

# Production System Development

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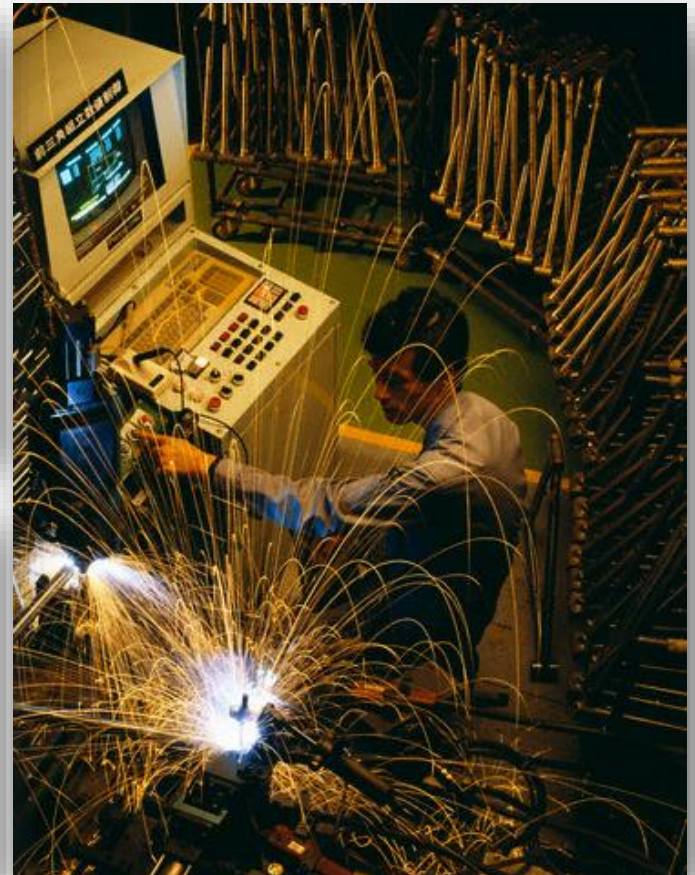
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# A Little About Us





# 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?



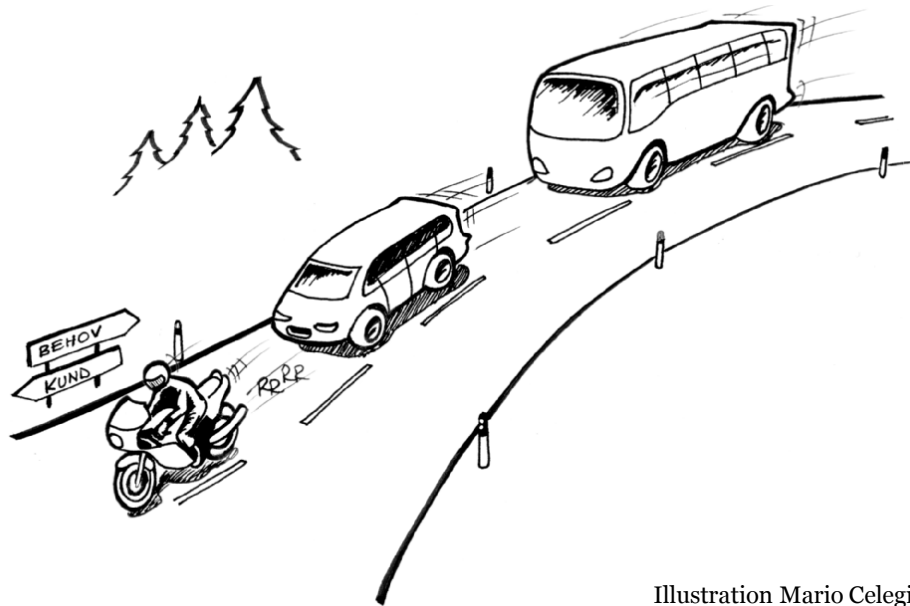


# A Process

- “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)







# Product Development Process



**Concept**  
Idea Generation

**Research**  
Assess Market

**Analysis**  
Business Analysis

**Develop**  
Product Development

**Launch**  
Go to Market



Key deliverables

Key deliverables

Key deliverables

Key deliverables

Key deliverables

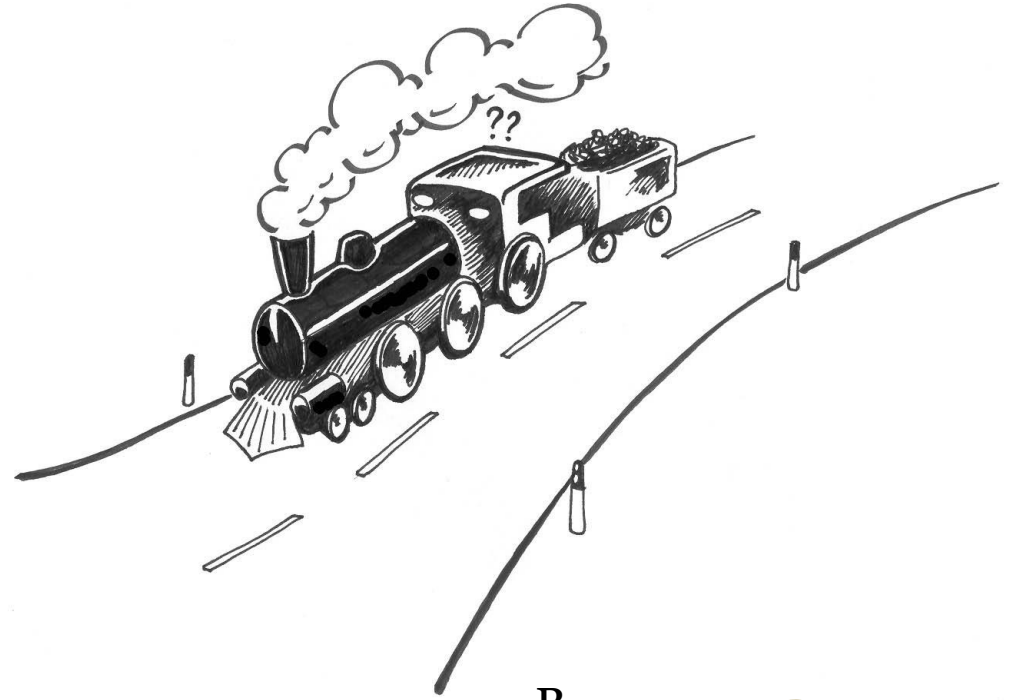




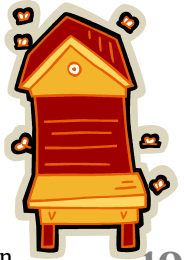
# What is the problem?



