



# Information and models

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## Content

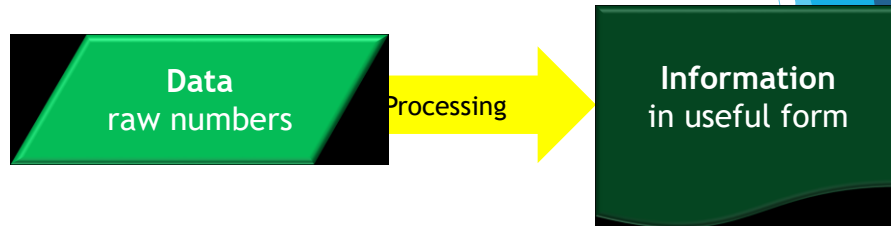
- ▶ Quantitative information
- ▶ Quantitative and qualitative approaches
- ▶ Models
- ▶ Model Abstraction

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## Quantitative information

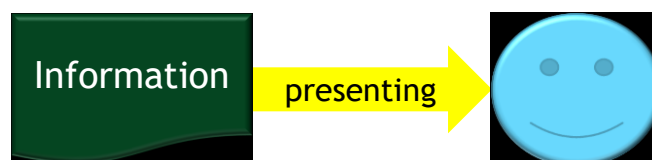
- ▶ Data and information are needed to find good decisions.
- ▶ The data becomes information when it is manipulated / summarized.



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## Quantitative information



- ▶ An item of data becomes information when it informs the user.
- ▶ The Internet has transformed the flow and the availability of data.

Using information already available or collecting our own additional information?

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## Quantitative information

- ▶ Quantitative methods involve more than obtaining numbers and working out a few statistics.
- ▶ A statistic is merely a descriptive number.
  - ▶ Population as of 31.12.2008 district Ruse Total (number) = 251 236.
  - ▶ Census - 2011 - 235 252
- ▶ In addition to providing a description, quantitative methods also include a number of ways of testing ideas and modeling problems.

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## Quantitative information

- ▶ Data can come from existing sources (**secondary data**) or may need to be collected for the purposes of our research (**primary data**).
- ▶ Data can come from the **census** (a complete enumeration of all those people or items of interest) or from a **sample** ( a selection from the population of interest).

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## Quantitative & Qualitative Approaches

- ▶ Numbers provide a universal language that can be easily understood and a description of some aspect of most problems.
- ▶ Distinguish between **quantitative** and **qualitative** approaches.

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## Quantitative & Qualitative Approaches

- ▶ The **quantitative approach** will describe and resolve problems using numbers. **Emphasis** will be given to the **collection** of numerical data, the **summary** of the data and the **drawing** of a conclusion from the data.

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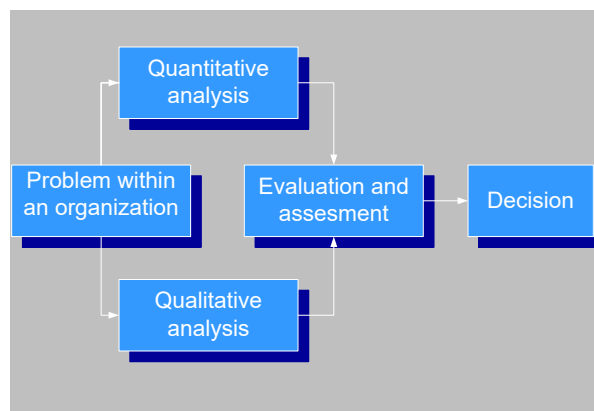
## Quantitative & Qualitative Approaches

- ▶ The **qualitative approaches** describe the behavior of people individually, in groups or in organizations. The description is difficult in numerical terms and is likely to use **illustrative** examples, **generalization**, and **case studies**.
- ▶ The qualitative approaches: observation, written response to unstructured questions, content analyze e.c.t.

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## Quantitative & Qualitative Approaches



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## Models

- ▶ The model is a simplified representation of the real object or situation.
- ▶ The models are used to investigate the reality and to test alternative decisions.

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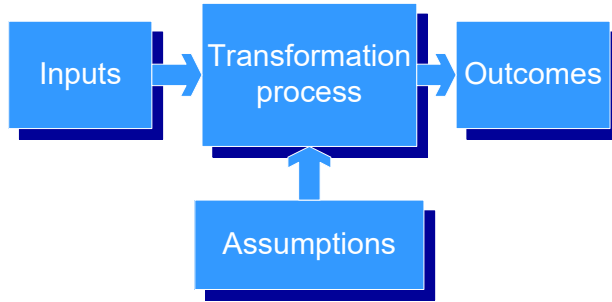
## Models

- ▶ Modeling is a **timely** and **cost-effective** way of examining problems than can include both **complexity** and **uncertainty**. Modeling involves a **transformational** process where **outcomes** are explained by a range of **inputs** and **assumptions**.

