

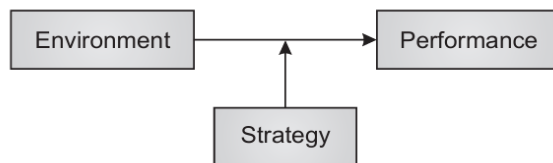
UNIT 1- RESEARCH METHODOLOGY

(From Variables-Hypotheses generation)

Variables in Research Problem Formulation

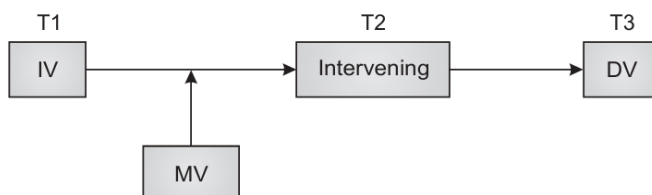
1. Types of Variables:

- **Independent Variable (IV):** Predicts or influences the Dependent Variable (DV).
- **Dependent Variable (DV):** The primary focus of research, which is influenced by the IV.
- **Moderator Variable (MV):** Alters the strength or direction of the relationship between IV and DV.



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

- **Intervening Variable:** Introduces a temporal dimension and does not add variance to the DV but is necessary for understanding the relationship over time.



■ **Fig. 4.5** Intervening variable

2. Examples:

- **Environment (IV)** and **Performance (DV)**: Performance is influenced by environmental conditions. A **Strategy (MV)** can moderate this relationship.
- **Organisational Climate (IV)** affects **Job Performance (DV)**, with **Job Design (MV)** moderating this relationship.
- **Training (IV)** impacts **Worker Performance (DV)**, modulated by **Motivation (MV)**.

3. Creative Problem-Solving Method:

- **Interpretive Structural Modeling (ISM)**: Developed by Warfield, ISM helps in generating and structuring variables and their relationships creatively.

Characteristics of Good Hypothesis

Generating hypotheses is a creative process where a researcher may produce numerous hypotheses about a research problem. However, many hypotheses are temporary and may not be pursued further. To identify useful hypotheses from a broad range of generated ideas, a rigorous evaluation process is necessary. This evaluation ensures that the hypothesis is useful, feasible, and worth the effort required for testing.

Criteria for Acceptable Hypotheses

1. Conceptual Clarity and Relevance:

- A hypothesis must be conceptually clear, meaningful, and communicable.
- It should be grounded in existing knowledge and acceptable to other researchers in the field.
- The hypothesis should align with the bulk of existing scientific knowledge and contribute meaningfully to the field.

2. Empirical Basis:

- Hypotheses should be based on empirical data rather than solely on theoretical or value judgments.

- Researchers must seek measurable facts related to the phenomenon to properly articulate and test the hypothesis.

3. Specificity and Testability:

- A hypothesis must be specific enough to facilitate quantitative testing using operational definitions.
- If necessary, a broad hypothesis can be broken down into more specific sub-hypotheses. For instance, if the hypothesis is that educational standards are declining, it should be divided into specific levels (primary, secondary, etc.) and locations (states, institutions) with detailed definitions and features.
- This helps in formulating more precise questions and sub-hypotheses related to various aspects like teaching methods, vocational guidance, and teacher motivation.

4. Alignment with Testing Techniques:

- Hypotheses should ideally be formulated to fit existing testing techniques.
- While the structure of testing methods can aid in hypothesis formulation, a valuable hypothesis should not be discarded just because a suitable testing method is not available.
- Developing new testing procedures for a strong hypothesis can become part of future research. Referencing conventional testing practices can provide guidance.

5. Theoretical Foundation:

- Hypotheses should be deduced from theory to extend or enhance existing theoretical frameworks.
- Hypotheses unrelated to any theory are less desirable as they do not test or build upon existing theoretical relationships.
- Even in unexplored areas, basing hypotheses on some theoretical foundation is preferable.

Classification of Hypotheses

1. **Form (Syntactical):**

- Refers to the structure of the hypothesis, such as statistical hypotheses.

2. **Reference (Semantic):**

- Deals with the basis of the hypothesis, whether it is based on experience, facts, or both.