A



B





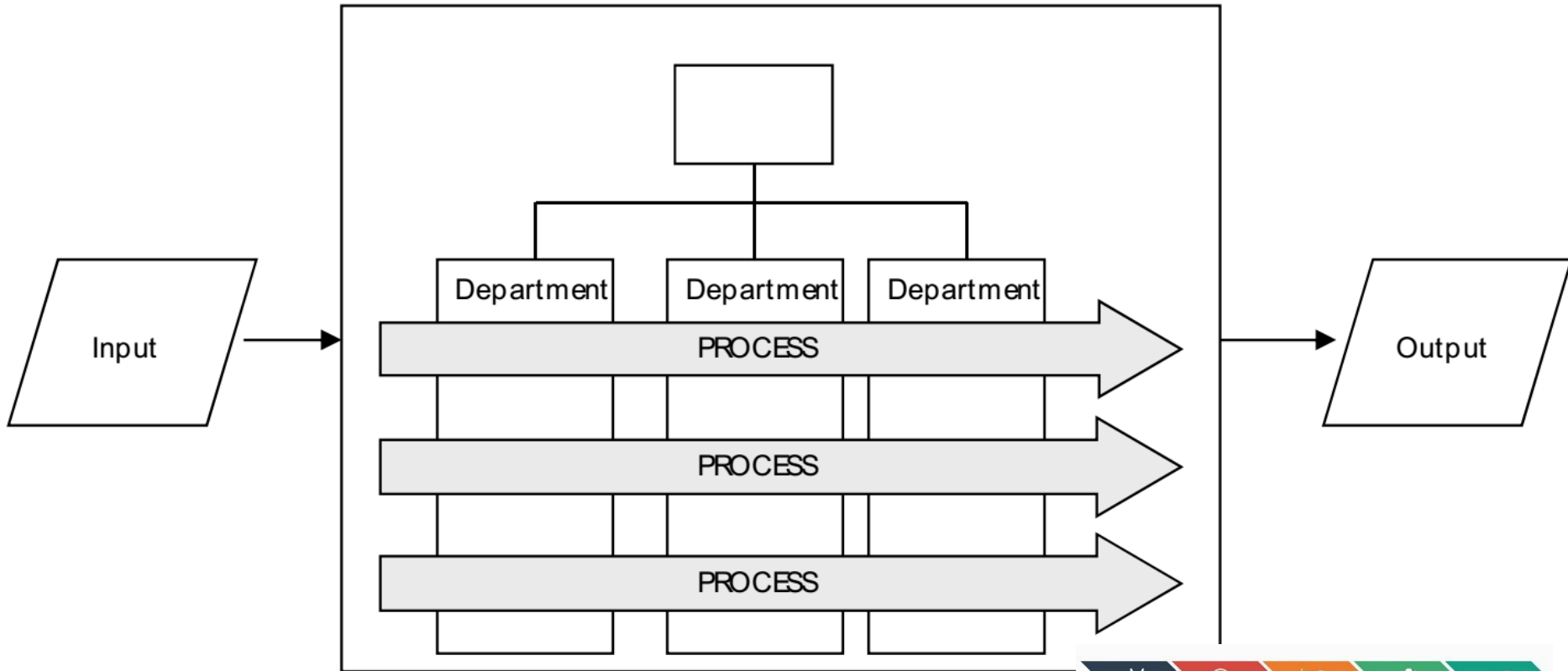
# What are the benefits of having a development process?

- Increasing the stability of the work, knowing which stage you are in
- Helping to plan your project
- Helps different department work together
- Routines often secure higher quality
- Easier to learn from other project
- Possible to improve the process





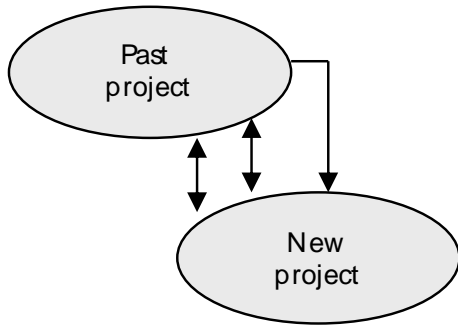
# Process goes through different departments



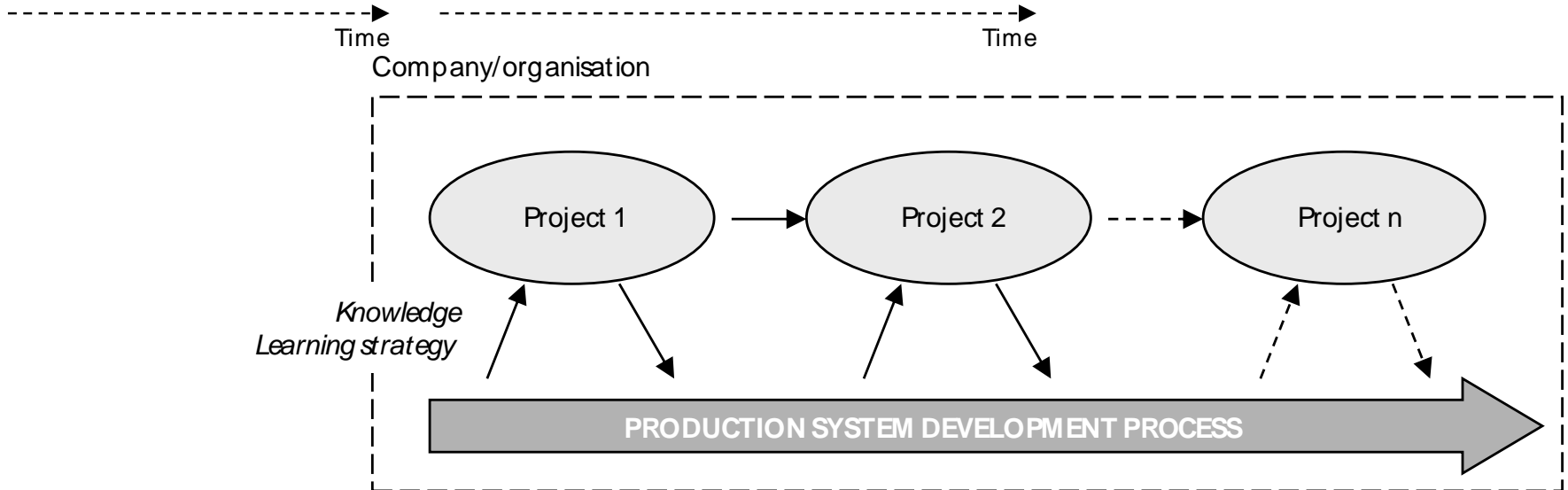
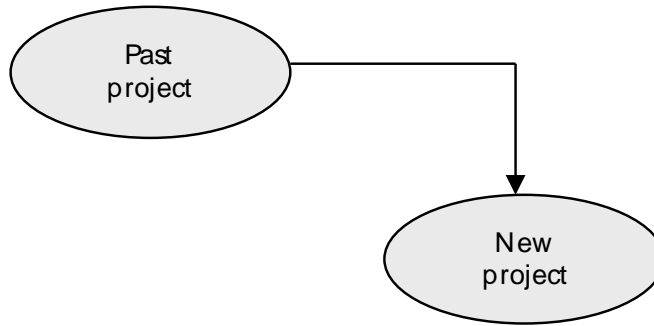


