Production System Development

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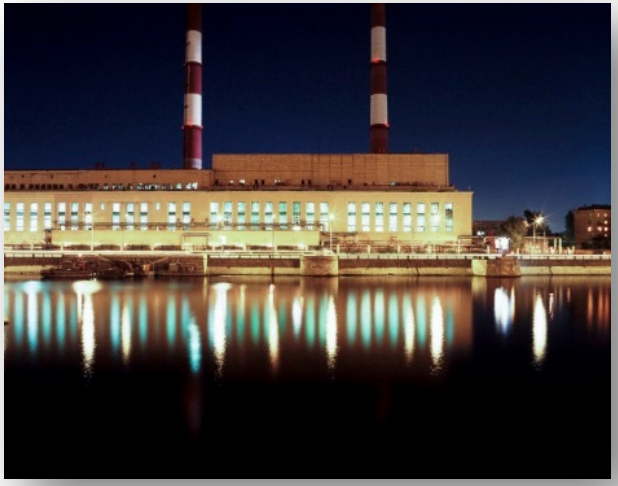
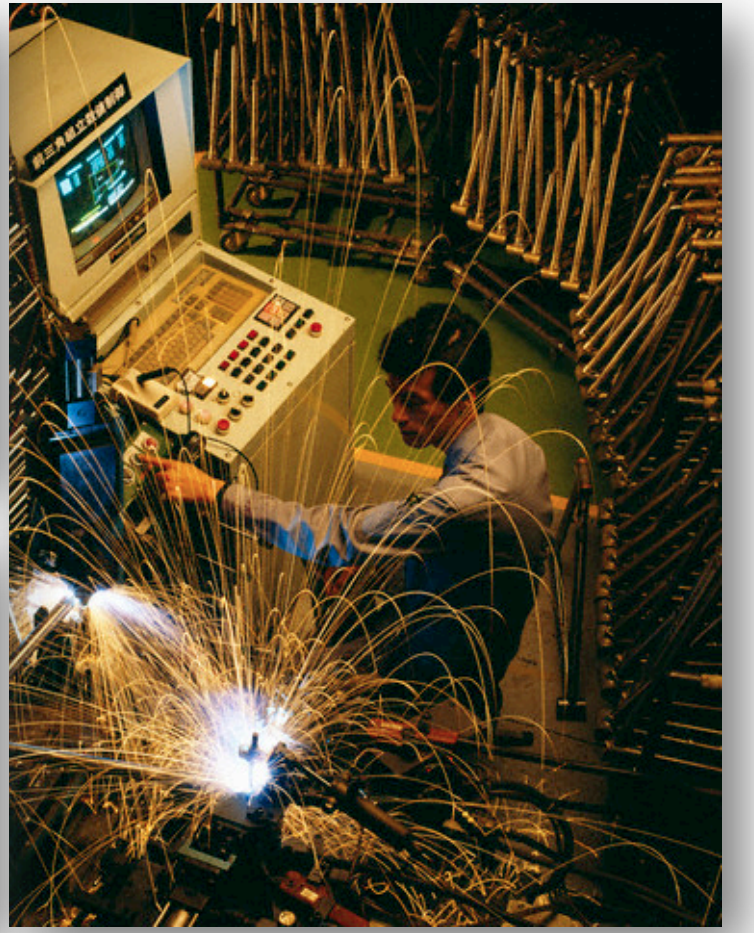
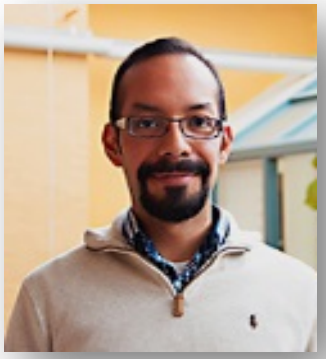
A Little About Us







Agenda

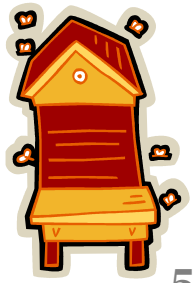
- Production system development – a process perspective
- Introducing a framework (mindset) and a structured way of working for production system development
- Simulation in production system development
- Problem formulation

Learning Outcomes

- Demonstrate knowledge and fully be able to explain what a process is and why you should apply a process in development projects
- Demonstrate knowledge and be able to describe the development process role in the design of production systems
- Understand basic simulation concepts
- Establish the importance of problem formulation

Tell Us About You

- How have you worked so far?
- How have you proceeded?
- What has been a good approach, what could have been done in a different way?



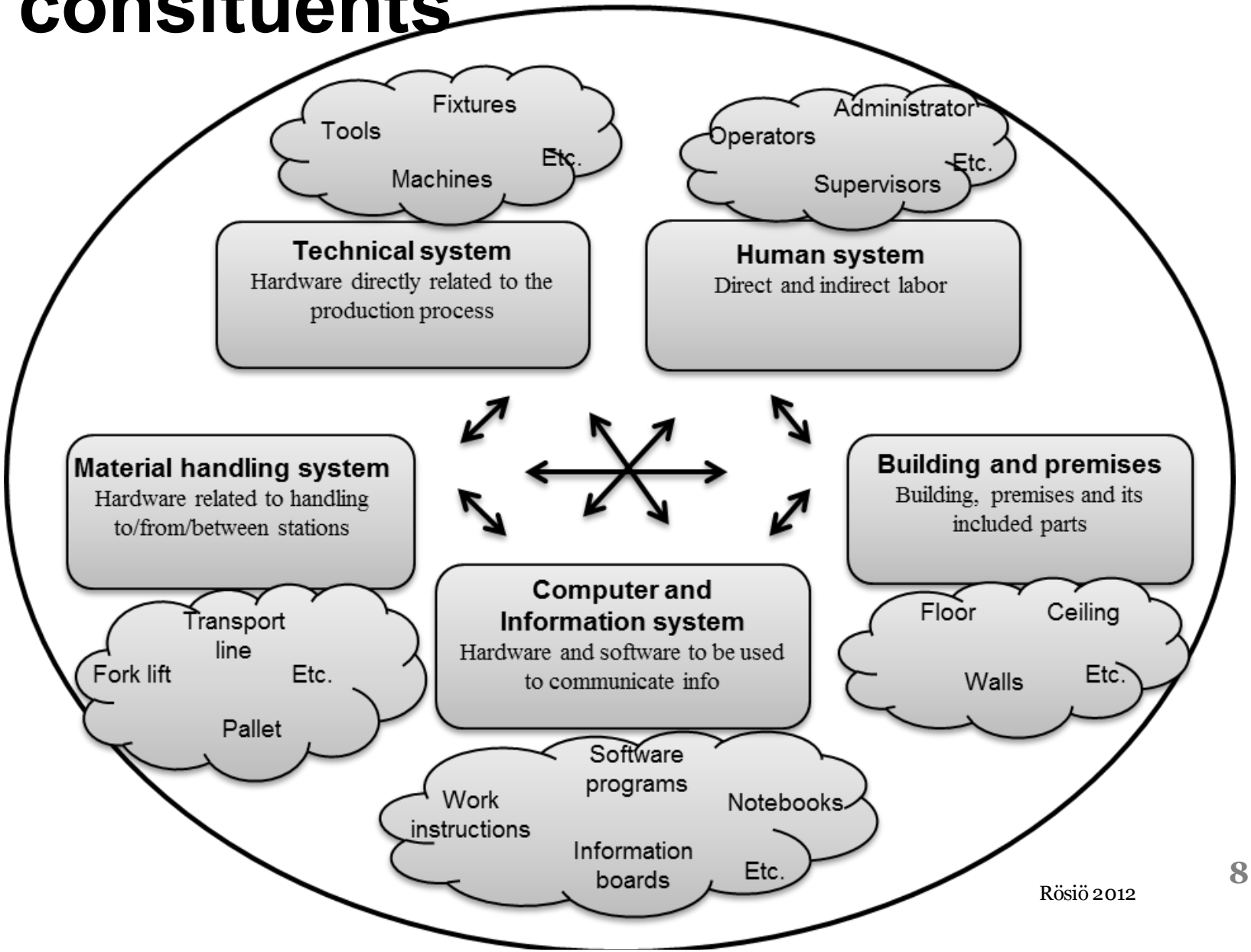
Tell Us About You

- Based on your reflection how can you continue to work in the remaining project?

Production system

- A production system comprises all activities and resources needed in order to transform raw material into products.

Production system consituents



A Process

- “A process is a repetitive network within a certain order linked activities using information and resources to transform ‘object in’ to ‘object out’, from identification to satisfaction of customer needs.”

Development as a process

- A process is as a road, starting with a need and ending in satisfaction
- The road (process) is used by different vehicles (projects)

