

# 22IM21T: RESEARCH METHODOLOGY

## Unit 1: Research Problem

**Dr. Anala M R**

Professor,

Department of Information Science & Engineering,  
RV College of Engineering, Bengaluru.

**Akhilesh S - 1RV22SIT02**

**Rahul J - 1RV22SIT07**

**Maharshi C. Relia - 1RV22SIT09**

**Sangram Biradar - 1RV22SIT10**

**Santhosh KM - 1RV22SIT11**

**Suraj ST - 1RV22SIT15**

# Outline

1. Problem Solving – General Problem Solving
2. Logical Approach
3. Soft System Approach
4. Creative Approach
5. Group Problem Solving Techniques for Idea Generation
6. Formulation of Research
7. Problems – Approaches to Research Problem
8. Exploration for Problem Identification
9. Hypothesis
10. Generation and Formulation of the problem.

# Introduction

In the field of **management research**, problem-solving plays a crucial role in **identifying and addressing** organizational challenges.

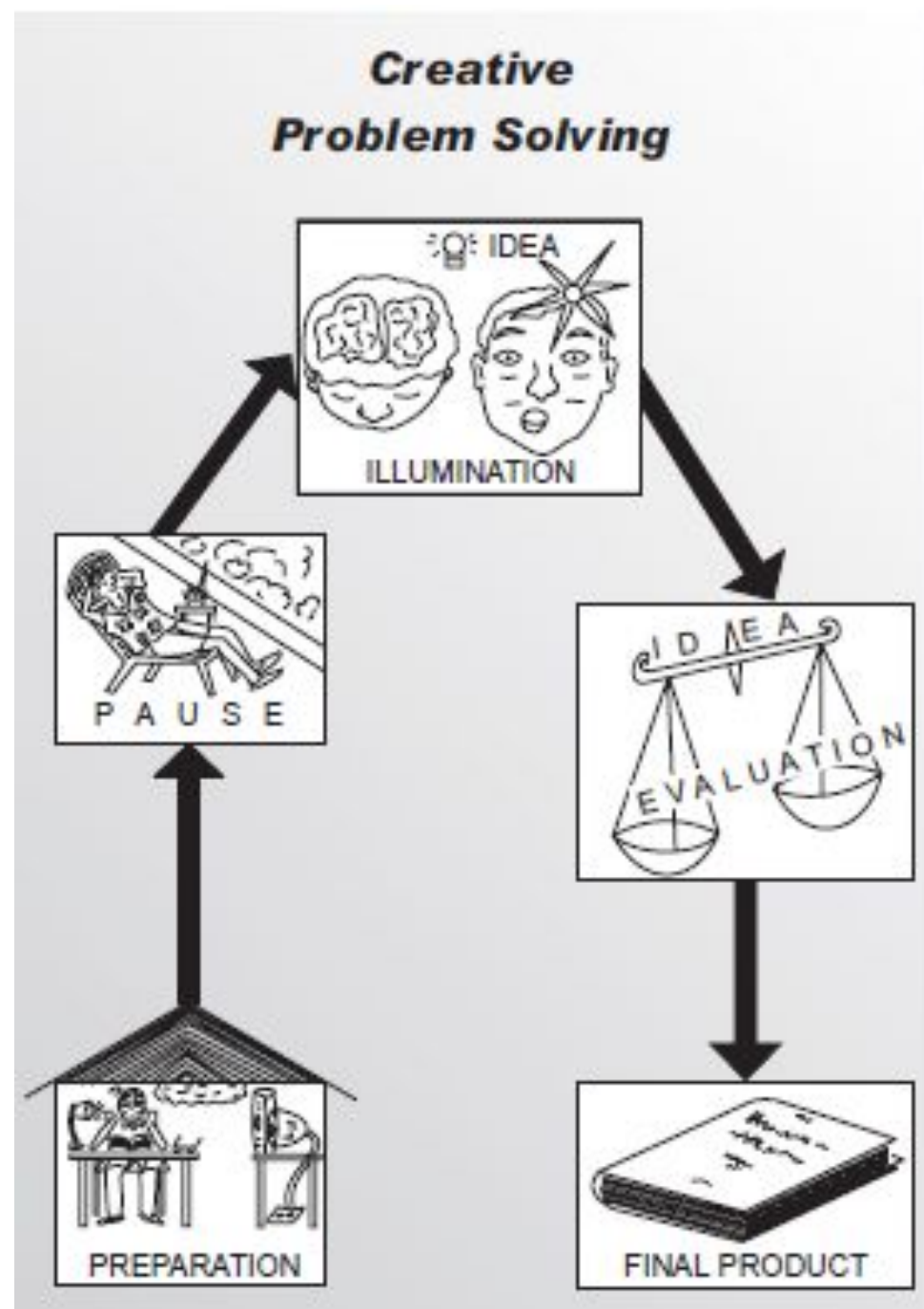
This presentation focuses on different approaches to problem-solving, including the logical approach, soft system approach, and creative approach.

By employing the outline techniques, researchers can effectively analyze problems, develop innovative solutions, and make informed decisions.

# Problem Solving

## Learning Objectives:

1. Appreciate the meaning of Problems
2. Enumerate Categories of Problems
3. Get an overview of Problem solving process
4. Three Basic Approaches of Problem Solving
5. Appreciate intense questioning as the root of all methods of Problem Solving
6. Understand why Creativity should be studied
7. Appreciate the difference in thinking strategies needed at different phases of research
8. Look at overall creative problem solving process
9. Get a feel for various ways of improving creativity
10. Appreciate problem solving techniques