# Transfer of experiences between projects

Concurrent transfer mode



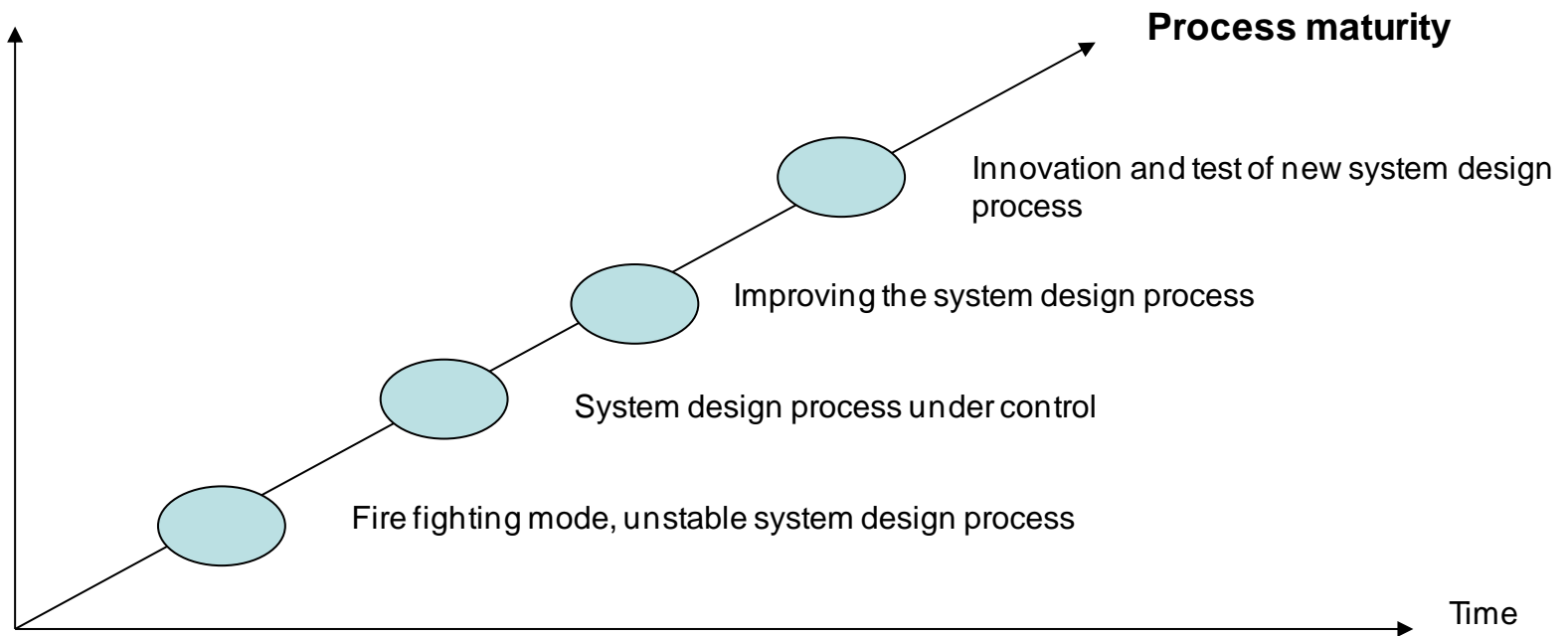
Sequential transfer mode





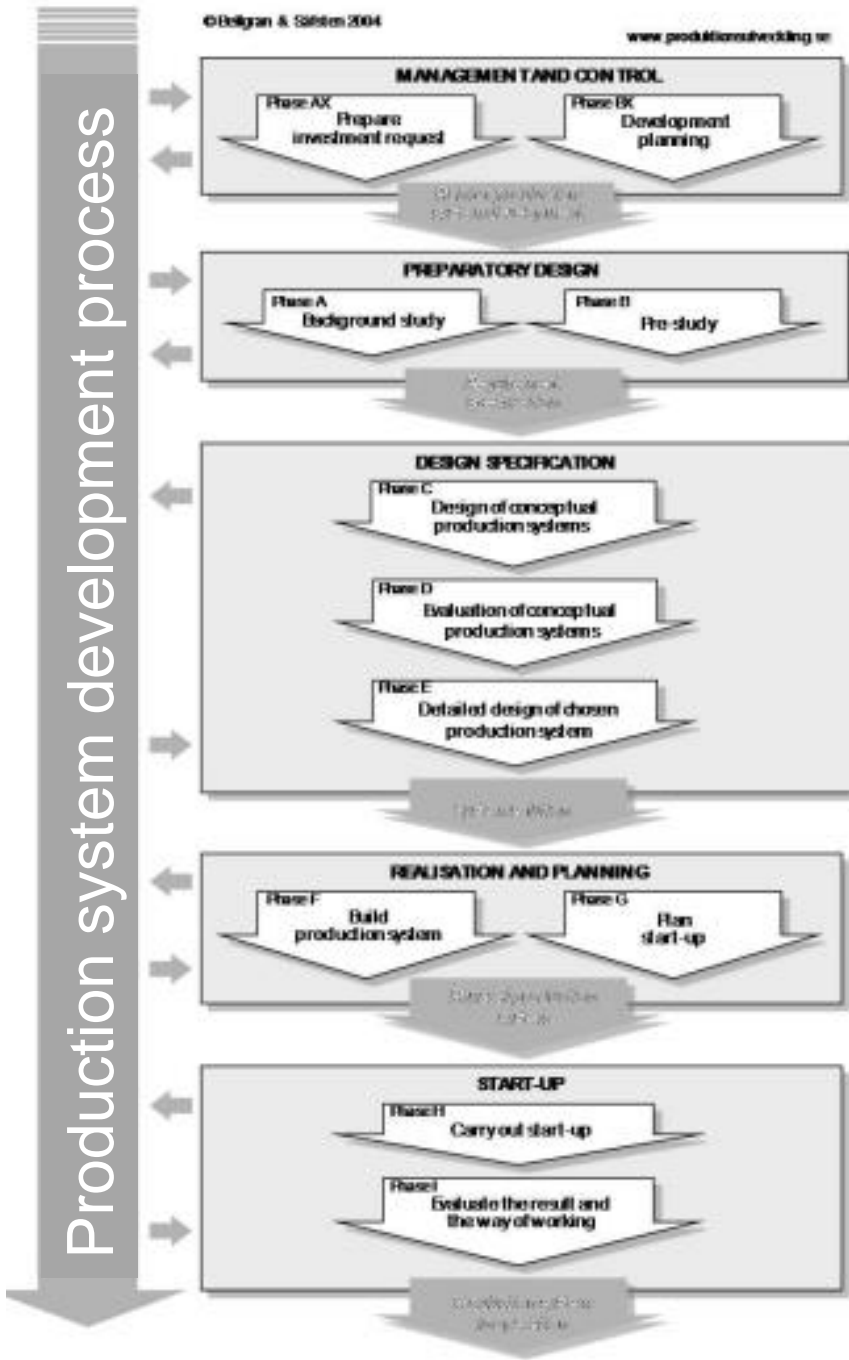
# Process maturity

Maturity level of the production system design process



**Is it common for manufacturing companies to have a production system development process?**





Planning of PDS

Pre-study

Conceptual design,  
Detailed design,  
Evaluation

Build and install

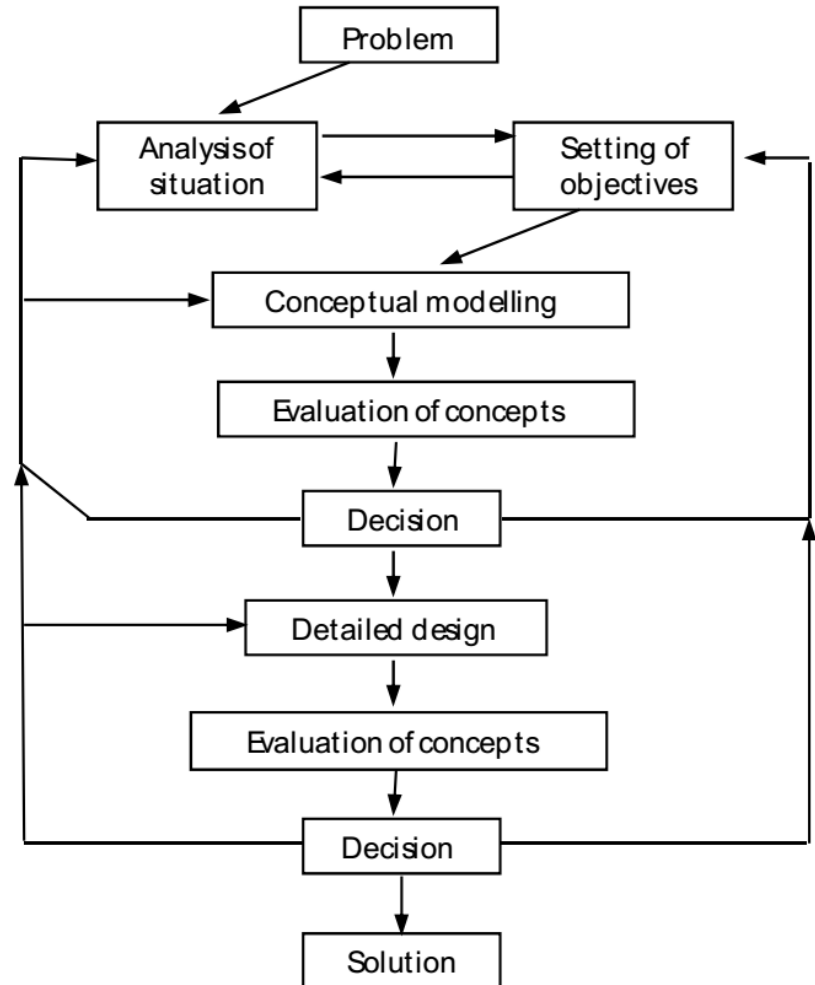
Start-up,  
In operation