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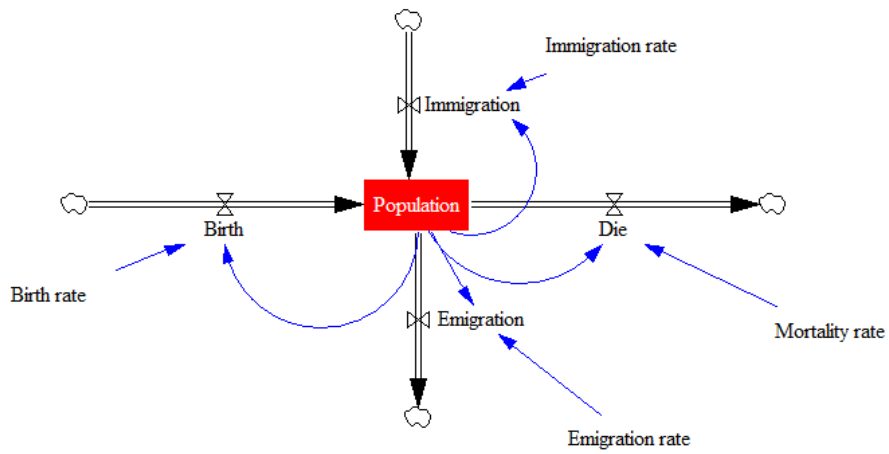
# Models



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# Model of population dynamics



## Models

- ▶ The transformation process is the modification of flow due to storage.
- ▶ Models can include the use of **descriptive statistics** and the use of **statistical theory** (two major reasons for working with numbers).
- ▶ Models or modeling is particularly useful when we cannot work directly with the real objects or situation.

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## Models

### **Requirements** to the modelers:

- ▶ The necessity to have a good understanding of the object or situation.
- ▶ The recognition of all relevant variables.
- ▶ The understanding the relationships.
- ▶ The ability to undertake analyzes.

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## Model Abstraction

- ▶ Modeling allows us all the advantages of not working with the real thing.
- ▶ Modeling should allow us to think more conceptually and imaginatively about the problems we need to deal with.

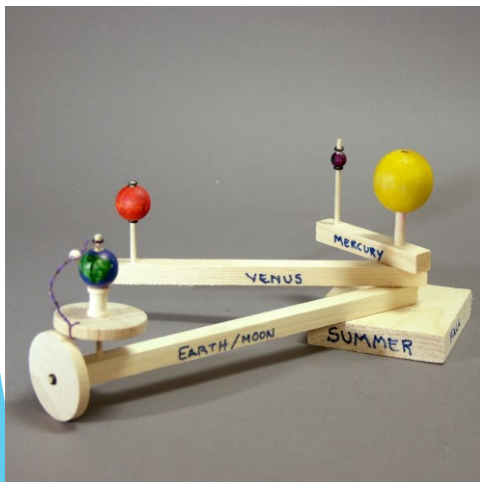
- ▶ Physical models
  - ▶ Schematic models
  - ▶ Analogue modeling
  - ▶ Symbolic (or mathematical) models

Least abstract

Most abstract

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## Physical models



- ▶ **Physical (iconic) models** - scaled or simplified version of the real thing. Using - generally for presentational purpose: architecture, engineering research, etc.

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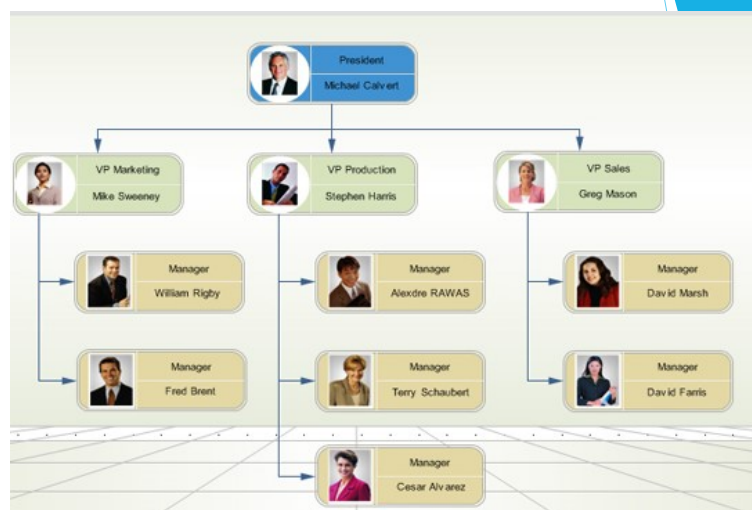
## Schematic models