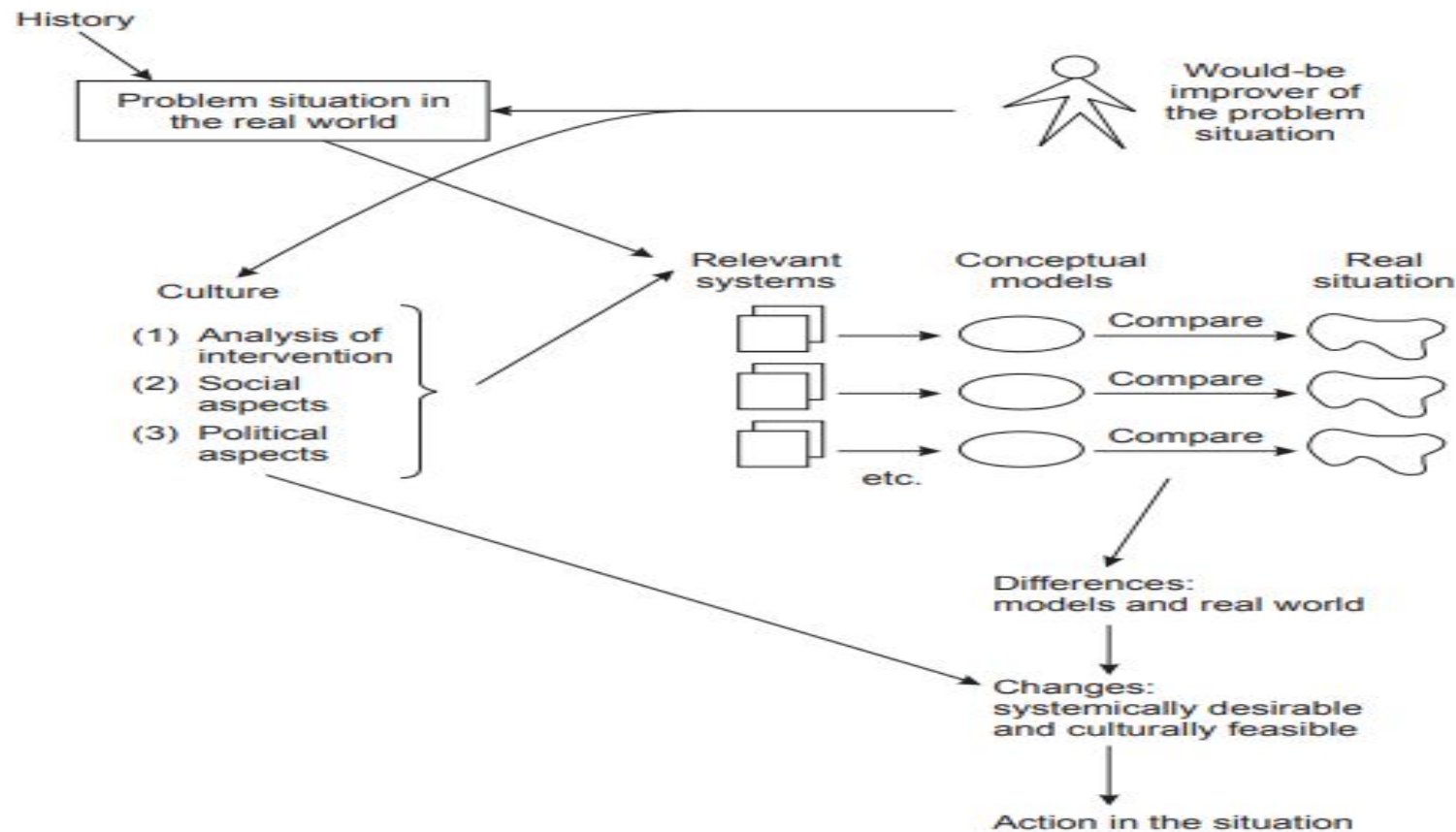


**Logical Approach to Problem Solving:** The logical approach to problem-solving involves a systematic and analytical methodology. Researchers follow a step-by-step process to identify, analyze, and solve problems. Key steps in the logical approach include:

- a) Problem Identification: Clearly defining the problem statement and understanding its context within the organization.
- b) Problem Analysis: Gathering relevant data, facts, and information to assess the problem's causes and consequences.
- c) Solution Generation: Applying logical reasoning and critical thinking to generate potential solutions.
- d) Solution Evaluation: Assessing the feasibility, effectiveness, and potential risks associated with each solution.
- e) Solution Implementation: Implementing the chosen solution and monitoring its outcomes.

# Soft system methodology

- In this method all complex details like opinions and reactions are obtained qualitatively, a clear differentiation is made between the clients, the problem solver and the problem owner.



1. Roles of these are listed in a pictorial diagram, called Rich Picture.
2. A conceptual model is developed using the human activity system.
3. The key principles and steps involved are:
  - 3.1. Problem Identification
  - 3.2. Systems Thinking
  - 3.3. Conceptual Models
  - 3.4. Rich Pictures
  - 3.5. Root Definition
  - 3.6. Feasible and Desirable Changes
  - 3.7. Action Plans
  - 3.8. Evaluation and Learning



# Creative Approach

- These require absence of mental regimentation, strong motivation and freedom of self expression which leads to a thinking process conducive to solving a problem in a novel way.

## Thinking Process

- Many types of thinking processes are employed in problem solving. Terms used to indicate the thinking process are classified as logical or analytical critical thinking and strategic thinking and creative or heuristic thinking.
- A thought is an interpretation of the relationship existing in the external universe. While there is a mechanism to generate thoughts, there is no mechanism in the brain to distinguish the correct thought from the incorrect one, that is, to distinguish the correct interpretation of the true relationships from the wrong interpretation

- **Thinking processes in problem solving:** There are many types of thinking that are employed in problem solving.
- **Logical thinking:** In this type of thinking cause-effect relationship is the dominant preoccupation of the individual.
- **Vertical thinking:** In this, the thinking process proceeds in a chosen line, step by step or age by stage towards the problem solution in a manner similar to climbing ladder.
- **Critical thinking:** This way of thinking is evaluative or judgmental in it the problem solver checks the feasibility of an idea or solution to a problem.
- **Analytical thinking:** In this type of thinking a problem or idea is broken down into parts. Each part is examined to understand how it functions and fits with other parts, like a puzzle, and explores how the parts are interrelated.

- **Strategic thinking:** Developing a specific overall route and direction to take for handling large scale problems, for example, large scale project planning. In this process, the problem will be looked at from all possible angles
- **Lateral thinking:** This type of thinking looks at the problem from several angles and jumps from one ladder to another (of vertical thinking) It tends to shift radically from an initially chosen line of thinking and reformulates the problem.
- **Outcome thinking:** In outcome thinking a problem is attacked tackled from the perspective of the desired solution or result.
- **Creative thinking:** In this mode of thinking existing factors of a problem are rearranged reset to come up with a flash of a new concept. This involves lateral thinking.

- **Divergent thinking:** It is a type of thinking in which one makes different associations with a problem and takes different lines of arguments to arrive at different solutions.
- **Heuristic thinking:** In heuristic thinking one makes rules of thumb based on an experience.

## Creative Thinking

- Creative thinking is characterized by sensitivity to the problem, fluency and flexibility of thinking. originality, ability to analyse and synthesise to redefine things.
- The important factors in developing creative thinking are using systems and variables, identifying assumptions, finding probability, and deductive changing relationship.

- **Using System and Variables:** Any change in any item will affect all other items in the universe, which is a large system to a more or less degree.
- **Identify assumptions:** Any object belongs to several systems. When we study the change in an object, we may wrongly assume that a particular system, which is active, is causing it.
- **Handling Probability:** This refers to the likelihood of a relationship being true. Probability refers not to the existence of relationship but to its correct identification. Probabilities indicate areas where the relationship has not been established.
- **Detecting Changing relationships:** Relationships change with time but time is not involved in the change. Many natural relationships change as the degree of one's experience of it changes. In this context, experience must be viewed with caution.

# Barriers to Creativity

- These are due to absence of pathways in the brain. Barriers can be overcome through discussion with others, using groups, trial and error method and changing areas which help in opening up new pathways in the brain.
- Stages of creative Process, there are four stages :
  1. **Preparation:** The stage in which the problem is investigated in all directions with intense effort, which is given up in the later part of investigation.
  2. **Incubation:** The stage, during which the individual is frustrated, exhausted, and is not constantly thinking about the problem, and is relaxed.

3. **Illumination:** The stage during which the idea occurs along with psychological factors like emotional release. Vividness of ideas and a feeling of insurgence immediately precede it and accompany its appearance.