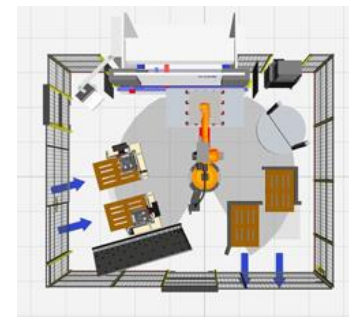
# General design process

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

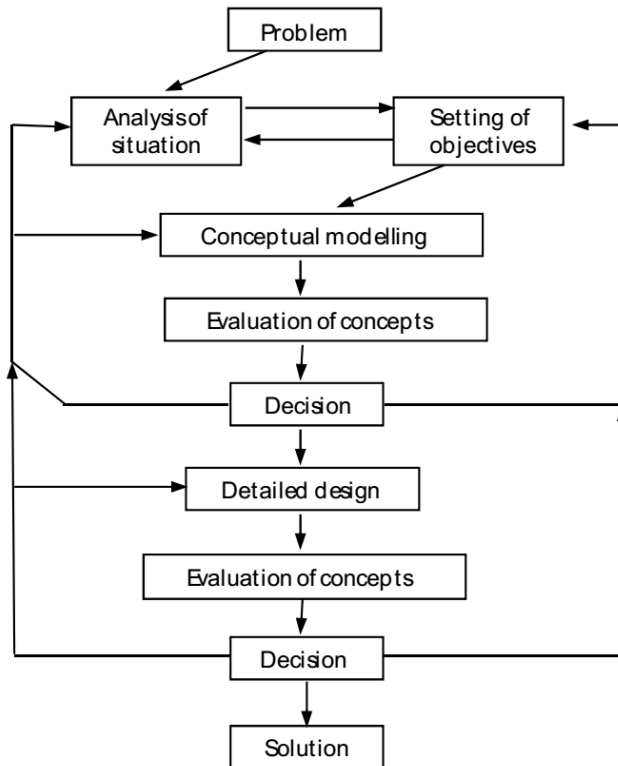




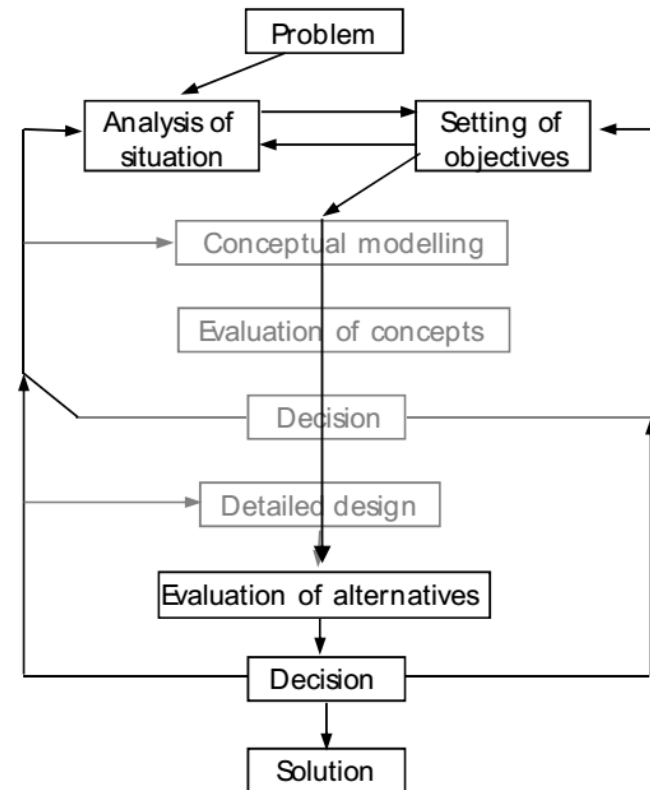
# Suppliers can take over design process



## General design process



## Supplier-driven design process







# 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



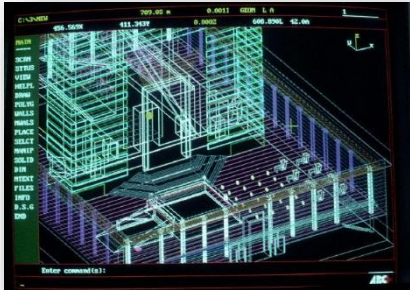
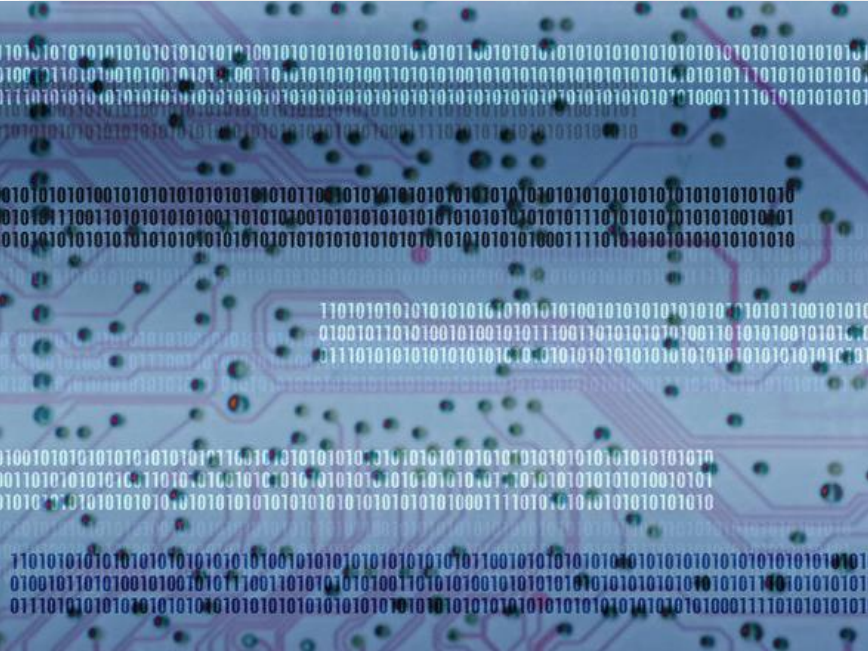
Illustration Mario Celegin adopted from Bellgran and Säfsten, 2000