3. **Cognitive Status (Epistemological):**

- Focuses on the depth, inception, and observation related to the hypothesis.
- This classification emphasizes understanding how the hypothesis was developed and its relevance to the research problem.

Origins of Hypotheses

1. **Decision-Making and Cultural Values**

- **Context Dependency:** Hypotheses related to decision-making are influenced by managerial and organizational value systems, which vary across cultures.
- **Cultural Relevance:** A hypothesis applicable in one culture may not hold in another due to differing value systems.
- **Cross-Cultural Research:** Replications of studies in different cultural settings can extend theory or lead to the formulation of new hypotheses relevant to different cultural contexts.

2. **Scientific Theory**

- **Theoretical Direction:** Scientific theories provide a foundation for research based on existing knowledge.
- **Logical Reasoning:** Applying logical reasoning to established theories can generate new hypotheses.

3. **Observation and Analogies**

- **Nature and Phenomena:** Observations from other disciplines can inspire hypotheses for management research.

- **Cautions with Analogies:** Analogies should be used cautiously; while they can suggest hypotheses, they need careful evaluation to avoid misleading conclusions.
- **Types of Analogies:** Analogies can be substantive (similar in kind) or structural (similar systems).

4. Personal Experiences

- **Individual Insights:** Personal experiences, viewpoints, or unique ideas can serve as sources of hypotheses.
- **Idiosyncrasies:** Individual quirks or strong personal beliefs can also lead to hypothesis generation.

5. Deviant Cases

- **Unexpected Findings:** Deviant or outlier cases may lead to the development of new hypotheses.
- **Refutation and Revision:** Such cases might refute existing hypotheses or lead to new insights not previously considered.

6. Intuitive Hypotheses

- **Spontaneous Ideas:** Some hypotheses arise intuitively, often after extensive reasoning, observation, and contemplation.
- **Underlying Process:** Intuition in hypothesis formation usually follows a period of deep thought and analysis.

7. Deductive Hypotheses

- **Logical Derivation:** Hypotheses can be derived deductively from established propositions or logical consequences.
- **Theoretical Consequences:** This involves deriving new hypotheses as logical extensions of stronger, existing propositions.

8. Cuckoo Technique

- **Cross-Disciplinary Approach:** This technique involves using theories from entirely different fields to generate hypotheses.

- **Example:** Biological theories applied to organizational theory or technology diffusion studies.
- **Probability Theory:** Often involves significant use of probability theory for hypothesis generation.

Process of Hypothesis Generation

1. Initial Literature Review and Pilot Study

- **Literature Review:** Start with a thorough review of existing literature to gain an understanding of the current state of research in the area of interest. This step involves searching for relevant studies, theories, and findings that pertain to your topic. It helps in identifying gaps in existing knowledge and informs you about the major contributions and debates within the field.
- **Pilot Study:** Conduct preliminary research or pilot studies to gather initial data. This may involve small-scale experiments, surveys, or observational studies that provide early insights into the research problem. Pilot studies help in refining research questions and methodologies by identifying potential issues and areas for improvement.
- **Preliminary Interviews and Meetings:** Engage with individuals who have expertise or experience related to your research area. This could include conducting interviews with industry professionals, attending relevant meetings or conferences, and participating in discussions. These interactions provide a broader understanding of the topic and offer practical perspectives that can shape your research approach.

2. Formulating Broad Problem Statements

- **Problem Identification:** Develop broad problem statements based on the insights gathered from the literature review, pilot study, and preliminary discussions. These statements should address key issues or gaps identified in the research. The goal is to frame the problem in a way that highlights its significance and relevance.
- **Purpose:** Ensure that the problem statements encompass all critical aspects of the issue and consider diverse viewpoints. This helps in forming a

comprehensive understanding of the problem and avoids overlooking important factors.

- **Clarification:** Use the gathered information to clarify and refine the problem definition. This may involve narrowing down the scope of the problem or focusing on specific aspects that are particularly significant.
- **Relevance:** Assess the importance and relevance of the problem for further investigation. Consider whether addressing this problem will contribute meaningfully to the field and whether it aligns with current research trends and practical needs.