4. **Verification:** The stage in which the validity of the idea is tested and evaluated. The idea is reduced to an exact form.

## Development of Creativity

- There are two principles of creativity development: principle of deferred judgment and principle of extended effort in idea production.
- The following are principles on the development of creativity:
  - **Principle of deferred judgment:** All problems that are implicit in a problem situation should be considered. Problem sensitivity has to be developed.

- **Principle of extended effort in idea production:** Generally, in problem solving one gets an idea, sees it as a possible solution, and settles for it without further ado.
- As we have said earlier, most people are creative to some extent and possess many of the traits that are given below, to a greater or lesser degree.
  - Independence
  - Curiosity
  - Intuitiveness
  - Unconcern for social norms
  - Sensible risk taking
  - Introversion
  - Wide span of interests
  - Cognitive flexibility
  - Self acceptance



# GROUP PROBLEM SOLVING TECHNIQUES FOR IDEA GENERATION

- Group problem solving techniques In this a formalized group of people come together to identify a problem or to develop solution to a problem.
- Diverse viewpoints throw light on several aspects of the problem, interaction among group members makes idea generation efficient, a number of new ideas can be created. **Brainstorming** and **Delphi** are two major examples.
- During the formulation of a problem or hypothesis, researchers can benefit from group collaboration.
- Group problem-solving techniques aid in generating problem ideas and fostering creativity. Various references provide detailed discussions on these techniques (Olsen, 1982; Hicks, 1991; Rawlinson, 1994).

The reasons for the efficiency of groups in solving problems are many:

- Diverse viewpoints throw light on several aspects of the problem
- Interactions among people are found to be very efficient in generating viable ideas
- A total lack of knowledge in a particular field may also be very helpful in creating a new idea rather than in winning an argument in conventional committee interactions.

# Brainstorming

- This is a group process in which 6 to 10 members from different backgrounds respond to a central question. The participants express whatever ideas come to them (free wheeling) without evaluating the ideas of others.
- Brainstorming sessions usually take place in a free and uninhibited atmosphere. The central principle involved is deferment of judgment on the quality or viability of the ideas presented by any member of the group.
- The operational procedure has a warm up session in which an introduction is made to the subject. Some interactive warming up takes place. The problem for focus of the particular session must be presented in a form that is terse, clear, and sharp, which will allow the formation of a range of ideas.

## A checklist may be useful for the participants:

- Using who, what, when, how, and where type questions to study the problem;
- Expanding, contracting, combining, reversing, eliminating, and modifying the problem;
- Forcing relationships among items seemingly unrelated;
- Morphological analysis;
- Encouraging wild idea generation; and
- Reverse brainstorming, where problems are anticipated

A panel of experts will later evaluate the ideas obtained in the session. The prime protagonists of this method believe that the larger the number of ideas generated the better it is. A few or at least one may be exceptionally original.

# Delphi Method

- This is a survey technique for achieving consensus among isolated anonymous participants. It is an application of expert opinion for problem identification or problem solution. Main features are **anonymity, interaction, controlled feedback and statistical responses.**
- There are many purposes for the technique but the ones that are of definite interest to students of research are:
  - To determine and develop a range of possible alternatives.
  - To explore and expose underlying assumptions or information leading to different judgment.

- The Delphi method has become an important tool in applied research in many areas of physical sciences, social sciences, business administration, and engineering; and is extensively used in technological forecasting.
- Delphi's main features, which are anonymity, interaction, controlled feedback, and statistical responses, are intended to minimise the biasing effects of dominant individuals or irrelevant communications and of group pressures towards conformity.
- The Delphi method utilises a **series of three or four polling**, with questionnaires, the first of which is generally open ended.
- The objective of Delphi is to get significant and substantial group consensus on priorities among items or divergent opinions.

# Formulation of the Research problem

- Approaches to Research Problem
- Exploration for Problem Identification
- Hypothesis Generation and Formulation of the problem

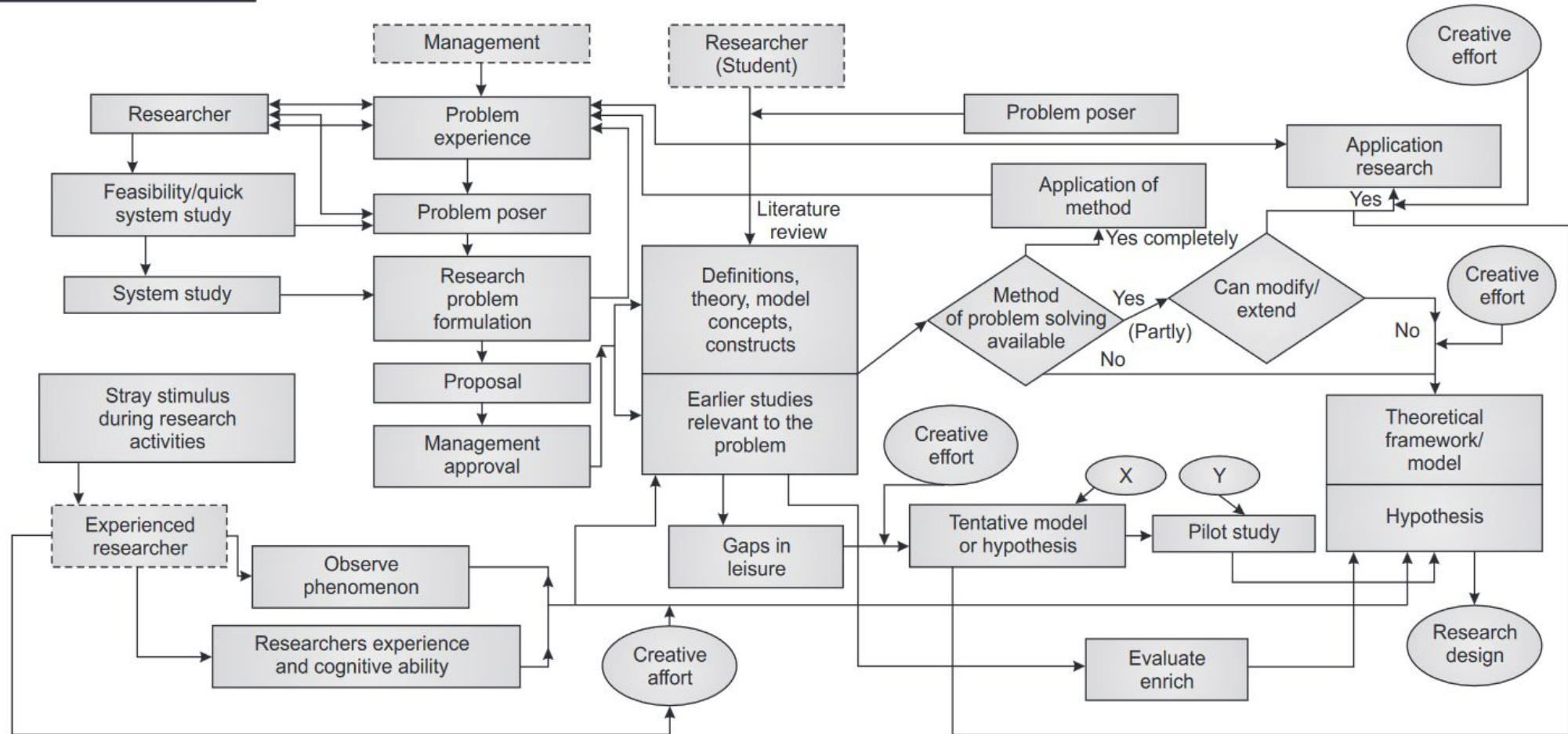
# Approaches to Research Problem

The typical approaches are as follows

1. A manager is in need of solving an organisational problem that he cannot solve by himself.
2. A mature researcher is cognitively aware of research problems in his field of research and any signal through conversations, discussions, conferences, or reflection may trigger an idea for research.
3. A fresh scholar of research is systematically introduced to the process of research through research training program courses and literature review in an area of interest to him.