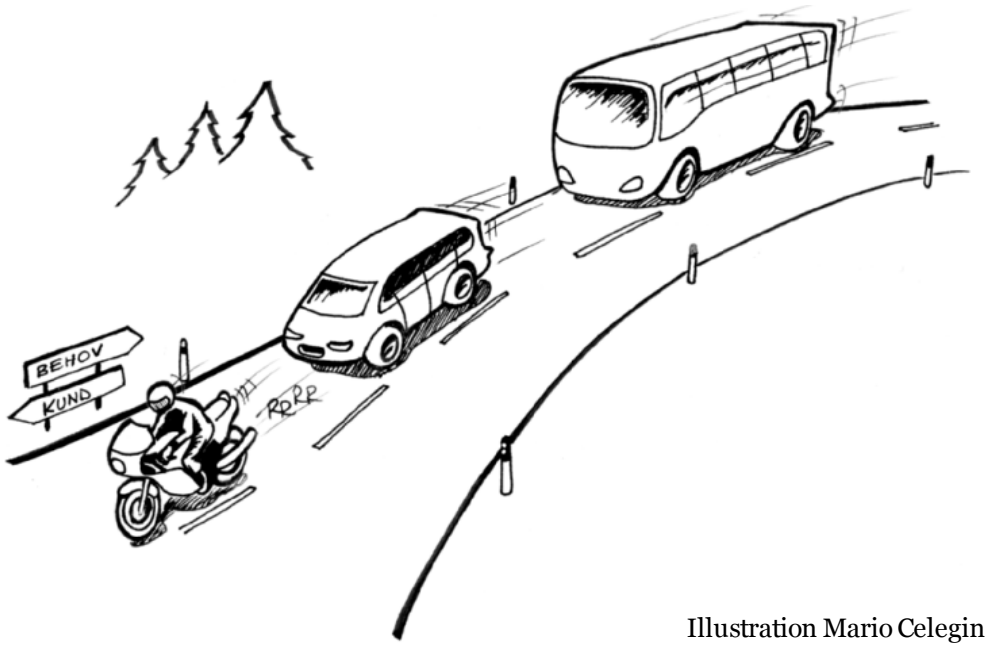
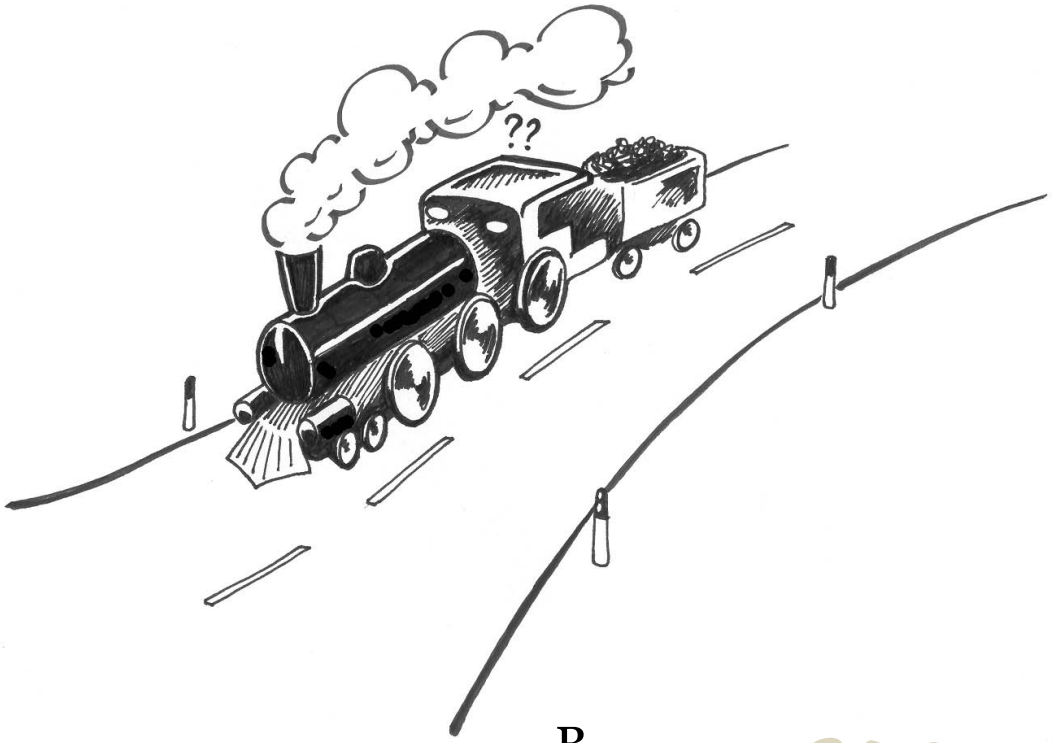


Illustration Mario Celegin adopted from Bellgran and Säfsten, 2000

What is the problem?

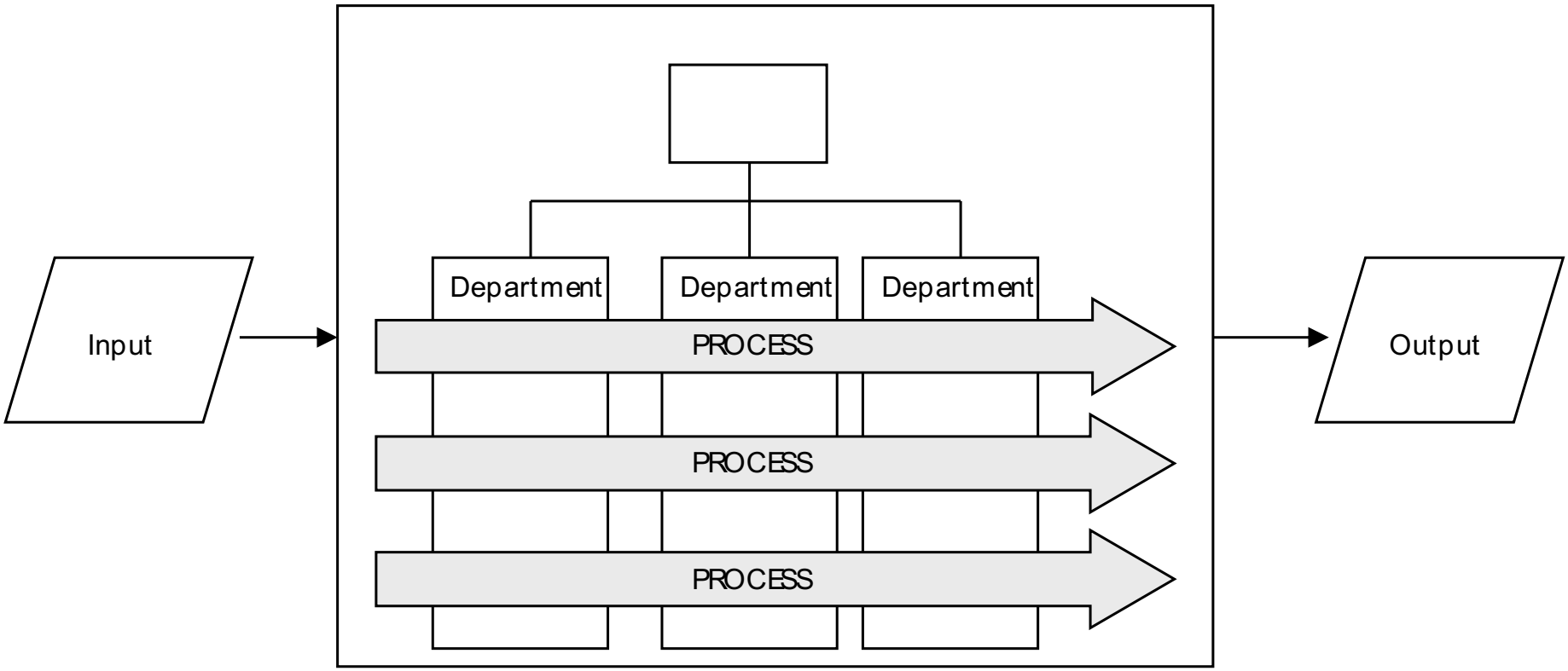
A



B

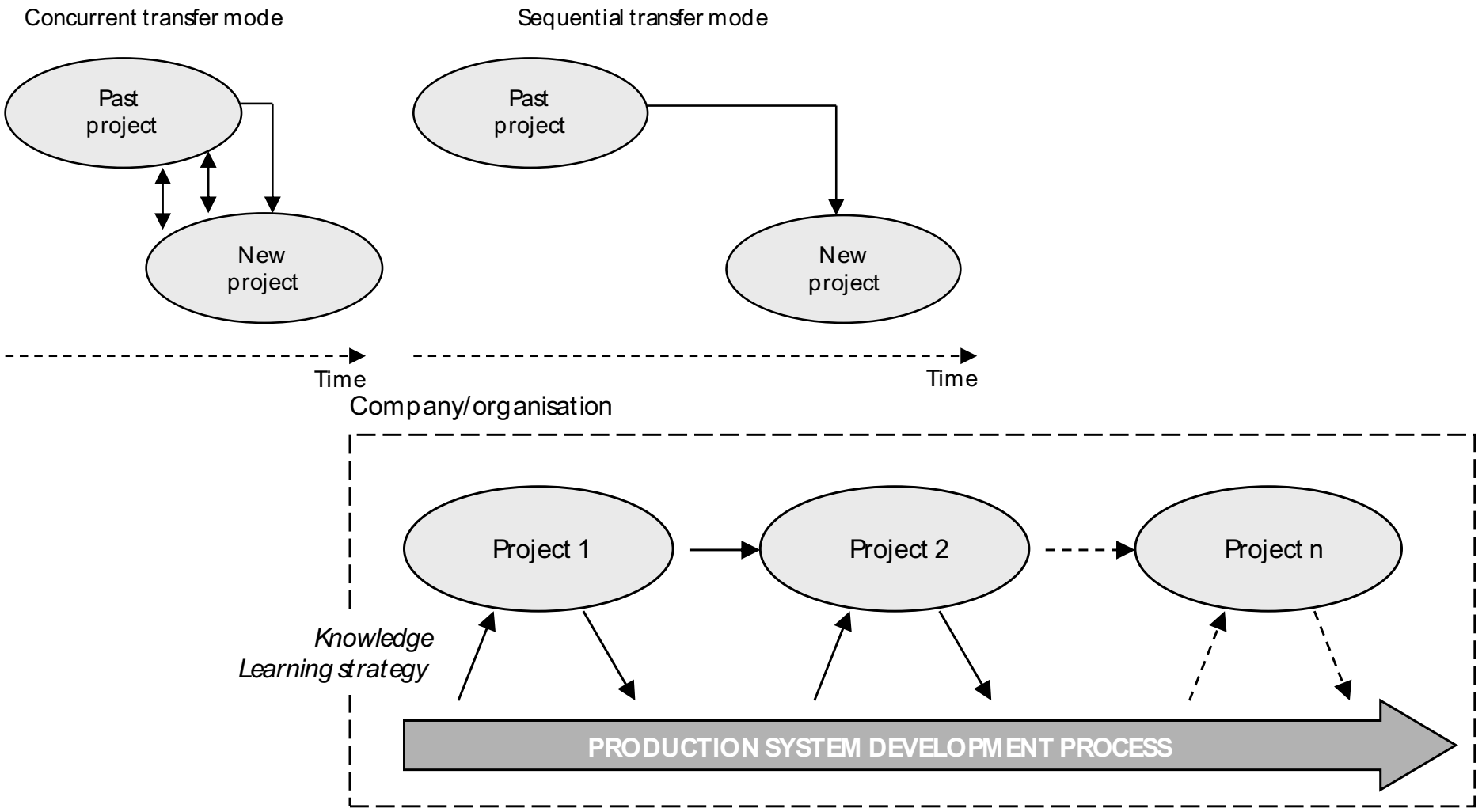
Illustration Mario Celegin adopted from Bellgran and Säfsten, 2000