3. Knowledge and Theoretical Framework

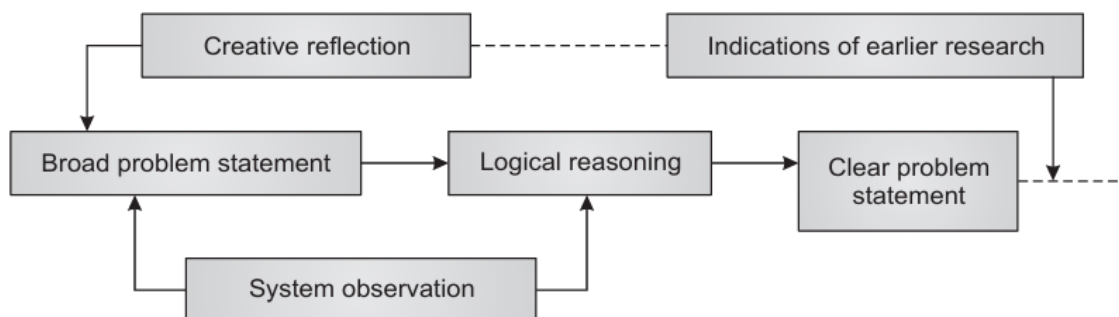
- **Demonstration of Knowledge:** Show a thorough understanding of the research area by using existing theories and findings to inform your problem statements. Demonstrating deep knowledge helps in generating relevant and well-grounded hypotheses.
- **Theoretical Framework:** Construct a theoretical framework that outlines the relationships among key variables related to your problem. This framework should be built on established theories and empirical evidence, providing a structured basis for your research.
- **Theory and Empirical Support:** Ensure that the problem and theoretical framework are supported by both theoretical insights and empirical data. This dual foundation strengthens the credibility and validity of your research approach.

4. Defining the Problem

- **Problem Definition:** Clearly articulate the problem, identifying it as either a gap in existing knowledge or an unanswered/ inadequately answered question. A well-defined problem serves as the foundation for developing testable hypotheses.
- **Conversion to Hypotheses:** Once the problem is clearly defined, convert it into a set of hypotheses. Hypotheses should be specific, measurable, and testable statements that address the problem and suggest potential relationships among variables.

5. Developing Variables and Theoretical Framework

- **Relevant Variables:** Identify and develop a set of variables that are pertinent to the problem. These variables should be directly related to the hypotheses and help in operationalizing the research.
- **Theoretical Framework:** Build a conceptual model that illustrates the relationships among the identified variables. This framework should visually and logically represent how the variables interact and contribute to addressing the research problem.
- **Systematic Analysis:** Construct the theoretical framework by systematically analyzing and classifying findings from the literature. This involves organizing the information in a coherent manner and ensuring that the framework is comprehensive and well-supported by existing research.



According to Goode and Hatt (1952), there are three main difficulties in generating hypotheses.

1. Absence of a theoretical framework
2. Absence of logical utilisation of theoretical framework
3. Lack of knowledge of research techniques available for phrasing the hypotheses

Methods for Developing Hypotheses

1. Selecting the Area of Study

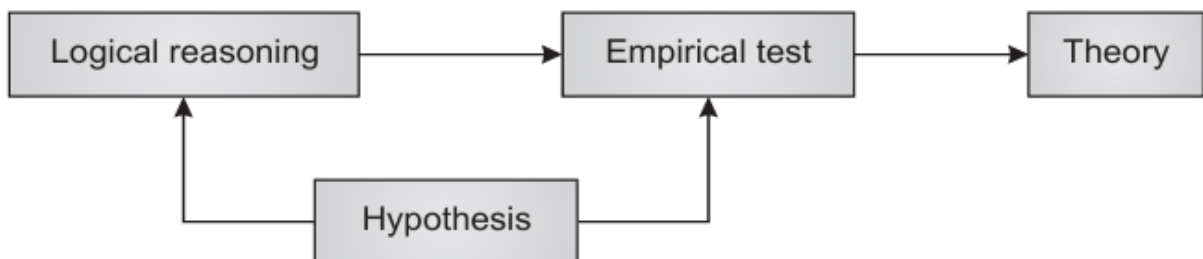
- **Replication:** Start by replicating previous research, particularly in management and social sciences where cultural factors might affect hypothesis relevance. This can add new insights if cultural effects are minimal.
- **Data Review:** Examine collected data to uncover potential new hypotheses.