**Fig. 4.1** Approaches to research in management



Note: See Fig. 4.3 for details of X & Y

# Management Problem is Posed to the Researcher

- Management problems are addressed by seeking scientific solutions through the help of a researcher.
- The problem posed by the executive serves as a symptom, requiring the researcher to identify the real problem.
- The dialogue between the manager and researcher provides crucial information about the problem's nature and consequences.
- Example Scenario:
  - A production manager expresses inability to meet delivery schedule requirements.
  - Research questions:
    - Is the plant's load well matched with its capacity?
    - Is the production control department using an appropriate scheduling rule?
    - If not, what rule should be designed?

## Two-Stage Approach:

- **Initial exploratory stage:** Feasibility assessment and system study through interviews and interactions.
- **System view:** Understanding the problem effects on different subsystems of the organization. Formulating the research problem using statistical or mathematical models (common in operations research).

## Hypothesis and Literature Review:

- Inadequate knowledge may lead to hypothesis-driven research.
- Acquiring necessary knowledge through literature review and verification.
- Applying existing methods from literature, if available and applicable to the problem.

## **Application-Oriented and Developmental Research:**

- Application-oriented research modifies existing methods to suit the current system.
- Creative effort required for modification based on principles like Ackoff's problem-solving approaches.
- Evaluative research involves evaluating alternate methods and selecting the best one.
- Developmental research focuses on developing new alternatives to solve the problem.

## **Case Study: “Marketing Programmes and Technological Developments Across Product Life Cycle”**

*by Madan Mohan at IISC Bangalore(1995)*

### **Objective:**

The main goal of this research study was to investigate the connection between marketing programs and technological developments in the machine building sector of India. The researchers aimed to identify which marketing strategies and technological advancements were prominent at different stages of a product's life cycle.

## Pilot Study - Phase I:

- In the initial phase, the researchers conducted a preliminary study to gather information about marketing program variables and technological developments.
- They used a combination of a semi-structured questionnaire and interviews with executives working in the relevant industry.
- Based on this preliminary study, the researchers finalized a set of 30 marketing program variables that they believed could be relevant to their investigation.
- Next, they collected data from marketing managers in nine organizations that were involved in manufacturing and marketing general-purpose machinery and components.

- The questionnaire presented these 30 marketing program variables, and for each variable, the managers were asked to indicate whether it was important during different phases of a product's life cycle.
- Through this pilot study, two variables were identified as irrelevant to the Indian context: "advertisement utilization ratio" and "distribution outlets." These variables were removed from the subsequent phases of the research.

## Common Marketing Variables:

1. The researchers observed that some marketing variables were common between specific phases of the product life cycle.
2. For example, five variables were found to be relevant during both the introduction and growth phases, while 20 variables were common between the growth and maturity phases. Additionally, four variables were shared between the maturity and decline phases.
3. However, the degree of importance of these common variables varied across the different phases of the product life cycle.



## Pilot Study - Phase II:

1. In the second phase of the pilot study, the focus shifted to validate and modify the selected marketing program and technology development variables.
2. The researchers wanted to examine how marketing programs and technological developments differed across various phases of the product life cycle.
3. The questionnaire was structured into three parts: one for **demographic details of organizations**, the second for **marketing programs at different life cycle phases**, and the third for **technological developments related to products and processes done in-house**.
4. The questionnaire used a five-point Likert scale to measure the responses for each variable.

## Respondents:

1. The study was conducted in the city of Bangalore, India, and included eleven organizations that were engaged in manufacturing and marketing industrial machinery.
2. The respondents were senior managers working in marketing and R&D/engineering functions within these organizations.
3. The researchers contacted the public relations officers or personnel managers in each organization, who helped identify the relevant executives to answer the questionnaire.

## Results:

1. The study's results indicated that both marketing programs and technological developments varied significantly depending on the specific phase of the product life cycle.
2. Furthermore, the relationship between marketing programs and technological developments also differed across the different phases.
3. The findings suggested that the approach to marketing and technology should be adapted according to the product's current life cycle stage.

## Finalization:

1. Based on the results and feedback received during the pilot study, the researchers made necessary adjustments to the questionnaire.
2. They also added two more marketing variables to the study that were considered important due to changing conditions in the country, particularly related to the process of liberalization.
3. The final version of the questionnaire was then used for the full-scale research to explore the relationship between marketing programs and technological developments in the machine-building sector of India across different phases of the product life cycle.

**Further Read:** <https://ieeexplore.ieee.org/document/653457>

# Exploration For Problem Identification

- Scanning of earlier research literature, which is very vital in all academic research.

One looks at the knowledge already generated and gaps that exist in it.

- **Observing and studying the phenomena**  
as a researcher will do when investigating a decision problem faced by the manager for which a research solution is sought. This is typically a system study.



- **Discussions with experts** in the area/executives with considerable decision-making experience, with specific requests for advice. This will provide multiple insights.
- **Attending conferences and seminars** and scholarly lectures by eminent scientists and keeping one's mind open for suggestions and indications for research.
- **Brainstorming** sessions with a select a group of people, aimed at generating problem ideas.
- **Creatively reflecting** on the problem area after intense questioning and critical enquiry.

# Literature Survey

The role of literature review, related to research problems translated from the problems faced by the manager, is only to check whether a similar problem was researched earlier and solved, whether it is totally new, or whether a method in the literature needs a modification to solve the current research problem.

Literature review has four broad aspects:

- (i) choice of literature
- (ii) search for location/source of literature
- (iii) study of literature.
- (iv) organisation of literature.

## **i. Choice of Literature:**

The choice of literature may vary depending on the research question, the level of comprehensiveness desired, and the relevance of the selected sources to the study's objectives.

Key considerations in the choice of literature include:

- Identifying the most relevant databases, libraries, and academic journals to search for sources.
- Determining the timeframe for selecting publications (e.g., recent studies or historical context).
- Defining the key concepts and keywords to be used in the literature search.
- Deciding on the types of sources to include, such as primary research articles, review papers, books, conference proceedings, or official reports.



