Modeling in logistics

Agenda

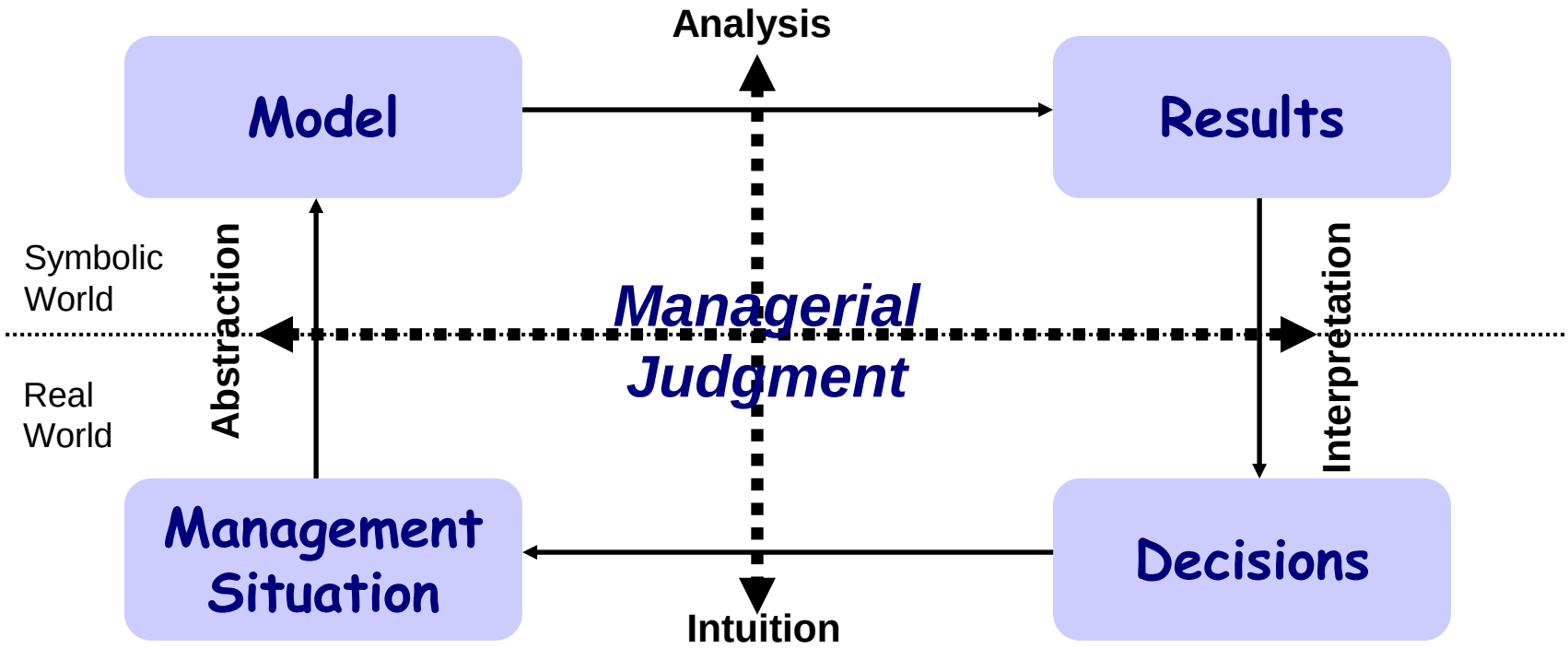
- Introduction to modeling
- Network modeling in logistics
- Types of logistics models

- **A model** is an abstraction of a business situation suitable for analysis to support decision making and provide managerial insights.

A Detailed View of the Modeling Process

1. Diagnose the problem
2. Select relevant aspects of reality
3. Organize the facts, identify objectives, and decisions to be made
4. Select the methodology
5. Construct the model
6. Solve the model (generate alternatives)
7. Interpret results
8. Validate the model (does it work correctly?)
9. Implement the solution
10. Monitor results

The Modeling Process



Reasons (cont.)