A process goes through departments

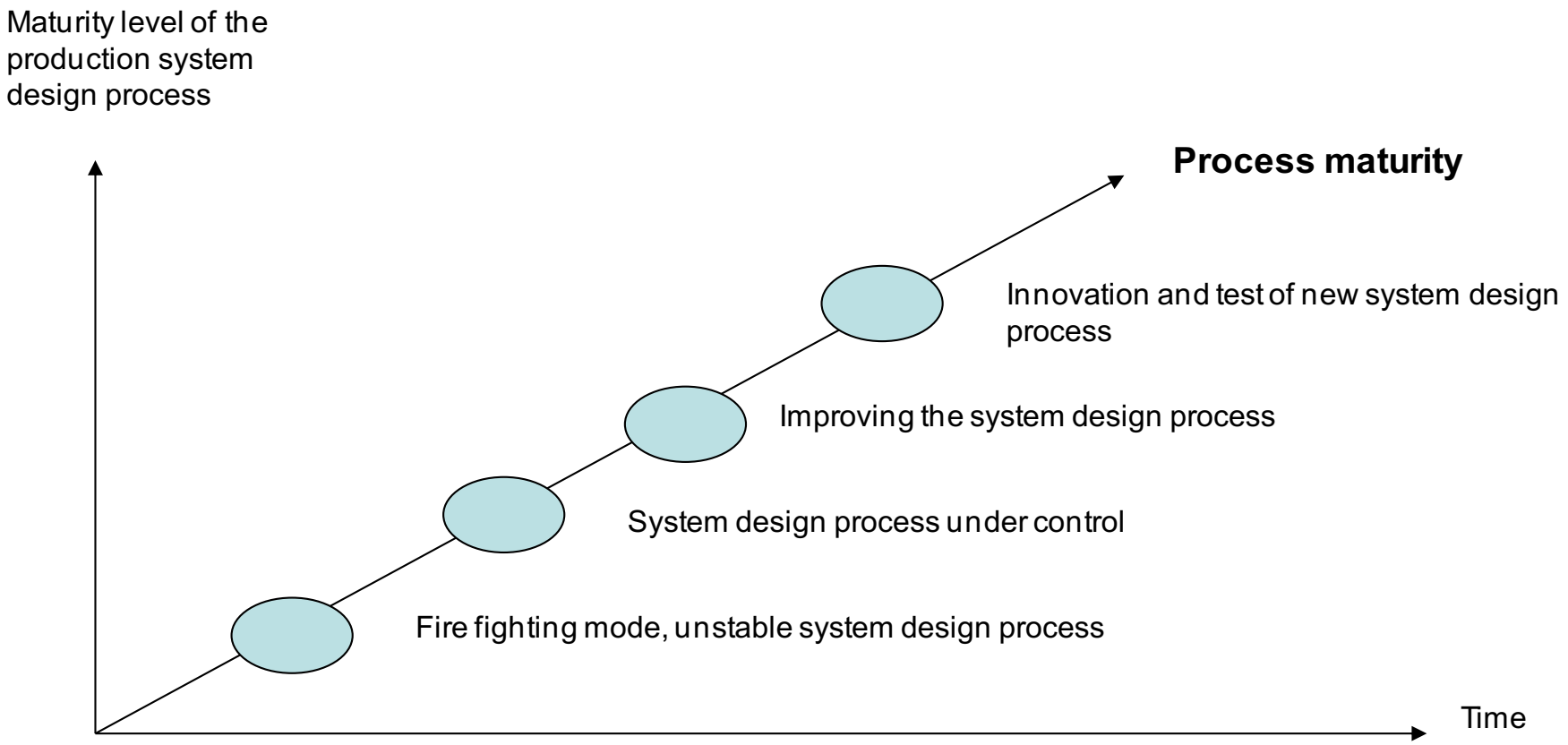


Lind 2001

Transfer of experiences between projects

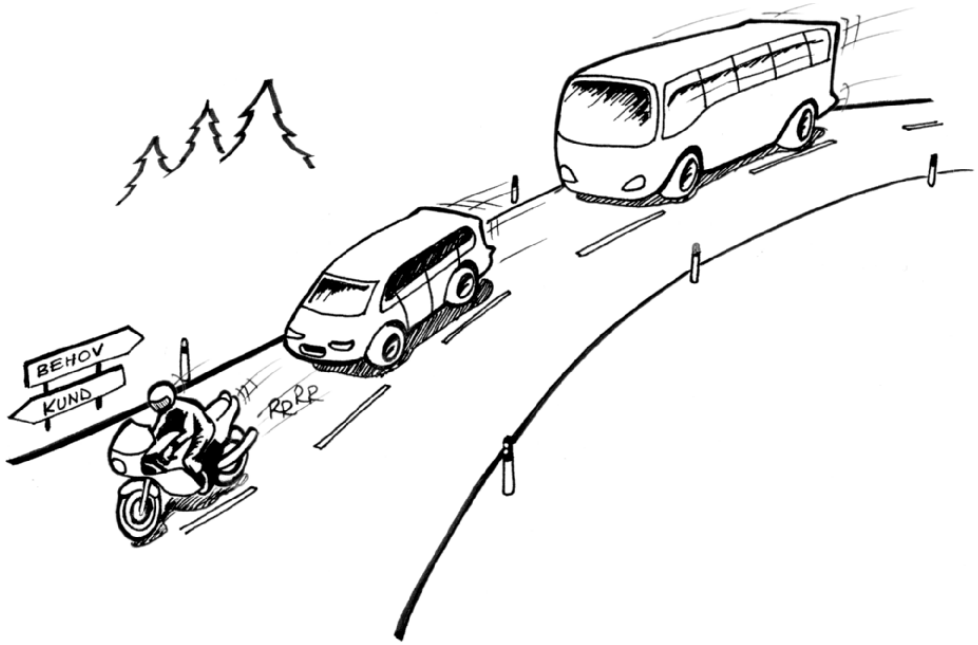


Process maturity



Bellgran 1998

Arguments for a process perspective on system development

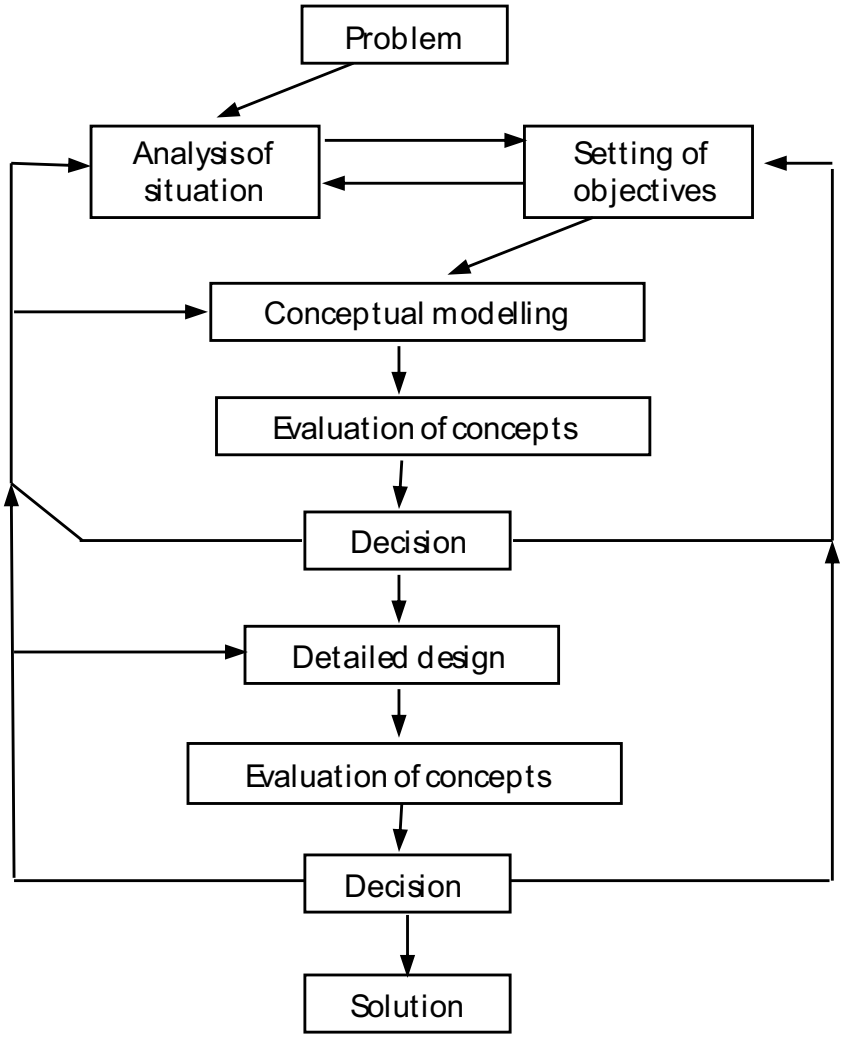


- Overlook functional borders to solve problems
- Improve ability to meet the customer in a comprehensive manner
- Prerequisite for learning, and development of knowledge

Illustration Mario Celegin adopted from Bellgran and Säfsten, 2000

Common activities in a design process

- Analysis
- Requirement specification
- Design or construction of subsystems
- Integration of subsystems into totality
- Evaluation and decision