## **ii. Search for Location/Source of Literature:**

This aspect involves conducting a thorough and systematic search to locate the chosen literature. The goal is to identify as many relevant sources as possible within the defined scope. Researchers use various search strategies and tools to ensure the comprehensiveness of their literature review.

Common methods for searching for literature include:

- Online databases like PubMed, Google Scholar, IEEE Xplore, or academic libraries.
- Searching for specific journals or publications related to the research area.
- Utilizing citation tracking to find additional sources through the references of already identified papers.

### **iii. Study of Literature:**

Once the relevant literature is gathered, the next aspect involves the critical study of the selected sources. Researchers carefully read, analyze, and synthesize the information from each source to understand the key concepts, methodologies, findings, and conclusions presented in the literature.

During the study of literature, researchers:

- Assess the quality and credibility of each source.
- Identify the main themes, theories, and trends present in the literature.
- Compare and contrast different studies to understand their similarities and differences.
- Look for gaps or inconsistencies in the existing knowledge that may warrant further investigation.

#### **iv. Organization of Literature:**

The final aspect focuses on how the literature is organized and presented in the research report. Proper organization is essential to present the findings of the literature review in a coherent and logical manner. This helps readers understand the context, relevance, and implications of the reviewed literature.

Common methods of organizing the literature include:

- Chronological: Arranging the literature by the order of publication to show the historical development of ideas and theories.
- Thematic: Grouping the literature based on common themes or topics to highlight different perspectives and research trends.
- Methodological: Organizing the literature according to research methodologies employed, allowing for an evaluation of the various approaches used in previous studies.

# System Study

System study is an essential component of research methodology that complements literature study. While literature study focuses on examining existing scholarly works, system study aims to understand the phenomena related to problem identification within a specific system.

The objectives of system study are multi-fold and can be categorized as follows:

- **To Improve the System:**

One of the primary objectives of system study is to identify opportunities for improvement within the system under investigation. The goal is to propose practical and effective solutions to enhance the overall performance and effectiveness of the system.

- **To Determine General Theories of System Development:**

Through system study, researchers seek to develop general theories and principles about how systems evolve and change over time. By understanding the patterns and dynamics of the system, researchers can contribute to the body of knowledge in the field of systems thinking and management.

- **To Advance Science:**

System study is also motivated by the pursuit of scientific advancement. Researchers aim to contribute to the knowledge base of their respective disciplines by conducting rigorous and systematic investigations into the functioning of complex systems. The findings from system studies can lead to new insights and conceptual frameworks, which contribute to the advancement of science.

The study of the system typically involves analyzing four major aspects of the problem:

### **1. The Decision System:**

Understanding how decisions are made within the system, including the decision-making processes, criteria used, and the impact of decisions on the overall system's performance. Researchers aim to identify decision-making patterns and opportunities for optimizing decision outcomes.

### **2. Objectives of the System:**

Examining the goals and objectives of the system under study. Researchers seek to understand the fundamental purpose and mission of the system and how these objectives influence its functioning and behavior.

### **3. The Environmental System:**

Analyzing the interactions and relationships between the system and its external environment. Researchers study how the system adapts to environmental changes, how it responds to external influences, and how it impacts and is impacted by its surroundings.

### **4. Options Open to Executives for Action:**

Exploring the available alternatives and courses of action that executives or decision-makers within the system can undertake. This aspect involves evaluating potential strategies and approaches to address challenges and achieve objectives.

# Error of Problem Identification in Research

Understanding and addressing these errors is essential to ensure that resources are effectively utilized and that the research is meaningful and impactful. Some of the errors that researchers should be cautious about are as follows:

- **Environmentally Generated Problems:**

Environmental factors, such as changes in the market, technology, or regulatory landscape, can lead to the emergence of specific problems within an organization. Researchers must be aware of the influence of external factors on problem identification to avoid attributing internal issues solely to the organization itself.



- **Technical Deficiencies in the Organization:**

Problems can also arise due to technical deficiencies within an organization, such as inadequate control systems or ineffective leadership. Researchers should be attentive to these internal factors and differentiate them from external issues to ensure accurate problem identification.

- **Self-Aggrandizing Behavior of Managers:**

Managers or decision-makers may sometimes make choices that prioritize their personal interests over the organization's well-being. This behavior can lead to problem misidentification or biased problem formulation. Researchers should be cautious about potential biases when interacting with managers and stakeholders.

- **Type III Errors - Misallocation of Resources:**

Type III errors refer to situations where significant resources, such as time, money, and effort, are committed to solving the wrong problem or addressing a problem that does not actually exist. This misallocation of resources can be detrimental to the organization and research efforts.

# Hypotheses

- The purpose of hypothesis testing is to determine whether there is enough statistical evidence in favor of a certain belief about a parameter.
- An hypothesis is a preliminary or tentative explanation or postulate by the researcher of what the researcher considers the outcome of an investigation will be. It is an informed/educated guess.
- It indicates the expectations of the researcher regarding certain variables. It is the most specific way in which an answer to a problem can be stated.

# Hypothesis

A tentative statement about a population parameter that might be true or wrong.

The identification and formulation of the research problem is one of the most difficult phases of research faced by a student. The problems of management research may be classified into two major categories.

The first centres around hypothesis testing or predicting, with or without statistical analysis, using empirical data to develop or extend theories. The second emphasises mathematical models in a decision-making environment.

The research design becomes more sophisticated and may tend to introduce constraints on the research process itself. The demand for development of newer research designs is increasingly felt. However, careful and detailed work is necessary at whatever level of abstraction one tries to theorise and set hypotheses.

# The Difference Between Hypothesis and Problem

- Both an hypothesis and a problem contribute to the body of knowledge which supports or refutes an existing theory.
- An hypothesis differs from a problem.
- A problem is formulated in the form of a question; it serves as the basis or origin from which an hypothesis is derived.
- An hypothesis is a suggested solution to a problem.
- A problem (question) cannot be directly tested, whereas an hypothesis can be tested and verified.

# PURPOSE AND FUNCTION OF AN HYPOTHESIS

- It offers explanations for the relationships between those variables that can be empirically tested.
- It furnishes proof that the researcher has sufficient background knowledge to enable him/her to make suggestions in order to extend existing knowledge.
- It gives direction to an investigation.
- It structures the next phase in the investigation and therefore furnishes continuity to the examination of the problem.

# Types of Hypotheses

## 1. **Descriptive Hypotheses**

- These are propositions that describe the characteristics ( such as size, form or distribution) of a variable. The variable may be an object, person, organization etc. ,

e.g., The rate of unemployment among arts graduates is higher than that of commerce graduates. The educational system is not oriented to human resource needs of a country.

## 2. **Relational Hypotheses**

- These are propositions which describe the relationship between two variables.

e. g. , Families with higher incomes spend more for recreation Upper – class people have fewer children than lower class people.

### 3. Causal Hypotheses

- It state that the existence of, or a change in, one variable Causes or leads to an effect on another variable.
- The first variable is called the independent variable, and the latter the dependent variable.
- When dealing with causal relationships between variables the researcher must consider the direction in which such relationship flow  
e.g: which is cause and which is effect

### 4. Working Hypotheses

- While planning the study of a problem, hypotheses are formed.
- Initially they may not be very specific. In such cases, they are referred to as ' working hypotheses' which are subject to modification as the investigation proceeds.