2. Starting with Broad Theory

- **Theory-Based Approach:** Use broad theories to deduce likely relationships and formulate them as hypotheses. These initial hypotheses may be general and need refinement.
- **Working Hypotheses:** Develop provisional hypotheses and refine them based on research findings.

3. Using Common sense Observations

- **Commonsense Hypotheses:** Use commonsense observations to generate hypotheses, but ensure these are critically examined and tested scientifically.
- **Ideal Relationships:** Explore complex, logically derived relationships from existing theory for empirical testing to extend theoretical knowledge.



Qualitative Methods in Management Research

1. Importance of Qualitative Methods

- **Key Proponents:** Glaser and Strauss (1967), Patton (1980), Maanen et al. (1982), Smith and Dainty (1991), Gummesson (2000) highlight the value of qualitative methods, particularly in organizational research.
- **Natural Science vs. Qualitative Research:** Traditional research often follows a natural science approach with structured hypothesis testing, whereas qualitative research emphasizes hypothesis generation and theory discovery from data.

2. Grounded Theory

- **Definition:** Grounded theory, introduced by Glaser and Strauss (1967), involves discovering theory from data. It involves generating a set of propositions or untested hypotheses that continuously develop during data collection.
- **Data Collection and Analysis:** Data collection and analysis are conducted in parallel, with the theory emerging as more data is gathered.
- **Theory Development:** Unlike quantitative research that requires a pre-existing theoretical framework, qualitative research avoids a predefined framework to prevent bias, allowing theory to develop organically from the data.

3. Qualitative Research Approach

- **Theory as an Evolving Entity:** In qualitative research, theory is seen as continuously developing rather than a finalized product. Concepts and relationships are generated and generalized from categories developed during data analysis.
- **Theoretical Sampling:** Sampling is guided by theoretical needs and aims to generate hypotheses based on the emerging theory.

4. Methods of Qualitative Research

- **Enquiry from Within:** Methods include unobtrusive observation, discussion, participant-observation, and case studies. Researchers immerse themselves physically and psychologically in the phenomenon.
- **Practical Value:** These methods provide access to internal facts, perceptions, and relationships within an organization, which might not be

obtainable from external perspectives.

5. Inductive Generalisation

- **First Degree Induction:** Generalization from specific observations to broader principles.
- **Second Degree Induction:** Generalizing from multiple generalizations. For instance, if increasing a decision variable affects costs in predictable ways, this principle may extend to other decision contexts.

Formulation of the problem

Model Building Context

Problem Formulation in Empirical Research

1. Sources of Problems

- **Observation of Phenomena:** Problems may be identified through direct observation by researchers or posed by practitioners.
- **Academic Research:** Theoretical researchers may refine existing models by identifying gaps or inadequacies and modifying assumptions.

2. Components of Problem Formulation

- **Decision Maker and Objectives:** Define who is making the decisions and what their goals are.
- **Environment of the System:** Understand the context and constraints affecting decision-making.
- **Alternative Courses of Action:** Identify and evaluate the options available to the decision maker.

3. Considerations for Problem Formulation

- **Objectives:** Recognize which aspects the manager wants to maximize or minimize.
- **Constraints:** Identify limitations that affect resource allocation and achievement of objectives.

- **Boundary Conditions:** Define the system boundaries influencing decisions.
- **Alternatives:** Explore and assess various possible actions.

4. Mathematical Representation

- **New or Modified Models:** Develop new or adjust existing mathematical models to address the problem.

5. Importance of Detailed Formulation

- **Implementation:** Ensure that the formulated solution is practical and feasible.
- **Error Prevention:** Avoid overlooking significant aspects or overemphasizing irrelevant ones to reduce Type I and Type II errors.

