**TYPES OF MODELS**

1. **PHYSICAL MODEL**: a physical replica that can be operated, tested, and assessed—

e.g., a model of an aircraft that is placed in a wind-tunnel to test its aerodynamic

characteristics and behavior.

2. **ANALOG MODEL:** a model that is analogous (shares similarities)—e.g., a map is

analogous to the actual terrestrial location it models.

3. **SYMBOLIC MODEL:** a model that is more abstract than the two discussed above and

that is characterized by a symbolic representation—e.g., a financial model of the

US economy used to predict economic activity in a particular economic sector

**CLASSIFICATION OF MODEL**

1. Deterministic
2. Probabilistic

|  |  |
| --- | --- |
| 1. Data rich 2. Data poor 3. Physical Model 4. Analog Model 5. Symbolic Model 6. Risk Profiles 7. Deterministic 8. Probabilistic 9. PMT () Function 10. Model or Problem Definition Phase 11. Process Flow Map 12. Complexity 13. Pre-Modeling or Design Phase 14. Modeling Phase 15. Analysis Phase 16. Final Acceptance Phase 17. **Influence Diagram (IFD)** | 1. Positive Influence 2. Negative Influence 3. Mutually Exclusive 4. Collectively Exhaustive 5. Decision Trees 6. Expected Value 7. Sensitivity Analysis 8. Quick Access Toolbar 9. Scroll Bars 10. Spinners 11. Combo Boxes 12. Option Buttons 13. Data Table 14. Macro 15. VBA 16. Group Box 17. Cell Link |

**TERMS**

What Is a **RISK PROFILE**? A risk profile is an evaluation of an individual's willingness and ability to take risks. It can also refer to the threats to which an organization is exposed. A risk profile is important for determining a proper investment asset allocation for a portfolio

**COLLECTIVELY EXHAUSTIVE**

In probability theory and logic, a set of events is jointly or **collectively exhaustive** if at least one of the events must occur. For example, when rolling a six-sided die, the events 1, 2, 3, 4, 5, and 6 balls of a single outcome are collectively exhaustive, because they encompass the entire range of possible outcomes.

An I**NFLUENCE DIAGRAM** is an intuitive visual display of a decision problem. It depicts the key elements, including decisions, uncertainties, and objectives as nodes of various shapes and colors. It shows influences among them as arrows.

An influence diagram is a graphical representation of a decision-making problem, which consists of the following key features:

1. **Nodes**:  
   * **Decision nodes**: Represented by squares, these nodes depict the decisions that the decision-maker can make.
   * **Chance nodes**: Represented by circles, these nodes represent random variables or uncertainties in the problem.
   * **Value nodes**: Represented by diamonds, these nodes represent the objectives or outcomes that the decision-maker aims to optimize.
2. **Arcs/Edges**:  
   * **Directed arcs**: These arcs represent the dependencies and information flow between the nodes. They indicate how the values of the nodes influence each other.
   * **Information arcs**: These arcs connect decision nodes to the chance nodes and value nodes that the decision-maker can observe or use to inform their decisions.
3. **Conditional Probability Distributions**:  
   * Each chance node is associated with a conditional probability distribution that represents the uncertainty of the corresponding random variable, given the values of its parent nodes (the nodes connected to it by directed arcs).
4. **Utility Functions**:  
   * The value nodes are associated with utility functions that quantify the decision-maker's preferences or objectives. These functions map the values of the random variables and decision variables to a numerical score representing the desirability of the outcomes.
5. **Decision Strategy**:  
   * The influence diagram represents the decision-maker's strategy, which is the set of decisions that optimizes the expected utility, given the available information and the constraints of the problem.

A **FLOW MAP** is a thematic map that visualizes the movement of quantities (e.g. information or ideas, weather phenomena, people and other living things or physical objects) from one location to another, simultaneously indicating their amount.

**POLYTELY** comprises complex problem-solving situations characterized by the presence of multiple simultaneous goals. These goals may be contradictory or otherwise conflict with one another, requiring prioritization of desired outcomes.