## 5. Null Hypotheses

- This hypotheses are formulated for testing statistical significance, since, this form is a convenient approach to statistical analysis. As the test would nullify the null hypotheses.

e.g., : There is a relationship between a family's income and expenditure on recreation, a null hypothesis may state: There is no relationship between families income level and expenditure on recreation.

## 6. Statistical Hypotheses

- These are statements about a statistical population. These are derived from a sample. These are quantitative in nature in that they are numerically measurable

eg: Group A is older than B'

## 7. Common Sense Hypotheses

- It state the existence of empirical uniformities perceived through day to day observations.

e.g., “ Shop-assistants in small shops lack motivation”

## 8. Complex Hypotheses

- These aim at testing the existence of logically derived relationships between empirical uniformities.

e.g., In the early stage human ecology described empirical uniformities in the distribution of land values, industrial concentrations, types of business and other phenomena.

## 9. Analytical Hypotheses

- It concerned with the relationship of analytic variables. These hypotheses occur at the highest level of abstraction.
- These specify relationship between changes in one property and changes in another.

Eg., The study of human fertility might show empirical regularities by wealth, education, region, and religion.

# Characteristics of a Good Hypotheses

- Conceptual Clarity
- Specificity
- Testability
- Availability of Techniques
- Theoretical relevance
- Consistency
- Objectivity
- Simplicity

# Sources of Hypotheses

- Theory
- Observation
- Analogies
- Intuition and personal experience
- Findings of studies
- State of Knowledge
- Culture
- Continuity of Research

# Categories of Management Research Problems

## Category 1: Hypothesis Testing/Predicting

- Using empirical data to develop or extend theories.
- May involve statistical analysis.

## Category 2: Mathematical Models in Decision-Making Environment

- Emphasizes the use of mathematical models for decision-making.

# Distinctive Features for Each Category

- Though the broad steps for research are similar, there are differences between the two categories.
- As theory develops, researchers tend to address problems in higher levels of abstraction.
- Increasing number of variables as theory develops.
- Formulation of hypotheses becomes more abstract and complex.
- Research design becomes more sophisticated and may introduce constraints.

# Features of a Theoretical Framework

- Clear identification and labeling of relevant variables.
- Explanation of relationships between variables.
- Indication of positive or negative nature of relationships based on previous research.
- Clear explanation of why relationships are expected to exist.
- Development of a schematic diagram to visualize theorized relationships.



# Variables in Research

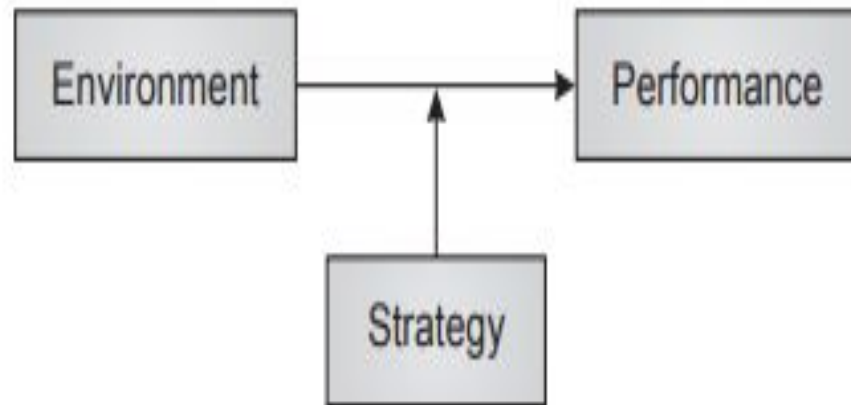
- Variables play a crucial role in problem definition and hypothesis formulation.
- Creative problem-solving methods, such as Interpretive Structural Modeling (ISM), can be useful in generating variables and relationships.

## Types of Variables:

1. **Independent Variable (IV) or Predictor Variable**
  - Influences the Dependent Variable (DV) or Criterion Variable.
2. **Dependent Variable (DV) or Criterion Variable**
  - Primary focus of the research.
  - Can have more than one independent or dependent variable in a problem situation.

## Moderator Variable

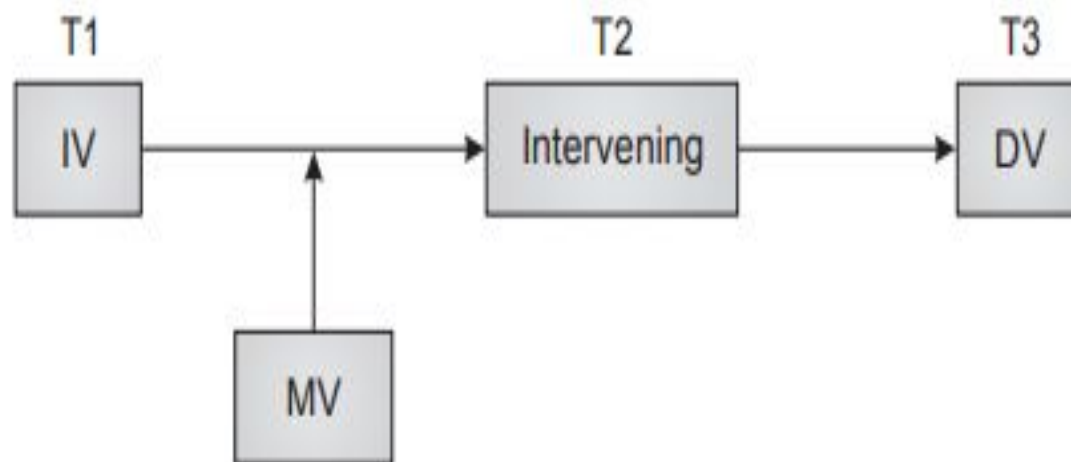
- A type of variable that influences the relationship between the independent variable and dependent variable.
- It modifies the strength or direction of the relationship.



■ **Fig. 4.4** Strategy as a moderator variable

## Intervening Variable

- A variable that comes between the independent variable and dependent variable in a causal chain.
- It helps explain the relationship between the two variables by providing a mechanism or process through which the effect occurs.



**Fig. 4.5** Intervening variable

## Importance of Defining Variables

- Clear definition of variables is crucial for research clarity and precision.
- Proper identification and operationalization of variables contribute to the validity and reliability of research findings.

# Characteristics of a Good Hypothesis

- Generating hypotheses is a creative process, and rigorous evaluation is necessary to identify useful ones.
- A good hypothesis should meet certain criteria for conceptual clarity and usefulness

## 1. **Conceptual Clarity and Compatibility**

- A hypothesis should be conceptually clear, meaningful, and grounded in previous knowledge.
- It should be compatible with existing scientific knowledge in the field.

## **2. Empirical Basis**

- A hypothesis should be empirically based, derived from measurable facts or phenomena.
- It should be supported by empirical evidence rather than solely based on theoretical or value judgments.