# Short Break?



# Simulation in Production Process Development

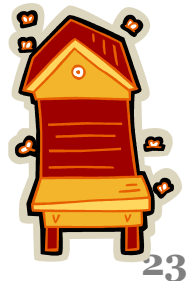




# Tell Us About You

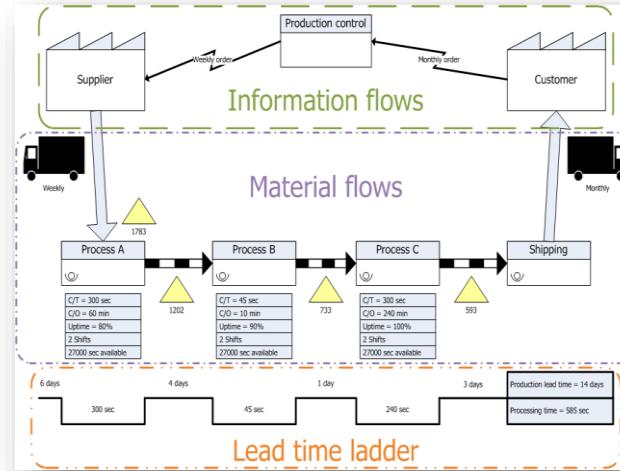
- How have you worked so far?
- How have you proceeded so far?

- How can we make sure we will get the answer we expect?
- When do we make sure we get the answer we wish for?



# Trying things early on

## What are our options?

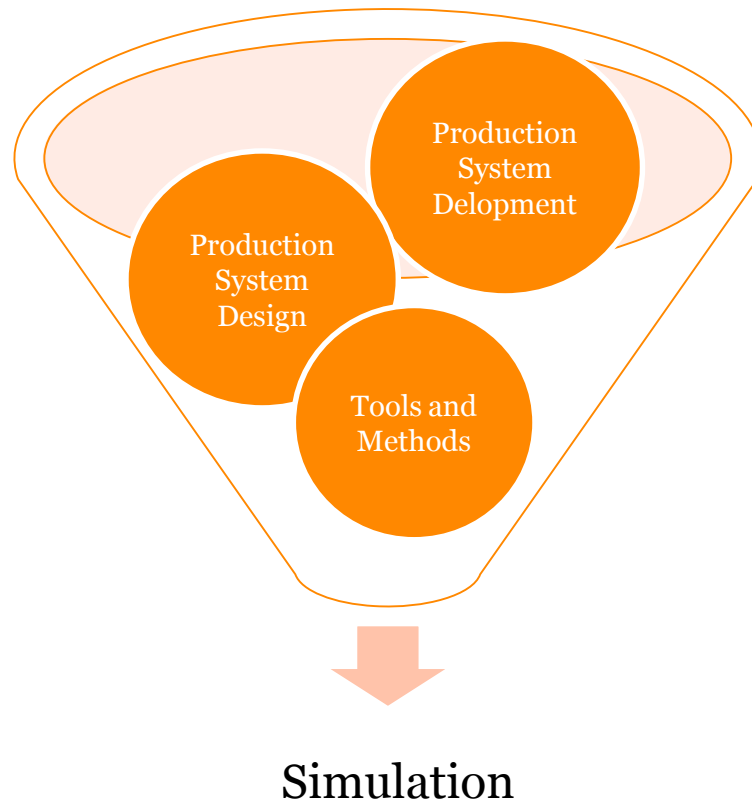






# Trying things early on

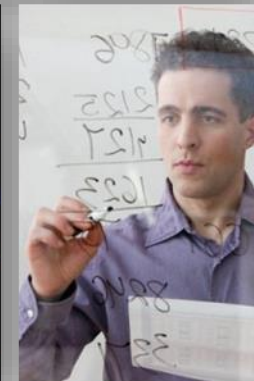
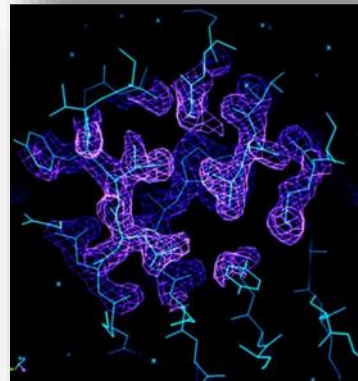
## Simulation as a tool



# Modeling

## What is it?

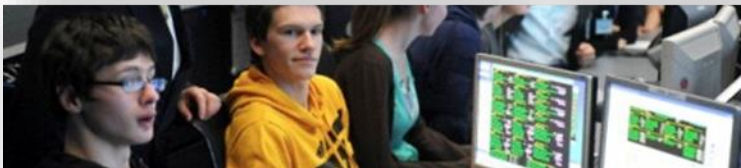
- A model is defined as representation of a system for the purpose of studying that system.  
- Banks (2010)
- Modeling is an approximation of a system, it is not an exact representation, i.e. we can not model every aspect of the system  
- Strickland (2010)
- A modeler has to make decisions about content and assumptions of the model  
- Robinson (2004)





