. We have tried to make the book very useful for the students but still we will thankfully solicit and incorporate the suggestions of our readers. This title “*Research Methodology*” provides them an opportunity to develop the skills necessary to meet the challenges.

This is an attempt to provide the students with thorough understanding of research methodology concepts. In writing this book we have benefited immensely from the studies of a number of books and the articles written by scholars spread over diversely.

We are sure this book will prove to be useful to students and teachers alike. The book would not have seen the light, but for the grace of God and the blessings and support of our family members and friends.

We offer our gratitude to Himalaya Publishing House Pvt. Ltd., who is leader in Commerce and Management publications. Our sincere regards to Mr. Niraj Pandey and Mr. Vijay Pandey for interest shown and for the best effort put forth by the matter of publication of this book.

Finally, we express our sincere thank to SPS, Bengaluru for their excellent computer typesetting work and the printing.

Any suggestions regarding improvement and errors, if any, will be gratefully acknowledged.

Ahmedabad
Feb. 2018

Authors

Syllabus

MODULE - 1:

Business Research Fundamentals

What is research?

Types of business research

Business Research Process

Problem identification, Problem statement

Research questions / objectives

Hypothesis formulation

MODULE - 2:

Research Methodology

Research design (Exploratory, Descriptive, Causal)

Sampling designs

Scaling

Types of data

Types of scales

Validity and reliability

Data Collection

Sources

Methods (Qualitative and Quantitative)

Tools (Includes Questionnaire designing)

MODULE - 3:

Data Analysis and Interpretation:

Univariate Data Analysis

Comparing observed data with standard / expected

Parametric – T test

Non-parametric – Runs, One Way Chi-Square

Bivariate Data Analysis

Difference between variables

Parametric - T-test (independent and paired)

Non-parametric – Mann-Whitney U test

Similarities between variables (No Numerical Problems – Understanding application through statistical software)

Parametric – Correlation and Regression

Non-parametric – Spearman's Rank Correlation Influence of one variable on another variable

Parametric – ONE WAY ANOVA

Non-parametric – Kruskal Wallis

MODULE - 4:

Research Writing:

Research Proposal

Review of Literature

Research Report

Citations and Bibliography



Contents

<i>Sl. No.</i>	<i>Module Name</i>	<i>Page No.</i>
Module - 1	Business Research	1 - 30
	Introduction Business Research Fundamentals What is Research? Types of Business Research Business Research Process Problem Identification Problem statement Research Questions Objectives Hypothesis Formulation Review Questions	
Module - 2	Research Methodology	31 - 114
	Research Methodology Research Design (Exploratory, Descriptive, Causal) Sampling Designs Scaling Types of Data Types of Scales Validity and Reliability Data Collection Sources of Data Collection Methods (Qualitative and Quantitative) Tools (Includes Questionnaire designing) Review Questions	

Module - 3	Data Analysis and Interpretation	115 - 210
	Data Analysis and Interpretation Univariate Data Analysis Comparing observed data with standard/expected Parametric – T test Non-parametric – Runs, One Way Chie-Square Bivariate Data Analysis Difference between variables Parametric - T-test (independent and paired) Non-parametric – Mann-Whitney U test Similarities between variables (No Numerical Problems – Understanding application through statistical software) Parametric – Correlation and Regression Non-parametric – Spearman’s Rank Correlation Influence of one variable on another variable Parametric – ONE WAY ANOVA Non-parametric – Kruskal Wallis Review Questions	
Module - 4	Research Writing	211 - 240
	Research Writing Research Proposal Review of Literature Research Report Citations and Bibliography Review Questions	
	Case Study	241 - 250

1

MODULE

BUSINESS RESEARCH

Highlights

- Introduction
- Business Research Fundamentals
- What is Research?
- Types of Business Research
- Business Research Process
- Problem Identification
- Problem statement
- Research Questions
- Objectives
- Hypothesis Formulation

INTRODUCTION TO RESEARCH

Research is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In it we study the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them. It is necessary for the researcher to know not only the research methods but also the methodology. Researchers not only need to know how to develop certain indices or tests, how to calculate the mean, the mode, the median or the standard deviation or chi-square, how to apply particular research techniques, but they also need to know which of these methods or techniques, are relevant and which are not, and what would they mean and indicate and why. Researchers also need to understand the assumptions underlying various techniques and they need to know the criteria by which they can decide that certain techniques and procedures will be applicable to certain problems and others will not. All this means that it is necessary for the researcher to design his methodology for his problem as the same may differ from problem to problem. For example, an architect, who designs a building, has to consciously evaluate the basis of his decisions, i.e., he has to evaluate why and on what basis he selects particular size, number and location of doors, windows and ventilators, uses particular materials and not others and the like.

Similarly, in research the scientist has to expose the research decisions to evaluation before they are implemented. He has to specify very clearly and precisely what decisions he selects and why he selects them so that they can be evaluated by others also. From what has been stated above, we can say that research methodology has many dimensions and research methods do constitute a part of the research methodology.

The scope of research methodology is wider than that of research methods. Thus, when we talk of research methodology we not only talk of the research methods but also consider the logic behind the methods we use in the context of our research study and explain why we are using a particular method or technique and why we are not using others so that research results are capable of being evaluated either by the researcher himself or by others. Why a research study has been undertaken, how the research problem has been defined, in what way and why the hypothesis has been formulated, what data have been collected and what particular method has been adopted, why particular technique of analyzing data has been used and a host of similar other questions are usually answered when we talk of research methodology concerning a research problem or study.

BUSINESS RESEARCH FUNDAMENTALS

Business research is a field of practical study in which a company obtains data and analyzes it in order to better manage the company. Business research can include financial data, consumer feedback, product research and competitive analysis.

Executives and managers who use business research methods are able to better understand their company, the position it holds in the market and how to improve that position.

Financial data takes qualitative information such as sales reports, revenues and cost reports to see what areas make money and what costs money. By reviewing data, managers can find the products, staff and departments that are most efficient and determine areas of unnecessary costs.

Understanding what the public says about the products and services a company provides is essential to making sure the company is meeting consumer needs. Customer feedback includes case studies, focus groups, customer surveys and questionnaires.

Product research seeks to improve the product to meet the needs of consumers. This may include technological advancements, improved customer service or access to the product through a variety of distribution channels.

Competitive analysis is when one company compares its products and services to those of another company. This can be done to improve the product, create a niche or determine a more attractive price point to lure customers.

Using research tools such as the information compiled by Dun & Bradstreet can help a company to understand how the industry as a whole is doing. This can help executives make decisions based on economic factors affecting their industry that are not limited to their own products.

WHAT IS RESEARCH?

Research refers to the search for knowledge, or as any systematic investigation, with an open mind, to establish novel facts, solve new or existing problems, prove new ideas, or develop new theories. The primary purposes of basic research as opposed to applied research are documentation, discovery, interpretation or the research and development of methods and systems for the advancement of human knowledge. Approaches to research depend on epistemologies, which vary considerably both within and between humanities and sciences.

DEFINITION OF RESEARCH

According to *Martin Shuttle Worth*, "Research includes any gathering of data, information and facts for the advancement of knowledge."

According to *Creswell*, "Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue".

The *Merriam-Webster Online Dictionary* defines research in more detail as "a studious inquiry or examination; especially: investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws".