## **3. Specificity and Testability**

- A hypothesis must be specific and testable to facilitate empirical testing.
- Operational definitions and measurable variables should be associated with the hypothesis.
- Sub-hypotheses can be formulated for more specific aspects of the phenomenon.

## 4. Utilization of Testing Techniques

- Hypotheses should be formulated so that existing testing techniques can be applied.
- However, the unavailability of testing methods should not prevent the formulation of strongly felt hypotheses.
- Referring to conventional hypothesis testing practices by other researchers in the field can provide guidance.

## 5. Connection to Theory

- Hypotheses should be deduced from theory to extend or enhance it.
- Hypotheses unconnected with theory are less desirable, as relationships are tested in hypotheses.
- Precedence and a connection to existing research are generally desirable.

# Classification of Hypotheses

- Hypotheses can be classified according to form (syntactical), reference (semantic), and cognitive status (epistemological).
- Examples include statistical hypotheses (syntactical), hypotheses referring to experience or facts (semantic), and hypotheses with different epistemological statuses.



# Origins of Hypotheses

- Hypotheses can originate from various sources and influences.
- Understanding the origins of hypotheses helps researchers develop meaningful and relevant research questions.

## 1. **Cultural Value Systems**

- Hypotheses related to decision-making are influenced by managerial and organizational value systems in a particular culture.
- Replication studies across different cultures can extend theory or formulate new hypotheses.

## 2. Scientific Theory

- Scientific theories provide direction for research and serve as a basis for generating hypotheses.
- Logical reasoning applied to existing theories can lead to the formulation of further hypotheses.

## 3. Observation and Analogies

- Observation of nature or phenomena in other disciplines can inspire hypotheses for management research.
- Analogies, either substantive (similar in kind) or structural (similar systems), can provide suggestive hypotheses but require careful evaluation.

## 4. Personal Experiences and Idiosyncrasies

- Personal experiences, viewpoints, or idiosyncrasies can spark the development of hypotheses.
- Researchers' unique perspectives and insights can contribute to hypothesis generation.

## 5. Deviant Cases

- Deviant cases or contradictory observations can lead to the formulation of new hypotheses.
- Such cases may challenge or refute existing hypotheses, prompting the need for further investigation.

## 6. Intuition and Deliberate Thinking

- Intuitively found hypotheses often emerge after extensive logical reasoning, observation, and deliberate thinking.
- Researchers' intuition can play a role in hypothesis generation.

## 7. Deductive Reasoning

- Hypotheses can be deductively derived from stronger propositions as logical consequences or derivations.
- Deductive reasoning helps establish relationships and connections between propositions and hypotheses.

## 8. Cuckoo Technique

- The Cuckoo technique involves using theories from different fields to derive hypotheses.
- Probability theory is often employed in hypothesis generation using this approach.

## Formulation of Problem

Often, in empirical research, the concept of a problem is obtained from an observation of the phenomenon.

The researcher observes the real world through a systematic study of the setting in which the symptoms are observed.

The problem itself is split up into its components.

1. The decision maker and his objectives
2. The environment of the system
3. The alternative courses of action open to the decision maker

## Formulation of Problem

The main considerations in problem formulation are the following:

1. Appreciation of particular aspects of the system, which the manager desires to maximise or minimise.
2. Understanding of constraints that hamper the manager's freedom in choosing the resources the way he would like to.
3. Delineation of the boundary conditions of the system that influence his decisions.
4. Alternative courses of action that the manager/researcher is cognisant of.

- A study of the decision-making structure will give information regarding who sets policies in the organisation and how it is set.
- The objectives can be classified as maintenance objectives and accomplishment objectives. The maintenance objectives, in which the managers would like to keep up the past performance of the organisation, are based on antecedents.
- The study of the environment of the organization is, in fact, key to proper problem formulation.
- Aspects like, kind of competition, governmental policies, and statutory regulations have to be clearly understood before recommending a particular course of action to the manager. For example, when competition is based on quality, for a high cost consumer item like the automobile, cost reduction approaches may get little consideration as a course of action.

## Alternative Course of Action

As in the case of objectives, it is necessary to edit the alternatives obtained. It may be done by any one of the following means:

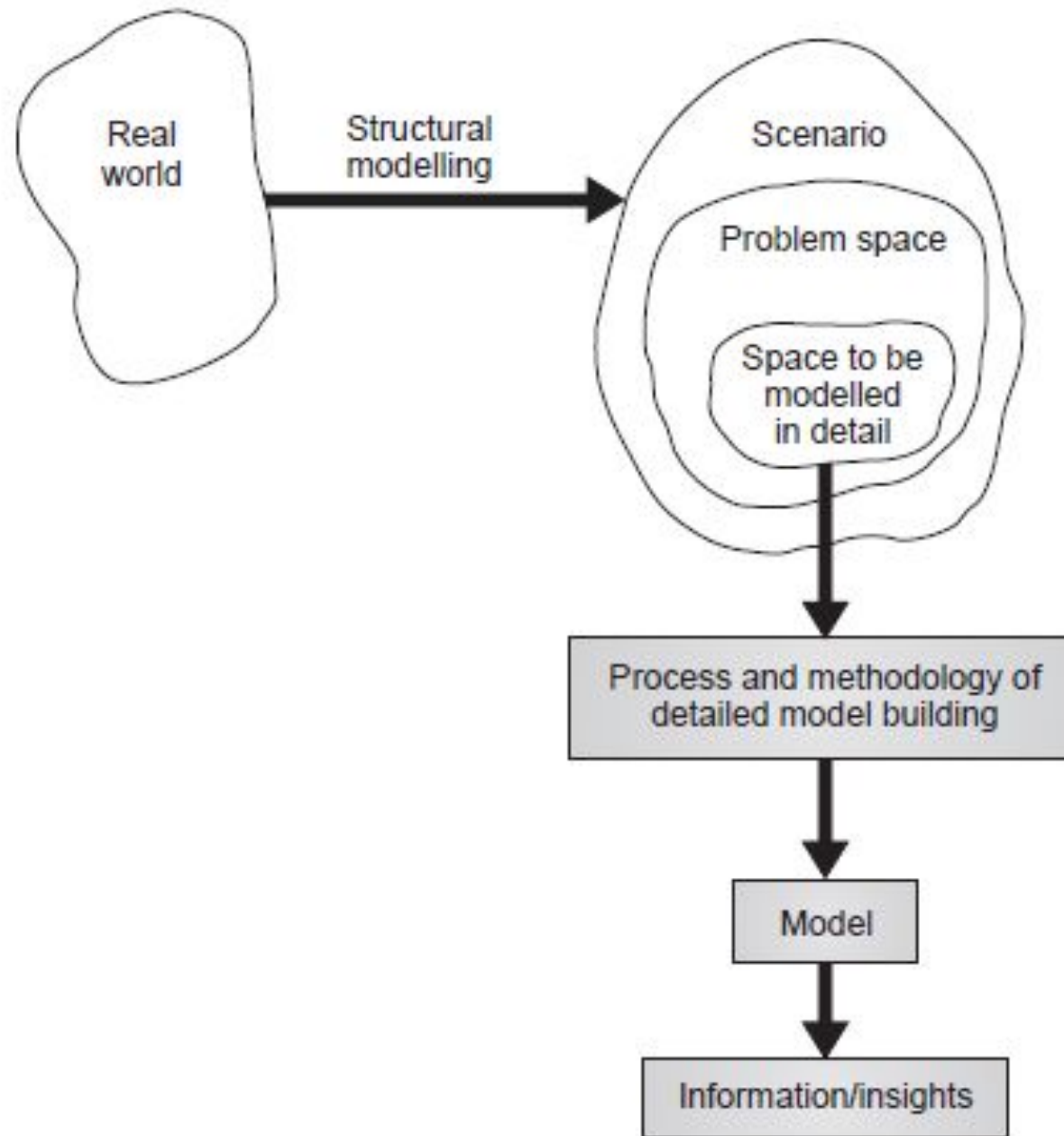
1. Eliminate previously tried alternatives which were found unsuitable.
2. Eliminate those that demand time and funds beyond what the management can provide.
3. Consider whether the short-term objectives or long term ones are emphasised. For example, in an inventory control procedure, if short-term benefits are to be obtained, the more costly items can be controlled using individual inventory models. If, however, policies have to be developed for long term control of the overall inventory, policy models will have to be developed and aggregate control becomes more important.