# Simulation

## What is it?

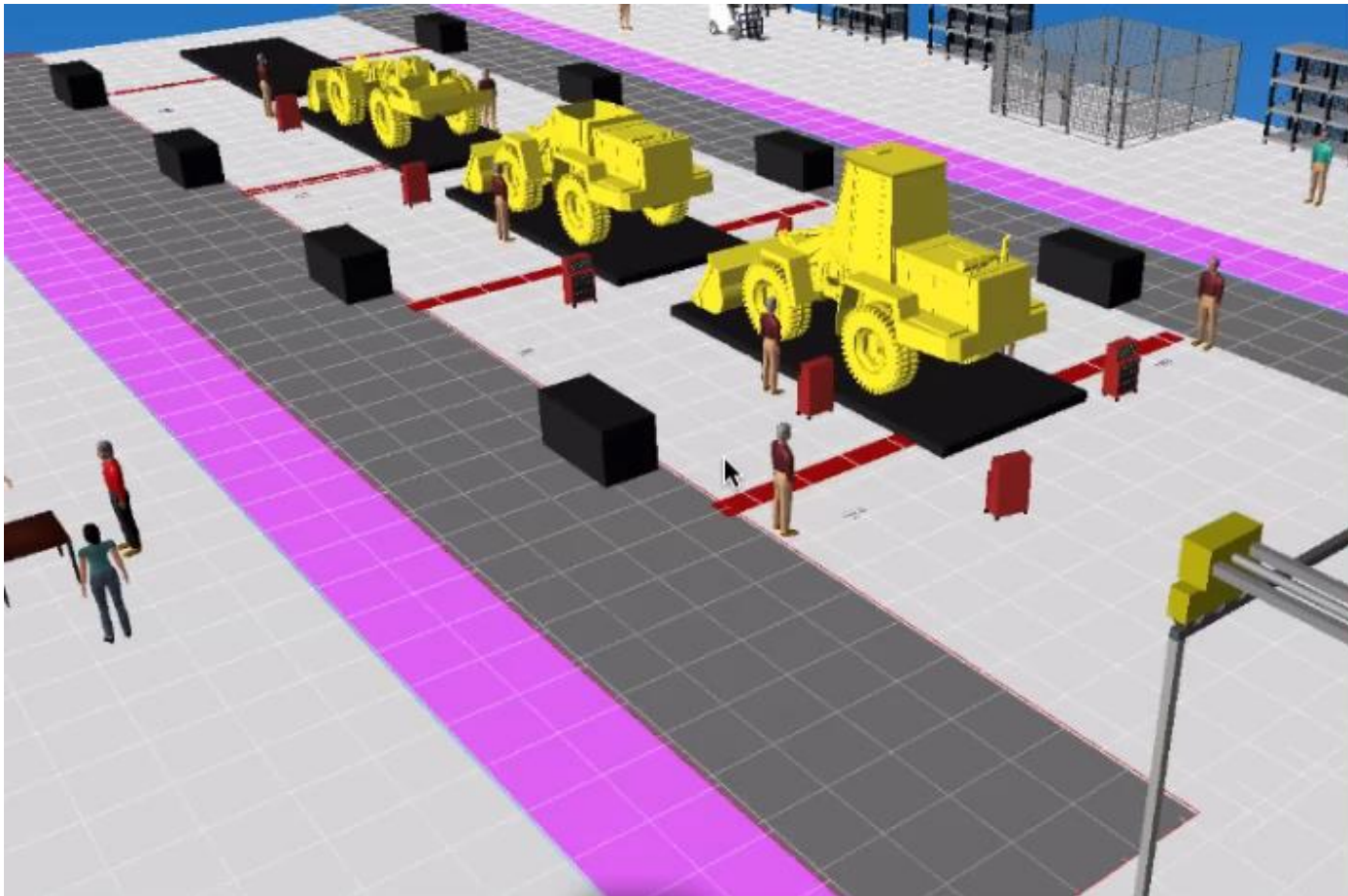


- An imitation of a system
- An imitation (on a computer) of a system as it progresses through time
- Experimentation with a simplified imitation (on a computer) of an operations system as it progresses through time, for the purpose of better understanding or improving that system

- Robinson (2004)

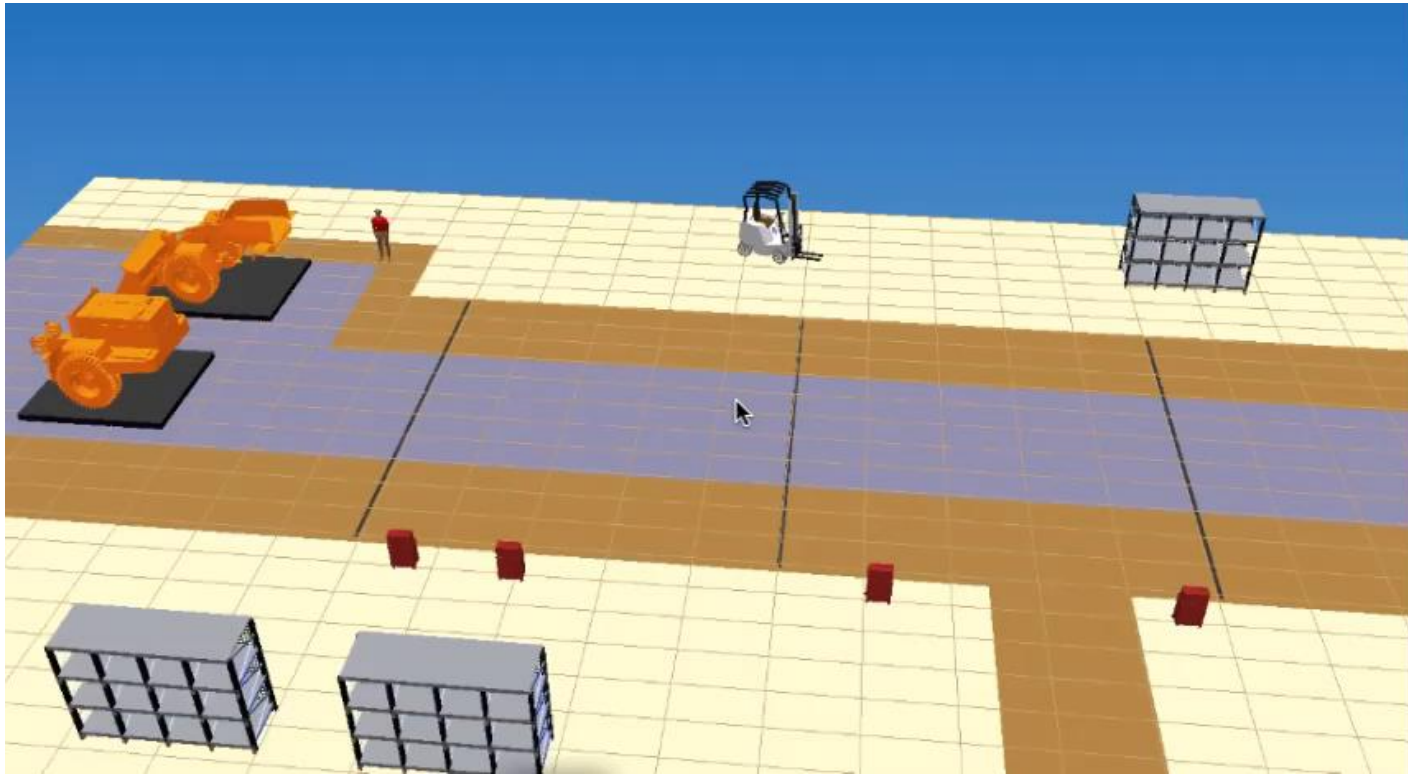


# Simulation





# Simulation





# Simulation

Why is simulation useful?





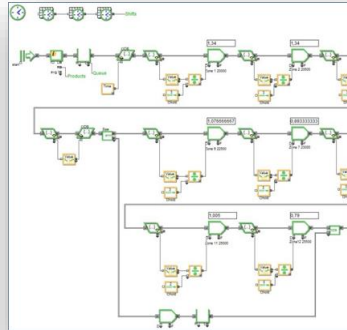
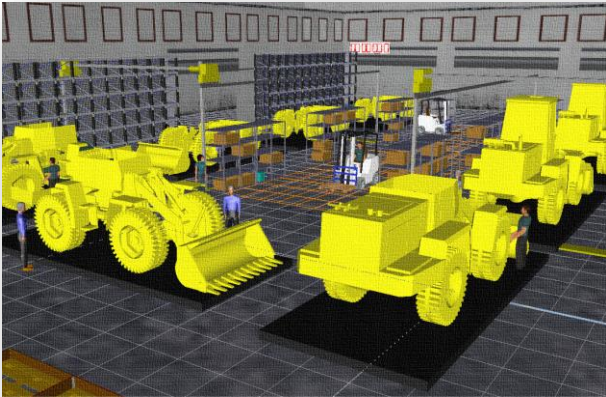
# Why simulate?





# Simulation

Why is it useful?



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





# Why simulate?





# Simulation

How do we do this?