OBJECTIVE OF RESEARCH

The purpose of research is to discover answers through the application of scientific procedures. The main aim of research is to find out the truth which is hidden and which has not been discovered as yet. Though each research study has its own specific purpose, may think of research objectives as falling into number of broad grouping:

- i) To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory or formularize research studies.
- ii) To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as descriptive research studies);
- iii) To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies).
- iv) To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis-testing research studies).

TYPES OF BUSINESS RESEARCH

1. Pure Research

Pure research advances fundamental knowledge about the human world. It focuses on refuting or supporting theories that explain how this world operates, what makes things happen, why social relations are a certain way, and why society changes. Pure research is the source of most new scientific ideas and ways of thinking about the world. It can be exploratory, descriptive, or explanatory; however, explanatory research is the most common.

Pure research generates new ideas, principles and theories, which may not be immediately utilized; though are the foundations of modern progress and development in different fields. Today's computers could not exist without the pure research in mathematics conducted over a century ago, for which there was no known practical application at that time. Pure research rarely helps practitioners directly with their everyday concerns. Nevertheless, it stimulates new ways of thinking about deviance that have the potential to revolutionize and dramatically improve how practitioners deal with a problem.

A new idea or fundamental knowledge is not generated only by pure research, but pure research can build new knowledge. In any case, pure research is essential for nourishing the expansion of knowledge. Researchers at the center of the scientific community conduct most of what is pure research. It is undertaken for increase in knowledge. There is no direct benefit as it is a research for the sake of research. It is conducted to satisfy any curiosity such as: (a) what makes things happen, (b) why society changes and (c) why social relations are in a certain way. In fact, it is the source of most new theories, principles and ideas. Basic research rarely helps

anyone directly. It only stimulates new ways of thinking. The main motivation is to expand man's knowledge. There is absolutely no commercial value to the discoveries resulting from such research.

However, in the long run, it forms the basis of applied research or development commercial products. If basic work is done first, then applied spin-offs often eventually result from this research. As Dr. George Smoot of LBNL says, "People cannot foresee the future well enough to predict what's going to develop from basic research. If we only did "applied research", we would still be making better spears." To sum up, basic research is purely theoretical to increase our understanding of certain phenomena or behavior but does not seek to solve any existing problem.

2. Applied Research

Applied research is a form of systematic inquiry involving the practical application of science. It accesses and uses some part of the research communities' (the academy's) accumulated theories, knowledge, methods, and techniques, for a specific, often state, business, or client driven purpose. Applied research is compared to pure research (basic research) in discussion about research ideals, methodologies, programs, and projects.

Applied research deals with solving practical problems and generally employs empirical methodologies. Because applied research resides in the messy real world, strict research protocols may need to be relaxed. For example, it may be impossible to use a random sample. Thus, transparency in the methodology is crucial. Implications for interpretation of results brought about by relaxing an otherwise strict canon of methodology should also be considered.

It is use of basic research or past theories, knowledge and methods for solving an existing problem. It deals with practical problems. It is opposed to pure research which is not problem-oriented but for the increase in knowledge which may or may not be used in future. In the present world situation, more emphasis is being given to applied research to solve problems arising out of overpopulation and scarcity of natural resources.

Applied research should not be treated the same as Research & Development (R&D) which is involved in developing products demanded by the existing clients. Applied Research, on the other hand, focuses on uncovering what needs are not being met and use that information in designing products or services that would create their own demand. Thus, applied research brings in new customers and also provides better products and services to the existing customers. In old days, the mobile phone was expensive, bulky and had a short range. Applied Research foresaw that this product would have a limited market and stressed on cost-cutting, reduced weight and long-distance communication. Such measures caused a heavy demand.

3. Causal Research

Causal Research explores the effect of one thing on another and more specifically, the effect of one variable on another. The research is used to measure what impact a specific change

will have on existing norms and allows market researchers to predict hypothetical scenarios upon which a company can base its business plan. When most people think of scientific experimentation, research on cause and effect is most often brought to mind. Experiments on causal relationships investigate the effect of one or more variables on one or more outcome variables. This type of research also determines if one variable causes another variable to occur or change. An example of this type of research would be altering the amount of a treatment and measuring the effect on study participants.

4. Descriptive Research

Descriptive research design is a scientific method which involves observing and describing the behavior of a subject without influencing it in any way.

Descriptive research seeks to depict what already exists in a group or population. An example of this type of research would be an opinion poll to determine which Presidential candidate people plan to vote for in the next election. Descriptive studies do not seek to measure the effect of a variable; they seek only to describe.

5. Relational Research

A study that investigates the connection between two or more variables is considered relational research. The variables that are compared are generally already present in the group or population. For example, a study that looked at the proportion of males and females that would purchase either a classical CD or a jazz CD would be studying the relationship between gender and music preference.

6. Analytical Research

Analytical research is a style of qualitative inquiry which draws from the disciplines of philosophy, history and biography. It is non-interactive document research. Analytical research describes and interprets the past or recent past from selected sources. The sources may be documents preserved in collections, and/or participants' oral testimonies.

7. Quantitative Research

This type of research mainly deal in numbers, number of tools are used to gather information from audience such as surveys, different type of media, stores audit and etc. Quantitative research is commonly used and getting popularity day by day because of variety of tools are available in the market. This approach is less expensive and takes less time as compared to Qualitative research, that the reason more companies opting this method as marketing research method.

8. Qualitative Research

This method is more than dealing in numbers, requires more expertise to perform this type of marketing research. Types of qualitative research include focus groups and observational

studies. Focus groups gather a small number of respondents together to discuss topics yielded by the research questions. A moderator leads the discussion and helps keep discussion lively and focused around the research questions.

9. Conceptual Research

Conceptual research involves investigation of thoughts and ideas and developing new ideas or interpreting the old ones based on logical reasoning. A conceptual framework is used in research to outline possible courses of action or to present a preferred approach to an idea or thought. For example, the philosopher Isaiah Berlin used the "hedgehogs" versus "foxes" approach; a "hedgehog" might approach the world in terms of a single organizing principle; a "fox" might pursue multiple conflicting goals simultaneously. Alternatively, an empiricist might approach a subject by direct examination, whereas an intuitionist might simply intuit what's next.

Conceptual frameworks are a type of intermediate theory that attempt to connect to all aspects of inquiry e.g., problem definition, purpose, literature review, methodology, data collection and analysis. Conceptual frameworks can act like maps that give coherence to empirical inquiry. Because conceptual frameworks are potentially so close to empirical inquiry, they take different forms depending upon the research question or problem.

10. Empirical Research

Empirical research is based on firm verifiable data collected by either observation of facts under natural condition or obtained through experimentation. Empirical research is a way of gaining knowledge by means of direct and indirect observation or experience. Empirical evidence the record of one's direct observations or experiences can be analyzed quantitatively or qualitatively. Through quantifying the evidence or making sense of it in qualitative form, a researcher can answer empirical questions, which should be clearly defined and answerable with the evidence collected usually called data. Research design varies by field and by the question being investigated. Many researchers combine qualitative and quantitative forms of analysis to better answer questions which cannot be studied in laboratory settings, particularly in the social sciences and in education.

SCOPE OF RESEARCH

The scope of research can be summarized as follows:

i) Business Competition

Competition in business is increasing day by day. You need to know about customers, products and industry competition.