Wu 1994

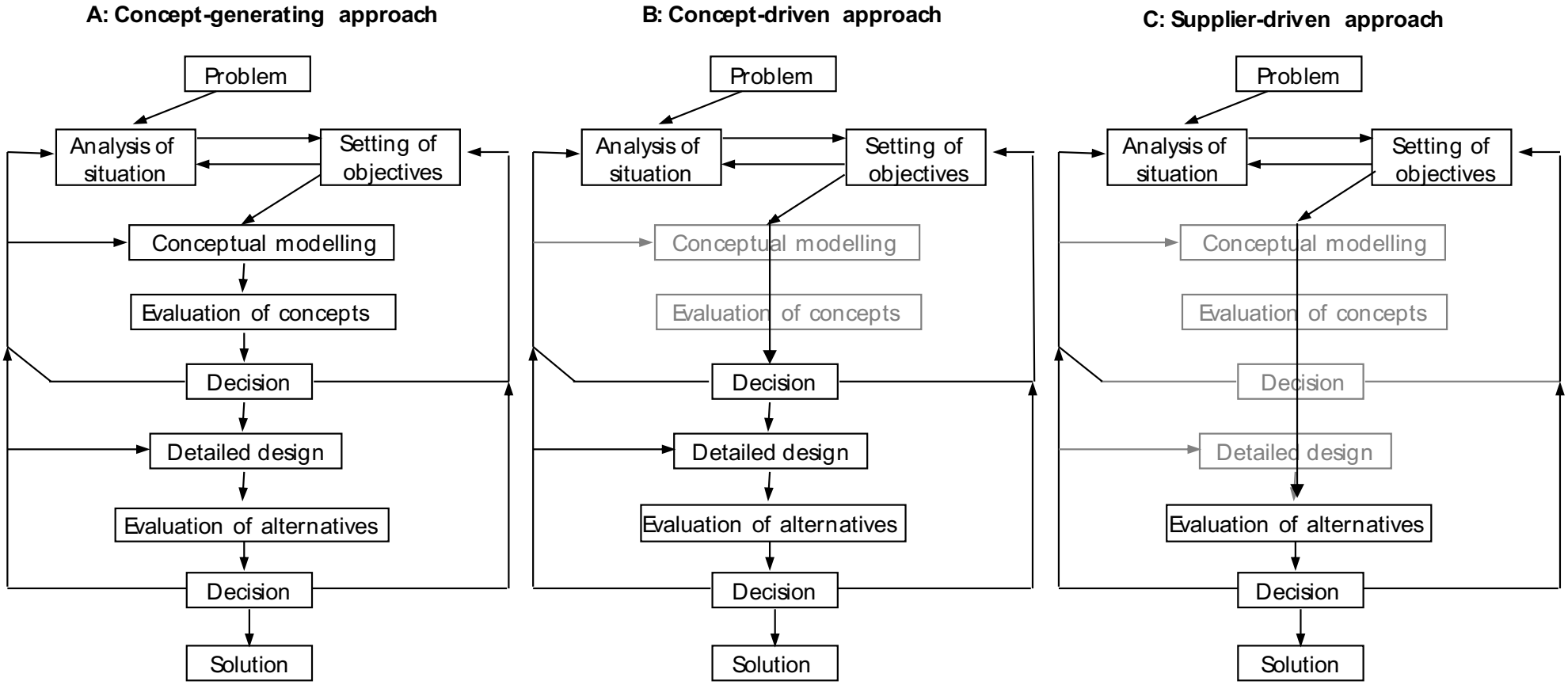
System development in practice

- Trial-and-error:

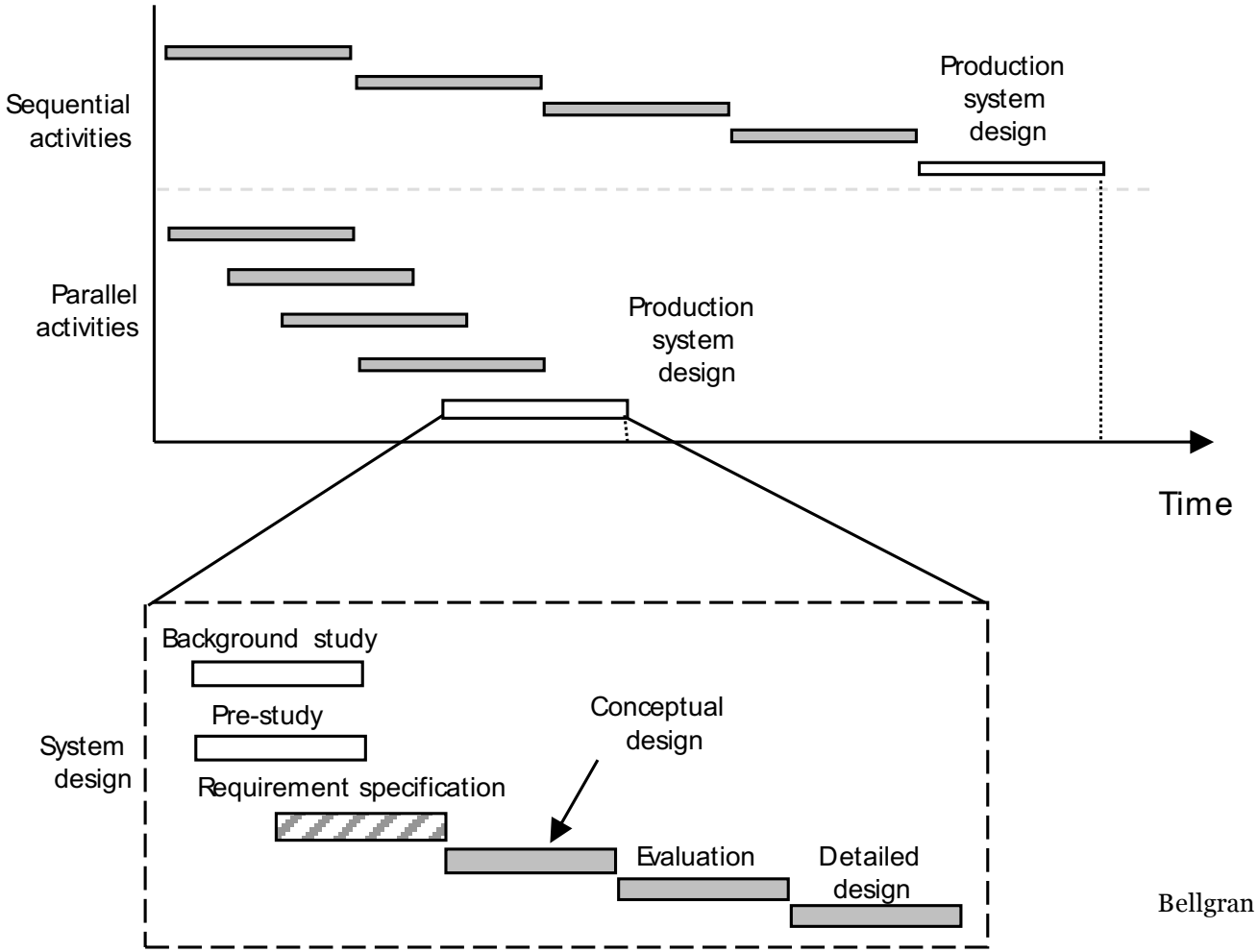
1. guess a suitable production system (*i.e.* guess values for an appropriate set of design variables); and

2. evaluate the performance of the system. If it satisfies the performance requirements, then stop the design process, otherwise return to step 1.

Practical approaches to system design

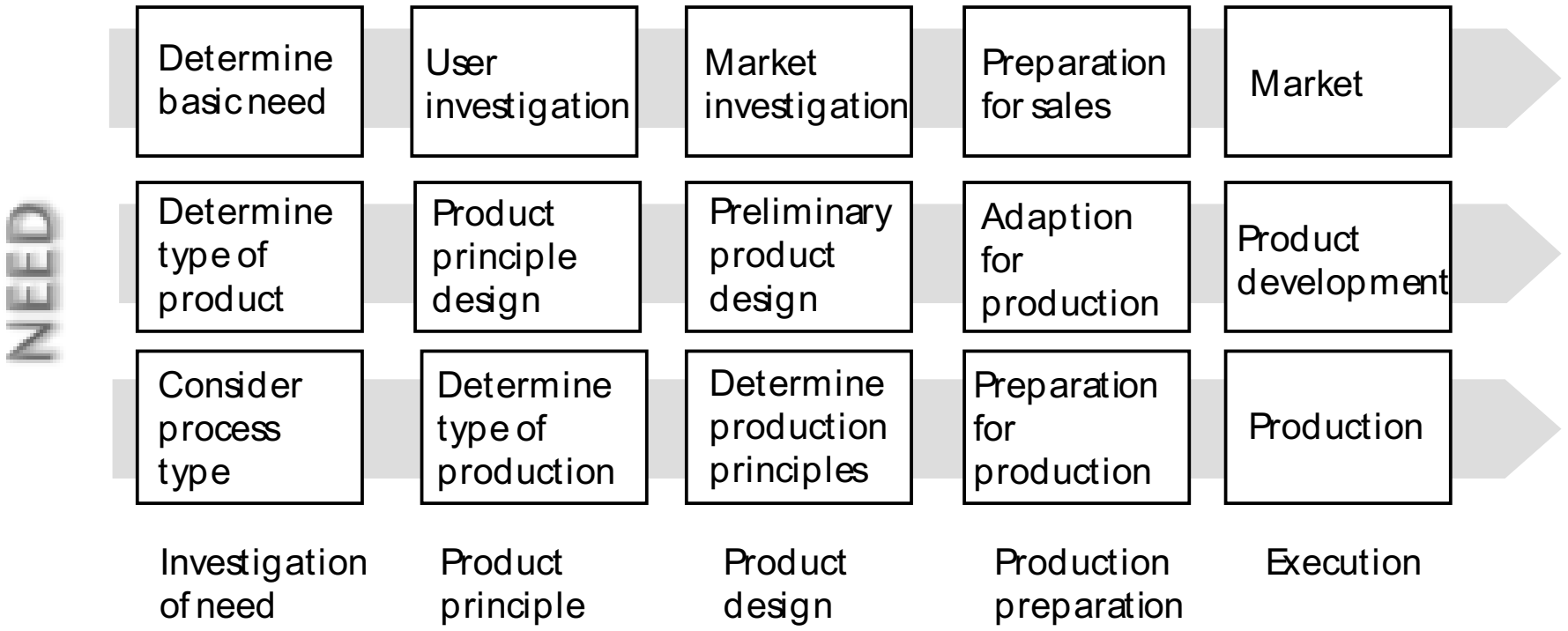


Sequential versus parallel activities



Bellgran 1998

Integrated product and production development



Why a structured methodology

- Time limits puts pressure on a schedule
- A foundation for quality assurance
- Facilitates coordination within the project and between product development and production development
- Facilitates project management
- Improvements in the way of working is possible/easier
- Long-term ability
- A better solution?