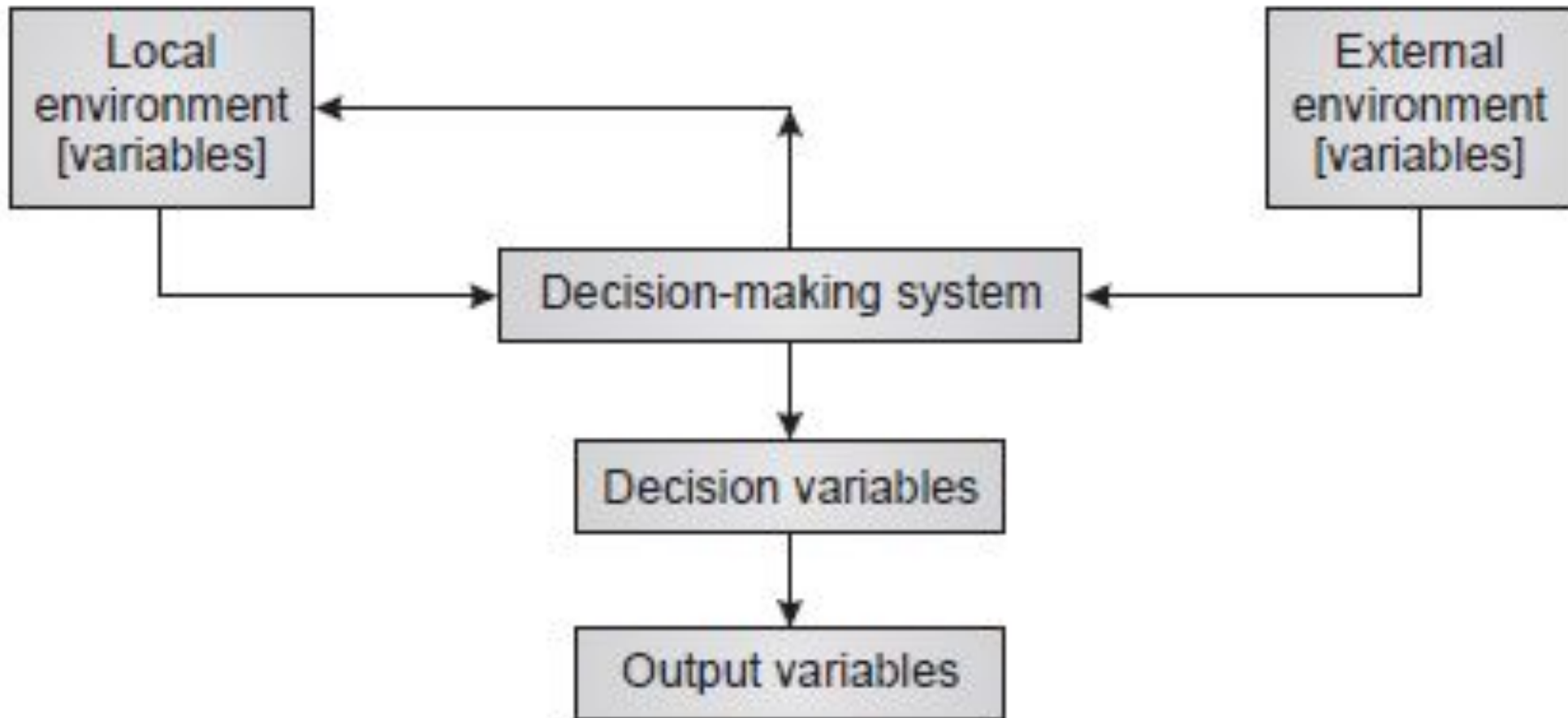


## Scenarios and Structural Modelling

The conceptual framework, emphasised in fundamental research, is very relevant to mathematical modelling for decisional research. As far as gaps in the theory or research are the origins of the research problem, a theoretical or conceptual framework arises necessarily out of a critical review of research literature. However, when the research problem emerges from the empirical world of management, where problems are experienced, model development has to be well-grounded in the system that is observed.

The framework for the model can be obtained by generating the scenario, the major elements of a management structure, and the inter-relationships among them for identifying the broad patterns of the mess or the problem.





## **Interpretive Structural Modelling**

This is a systematic procedure of affiliation of the principle of graph theory to efficiently construct a directed graph or network representation of the complex patterns of contextual relationships among a set of elements (Malone, 1975). This is a computer-assisted interactive learning process whereby structural models are produced. Learning is through graph interaction. The vehicle for learning is accumulation of information in the interaction to construct an ISM of Map(s) through group discussion, ISM software is available. The main benefit is in learning to structure complex systems or themes in order to improve them. It can be used for various purposes like management of learning of disabled workers, priority setting in urban systems management, social learning, and city and regional planning (Baldwin, 1975).

## Interpretive Structural Modelling

ISM can be described in terms of three components (Warfield, 1974):

1. People: a broker, a facilitator, technician, participants, and observers;
2. Equipment: mainly a computer and class room features; and
3. Substantive content: (the information and dealing with it) this may be a theme, issue, or problem element, and contextual relationships, votes, relation maps, and interpretations.

### **Example Interpretive Structural Modeling—Research as a Social Process**

Research can be understood as a social process. Research output is greatly influenced by the researcher and his or her experience. Research perspective, a theoretical underpinning of the research methodology, is formed by researchers in which the research institution (university) and the research questions play a part.

**Solution: The elements of the structure can be stated as:**

- (i) Researcher
- (ii) Previous research experience
- (iii) Research perspective
- (iv) Research methodology
- (v) Research institutes
- (vi) Research output
- (vii) Research question
- (viii) Family
- (ix) Education (x) Sex
- (xi) Age (xii) Personality
- (xiii) Culture

# Thanks !

---