- a) **Customers:** You need to know about your customers, their needs, their perceptions and future requirements. Research helps you to find out the variables and factors which are significant for increasing customer loyalty and adding new customers.

- b) **Products:** Research helps you to know consumer need and this in turn is used to develop new product. To decide about pricing, positioning, packaging, branding, sales promotion and other promotional techniques, we need to carry out business research.
- c) **Industry competition:** You need to know what other companies are doing to increase their market share, factors responsible for increase and decrease of market share, and trends in industry growth.

2. Business Environment

Business environment is the totality of all those factors which affect the business but are not under the control of managers. Economic and non-economic elements of environment include economic system (ownership rights like in capitalism and socialism), economic anatomy (structure of households whether manufacturing, trading or agriculture society), Government legislations, Government policies, movement of policies, velocity of policies, fiscal and monetary policies, ideology of ruling party, social ideology, social values and systems, social structures, etc. Changing environment affect the business. You need to know the trend in environment and factors responsible for change in environment.

3. Maturing of management as a group of disciplines

The quality of theories and models to explain tactical and strategic results in human resources, marketing, operations, and finance is improving, providing managers with more knowledge. In turn managers are expected to use these models to specific field they are attached to; business research can help managers to understand these models and their use in specific situation.

4. Explosive growth and influence of the Internet

The explosive growth of company websites, e-commerce and electronic publications brings extensive amounts of new information, but this information does not help us to make decisions. (We shall read in the coming chapters that information is not knowledge). Information need to be processed to arrive at knowledge. This knowledge can be helpful to have competitive advantage.

5. Stakeholders demanding greater influence

Customers, workers, shareholders and the general public demand to be included in company decision-making; armed with extensive information, they are more sensitive to their own self-interests than ever before and more resistant to an organization's stimuli.

6. More global competition

Competition, both global and domestic, is growing and often coming from unexpected sources; many organizations re-focus on primary competencies, while they seek to improve operations by reducing costs and converting customers to advocates.

7. More government intervention

Governments continue to show concern with all aspects of society, becoming increasingly aggressive in protecting various segments of society with various policies. This throws challenges to managers to be alert to various factors which are not under their control. The decisions under such circumstances can be made after the use of managerial and business research tools.

8. More complex decisions

Managers have more variables to consider in every decision, increasing their need for more and better knowledge and greater insights from that information.

9. Lower-cost data collection

Computers and telecommunications lowered the costs of data collection. Everybody has access to data. Research helps to convert information into knowledge, hence knowledge is easily available. This drastically changes knowledge about consumers at both store and household levels; employees at the position, team, and department levels; suppliers and distributors at the transaction division, and company levels; and machines at the part process, and production-run levels resulting into increased competition. Due to heavy competition among companies and also due to easy availability of data, continuous research process is required.

10. Better visualization tools

With the use of technology, it is possible to download at high speed. High-speed downloads of images allow researchers to visualize complex concepts, which enrich measurement capabilities and in turn help consumers to arrive at better decisions of purchasing the products. Researchers can develop new techniques to create images which can be more competitive.

11. Powerful computations

Sophisticated techniques of quantitative analysis are emerging to take advantage of increasingly powerful computing capabilities. Computer advances permit businesses to create and manage a data warehouse, an electronic storehouse where vast arrays of collected, integrated data are ready for mining. The power and ease of use of computers offer us the capability to analyze more data more quickly to deal with complex managerial problems. Yet, the quantity of collected raw data overwhelms users, necessitating a means to manage it. Early efforts to provide a flow of information to managers used a Management Information System (MIS). Now the challenge of database management from an MIS perspective has increased which include removing obstacles like resistance to use, keenness of managers to disclose fully their information needs and decision criteria, decreasing costs of single-user report generation, system design time, increasing adaptation to changing organization structures, and decision relevance (standard versus tailored reports). While routine MIS reports are useful for well-structured

problems and those amenable to a standardized set of procedures, data must be more than timely and standardized; reporting must be customized to be truly meaningful to the user.

12. Advanced analytical tools for enhanced insights

Organizations increasingly practice data mining, applying mathematical models to extract meaningful knowledge from volumes of data contained within internal databases. Enormous quantities of research data are reduced to relatively straightforward equations with statistical models. Expert systems and outgrowth of artificial intelligence, and data mining entered the 21st century as important tools for research. Advanced analytical tools are available to answer a variety of research questions. Traditional topics open to modeling market share, price elasticity, the cannibalization of one product's sales by the introduction of another product, the effects on productivity of changing an employee compensation system, to name a few create decision support models that reflect the behaviour of individuals, households, and industries. Programmes that combine modeling and decision support systems evolved in the latter part of the 20th century to provide the most utility to users.

13. New perspectives on established research methodologies

Older tools and methodologies once limited to exploratory research are gaining wider acceptance in dealing with a broader range of managerial problems.

CHARACTERISTICS OF A GOOD RESEARCH

Good research generates dependable data that are derived by professionally conducted practices and that can be used reliably for decision-making. In contrast, poor research is carelessly planned and conducted, resulting in data that a manager can't use to reduce his or her decision-making risks. Good research follows the standards of the scientific method: systematic, empirically based procedures for generating replicable research.

Following are the characteristics of a good research for managerial decisions:

1. Purpose clearly defined

The purpose of the business research, the problem involved or the decision to be made should be clearly defined and sharply delineated in terms as unambiguous as possible. Getting this in writing is valuable even in instances where the same person serves as researcher and decision-maker. The statement of the decision problem should include its scope, its limitations, and the precise meanings of all words and terms significant to the research. Failure of the researcher to do this adequately may raise legitimate doubts in the minds of research report readers as to whether the researcher has sufficient understanding of the problem to make a sound proposal attacking it. This characteristic is comparable to developing a strategic plan for achieving an objective before developing a tactical plan or an action map.

2. Research process detailed

The research procedures used should be described in sufficient detail to permit another researcher to repeat the research. Except when secrecy is imposed, research reports should reveal with candor the sources of data and the means by which they were obtained. Omission of significant procedural details makes it difficult or impossible to estimate the validity and reliability of the data and justifiably weakens the confidence of the reader in the research itself as well as any recommendations based on the research. This characteristic is comparable to developing a tactical plan.

3. Research design thoroughly planned

The procedural design of the research should be carefully planned to yield results that are as objective as possible. When a sampling of the population is involved, the report should include evidence concerning the degree of representativeness of the sample. A survey of opinions or recollections ought not to be used when more reliable evidence is available from documentary sources or by direct observation. Bibliographic searches should be as thorough and complete as possible. Experiments should have satisfactory controls. Direct observations should be recorded in writing as soon as possible after the event. Efforts should be made to minimize the influence of personal bias in selecting and recording data. This characteristic is comparable to developing detailed action plans for each tactic.

4. High ethical standards applied

Researchers often work independently and have significant latitude in designing and executing research projects. A research design that includes safeguards against causing mental or physical harm to participants and makes data integrity a first priority should be highly valued. Ethical issues in research reflect important moral concerns about the practice of responsible behavior in society. Researchers frequently find themselves precariously balancing the rights of their subjects against the scientific dictates of their chosen method. When this occurs, they have a responsibility to guard the welfare of the participants in the studies and also the organizations to which they belong, their clients, their colleagues, and themselves. Careful consideration must be given to those research situations in which there is a possibility of physical or psychological harm, exploitation, invasion of privacy, and/or loss of dignity. The research need must be weighed against the potential for adverse effects. Typically, you can redesign a study, but sometimes you cannot. The researcher should be prepared for this dilemma.

