# IDLAB – TECHNO-ECONOMICS

## SOFIE VERBRUGGE

# TECHNO-ECONOMIC RESEARCH SOLVES DIFFERENT QUESTIONS
## IN A BROAD RANGE OF APPLICATION DOMAINS

- Evaluate **technological** projects from an **economic** perspective

- Network planning and dimensioning
- Cost modeling: equipment and processes
- Business case analysis
- Business model evaluation

- Close link to technology
- Strong focus on quantitative results

ICT

energy

health

media

smart cities

manufacturing

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# NETWORK PLANNING, COST MODELING AND EVALUATION
## TYPICALLY DONE FOR OPERATORS OR EQUIPMENT VENDORS

- Focus on standardized methods and input data
- Based on in-house developed planning tools

# MODELING TECHNOLOGY IMPACT ON OPERATIONAL PROCESSES
IN SMART CITIES, SMART TRANSPORT, SMART CARE, ETC.

- Comparison of as-is versus to be for Internet-of-Things based solutions

# VALUE NETWORK ANALYSIS AND BUSINESS MODELING
## GIVES AN INSIGHT IN STRATEGIC IMPACT FOR DIFFERENT ACTORS

- Policy supporting research for governments and utility providers
- Strategic technology choices to be made by private as well as public companies

# OUR STANDARDIZED TECHNO-ECONOMIC METHODOLOGY
## IS APPLICATION DOMAIN AGNOSTIC
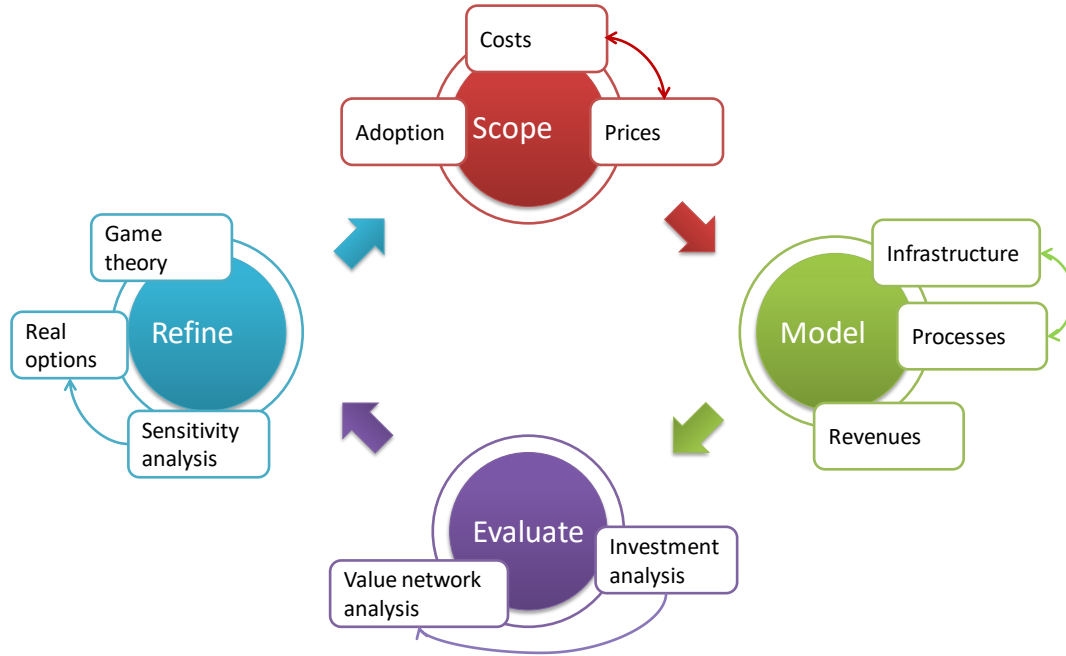
# COST MODELLING BASED ON LIFECYCLE COST BREAKDOWN
## CONSIDERS INFRASTRUCTURE, EQUIPMENT AS WELL AS PROCESS COSTS

- Aim at getting full cost overview
  - Helps to understand the potential impact of a certain optimization
- Find balance between required level of detail and available input data