Decision Maker and His Objectives

Study of Decision-Making Structure

1. Decision-Making Information

- **Policy Setting:** Identify who is responsible for setting policies within the organization.
- **Approval Procedures:** Understand the procedures for approving expenditures.
- **Decision Execution:** Learn about the procedures for executing decisions.
- **Outcome Evaluation:** Know the methods used for evaluating the outcomes of decisions.

2. Relevance to Problem Formulation

- **Guiding Framework:** Although not directly used in problem formulation, understanding these procedures provides a guiding framework.
- **Constraints:** The structure and procedures constrain and guide the formulation of the problem by influencing how decisions are made and evaluated

Objectives

Classification and Editing of Objectives

1. Types of Objectives

- **Maintenance Objectives:** Aimed at sustaining past performance levels based on previous outcomes. These are more conservative and focus on preserving current status.
- **Accomplishment Objectives:** Involve strategic planning for growth and improved performance. These objectives are more dynamic and forward-looking, targeting new achievements.

2. Challenges in Identifying Objectives

- The objectives of individual decision-makers might not entirely reflect the organization's goals, as different managers may have varying priorities.
- The process of defining objectives is complex and requires careful consideration to accurately capture and align with the organization's broader aims.

3. Editing Objectives

- **Independence:** Ensure each objective is unique and not implied by another. For example:
 - If the objective is to maximize ROI, the goal of maximizing profit might be redundant, as high ROI generally indicates high profit.
 - Similarly, if one objective is to enhance sales promotion, it might inherently include aspects like advertising.
- **Combination:** Merge similar or overlapping objectives to avoid redundancy. For instance:
 - Objectives related to increasing sales through various methods (like promotions and advertising) should be consolidated if they cover similar strategies.

4. Process of Editing

- **Review and Consolidate:** Examine all stated objectives to identify overlaps and eliminate redundant ones.
- **Ensure Clarity:** Combine or refine objectives to ensure they are clear, actionable, and not conflicting.
- **Focus on Relevance:** Ensure that the final set of objectives aligns with both short-term and long-term organizational goals.

Environment

- **Significance of Environmental Analysis**
 - **Essential for Accurate Formulation:** A thorough understanding of the organization's environment is critical to defining problems and recommending viable solutions.
- **Key Environmental Factors**
 - **Competition:** Examine the type of competition—whether it focuses on quality, cost, or other factors. For high-cost consumer items like automobiles, cost reduction might be less relevant if the market prioritizes quality over price.
 - **Government Policies and Regulations:** Consider relevant governmental policies and statutory regulations that could impact the organization's strategies and operations.
 - **Plant Capacity and Technology:** Evaluate the availability of plant capacity, subcontractors, and technology. For example:
 - **Capacity Constraints:** If specific machine capacities are lacking, subcontracting may be necessary despite additional costs.
 - **Cost-Benefit Analysis:** Optimize production plans by balancing the costs of subcontracting against potential machine idle time.
- **Impact on Problem Formulation**
 - **Resource Constraints:** Environmental factors help introduce constraints related to both internal and external resources into the problem model.

- **Informed Decision-Making:** Understanding these constraints enables the researcher to recommend practical and feasible solutions for the organization's management.

Alternative Courses of Action

- **Types of Courses of Action**

- **Existing Alternatives:** Evaluate the current options available to the decision-maker.
- **Cognitive Comprehension:** Consider alternatives the decision-maker is aware of but has not yet fully explored.
- **New Alternatives:** Develop new options that were not initially considered by the decision-maker.

- **Evaluation of Alternatives**

- **Objective Achievement:** Assess how well each alternative meets the edited objectives (see effectiveness function formulation later).
- **Efficiency Assessment:** Determine the effectiveness of each alternative in achieving the goals.

- **Editing Alternatives**

- **Eliminate Ineffective Alternatives:** Remove alternatives previously tried and found unsuitable.
- **Resource Constraints:** Discard options that exceed available time and funds.
- **Short-term vs. Long-term Focus:** Align alternatives with the focus of objectives:
 - **Short-term:** Use individual inventory models for immediate benefits.
 - **Long-term:** Develop aggregate control policies for comprehensive inventory management.