5. Limitations frankly revealed

The researcher should report, with complete frankness, flaws in procedural design and estimate their effect on the findings. There are very few perfect research designs. Some of the imperfections may have little effect on the validity and reliability of the data; others may invalidate them entirely. A competent researcher should be sensitive to the effects of imperfect design. The

researcher's experience in analyzing data should provide a basis for estimating the influence of design flaws. As a decision-maker, you should question the value of research where no limitations are reported.

6. Analysis adequate for decision maker's needs

Analysis of the data should be extensive enough to reveal its significance, what managers call "insights." The methods of analysis used should be appropriate. The extent to which this criterion is met is frequently a good measure of the competence of the researcher. Adequate analysis of the data is the most difficult phase of research for the novice. The validity and reliability of data should be checked carefully. The data should be classified in ways that assist the researcher in reaching pertinent conclusions and clearly reveal the findings that have led to those conclusions. When statistical methods are used, the probability of error should be estimated and the criteria of statistical significance applied.

7. Findings presented unambiguously

Some evidence of the competence and integrity of the researcher may be found in the report itself. For example, language that is restrained, clear, and precise; assertions that are carefully drawn and hedged with appropriate reservations; and an apparent effort to achieve maximum objectivity tend to leave a favorable impression of the researcher with the decision-maker. Generalizations that outrun the evidence on which they are based, exaggerations, and unnecessary verbiage tend to leave an unfavorable impression. Such reports are not valuable to managers wading through the minefields of organizational decision-making. Presentation of data should be comprehensive, easily understood by the decision-maker, and organized so that the decision-maker can readily locate critical findings.

8. Conclusions justified

Conclusions should be limited to those for which the data provide an adequate basis. Researchers are often tempted to broaden the basis of induction by including personal experiences and their interpretations data not subject to the controls under which the research data were gathered. Equally undesirable is the all-too-frequent practice of drawing conclusions from a study of a limited population and applying them universally. Researchers also may be tempted to rely too heavily on data collected in a prior study and use it in the interpretation of a new study. Such practice sometimes occurs among research specialists who confine their work to clients in a small industry. These actions tend to decrease the objectivity of the research and weaken readers' confidence in the findings. Good researchers always specify the conditions under which their conclusions seem to be valid.

9. Researcher's experience reflected

Greater confidence in the research is warranted if the researcher is experienced, has a good reputation in research, and is a person of integrity. Were it possible for the reader of a research

report to obtain sufficient information about the researcher, this criterion perhaps would be one of the best bases for judging the degree of confidence a piece of research warrants and the value of any decision based upon it. For this reason the research report should contain information about the qualifications of the researcher.

Good business research has an inherent value only to the extent that it helps management make better decisions that help achieve organizational goals. Interesting information about consumers, employees, competitors, or the environment may be pleasant to have, but its value is limited if the information cannot be applied to a critical decision. If a study does not help management select more effective, more efficient, less risky, or more profitable alternatives than otherwise would be the case, its use should be questioned. Alternatively, management may have insufficient resources (time, money, or skill) to conduct an appropriate study or may face a low level of risk associated with the decision at hand. In these situations, it is valid to avoid business research and its associated costs in time and money. Business research finds its justification in the contribution it makes to the decision-makers task and to the bottom line.

RESEARCH IN MANAGEMENT

Research in management is a systematic way to collect information and get knowledge out of it with a methodology so that the derived knowledge can be used to make decisions. Usually, managers face major issues like ongoing complaints from customers; need to convince financiers/bankers for advances, unmet needs among customers, the need to polish an internal process, issues while managing men, machines, materials and money, issues of forecasting and future plans. Research helps us decide rationally. Business research is the process and the tool needed to reduce risk in managerial decision-making. Business research is a systematic inquiry that provides systematic knowledge to guide managerial decisions. More specifically, it is a process of planning, acquiring, analyzing, and disseminating relevant data, information, and insights to decision-makers in ways that mobilize the organization to take appropriate actions that, in turn, maximize business performance.

Research is essential to collect facts and statistics about a company's customers, employees and competitors. On the basis of these numbers, companies are able to make better managerial decisions. The collected statistics are organized into reports and the management team uses them to take action. A good research mechanism is essential, irrespective of the size of the company and its client base. Research is imperative for staying competitive in the market.

A business is able to make knowledgeable decisions because of research. In the research process, the company is able to obtain information about key business areas, analyze it, develop a strategy and distribute business information. Reports, provided to the top management, often include information on consumer and employee preferences and all the available routes for sales, marketing, finance and production. Management uses this information to decide the best strategy.

Research is a prerequisite at all stages and phases of business operations. Initial research is required to gauge whether getting into the given type of business would be profitable and whether there is demand for the proposed product.

By conducting business research, the organization ascertains what its customers want and then takes steps to prepare a product meeting those desires. Research also helps determine whether a product is accepted in the market. Research aids expansion into new markets.

Conducting research involves cost and time. The organization must weigh the pros and cons before hiring consultants to conduct research. Consultants must be made fully aware of what the organization is looking for from the research.

The primary benefit to business research is that the organization is able to learn more about consumer choices and preferences. Research provides information on the product features that lure customers and flaws in the product or marketing that contribute to slow sales. Research helps the organization fix problems and cash in on the strengths. Research also contributes to a company's ability to clearly identify the customer demographics and target demographic, including age, gender and monthly income of the household and educational levels. Research mitigates business risks and can help increase demand and sales.

RESEARCH AND SCIENTIFIC METHOD

The scientific method encourages a rigorous, impersonal mode of procedure dictated by the demands of logic and objective procedure. Accordingly, scientific method implies an objective, logical and systematic method, i.e., a method free from personal bias or prejudice, a method to ascertain demonstrable qualities of a phenomenon capable of being verified, a method wherein the researcher is guided by the rules of logical reasoning, a method wherein the investigation proceeds in an orderly manner and a method that implies internal consistency.

Research can be termed as “an inquiry into the nature of, the reasons for, and the consequences of any particular set of circumstances, whether these circumstances are experimentally controlled or recorded just as they occur. Further, research implies the researcher is interested in more than particular results; he is interested in the repeatability of the results and in their extension to more complicated and general situations.” On the other hand, the philosophy common to all research methods and techniques, although they may vary considerably from one science to another, is usually given the name of scientific method. In this context, Karl Pearson writes, “The scientific method is one and same in the branches (of science) and that method is the method of all logically trained minds, the unity of all sciences consists alone in its methods, not its material; the man who classifies facts of any kind whatever, who sees their mutual relation and describes their sequences, is applying the Scientific Method and is a man of science.” Scientific method is the pursuit of truth as determined by logical considerations. The ideal of science is to achieve a systematic interrelation of facts. Scientific method attempts to

achieve “this ideal by experimentation, observation, logical arguments from accepted postulates and a combination of these three in varying proportions.” In scientific method, logic aids in formulating propositions explicitly and accurately so that their possible alternatives become clear.

