Chapter 3

Problem Solving

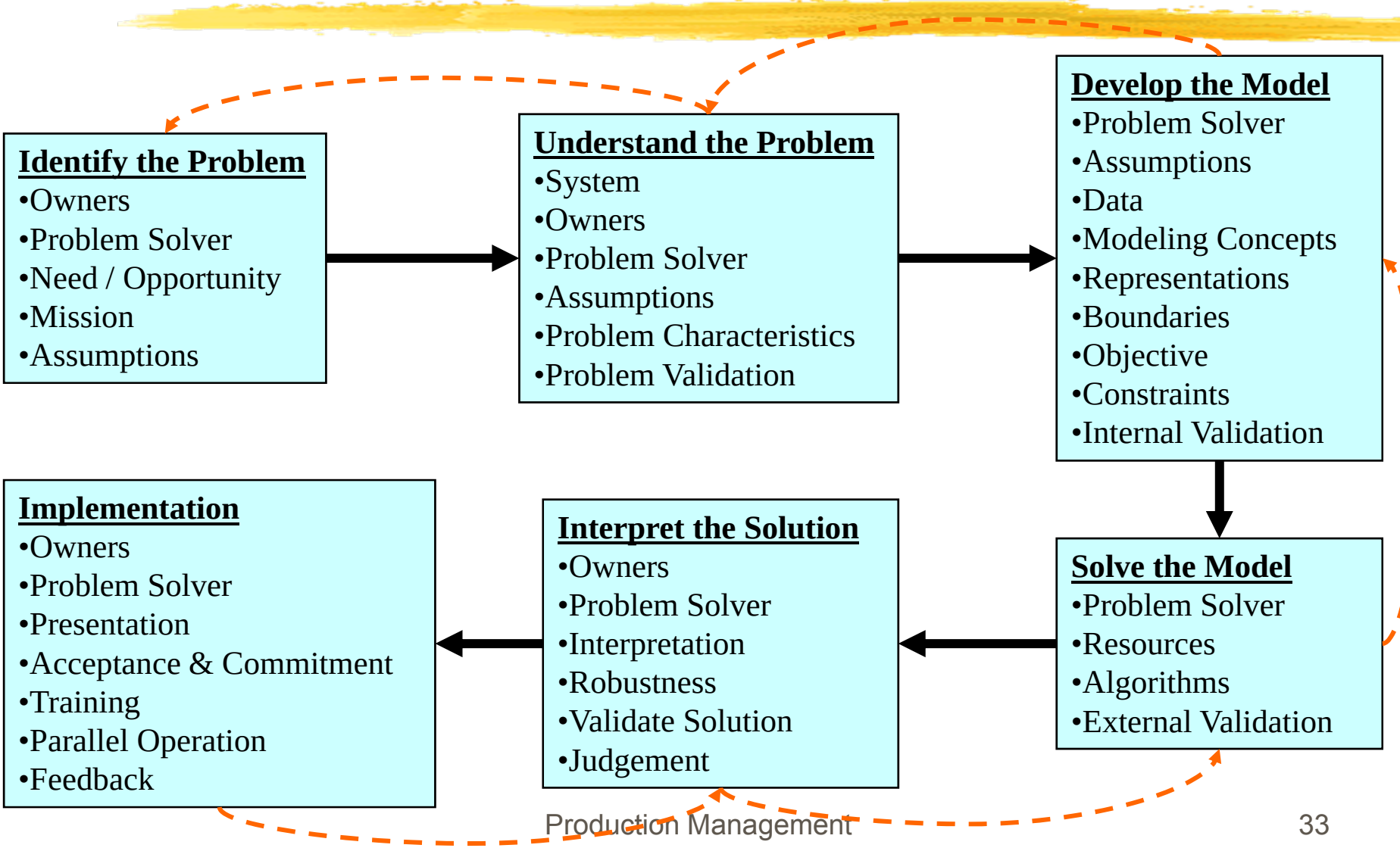
Problem Solving

- **Current state → goal state**
- **impact:** should be worth the resource
- ability to measure the gap
- ability to close the gap
- solve or dissolve