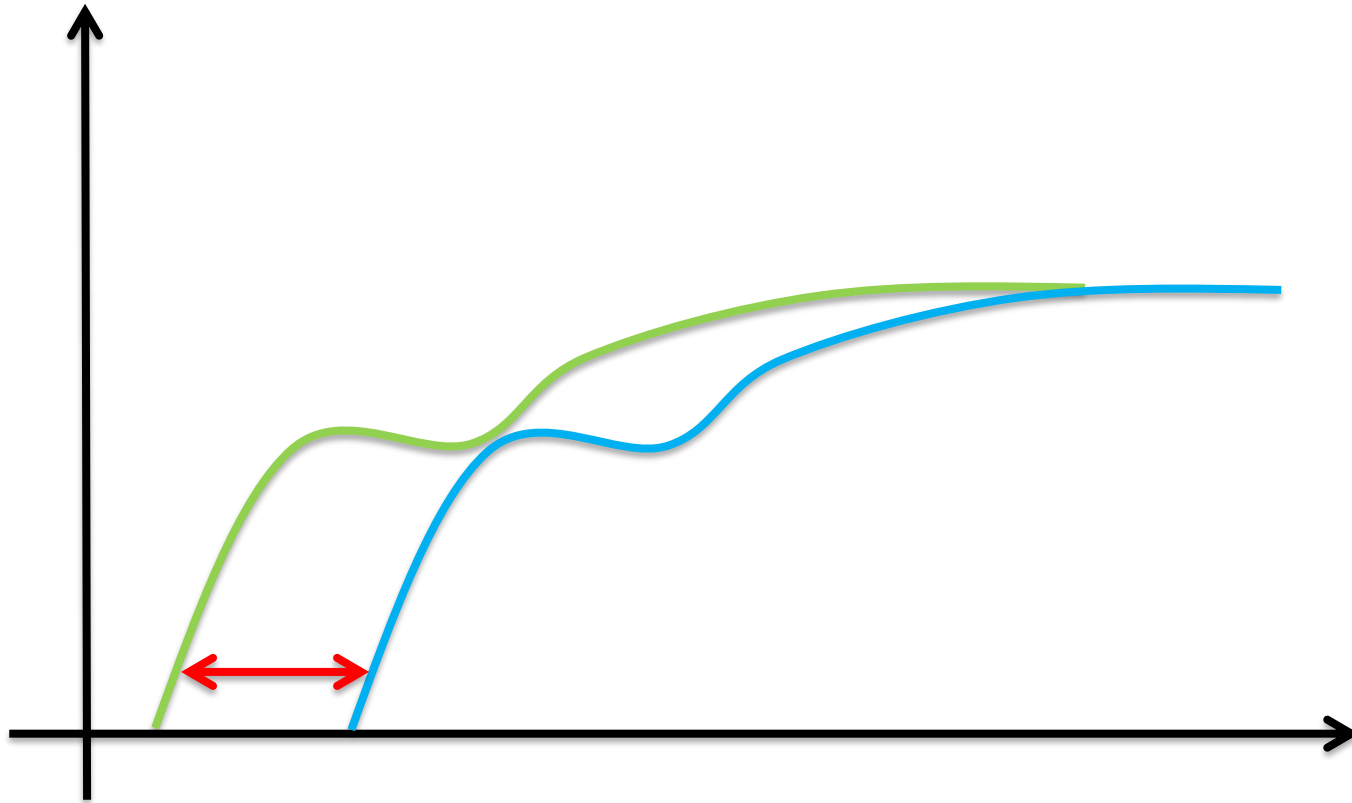


- Historical data
- Account for uncertainty
- Doing the right thing
- Doing the thing right



# Simulation

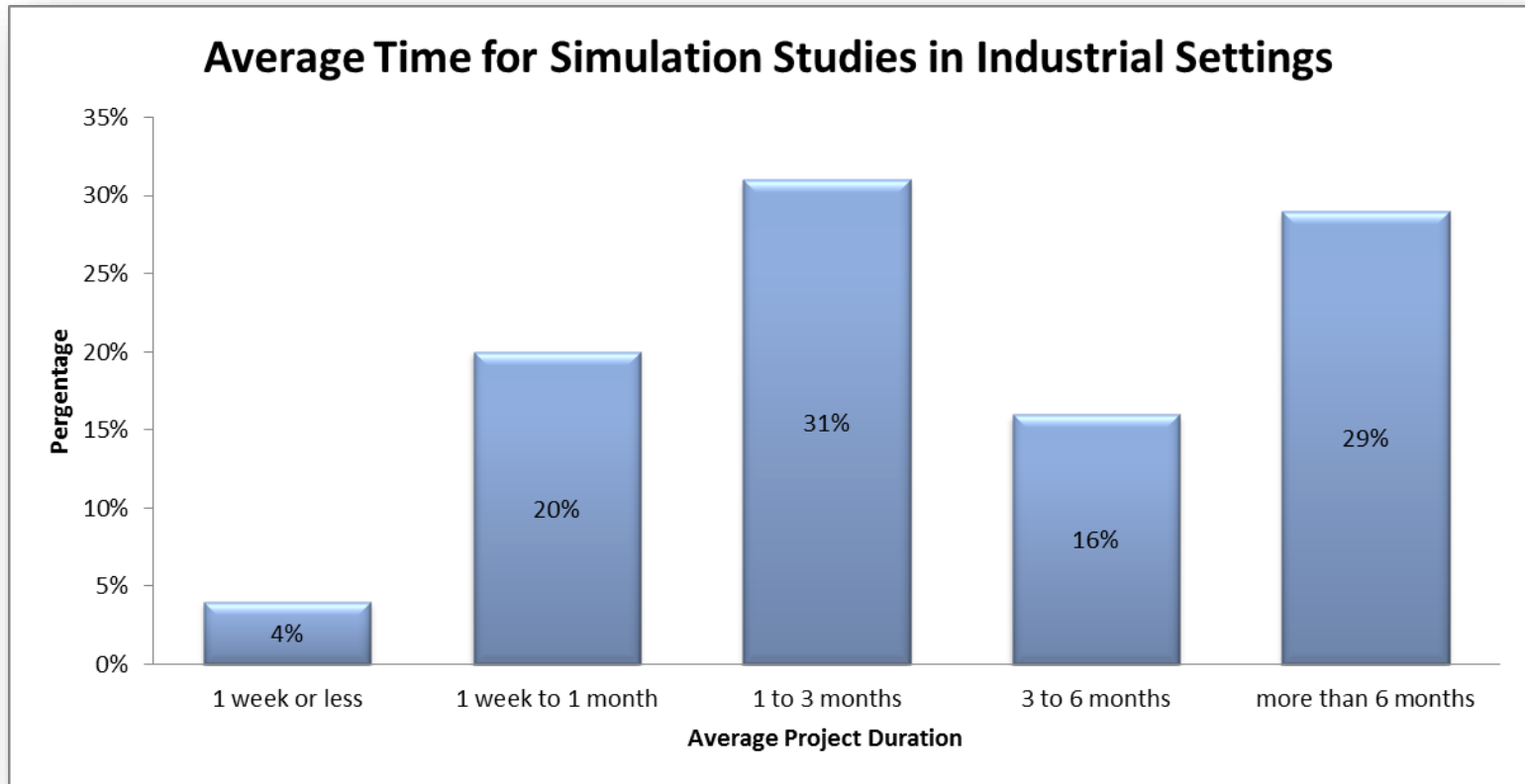
How do we do this?