Further, logic develops the consequences of such alternatives, and when these are compared with observable phenomena, it becomes possible for the researcher or the scientist to state which alternative is most in harmony with the observed facts. All this is done through experimentation and survey investigations which constitute the integral parts of scientific method.

Experimentation is done to test hypotheses and to discover new relationships. As such the researcher must pay all possible attention while developing the experimental design and must state only probable inferences. The purpose of survey investigations may also be to provide scientifically gathered information to work as a basis for the researchers for their conclusions.

The scientific method is, thus, based on certain basic postulates which can be stated as under:

1. It relies on empirical evidence;
2. It utilizes relevant concepts;
3. It is committed to only objective considerations;
4. It presupposes ethical neutrality, i.e., it aims at nothing but making only adequate and correct statements about population objects;
5. It results into probabilistic predictions;
6. Its methodology is made known to all concerned for critical scrutiny is for use in testing the conclusions through replication;
7. It aims at formulating most general axioms or what can be termed as scientific theories.

SOCIAL SCIENCE AND BUSINESS RESEARCH

Social science refers to the academic disciplines concerned with society and human nature. "Social science" is commonly used as an umbrella term to refer to anthropology, archaeology, criminology, economics, education, linguistics, law, communication studies, history, political science, sociology, human geography and psychology.

Social Science is a group of academic disciplines that examine society and how people interact and develop as a culture. Social science as a field of study is separate from the natural sciences, which cover topics such as physics and chemistry. Economics, political science, history, law and geography can be considered social sciences.

Social science as an academic field of study developed out of the Age of Enlightenment as individuals began to take a more disciplined approach to quantifying their observations of society. Over time, similar aspects of a society, such as communication, were separated into unique fields of study. Statistical surveys and research methodologies helped prove or disprove theories.

BUSINESS RESEARCH PROCESS

Business research process deals with the ways and strategies used by researchers to understand the world around us. The market research process involves a round of separate stages of data interpretation, organization and collection. These stages could be considered as a benchmark of market research, but it depends on an organization how they have encapsulated their strategies to follow this process. Hence some of the interlinked stages could be conducted repeatedly and some of the stages can also be omitted.

STEPS IN THE BUSINESS RESEARCH PROCESS

Step 1: Formulation of Research Problem

The most common sources of research ideas are the experience of practical problems in the field. Many researchers are directly engaged in social, health, or human service program implementation and come up with their ideas based on what they see happening around them. The first step in any marketing research project is to define the problem. In defining the problem, the researcher should take into account the purpose of the study, the relevant background information, what information is needed, and how it will be used in decision-making. Problem definition involves discussion with the decision makers, interviews with industry experts, analysis of secondary data, and, perhaps, some qualitative research, such as focus groups. Once the problem has been precisely defined, the research can be designed and conducted properly.

“The formulation of the problem is often more essential than its solution.”

Albert Einstein.

Formulation of research problems asks the following questions:

1. What is your area of interest?
2. Where could you look for help in deciding upon a specific research problem?
3. What criteria will you apply when deciding upon a specific research problem?
4. How could you narrow down your research problem?
5. How might your value-judgments affect your research activities?

Step 2: Defining Research Problem

A research problem in general refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants a solution for the same.

Components of research problems:

1. There must be an individual or a group which has some difficulty or the problem.
2. There must be some objective(s) to be attained.
3. There must be alternative courses of action for obtaining the objective.

4. There must remain some hesitation in the mind of a researcher with regard to the selection of alternatives.
5. Research must answer the relative efficiency of the possible alternatives.

Step 3: Development of an Approach to the Problem

Development of an approach to the problem includes formulating an objective or theoretical framework, analytical models, research questions, hypotheses, and identifying characteristics or factors that can influence the research design. This process is guided by discussions with management and industry experts, case studies and simulations, analysis of secondary data, qualitative research and pragmatic considerations.

Step 3: Research Design

A research design is a framework for conducting the research project. It details the procedures necessary for obtaining the required information. Its purpose is to design a study that will test the hypotheses of interest, determine possible answers to the research questions, and provide the information needed for decision making.

Components of research Design:

- i) Define the information needed
- ii) Design the exploratory, descriptive, and causal phases of the research.
- iii) Specify the measurement and scaling procedures.
- iv) Construct and pre-test a questionnaire or an appropriate form for data collection.
- v) Specify the sampling process and sample size.
- vi) Develop a plan of data analysis.

Conducting exploratory research, precisely defining the variables, and designing appropriate scales to measure them are also a part of the research design. The issue of how the data should be obtained from the respondents (for example, by conducting a survey or an experiment) must be addressed. It is also necessary to design a questionnaire and a sampling plan to select respondents for the study. More formally, formulating the research design involves the following steps:

- i) Secondary data analysis
- ii) Qualitative research
- iii) Methods of collecting quantitative data.
- iv) Definition of the information needed
- v) Measurement and scaling procedures
- vi) Questionnaire design

- vii) Sampling process and sample size
- viii) Plan of data analysis

Step 4: Field Work or Data Collection

Data collection involves a field force or staff that operates either in the field, as in the case of personal interviewing (in-home, mall intercept, or computer-assisted personal interviewing), from an office by telephone (telephone or computer-assisted telephone interviewing), or through mail (traditional mail and mail panel surveys with persecuted households). Proper selection, training, supervision, and evaluation of the field force help minimize data-collection errors.

Step 5: Data Preparation and Analysis

Data preparation includes the editing, coding, transcription, and verification of data. Verification ensures that the data from the original questionnaires have been accurately transcribed. The final data is then segmented according to the business standards and inserted into the Customer Relationship Management database in a more tabulated form so that search or combination could be made easily. The researcher finally has data to analyze so that the research question can be answered. In the instrumentation plan, the researcher specified how the data will be analyzed. The researcher now analyzes the data according to the plan. The results of this analysis are then reviewed and summarized in a manner directly related to the research questions. In the obesity study, the researcher compares the measurements of weight, percentage of body fat, and cholesterol that were taken at the first meeting of the subjects to the measurements of the same variables at the final program session. These two sets of data will be analyzed to determine if there was a difference between the first measurement and the second measurement for each individual in the program. Then, the data will be analyzed to determine if the differences are statistically significant. If the differences are statistically significant, the study validates the theory that was the focus of the study. The results of the study also provide valuable information about one strategy to combat childhood obesity in the community.

Step 6: Report Preparation and Presentation

The entire project should be documented in a written report which addresses the specific research questions identified, describes the approach, the research design, data collection, and data analysis procedures adopted and present the results and the major findings.

The findings should be presented in an understandable format so that they can be readily used in the decision making process.

An oral presentation should be made to management using tables, figures, and graphs to enhance clarity and impact. For these reasons, interviews with experts are more useful in conducting marketing research for industrial firms and for products of a technical nature, where it is relatively easy to identify and approach the experts.

A research design is a framework for conducting the research project. It details the procedures necessary for obtaining the required information. Its purpose is to design a study that will test the hypotheses of interest, determine possible answers to the research questions, and provide the information needed for decision making.

Conducting exploratory research, precisely defining the variables, and designing appropriate scales to measure them are also a part of the research design. The issue of how the data should be obtained from the respondents (for example, by conducting a survey or an experiment) must be addressed. It is also necessary to design a questionnaire and a sampling plan to select respondents for the study.