- Remember: Output is never better than input!

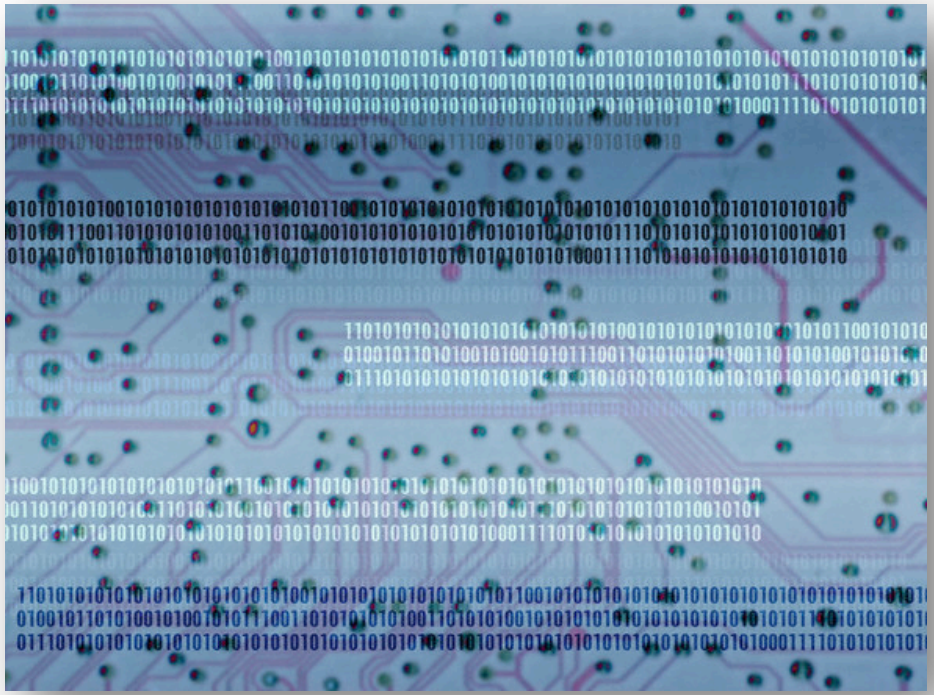
Summary

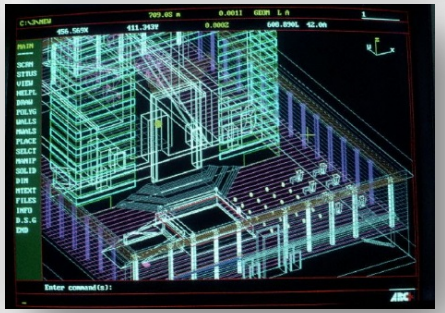
- Focus on the development process is necessary for a sustainable production development capability
- A framework creates systematic thinking – includes planning and design/development
- A systematic way of working support focus on the task of designing

Illustration Mario Celegin adopted from Bellgran and Säfsten, 2000

Short Break?

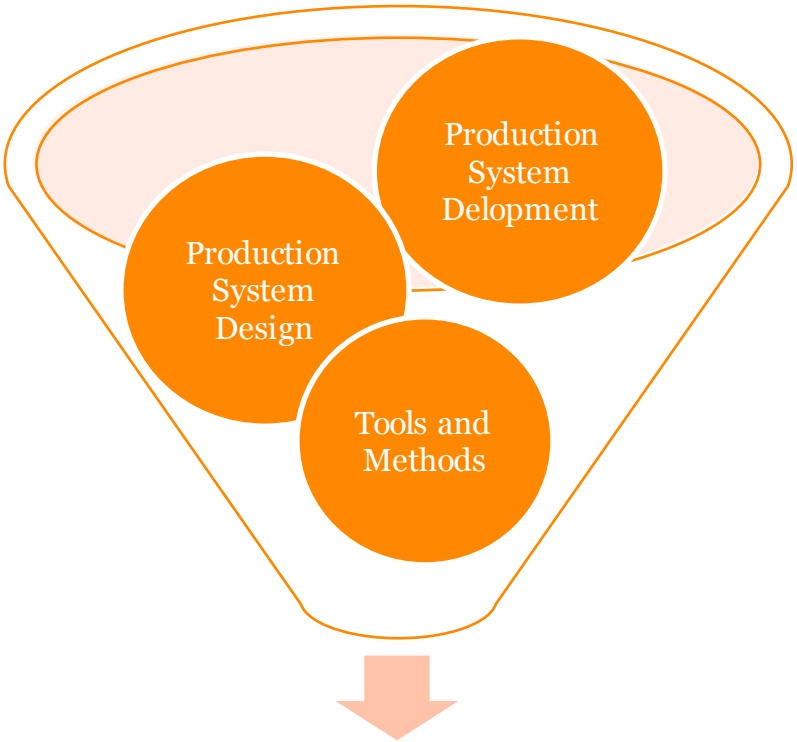
Discrete Event Simulation in Production Process Development





Trying things early on

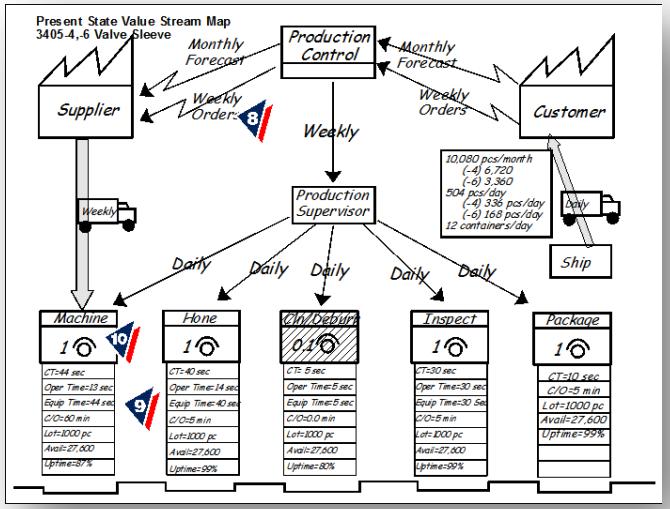
Discrete Event Simulation as a tool

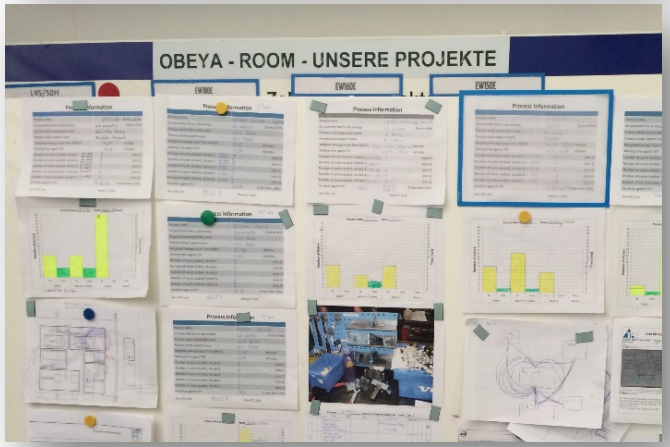


Discrete Event Simulation (DES)

Trying things early on

Discrete Event Simulation as a tool





Trying things early on

Discrete Event Simulation as a tool

Modeling

What is it?

- A model is defined as representation of a system for the purpose of studying that system.

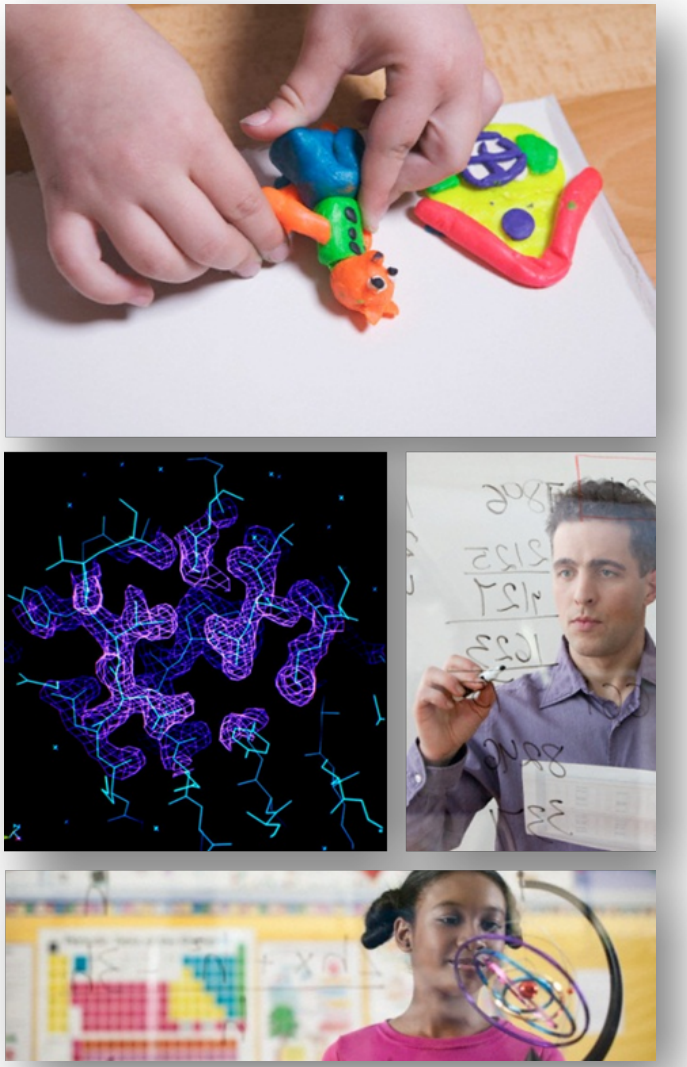
  - Banks (2010)

- Modeling is an approximation of a system, it is not an exact representation, i.e. we can not model every aspect of the system

  - Strickland (2010)

- A modeler has to make decisions about content and assumptions of the model

  - Robinson (2004)



Simulation

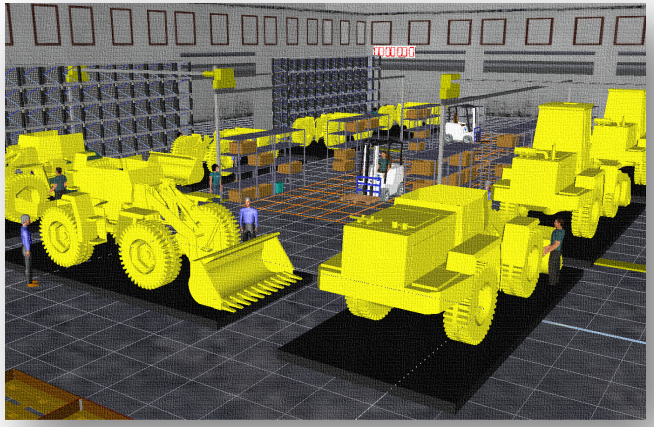
What is it?