A **COMPLEX DECISION** is a decision-making process that involves multiple factors, uncertainties, and potential consequences that make it challenging to arrive at an optimal solution. Some key characteristics of complex decisions include:

1. Multiple Stakeholders: Complex decisions often involve multiple parties or groups who have different interests, priorities, and decision-making criteria.
2. Conflicting Objectives: The decision-making process needs to balance and prioritize potentially conflicting objectives, such as cost, quality, risk, and time.
3. Uncertain Outcomes: There are often significant uncertainties around the outcomes and impacts of the decision, making it difficult to predict the consequences with a high degree of confidence.
4. Interdependencies: Complex decisions are often interconnected with other decisions and have ripple effects across an organization or system.
5. Incomplete Information: Decision-makers may not have access to all the relevant information needed to make an informed choice, leading to the need to make assumptions and inferences.
6. Dynamic Environments: The context in which the decision is made is often rapidly changing, requiring the decision-maker to continually reevaluate and adapt their approach.

**FACTS OF COMPLEXITY OF DECISION MAKING**

1. Choice structure.
2. Choice information
3. Dynamic range
4. Interconnectedness
5. Choice environment

Complexity of a decision problem significantly impacts one’s decisions and their outcomes. It can be manifested in various ways, ranging from number of available choice options, their presentation, how these options evolve over time, the level of uncertainty about the information about a decision problem, to the physical environment in which a decision is taken.

**MODELING STAGES**

1. A **PRE-MODELING OR DESIGN PHASE** that contributes to our preliminary understanding of the problem. This could, and often is, called the problem definition phase. This step can take a considerable proportion of the entire modeling effort.

After all, if you define the problem poorly, no amount of clever analysis will be helpful. At this stage, the goal of the modeling effort should be made clear.

**What are we expecting from the model? What questions will it help answer? How will it**

**be used and by whom?**

2. A **MODELING PHASE** where we build and implement a model that emerges from the

pre-modeling phase. Here we refine our specification of the problem sufficiently

to explore the model’s behavior. At this point the model will have to be populated

with very specific detail.

**INFLUENCE DIAGRAM**

*An influence diagram is a compact graphical and mathematical representation of a decision situation. It is a generalization of a Bayesian network, in which not only probabilistic inference problems but also decision making problems can be modeled and solved.* [*Wikipedia*](https://en.wikipedia.org/wiki/Influence_diagram)

*Note*

*IFD does not suggest the intensity of the influence, only the direction.*

3. An **ANALYSIS PHASE** where we test the behavior of the model developed in steps (1)

and (2), and we analyze the results. In this phase, we collect data that the model

produces under controlled experimental conditions and analyze the results.

4. A **FINAL ACCEPTANCE PHASE** where we reconsider the model specification, if the

result of the analysis phase suggests the need to do so. At this point, we can

return to the earlier phases until the decision maker achieves desired results. It

is, of course, also possible to conclude that the desired results are not achievable.

**ASPECTS OF THE SPREADSHEET MODEL IN THE FOLLOWING ORDER:**

(1) **THE BASIC MODEL**

and its calculations,

(2) the **SENSITIVITY ANALYSIS** that can be performed on the model,

and

(3) the **CONTROLS** that have been used in the spreadsheet model (scroll bars and

options buttons) for user ease of control.

Although modeling contains an element of art, a substantial part of it is science.

Just as problem definition is the most important step in problem solving, model conceptualization is the most important step in modeling.

**TYPICAL MODEL BUILDING PHASES**

1. Set goals
2. deterministic influence diagram
3. Sensitivity analysis
4. Iterate, add decisions, and perform probabilistic analysis
5. Analyze, Refine, and Update.

**SIMULATION, SCENARIOS, GOAL SEEK, TERMINOLOGIES.**

|  |  |
| --- | --- |
| Solver  Prescriptive Analysis  Scenario  Goal Seek  Descriptive Analysis  Constrained Optimization  Linear Programming  Decision Variables  Objective Function  Constraints  Technology of LP  Infeasibility  Coefficients  LP Formulation  Target Cell | Changing Cell  Right-Hand Side (RHS)  Slack  Not Binding  Binding  Shadow Price  Allowable Increase  Allowable Decrease  Reduced Cost  Non-Linear Programs (NLP)  Integer Programs (IP)  Mixed Integer Programs (MIP)  0-1 Integer Programs  CUMIMTP  Local Optimum |