PROBLEM IDENTIFICATION

The identification of research problem is the first and foremost step that every researcher has to undertake. At times, it becomes rather difficult for an inexperienced researcher or a novice/beginner in research to conceptualize a research problem. In general, a research problem should be understood as some difficulty, unclear situation which a researcher experiences in practical or theoretical context and wants to obtain a tangible explanation, clarification or offer solution to it. For students, this problem may be as a result of theoretical encounter in the area of specialization. As such, before embarking on any research, you should identify the major research area of your interest, mostly the area of your specialization. For instance from: Education, Social sciences, Humanities, Business administration among others.

Once you have the broad area, you narrow down the area by selecting a particular topic. This should be done after going through most of the literature related to the area. The topic should further be narrowed down to a specific researchable problem.

COMPONENTS OF A RESEARCH PROBLEM

For a research problem to exist, there are a number of core elements that have to be inherent. There must be:

1. An individual or community or an organization/institution to whom the problem could be attributed

These occupy a certain geographical area. For instance, teacher/parental factors affecting students' performance in private secondary schools in Embu Municipality. In this study, there are individuals (parents, teachers, students), there are institutions (private secondary schools), and there is the area of study (Embu Municipality).

2. Some Objectives for pursuing the problem

There must be some objectives pursuing the problem, otherwise it would be repugnant to reason and common understanding to undertake the research. For example: To find out teacher/

parental factors affecting the students' academic performance in private secondary schools in Embu Municipality.

3. Some lines of action to be taken

There must be at least two lines of action to be taken to attain the objective. For example, poor academic performance may be attributed to negative teacher and parental factors. Thus altering negative teacher factors and parental factors become the lines of action to be pursued. Here, the underlying question is “what is the cause of this problem – poor academic performance?” It is in answering this question that you must pursue some lines of action through stating some variables (teacher factors and parental factors).

PROBLEM STATEMENT

A research problem is a definite or clear expression [statement] about an area of concern, a condition to be improved upon, a difficulty to be eliminated, or a troubling question that exists in scholarly literature, in theory or within existing practice those points to a need for meaningful understanding and deliberate investigation. A research problem does not state how to do something, offer a vague or broad proposition, or present a value question.

The purpose of a problem statement is to:

- i) Introduce the reader to the importance of the topic being studied. The reader is oriented to the significance of the study and the research questions, hypotheses, or assumptions to follow.
- ii) Place the topic into a particular context that defines the parameters of what is to be investigated.
- iii) Provide the framework for reporting the results and indicates what is probably necessary to conduct the study and explain how the findings will present this information.

RESEARCH QUESTIONS

A research question is the fundamental core of a research project, study, or review of literature. It focuses the study, determines the methodology, and guides all stages of inquiry, analysis and reporting. Specifying the research question is one of the first methodological steps the investigator has to take when undertaking research. The research question must be accurately and clearly defined.

Choosing a research question is the central element of both quantitative and qualitative research and in some cases it may precede construction of the conceptual framework of study. In all cases, it makes the theoretical assumptions in the framework more explicit, most of all it indicates what the researcher wants to know most and first.

The student or researcher then carries out the research necessary to answer the research question, whether this involves reading secondary sources over a few days for an undergraduate term paper or carrying out primary research over years for a major project.

When the research is complete and the researcher knows the (probable) answer to the research question, writing up can begin (as distinct from writing notes, which is a process that goes on through a research project). In term papers, the answer to the question is normally given in summary in the introduction in the form of a thesis statement.

The research question begins with a research problem, an issue someone would like to know more about or a situation that needs to be changed or addressed, such as:

Areas of concern

Conditions that could be improved

Difficulties that need to be eliminated

Questions seeking answers

RESEARCH OBJECTIVES

Objective of research is one the important elements for conducting any research because it helps in determining the possibility of conducting the study. Basically, the broad aim of all researches is to confirm the reliability of existing knowledge and to find the deviation of existing knowledge i.e. to contribute new knowledge in the existing knowledge. Before conducting the research it is important to identify your objective(s) because it evades wastage of time and efforts in afterward stages. Keeping the system requirement into consideration, research objectives must be clearly identifiable. To identify a research objective(s) following things are important: Research Questions, Hypotheses, Research Study Boundary.

Research Questions

Research questions arise before the study is conducted. These problems are the issues which are not resolved till date. Some of the important problems which can arise during research are: What is the objective(s) of the study? How would the objective(s) of the study be achieved? And why is the specified method applied for the study? Objectives and Hypotheses of the study or research problem would be achieved by giving answers to the above questions.

Hypotheses

Hypotheses are assumptions about some characteristics of population which must be accepted or rejected on the basis of empirical evidence. Few examples of the hypotheses are given below:

A firm performance has positive relationship with capital structure.

There is a positive relationship between firm performance and CEO compensation.

Direct foreign investment has no influence over the employment of the country.

In the above conditions, Hypotheses may be true or false. It is generally constructed for a situation where the influence is not explicit. After collecting and analyzing the data the fact can be identified.

Research Study Boundary

After clearly defining the research problems and hypotheses, the boundaries and limits of the study must be properly defined. Assumptions of the study will make the research infeasible when it will consider the whole universe in the study. Although, it may be beneficial for the firm to evaluate each and every aspect during the process of research but it is not possible due to size constraints and complexities.

CATEGORIZATION OF RESEARCH OBJECTIVES

Research objective(s) can be categorized into qualitative and quantitative. The aim of the qualitative objective is to test the hypotheses significance of a research. Examples of the qualitative objectives are following:

- a) A research on testing the impact of cultural change on national economy.
- b) A research on the impulse buying behavior of consumers at grocery stores.
- c) A study on testing the relationship between the level of employment and industrial automation.
- d) A research on testing the relationship between sales and the education level of sales force of an organization.

The purpose of the quantitative objectives is to optimize certain performance measures of the research system. Here are few examples of quantitative research objectives:

- a) A research to predict the product demand with high precision.
- b) A research on training methods to find out the merits and demerits of numerous training methods applied in a firm with a view to increase the productivity of labor.
- c) A research on layout design aimed to minimize the material handling cost and increase the equipment utilization.
- d) A research on advertising budget in relation to other expenditures such that the incremental sales revenue is maximized.

THE IMPORTANCE OF RESEARCH OBJECTIVES

- a) They define the research since it provides meaning to the research.
- b) A research is meaningless without research objectives as is the same for any other task.

- c) They aid in the formulation of hypothesis.
- d) They are a guideline on which the researcher conducts the study. In every step of research, the researcher uses objectives to be more specific.
- e) It also helps in narrowing down the research and provides a focal point.
- f) The development of research methodology also depends on them.
- g) They also guide to the conduction of a valid and reliable research study.
- h) They also summarize the research to the readers and to the researcher. The researcher and the reader know by reading the research objectives what the author wants to accomplish.
- i) It also saves the time of the researcher because he/she avoids collection of unnecessary data.
- j) They also provide a step-by-step guideline that makes the research well-planned and sequential.

TYPES OF RESEARCH OBJECTIVES

There are two types of research objectives, namely, general objectives and specific objectives. Some researchers use the terms primary objectives and secondary objectives regardless of the name the purpose is same. Primary objectives are same as specific objectives while secondary objectives are same as general objectives. Not every research has secondary or general objectives but every research has a specific objective.