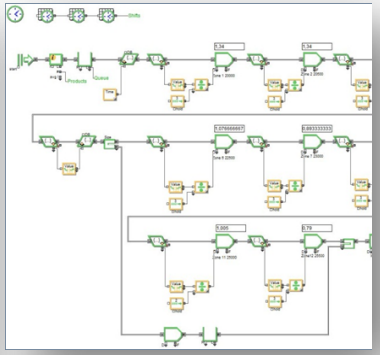
- An immitation of a system
- An immitation (on a computer) of a system as it progresses through time
- Experimentation with a simplified imitation (on a computer) of an operations system as it progresses through time, for the purpose of better understanding or improving that system

- Robinson (2004)

Discrete Event Simulation

Why is it useful?





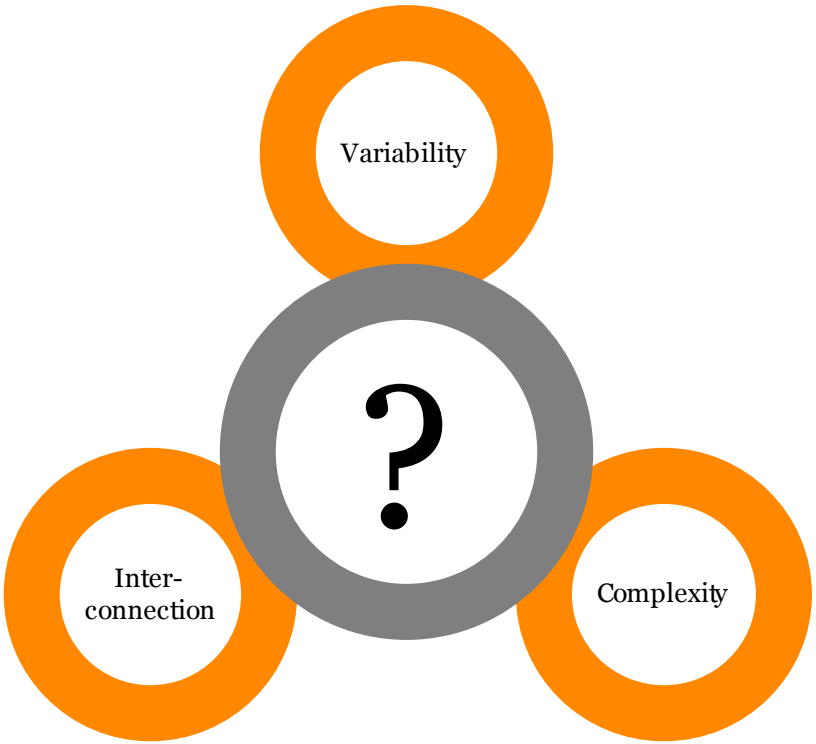
- Experiment without disruption
- Test before rollout
- Hypothesis and feasibility
- Time for experimentation
- Variable interaction
- What if…?
- Bottlenecks

Discrete Event Simulation

Why is it useful?

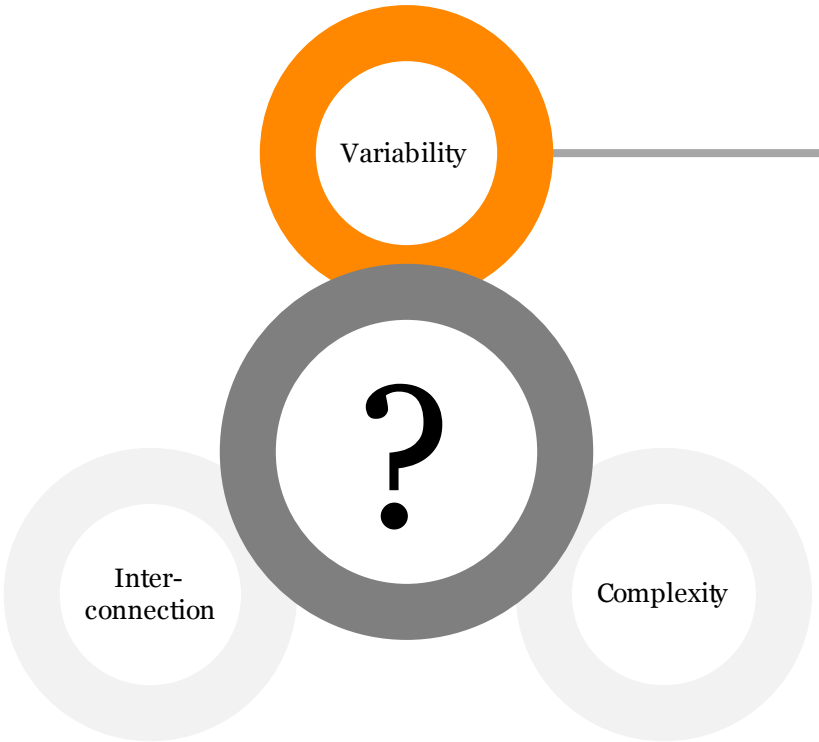
Discrete Event Simulation

Why is it useful?



Discrete Event Simulation

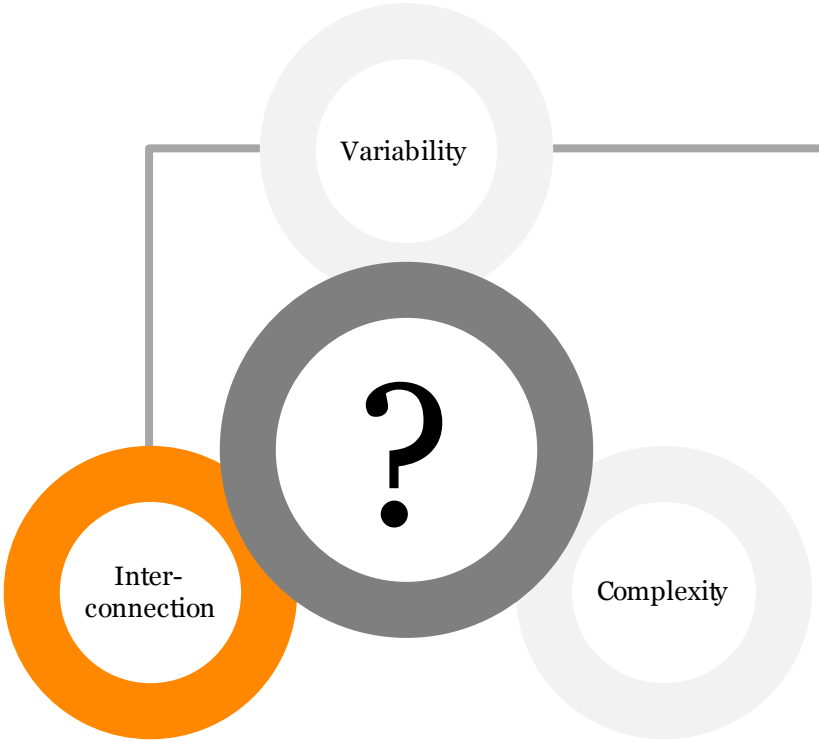
Why is it useful?



- Happens everyday
- Seldom taken into account
- Affect production system performance
- Predictable
- Unpredictable

Discrete Event Simulation

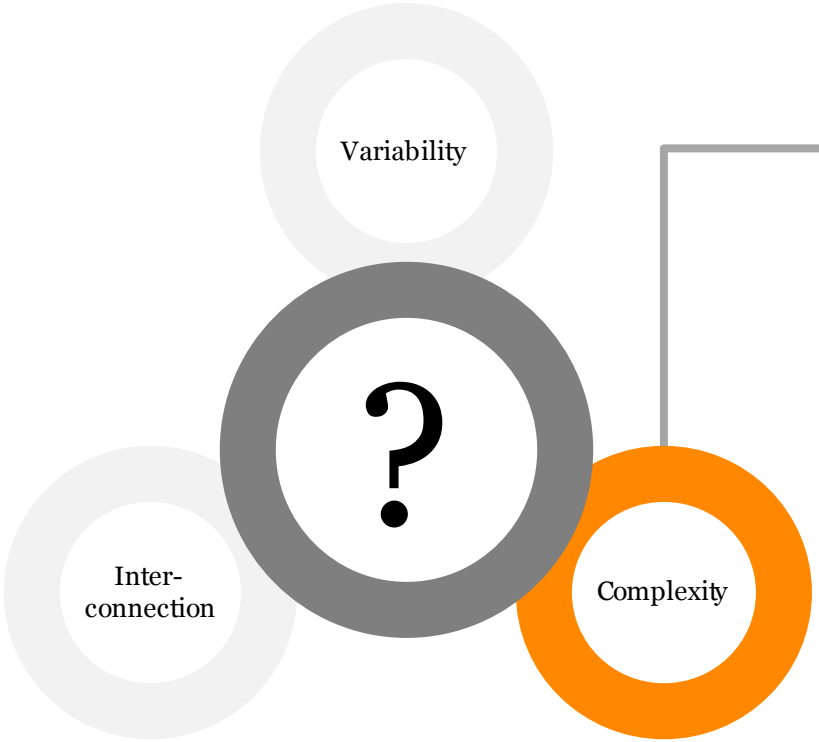
Why is it useful?