Scenarios and Structural Modelling

1. Conceptual Framework and Mathematical Modelling

- **Fundamental Research:** Emphasizes the importance of a conceptual framework, which is crucial for mathematical modelling in decisional research.
- **Theory and Empirical Origins:** Frameworks arise from a critical review of literature or from empirical observations in management.

2. Scenario Generation

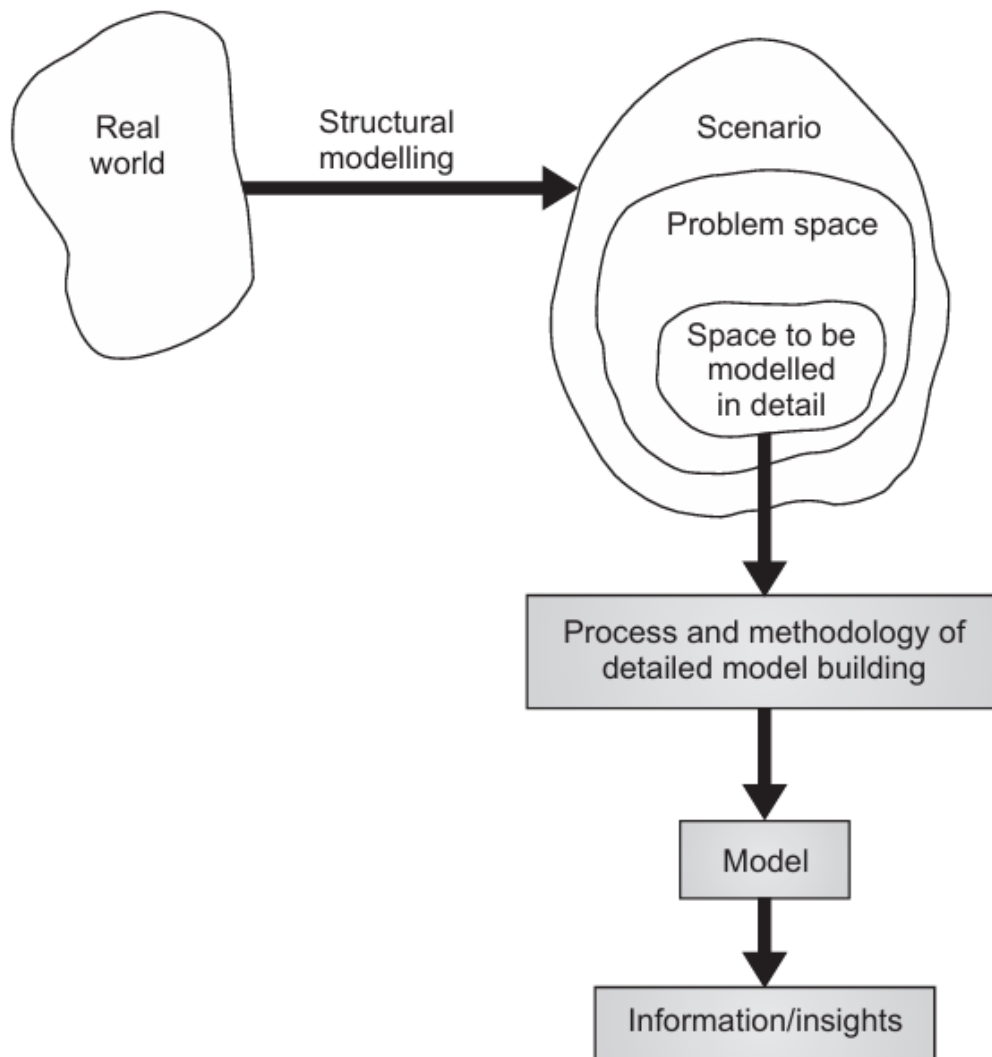
- **Definition:** Develop scenarios to capture major elements of a management structure and their inter-relationships.
- **Objective:** Identify broad patterns and issues in the problem-space.

3. Structural Modelling

- **Purpose:** Narrow down the problem-space based on scenario analysis.
- **Process:** Transform managerial perceptions into a systematic presentation of scenarios and problems.
- **Soft Systems Approach:** Focus on systems thinking and goal definition, as described in Chapter 3.