1. General objectives

General or secondary objectives provide a detailed view of the aims of the study. They provide a general overview of the study usually; there is one general objective in each study.

2. Specific objectives

The specific or broad objectives define what the main aim of the study is. There can be many specific objectives because every “what”, “where” and “how” of the research should be provided in the specific objectives. The specific objective is the essence of the study and it gives the main idea since they provide focus to the study.

HYPOTHESIS FORMULATION

Hypothesis formulation helps in formulating the research problem. Hypothesis formulation is not a necessary but an important step of the research. A valid and reasonable research can be conducted without any hypothesis. Hypothesis can be one and it can be as many as possible. Some studies are conducted to develop a hypothesis, like exploratory studies, so exploratory studies do not have a clear hypothesis. Descriptive studies can also be conducted without a

hypothesis. In explanatory studies, that develop a relationship between dependent and independent variable, as well as, explain the type of relationship between the two variables, there is always a hypothesis.

DEFINITION OF HYPOTHESIS

A hypothesis is a possible answer to a research question. It is a presumption or a hunch on the basis of which a study has to be conducted. This hypothesis is tested for possible rejection or approval. If the hypothesis gets accepted it shows that your hunch was right if it get rejected it still does not mean that your research was not valid, but it means that it is the opposite way you thought and perceived. Whether it is approved or not it gives you some conclusion and adds to the available body of knowledge.

A hypothesis which has been tested again and again by various researchers can still be tested for making it more valid but if the hypothesis has been approved in such a manner that it has become a law that it is better to test something that adds to the available knowledge rather than approving something which has been approved many times before.

Example:

If you want to conduct a study on the Effects of Parental Depression on the Academic Performance of Children, you may like to conduct it without any hypothesis but then you will have many dimensions to think upon and will be more likely get distracted. If you formulate a hypothesis, that parental depression results in depression in children too and this depression leads to low grades, your research will get a direction and you will not think about the broader effects of depression everything is well defined you have to test the impact of depression on the children's depression and as well as on the grades of children. You may not need to test the impacts on the extracurricular activities, class conduct, and other such things.

CHARACTERISTICS OF A WELL-FORMULATED RESEARCH HYPOTHESIS

Testable and Verifiable: A research hypothesis has to be checked for possible approval or rejection. This analysis is done statistically and, therefore it should be such that can be tested and analyzed. After analysis, the results can be obtained. Some hypothesis cannot be tested because they are too subjective and they are not suitable for research. Research needs objectivity and evidences without these two things any research is impossible to conduct. For example you may want to conduct a research on the existence of God but to prove the existence of God is a far different phenomenon and even you may formulate a hypothesis is but you cannot test it statistically, therefore, such hypothesis and research questions should be avoided.

Simple and Clear: The wording of the hypothesis should have to be simple and clear. Any complex ideas and wordings should be avoided. A simple hypothesis will make it easier for you

to carry on throughout the research and will be easy to read and understand. In addition to the terminology and phrasing, the hypothesis should have to be clear in your mind from every perspective. If there are any ambiguities or questions in your mind, resolve them at this stage; if they are not clear you will find it hard to conduct the study in later stages.

Relevant: The hypothesis should have to be relevant to the study that you are about to conduct. An irrelevant hypothesis will lead to an invalid research. Hypothesis is the possible answer to your research question if your presumption or your presumed answer is wrong and irrelevant your method to find its accuracy too will not result in any relevant conclusions. Check whether your hypothesis is related to the direction in which you have planned to take your research or not.

IMPORTANCE OF RESEARCH HYPOTHESIS

For a new researcher, it is important to have a research hypothesis so as to be directional. Research hypothesis can be present in research and it may not be but if it is present it can have following benefits.

Clarity: Hypothesis brings clarity to research. It makes your mind clear about the way in which you have to carry on the research. Methodology of the research depends greatly on the research hypothesis. Clarity brings 50 % chances of success in research. At each step, you need to be clear about every aspect and dimension. If you are not clear about a single thing you should not go forward, stay where ever you are and resolve the issue and then move to the next step.

Focus: You formulate your research hypothesis and you get a focal point in your research. You need not go off the track and stay intact to the main objective which you set for the hypothesis. Your research becomes organized and haphazard actions are minimized.

Direction: Hypothesis sets a direction of research. This direction shows you what should be the objectives, methodology, mode of analysis and research design. With a hypothesis, you have a confidence that whatever you have presumed will be tested rather than testing something that is irrelevant to the research.

Objectivity: Every research requires objectivity but without hypothesis you may collect data which is not relevant to the research and hence decreases the objectivity of the research. When you know that your hypothesis only deals with a particular aspect of the phenomenon you will not collect data that is not required and the objectivity and validity of the research increases.

Add to the Body of Knowledge: A hypothesis adds to the available body of knowledge. For example you study different literature and you find out that this much work has already been done on this topic and you should concentrate on the gaps that are yet to be filled by new research you formulate a hypothesis and keep your direction towards it.

HYPOTHESIS TEST

Hypothesis test is a method of making decisions using data from a scientific study. In statistics, a result is called statistically significant if it has been predicted as unlikely to have occurred by chance alone, according to a pre-determined threshold probability, the significance level. The phrase "test of significance" was coined by statistician Ronald Fisher. These tests are used in determining what outcomes of a study would lead to a rejection of the null hypothesis for a pre-specified level of significance; this can help to decide whether results contain enough information to cast doubt on conventional wisdom, given that conventional wisdom has been used to establish the null hypothesis. The critical region of a hypothesis test is the set of all outcomes which cause the null hypothesis to be rejected in favor of the alternative hypothesis. Statistical hypothesis testing is sometimes called confirmatory data analysis, in contrast to exploratory data analysis, which may not have pre-specified hypotheses. Statistical hypothesis testing is a key technique of frequent inference.

Statistical hypothesis tests define a procedure that controls (fixes) the probability of incorrectly deciding that a default position (null hypothesis) is incorrect based on how likely it would be for a set of observations to occur if the null hypothesis were true. Note that this probability of making an incorrect decision is not the probability that the null hypothesis is true, nor whether any specific alternative hypothesis is true. This contrasts with other possible techniques of decision theory in which the null and alternative hypothesis are treated on a more equal basis. One naive Bayesian approach to hypothesis testing is to base decisions on the posterior probability, but this fails when comparing point and continuous hypotheses. Other approaches to decision making, such as Bayesian decision theory, attempt to balance the consequences of incorrect decisions across all possibilities, rather than concentrating on a single null hypothesis. A number of other approaches to reaching a decision based on data are available via decision theory and optimal decisions, some of which have desirable properties, yet hypothesis testing is a dominant approach to data analysis in many fields of science. Extensions to the theory of hypothesis testing include the study of the power of tests, which refers to the probability of correctly rejecting the null hypothesis when a given state of nature exists. Such considerations can be used for the purpose of sample size determination prior to the collection of data.

Meaning of Hypothesis testing

Hypothesis testing refers to the formal procedures used by statisticians to accept or reject statistical hypotheses. It is an assumption about a population parameter. This assumption may or may not be true.

Explanation:

The best way to determine whether a statistical hypothesis is true would be to examine the entire population. Since that is often impractical, researchers typically examine a random sample

from the population. If sample data are not consistent with the statistical hypothesis, the hypothesis is rejected.