- Consider what data are necessary for quantification of those variables and determining their interactions
- Recognize constraints (limitations) on the values that those quantified variables may assume
- Allow communication of your ideas and understanding to facilitate teamwork

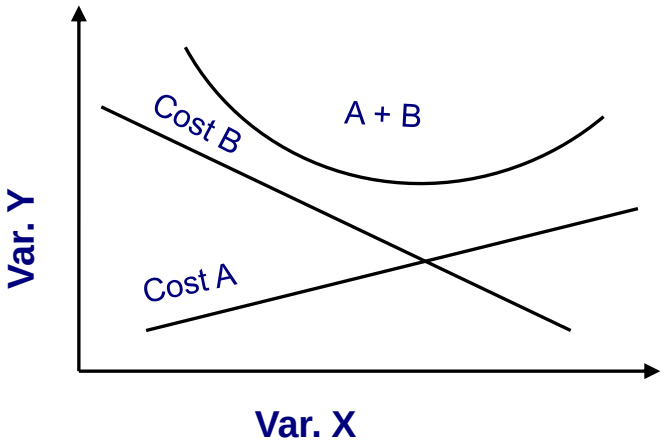
TYPES OF MODELS

Type	The model is	What is being modeled	Examples
Physical	Tangible	Tangible	Model airplane, building, etc.
Analog	Tangible	Abstract	Speedometer Thermometer Painting
Symbolic	Abstract	Either tangible or Abstract	Language Mathematics

Building Models

Symbolic Model Construction

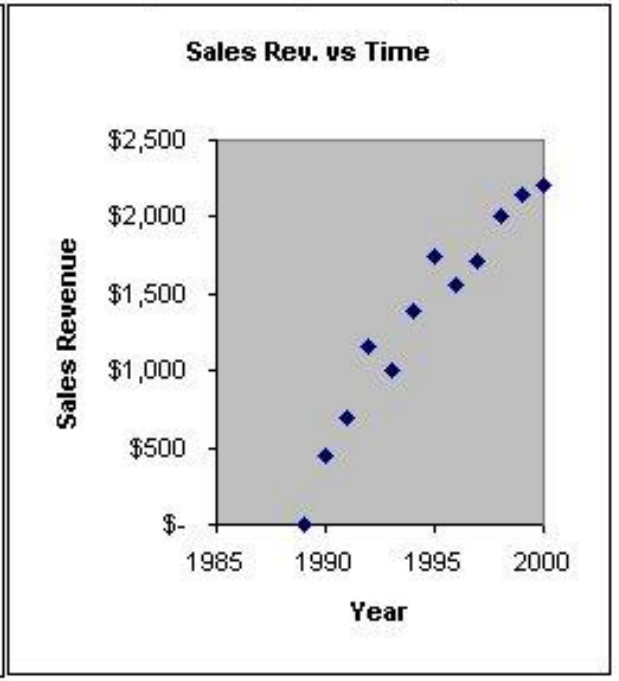
- **Mathematical relationships are developed from data. Graphing the variables may help define the relationship.**