4. Integration with Mathematical Modelling

- **Structural vs. Mathematical Modelling:** Structural modelling provides the framework for transforming perceptions into a mathematical model (see Fig. 4.8).



- **System and Environment:** The system and environment are parts of the overall system where the problem exists.
- **Environment Types:**
 - **Local Environment:** Directly influences and is influenced by managers' decisions (e.g., other parts of the organization).
 - **External Environment:** Immune to managers' decisions but affects their choices (e.g., market, regulations).

- **Key Variables:** Defined for the system, local, and external environments to study their interactions.
- **Constraints:** Limit the range of values these variables can take, affecting both the system and the environment.
- **Structural Modelling:** Variables and constraints are used to build a detailed model of the system.
- **Problem Formulation:** An example is provided in **Annexure 4.5** to illustrate the system study and problem definition.

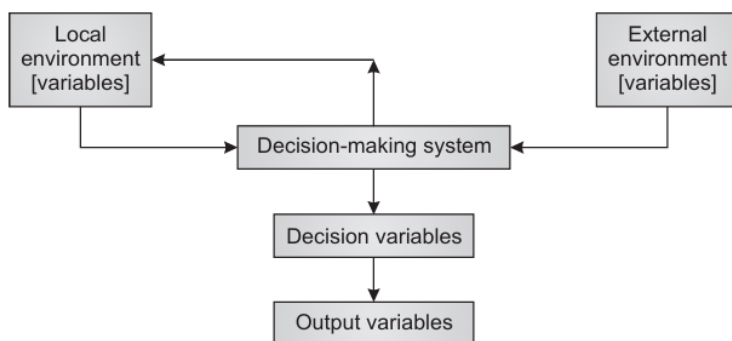


Fig. 4.9 Influence of local and external environments on the decision-making system

Interpretive Structural Modelling (ISM)

1. ISM Overview:

- ISM applies graph theory to construct a network of contextual relationships among elements.
- A computer-assisted, interactive learning process where structural models are created.
- The process helps structure complex systems to improve understanding and solutions.

2. Learning and Applications:

- ISM promotes learning through interaction and group discussion.

- Applicable in areas like urban management, social learning, planning, and managing learning for disabled workers.

3. **Tackling Complexity:**

- ISM addresses complex socio-economic problems by breaking them down into manageable relationships.
- Elements are modeled in pairs (e.g., A influences B) and stored in a matrix that forms a structured graph.

4. **ISM Process:**

- **Steps:** Identify important elements, define interrelationships (e.g., influence, dependence), and structure them.
- Questions like "Does A influence B?" guide the model construction.
- Group discussions focus on pairs of elements to maintain control and focus.

5. **ISM Components (Warfield, 1974):**

- **People:** Includes a broker, facilitator, technician, participants, and observers.
- **Equipment:** Requires a computer and classroom setup.
- **Content:** Information, themes, and relationships being modeled.

6. **Output:**

- The output is MAPS (ISM models) representing hierarchical relationships among elements.
- Can handle various relationships: comparative, causal, spatial, temporal, etc.

7. **Research Example:**

- Research as a social process influenced by various factors like experience, methodology, and personal attributes.
- Structural model includes elements like researcher, research question, institution, family, culture, and education.

- Influences are mapped step-by-step, as shown in Annexure 4.6.

8. Matrix of Influences:

- The influence matrix at the end of Annexure 4.6 (Exhibit 4.8) displays the directional relationships among elements.

Formulation of Effectiveness Function

Explanation of the Effectiveness Function

- **Effectiveness Function (Ef):** This function calculates the effectiveness of each alternative in achieving all given objectives.
- **Formula:**

$$Efi = \sum_{j=1}^m eij$$

- **Efi:** Effectiveness of the ith alternative.
- **eij:** Efficiency of the ith alternative with respect to the jth objective.
- **m:** Total number of objectives.
- **Objective:** To determine the **optimal choice** of the alternative course of action by assessing the effectiveness of each alternative across all objectives.
- The function sums up the efficiencies of a given alternative across all objectives, providing an overall measure of effectiveness.

However certain aspects needs to be considered.