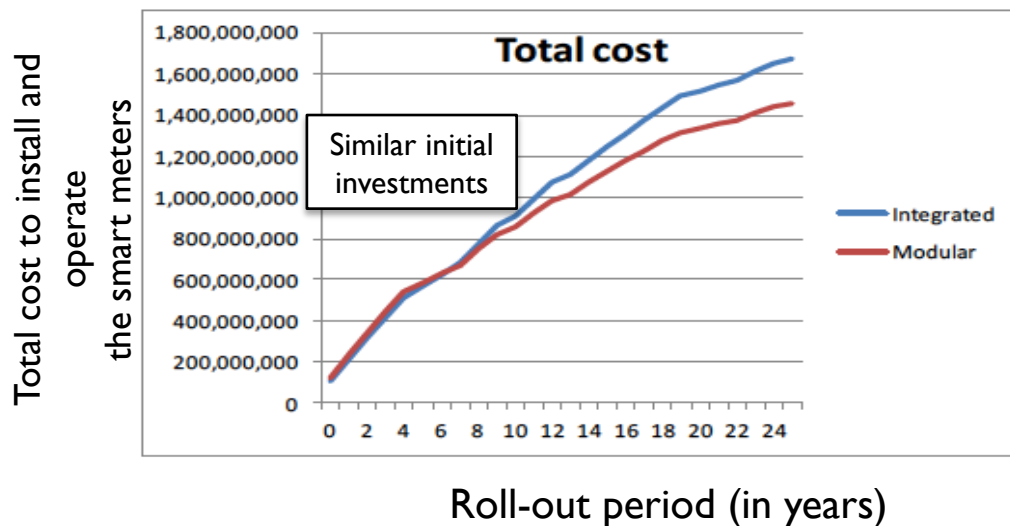- Models helps to understand the trade-off that often exists between investment costs and operational efficiency
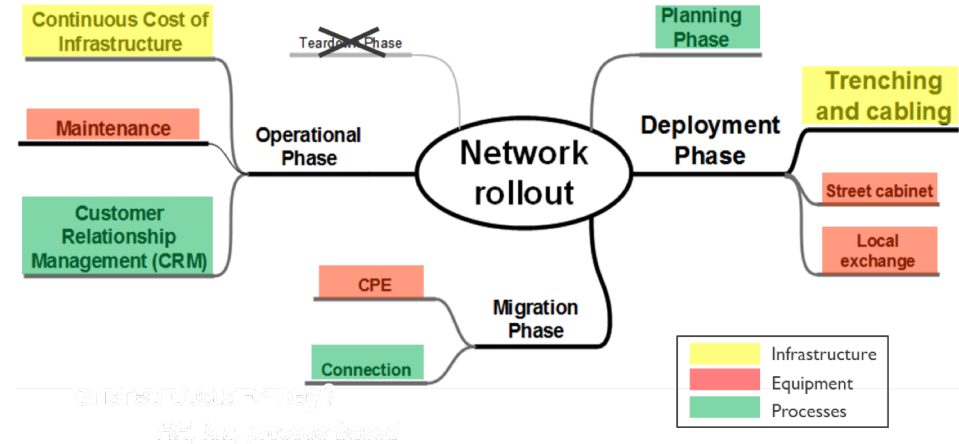
# EXAMPLE OF COST MODELING
## IN THE SMART ENERGY DOMAIN

Comparison based on total cost of ownership (TCO) between

- integrated smart meter rollout (i.e., meters integrated with communication) vs
- modular smart meters (replacable communication module)



**Total cost**

Similar initial investments

Integrated
Modular

Total cost to install and operate the smart meters

Roll-out period (in years)

Cost to repair defective meters is key:
As of 8 years after installation, TCO for modular meter is better