# Simulation

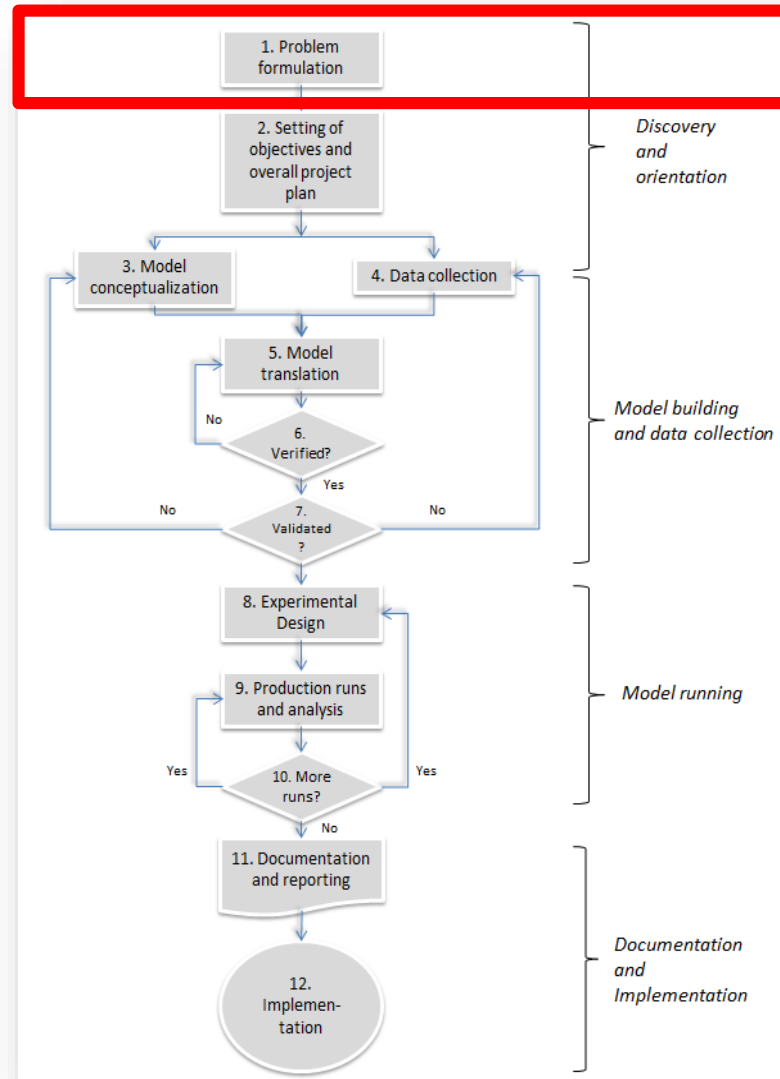
## A long journey



- Robinson (2004)



# Simulation process



- Banks (2010)

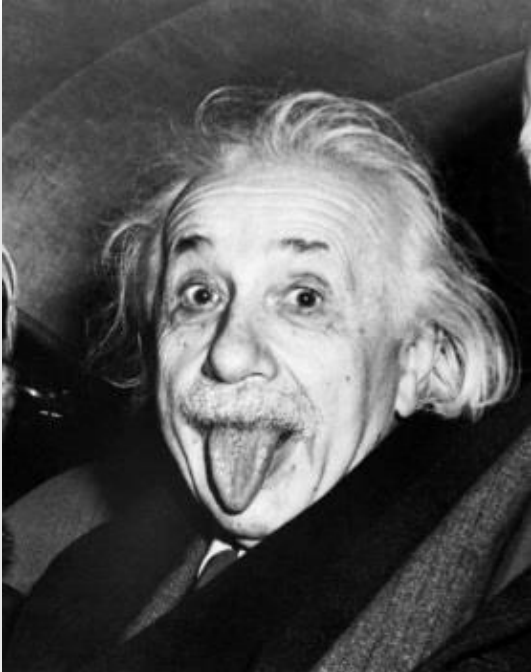


# What is Your Problem?





# What is the Problem?



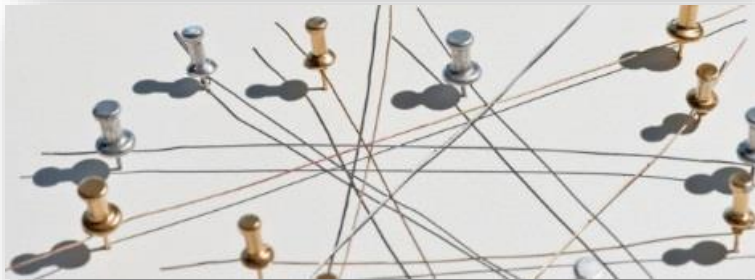
If I were given one hour to save the planet, I would spend 59 minutes defining the problem and one minute resolving it

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

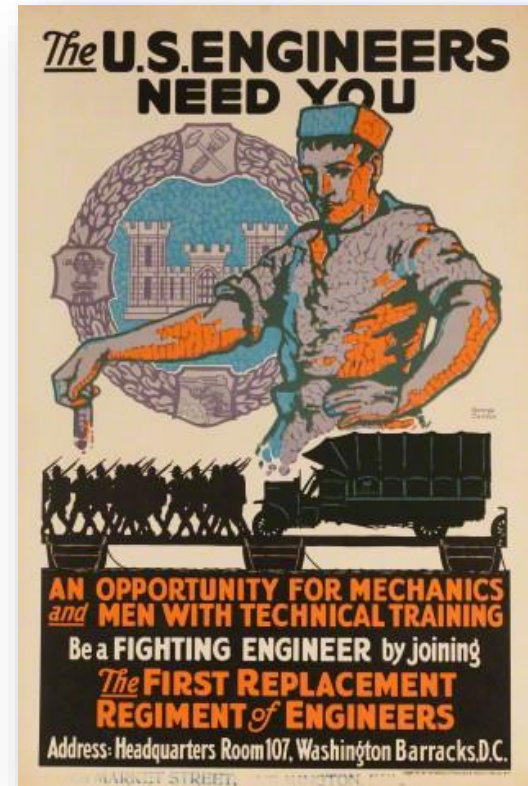
- Problem stated by a decision maker
  - It may not be stated precisely or in quantitative terms
  - Iterations are often necessary
- Meet stake holders
  - Overall objectives
  - What **specific question** is to be answered?
  - What performance measure will you use to evaluate this?
  - Define scope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



# 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

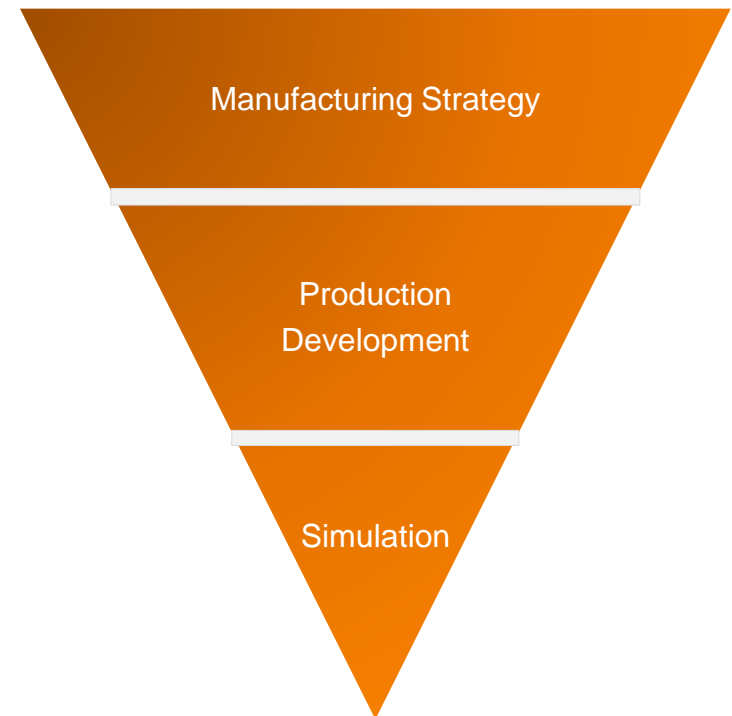




# PPU431 – Industrial Excellence

Are you up for the Challenge?

- The roll of **Manufacturing Strategy** in a company
- The importance that **Production Development** plays in competitiveness
- Based on a **real-life case** of relevance to industry





# PPU432 – Simulation of production systems

- **Develop competence** in the use of discrete event simulation (DES) – theory, hands on exercises, and workshops
- Support the **improvement of industrial processes** that involve complex change
- **Close to industry** – participation of industrial partners in the region







# Questions?