- Components do not work in isolation
- Changes affect the entire production system
- Difficult to predict effects when variability exists

Discrete Event Simulation

Why is it useful?



- Many possibilities of how to solve an issue
- Each possibility has consequences
- Difficult to predict effects over time
  - Short / long term effects
  - One part of the system to another
  - Non-obvious results

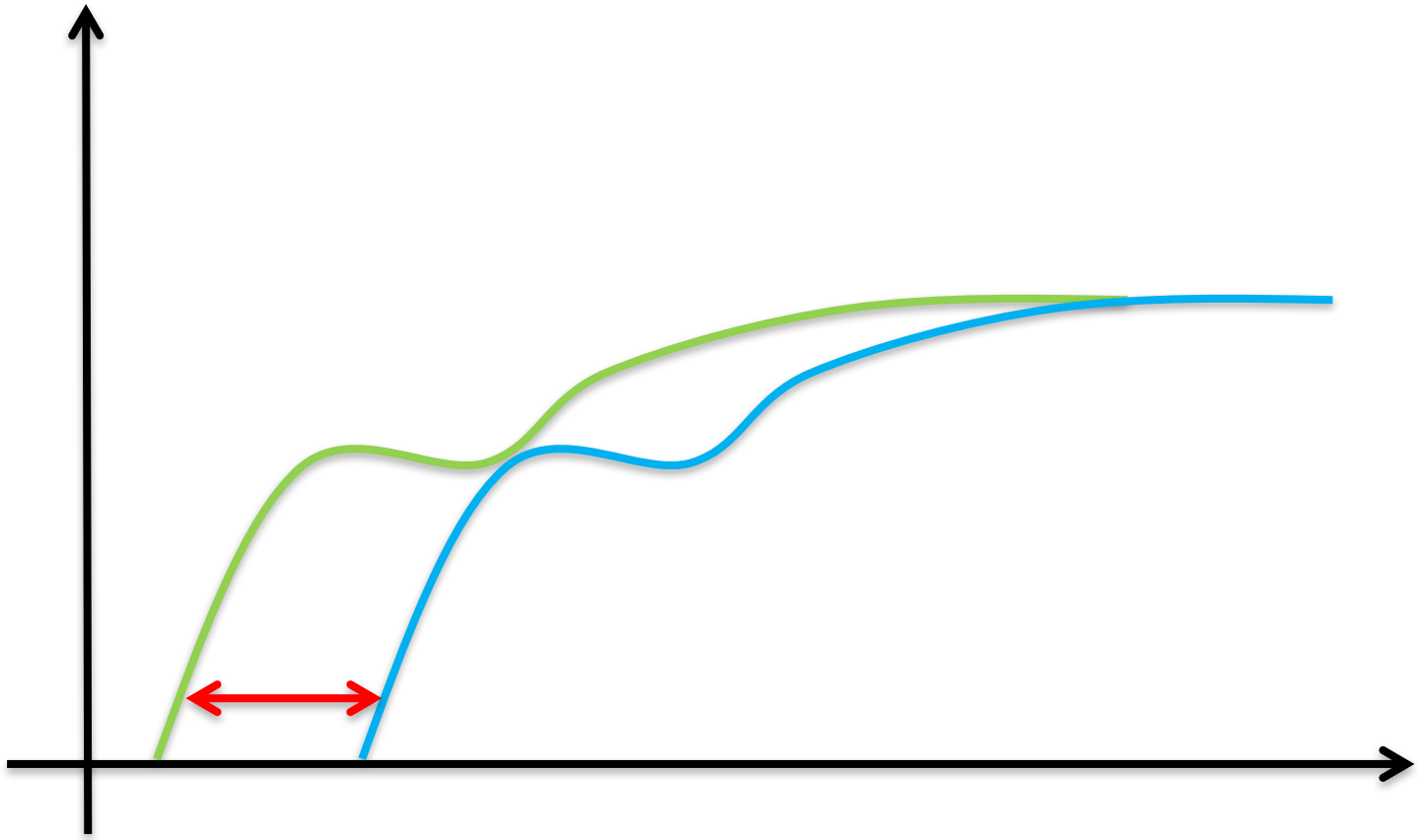
Discrete Event Simulation

How do we do this?

- Historical data
- Account for uncertainty
- Doing the right thing
- Doing the thing right

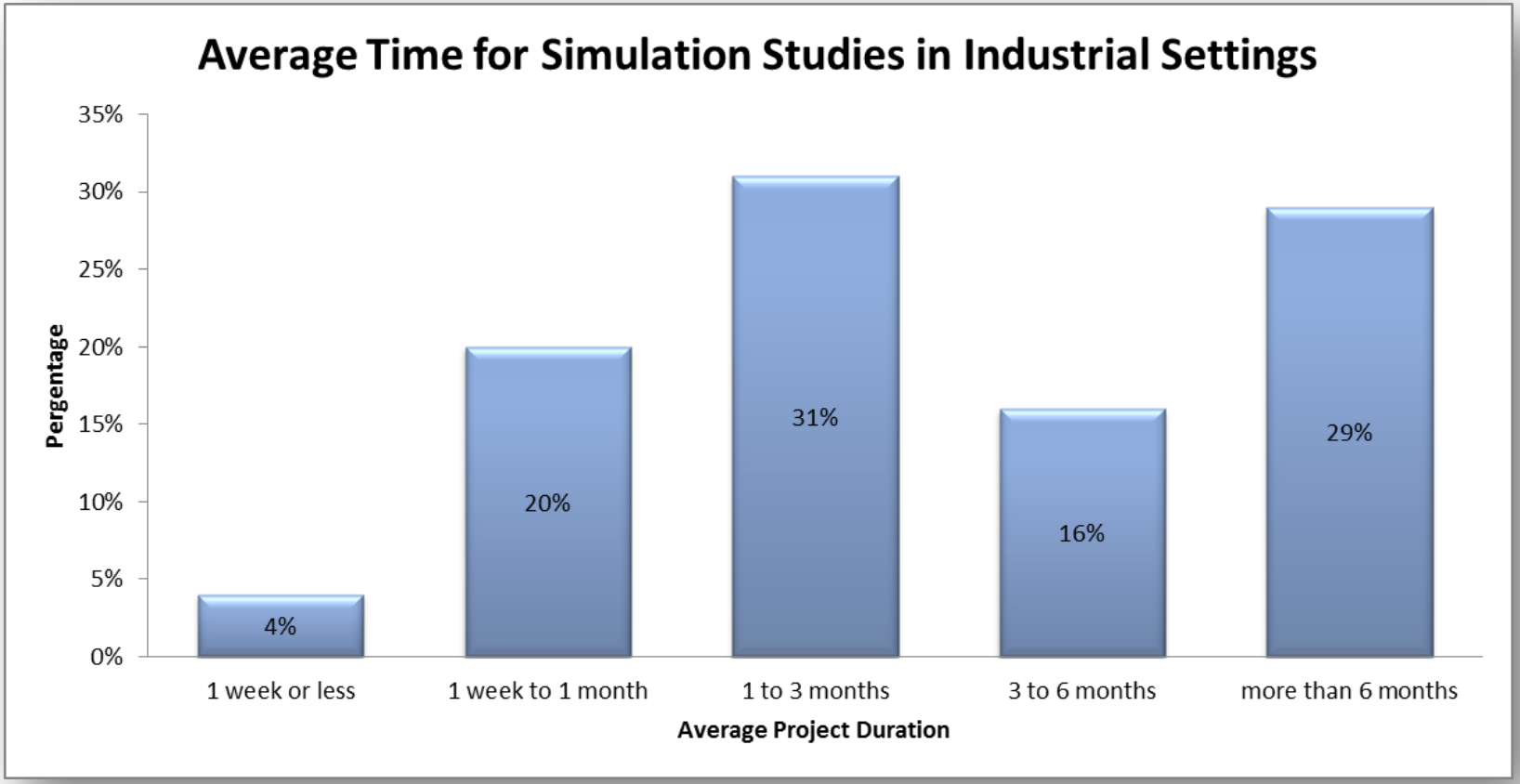
Discrete Event Simulation

How do we do this?