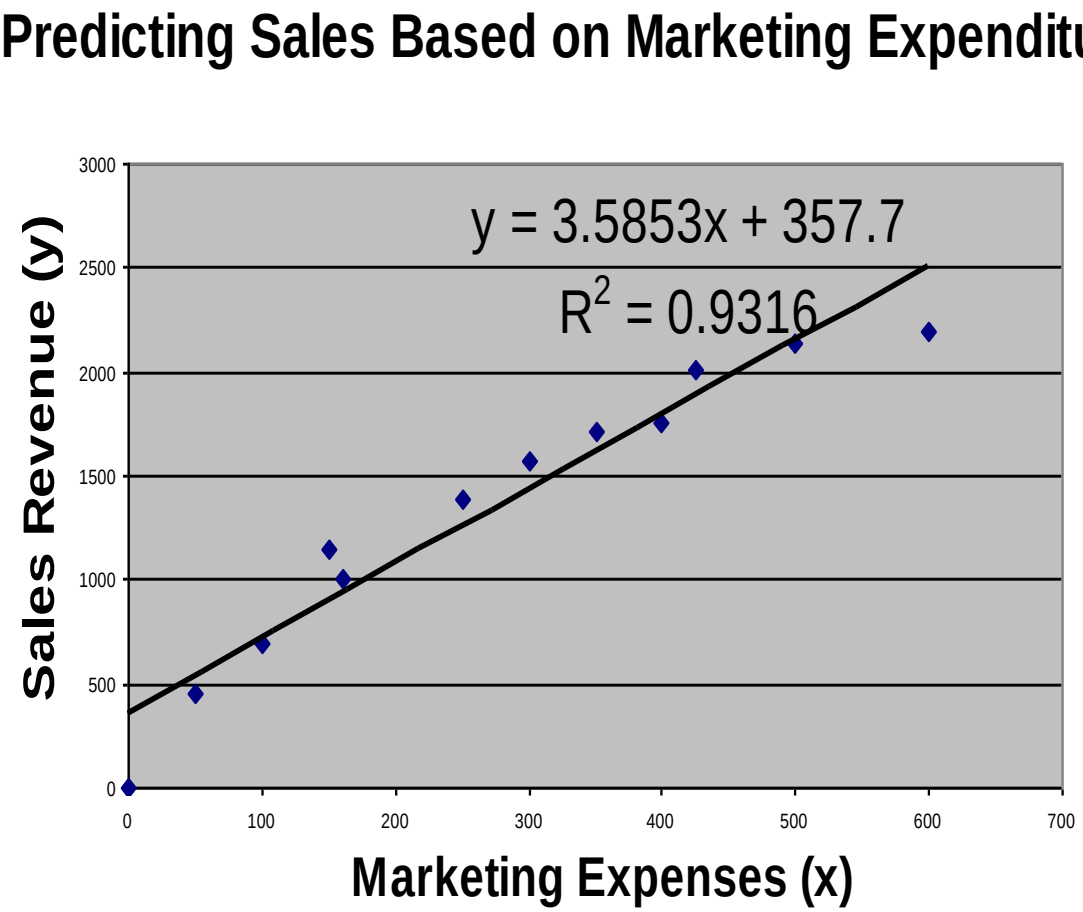
Modeling with Data

Consider the following data.
Graphs are created to view any relationship(s) between the variables.
This is the first step in formulating the equations in the model.

	A	B	C
1	Year	Mktg. Exp.	Sales Rev.
2	1989	0	$ 0
3	1990	50	$ 450
4	1991	100	$ 700
5	1992	150	$ 1,150
6	1993	160	$ 1,000
7	1994	250	$ 1,390
8	1995	400	$ 1,750
9	1996	300	$ 1,565
10	1997	350	$ 1,715
11	1998	425	$ 2,010
12	1999	500	$ 2,140
13	2000	600	$ 2,200



Creating the Symbolic Model



Dragon1 - Example Logistics Business Model

Deleting Waiting Times By Creating Streams

To create the most efficient and effective logistics networks, businesses must use logistics network modeling. These simulations measure, evaluate, and optimize the logistics network a business uses.

What Is Logistics Network Modeling?

Logistics is the movement of goods, and a logistics network is the sequence of systems and operations that work together to design, produce, and bring a product to market.

Companies must create new logistics networks every time they launch new products, create a new business model, or enter a new market. When a company is designing its new logistics network, it will take into account all the location elements such as:

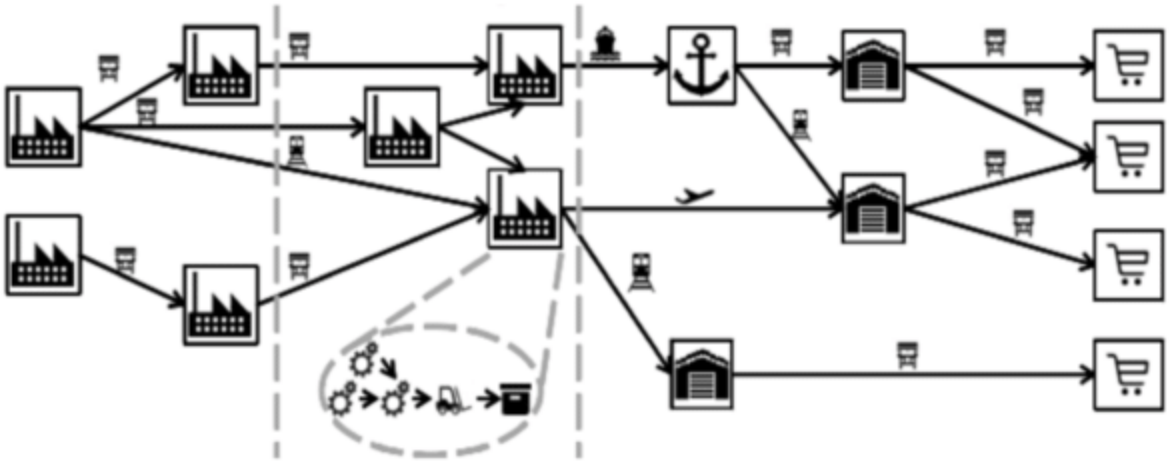
- Labor pool
- Distribution and shipping channels
- Government incentives
- Customs requirements
- Security requirements
- Supplier and customer locations

modeling methods

levels of concern

views

logistics system



Delivery Production Distribution

process runs
material flow
layout structure

information flow
organisational structure
carriers

requirements
design
realization

simulation
optimization
verificatio

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Types of Logistics Network Modeling

There are a number of modeling techniques that can be used, each with its own benefits and pitfalls.