In doing so, one has to take the help of certain assumptions or hypothetical values about the characteristics of the population if some such information is available. Such hypothesis about the population is termed as statistical hypothesis and the hypothesis is tested on the basis of sample values. The procedure enables one to decide on a certain hypothesis and test its significance. “A claim or hypothesis about the population parameters is known as Null Hypothesis and is written as, H_0 .”

This hypothesis is then tested with available evidence and a decision is made whether to accept this hypothesis or reject it. If this hypothesis is rejected, then we accept the alternate hypothesis. This hypothesis is written as H_1 .

For testing hypothesis or test of significance we use both parametric tests and nonparametric or distribution free tests. Parametric tests assume within properties of the population, from which we draw samples. Such assumptions may be about population parameters, sample size, etc. In case of non-parametric tests, we do not make such assumptions. Here we assume only nominal or ordinal data.

TYPES OF STATISTICAL HYPOTHESES

There are two types of statistical hypotheses:

1. **Null hypothesis:** The null hypothesis, denoted by H_0 , is usually the hypothesis that sample observations result purely from chance.
2. **Alternative hypothesis:** The alternative hypothesis, denoted by H_1 or H_a , is the hypothesis that sample observations are influenced by some non-random cause.

For example, suppose we wanted to determine whether a coin was fair and balanced. A null hypothesis might be that half the flips would result in Heads and half, in Tails. The alternative hypothesis might be that the number of Heads and Tails would be very different. Symbolically, these hypotheses would be expressed as:

$$H_0: P = 0.5$$

$$H_a: P \neq 0.5$$

Suppose we flipped the coin 50 times, resulting in 40 Heads and 10 Tails. Given this result, we would be inclined to reject the null hypothesis. We would conclude, based on the evidence, that the coin was probably not fair and balanced.

STEPS IN HYPOTHESIS TESTS

Statisticians follow a formal process to determine whether to reject a null hypothesis, based on sample data. This process, called hypothesis testing, consists of four steps:

Step-1: State the hypotheses: This involves stating the null and alternative hypotheses. The hypotheses are stated in such a way that they are mutually exclusive. That is, if one is true, the other must be false.

Step-2: Formulate an analysis plan: The analysis plan describes how to use sample data to evaluate the null hypothesis. The evaluation often focuses around a single test statistic.

Step-3: Analyze sample data: Find the value of the test statistic (mean score, proportion, t-score, z-score, etc.) described in the analysis plan.

Step-4: Interpret results: Apply the decision rule described in the analysis plan. If the value of the test statistic is unlikely, based on the null hypothesis, reject the null hypothesis.

DECISION ERRORS

Two types of errors can result from a hypothesis test.

- i) **Type I error:** A Type I error occurs when the researcher rejects a null hypothesis when it is true. The probability of committing a Type I error is called the significance level. This probability is also called alpha, and is often denoted by α .
- ii) **Type II error:** A Type II error occurs when the researcher fails to reject a null hypothesis that is false. The probability of committing a Type II error is called Beta, and is often denoted by β . The probability of not committing a Type II error is called the Power of the test.

DECISION RULES

The analysis plan includes decision rules for rejecting the null hypothesis. In practice, statisticians describe these decision rules in two ways - with reference to a P-value or with reference to a region of acceptance.

1. **P-value:** The strength of evidence in support of a null hypothesis is measured by the P-value. Suppose the test statistic is equal to S. The P-value is the probability of observing a test statistic as extreme as S, assuming the null hypothesis is true. If the P-value is less than the significance level, we reject the null hypothesis.
2. **Region of acceptance:** The region of acceptance is a range of values. If the test statistic falls within the region of acceptance, the null hypothesis is not rejected. The region of acceptance is defined so that the chance of making a Type I error is equal to the significance level. The set of values outside the region of acceptance is called the region of rejection. If the test statistic falls within the region of rejection, the null hypothesis is rejected. In such cases, we say that the hypothesis has been rejected at a level of significance.

ONE-TAILED AND TWO-TAILED TESTS

A test of a statistical hypothesis, where the region of rejection is on only one side of the sampling distribution, is called a one-tailed test. For example, suppose the null hypothesis states that the mean is less than or equal to 10. The alternative hypothesis would be that the mean is greater than 10. The region of rejection would consist of a range of numbers located on the right side of sampling distribution; that is, a set of numbers greater than 10.

A test of a statistical hypothesis, where the region of rejection is on both sides of the sampling distribution, is called a two-tailed test. For example, suppose the null hypothesis states that the mean is equal to 10. The alternative hypothesis would be that the mean is less than 10 or greater than 10. The region of rejection would consist of a range of numbers located on both sides of sampling distribution; that is, the region of rejection would consist partly of numbers that were less than 10 and partly of numbers that were greater than 10.

PROCEDURE FOR TESTING OF HYPOTHESIS

1. State the null hypothesis as well as the alternate hypothesis

For example, let us assume the population mean = 50 and set up the hypothesis $\mu = 50$. This is called the null hypothesis and is denoted as;

Null hypothesis, $H_0: \mu = 50$

Alternative hypothesis $H_1: \mu \neq 50$

Or $\mu > 50$

$\mu < 50$

2. Establish a level of significance

The level of significance signifies the probability of committing Type 1 error α and is generally taken as equal to 0.05. Sometimes, the value α is established as 0.01, but it is at the discretion of the investigator to select its value, depending upon the sensitivity of the study. To illustrate per cent level of significance indicates that a researcher is willing to take 5 per cent risk of rejecting the Null Hypothesis when it happens to be true.

3. Choosing a suitable test statistic

Now the researcher would choose amongst the various tests (i.e. z, t, χ^2 and f-tests). Actually, for the purpose of rejecting or accepting the null hypothesis, a suitable statistics called 'test statistics' is chosen. This means that H_0 is assumed to be really true. Obviously due to sampling fluctuations, the observed value of the statistic based on random sample will differ from the expected value. If the difference is large enough, one suspects the validity of the assumption and rejects the null hypothesis (H_0). On the other hand, if the difference may be assumed due to sampling (random) fluctuation, the null hypothesis (H_0) is accepted.

4. Defining the critical rejection regions and making calculations for test statistics

If we select the value of α = Level of significance = 0.05, and use the standard normal distribution (z-test) as our test statistic for testing the population parameter μ , then the value of the difference between the assumption of null hypothesis (assumed value of the population parameter) and the value obtained by the analysis of the sample results is not expected to be more than 1.96σ at $\alpha = 0.05$.

REVIEW QUESTIONS**Conceptual Type**

1. What is research?
2. What is Business Research?
3. What is Pure Research?
4. What is action research?
5. What is Problem identification?
6. What is Problem statement?
7. What is Research question?
8. What is research Objective?
9. What is Hypothesis?
10. What is Hypothesis Formulation?

Descriptive Type

1. Discuss about Business Research Fundamentals.
2. State the objectives of Research.
3. Explain various name or types of Research.
4. State the characteristics of Research.
5. Discuss the scope of Research.
6. Write note on: Research in Business/Management.
7. Discuss Social Science and Business Research.
8. Discuss about research problem identification.
9. Explain in details about research objectives.
10. Discuss about hypothesis formulation.