Problem Solving

- **Problem Identifikation**
  - Symptoms
  - Problem mission
  - mission will be translated into goals and objectives
  - problem owners: people who must live with the solution
  - Assumptions
  - Initial Problem Statement

Problem Solving



Problem Solving

- **Understand the problem**
  - The systems perspective
    - analysis
    - synthesis
  - Goals
  - Problem Characteristics
    - one-time - recurrent
    - level of detail
  - Validate Understanding

Problem Solving

- **Develop a model**
  - Model representation
    - iconic
    - analog
    - symbolic
  - Data
  - Modeling concepts
    - Boundaries
    - Objectives
    - Constraints
  - Relationships
  - Assumptions and Involvement
  - Internal validation

Problem Solving

- **Solve the Model**
  - External validation
  - Simplification
  - Solution Strategy
    - Exact
    - Heuristic
    - Simulation
- **Interpret the solution**
  - robustness
  - plausibility
- **Implementation**

Example: MaTell – Identifiy

- **MaTell produces telephones: desk phones, wall phones, answering machines**
- **All 3 products are made at a single plant**
- **Customers cannot buy the products because they are unavailable**

- **Is there a problem?**
- **What is the problem mission?**
- **Who are the owners of this problem?**
- **Assumptions?**

- **Initial problem statement:**
  - Current state: Some customers who want our product cannot get them.
  - Goal state: Deliver a product to all of our customers who want one.
  - Problem: How can we provide products to all out customers?

Example: MaTell - Understand

- **variety of ways to provide more products**
  - build a new plant
  - expand the existing plant
  - subcontracting
  - ...
- **actual production system**
  - fabrication department - assembly department
  - 15000 wall phones (W), 17000 desk phones (D), 5000 answering machines (A) per weak
  - plant works a three eight-hour shifts a day, seven days a week
  - fabrication: 135 hours per week
  - assembling: 163 hours per week
- **new problem owner: production department**
- **2 strategies:**
  - using capacity more effectively
  - reducing the time a product spends in assembly

Example: MaTell - Develop

- **data available: time it takes to make each product in the fabrication and assembly department**
  - 1000 desk phones: 2.5 hours fabrication, 3 hours assembly
  - 1000 wall phones: 4 hours fabrication, 3 hours assembly
  - 1000 answering machines: 6 hours fabrication, 14 hours assembly
- **objective:**

  W+D+A
- **total fabrication time:**

  4 W + 2.5 D + 6 A
- **total assembly time:**

  3 W + 3 D + 14 A
- **marketing department: at most 30000 desk phones, 30000 wall phones and 12000 answering machines can be sold per week.**
- **assumptions:**
  - Demand will continue at the same levels or higher for some time
  - The number of products made is a good measure for increasing the throughput.
  - There is a linear relationships between products and fabrication (assembly) time.
  - Data are accurate.

Example: MaTell – Solve / Interprete

- **Solve using Excel spreadsheet / Solver**
- **Is the new mix more or less profitable ?**
- **margins: $2.20 (D), $2.00 (W), $7.00 (A)**
- **alternative objective:**

  2.2 D + 2 W + 7 A
- **add lower bounds: 10 (D), 10 (W), 4 (A)**

Example: MaTell – Implementation

- **present the solution**
  Though the spreadsheet was not used to get the solution, it would be a good way to introduce the LP solution

- **acceptance relatively easy (owners were involved)**

- **commitment may be more difficult, but only few resources needed (LP package, training for the planner)**

- **check the system from time to time (conditions may change)**

Problem Solving

- **Work to do:**
- **Examples: 3.12 abcd, 3.19 ab, 3.30abc, 3.36abc, 3.41 abc, 3.46**