Optimization Modeling

Optimization models are based on a mathematical formula intended to determine the procedures that offer the best or optimum solution based on that formula.

The optimization model looks at data such as the:

- Level of customer service to be obtained
- Number and location of distribution centers
- Number of manufacturing plants
- Distribution centers assigned to a manufacturing plant
- Inventories that must be maintained

Simulation Models

A simulation model is based on the real world. When the model has been created, you can perform experiments on the model to see how changes made to the model can affect the overall cost of the logistics network.

For a simulation model to be effective, you need to collect significant amounts of data on variables such as:

- Transportation
- Warehousing
- Labor costs
- Material handling
- Inventory levels

Heuristic Model

Similar to simulation models, ***heuristic models*** do not generate an optimum solution for a logistics network.

A heuristic model is used to reduce a large problem to a more manageable size. It does not guarantee a solution, and a number of heuristic models may contradict each other or offer different answers to the same question.

For example, a heuristic model could be used to consider the best site for a distribution center that is at least ten miles from the market area, fifty miles from a major airport, and more than three hundred miles from the next closest distribution center.

A heuristic model will look at all areas that fit the defined parameters and find the most suitable areas.

Exercises:

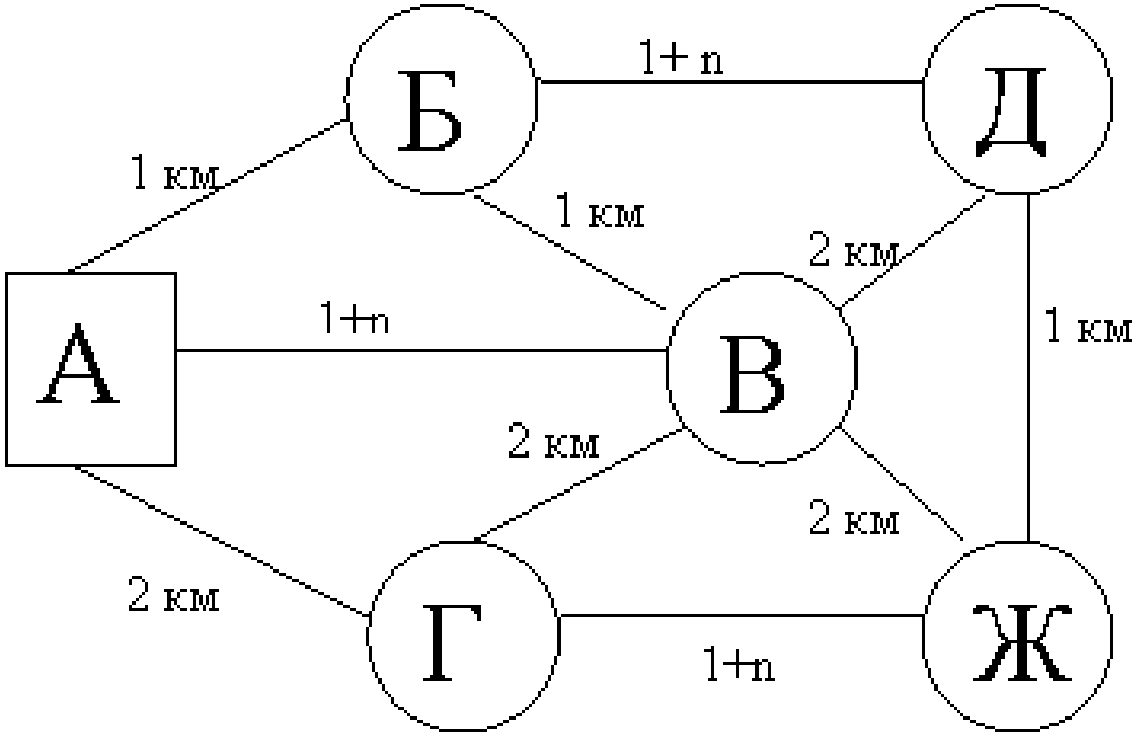
1. Average stock

$$S_{av} = \frac{S_b + S_e}{2}$$

$S_1=150$; $S_2=220$; $S_3=543$; $S_{4,5,6,7,8}=220$; $S_{9\text{-}10}=0$; $S_{11,12}=497$.

S_{av}-?

2. Optimal road



А – warehouse
Б, В, Г, Д, Ж – shops
n - your individual number
Identify the optimal route