- ▶ **Schematic models** are a more abstract representation of the reality and include all forms of **graphs and diagrams**.  
**Organizational chart**- job role and authority, relationships; **Flowchart** - how computer software works; **Network diagrams** - shows various steps in project management. It gives us a visual picture and it is often said *‘that a picture is worth 1000 words’*

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## Schematic model

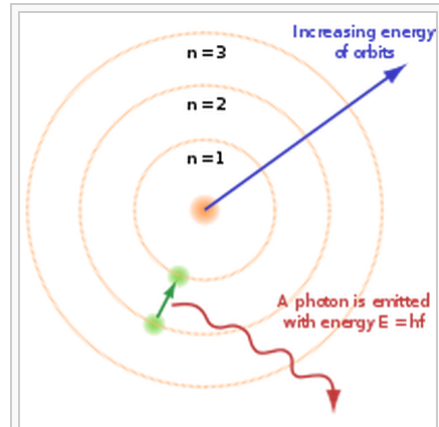


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## Analogy modeling

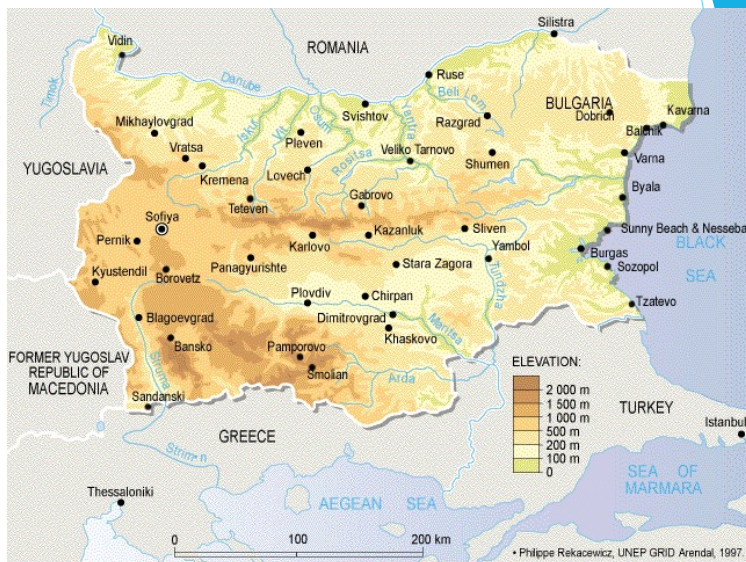
- ▶ Analogy modeling is where **one** factor, with different properties, is used to describe **another**. Speed can be represented by the needle on a speedometer; colors on a map can represent water or forests.

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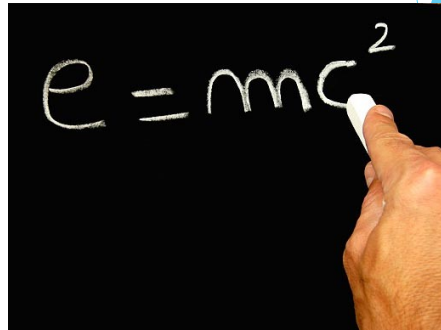
Niels Bohr's model of the atom made an analogy between the atom and the solar system.

## Analogy model



## Symbolic models

- ▶ **Symbolic models or mathematical models** use a range of numbers, letters, special characters and symbols to represent problem situation. They have the precision and neatness of mathematics but are most abstract.



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## Symbolic model

$$P_{t_2} = P_{t_1} + B_{t_1-t_2} - D_{t_1-t_2} + M_{t_1-t_2}$$

$P_{t_2}$  - population on date  $t_2$

$P_{t_1}$  - population on basic date  $t_1$

$B_{t_1-t_2}$  - number of newborns in time interval  $t_2$ .  $t_1$

$D_{t_1-t_2}$  - number of dead in time interval  $t_2$ .  $t_1$

$M_{t_1-t_2}$  - net migration in time interval  $t_2$ .  $t_1$

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## Model Abstraction

- ▶ A **deterministic** model will give a certain outcomes or outcomes once the input have been set.
- ▶ A **probabilistic** model will need to attach measures of uncertainty to outcomes.

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