Discrete Event Simulation

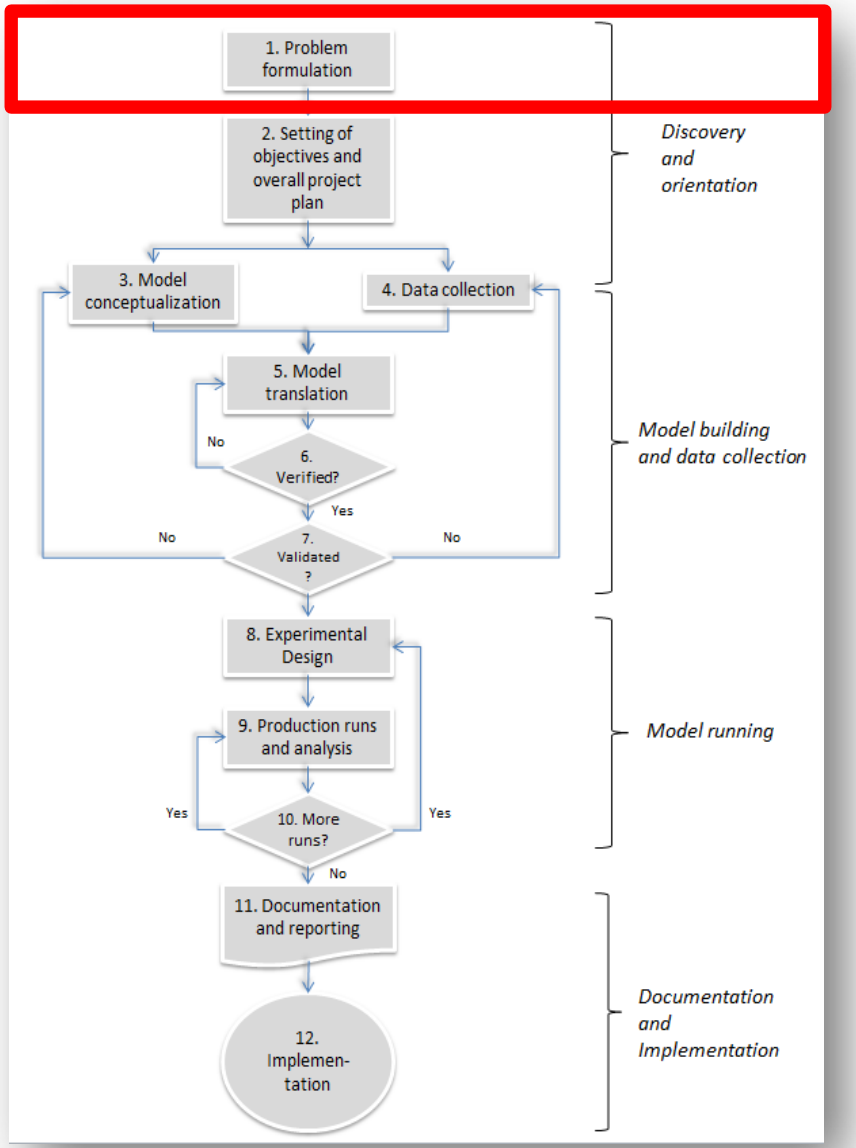
A long journey



- Robinson (2004)

Discrete Event Simulation

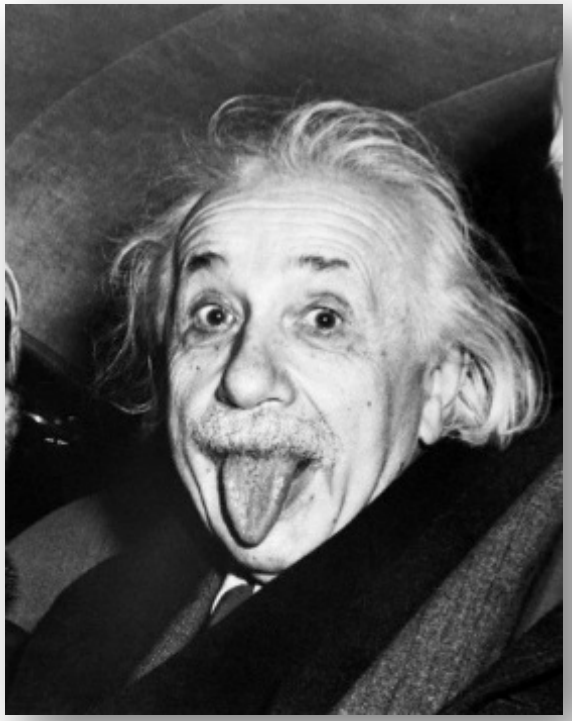
Process



- Banks (2010)

What is Your Problem?

What is the Problem?

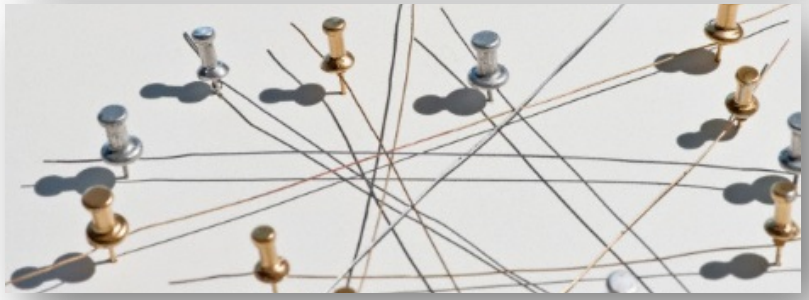


If I were given one hour to save the planet, I would spend 59 minutes defining the problem and one minute resolving it

Albert Einstein

What is the Problem?

Toyota´s Way



5 Why´s

1. Grasping situation thoroughly with an open mind
2. Go to where the problem is
3. First attempt at identifying the problem
4. Where is the problem observed?
5. What is the likely cause?

- Liker (2004)

Problem Formulation

An outsider's view

- Problem stated by a decision maker
  - It may not be stated precisley or in quantitative terms
  - Iterations are often necessary
- Meet stake holders
  - Overall objectives
  - What **specific question** is to be answered?
  - What performance measure will you use to evaluate this?
  - Define scope of your study
  - Time frame for you study
- Collect information
  - Make sure you know what information you will collect
  - Collect information from a reliable source
  - Document assumptions, summarized date, etc.

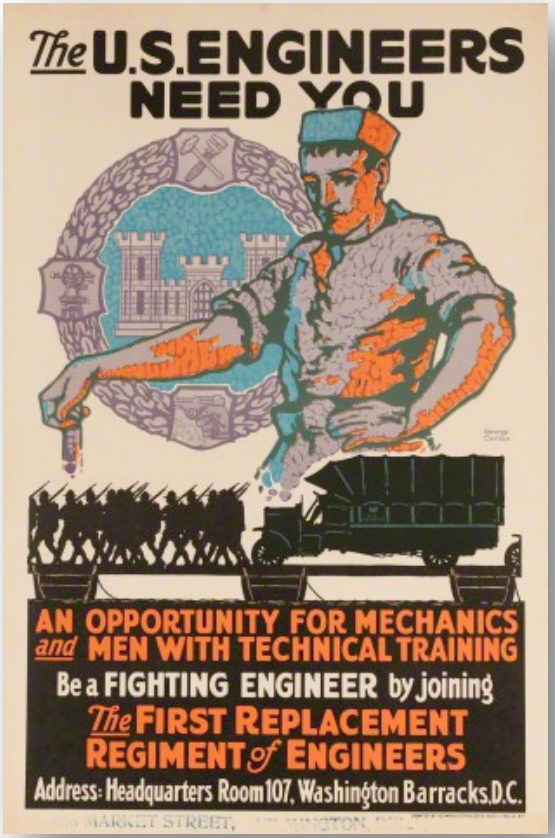
- Law (2009)

Problem Formulation

Solving the Right Problem

1. Establish the Need for a Solution

   - What is the basic need?
   - What is the desired outcome?
   - Who stands to benefit and why?



- Spradlin (2012)

Problem Formulation

Solving the Right Problem

2. Justify the need

- Aligned with company strategy?
- What are the desired benefits and how will we measure them?
- How will we ensure that a solution is implemented?

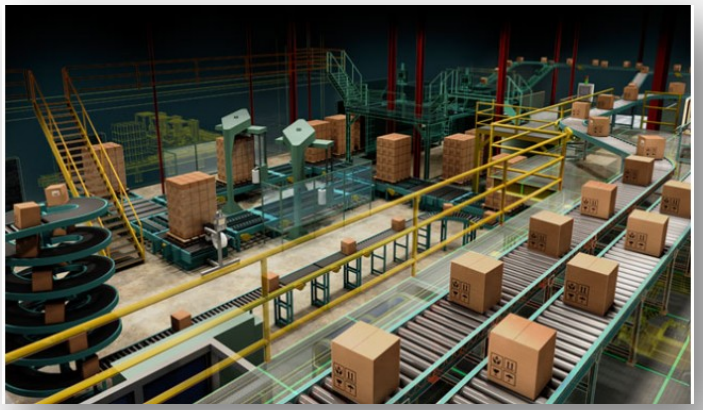
- Spradlin (2012)

Problem Formulation

Solving the Right Problem

3. Contextualize the problem

- What approaches have been tried?
- What have others tried?
- What constraints do we have?



- Spradlin (2012)

Problem Formulation

Solving the Right Problem

4. We can now write the problem statement

- Spradlin (2012)

Setting up the Problem

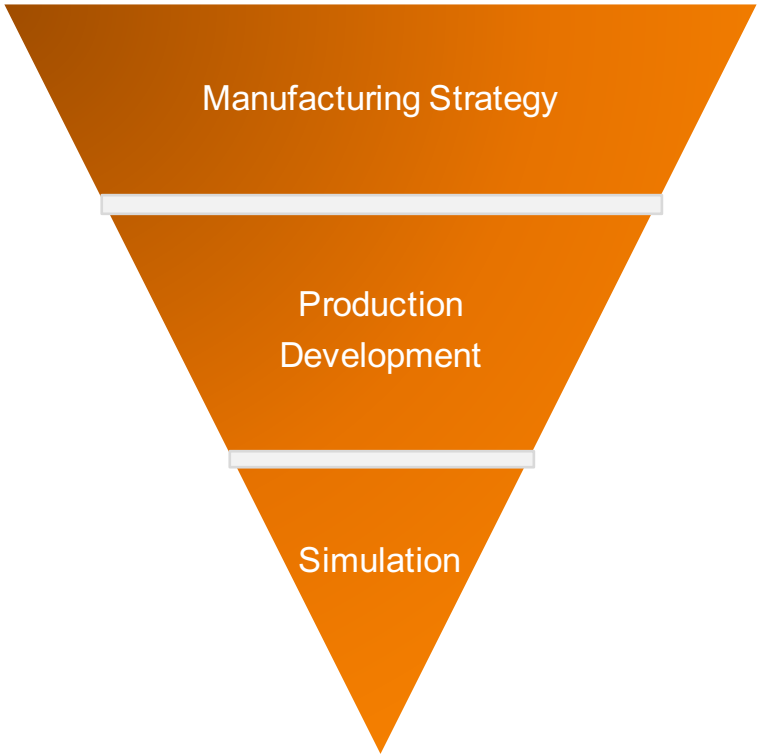
Summary

- Problem formulation is the most important part
- Methods / Strategies exist to define problem
- Outsider's perspective
- Solving the right problem

PPU412 – Industrial Excellence

Are you up for the Challenge?

- The roll of Manufacturing Strategy in a company
- The importance that Production Development plays in competitiveness
- Simulation as a tool to improve a Production System



Questions?