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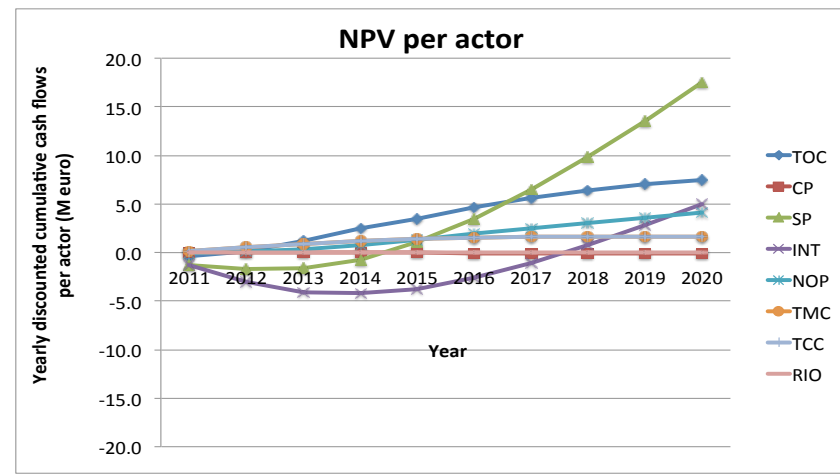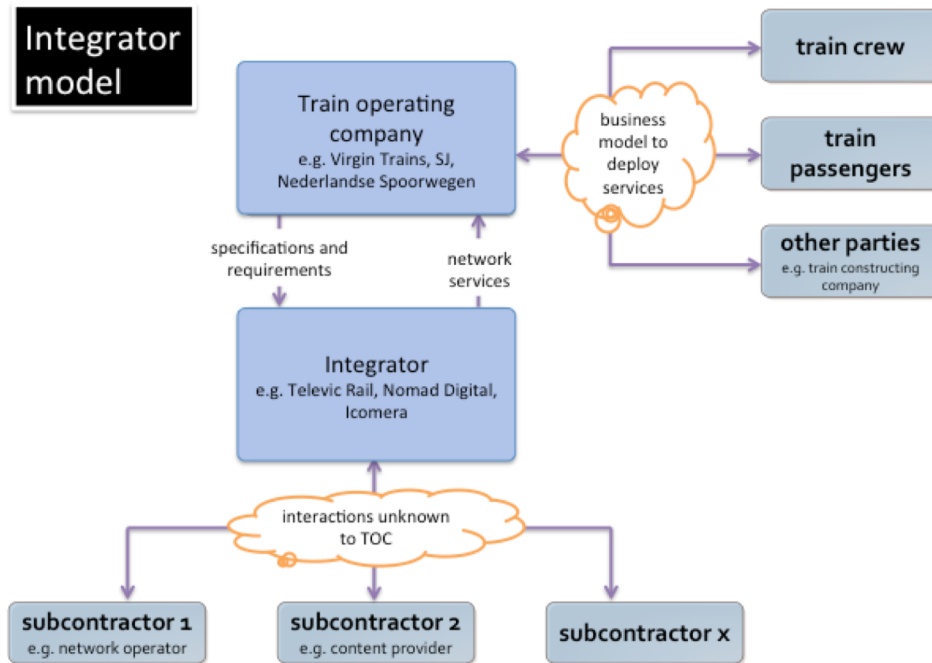
# INVESTMENT ANALYSIS
## INDICATES WHICH INVESTMENT TO BE MADE AT WHICH POINT IN TIME

- Compare costs and benefits
- Take into account time value of money

- Investment decision metrics
  - Payback time
  - Discounted payback time
  - Net present value (NPV)
  - Internal rate of return (IRR)

- Add quantitative view to business model
  - by calculating economic viability of business case

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# EXAMPLE OF INVESTMENT ANALYSIS
## IN THE SMART TRANSPORT DOMAIN (INTERNET ON TRAINS)

**Tr@ins**



Integrator model

Train operating company
e.g. Virgin Trains, SJ, Nederlandse Spoorwegen

business model to deploy services

train crew

train passengers

other parties
e.g. train constructing company

specifications and requirements

network services

Integrator
e.g. Televic Rail, Nomad Digital, Icomera

interactions unknown to TOC

subcontractor 1
e.g. network operator

subcontractor 2
e.g. content provider

subcontractor x



**NPV per actor**

Yearly discounted cumulative cash flows per actor (M euro)

Year

Legend: TOC, CP, SP, INT, NOP, TMC, TCC, RIO

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11

# REFINING INVESTMENT ANALYSIS
## CONSIDER UNCERTAINTY, MULTIPLE ACTORS AND MULTIPLE OBJECTIVES
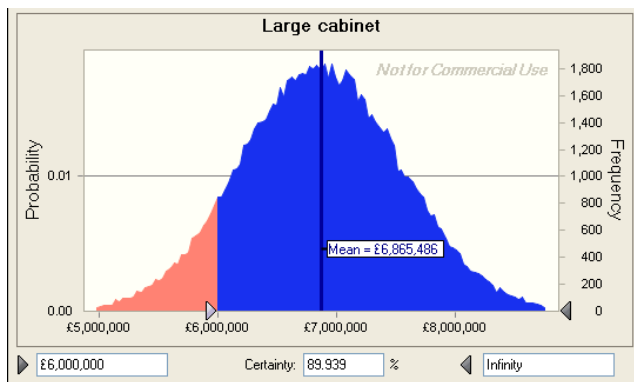
- Several evaluation techniques help to extend standard NPV analysis

- Sensitivity Analysis
  - Uncertainty on input parameters
- Game Theory
  - multiple actors with different, possibly conflicting objectives
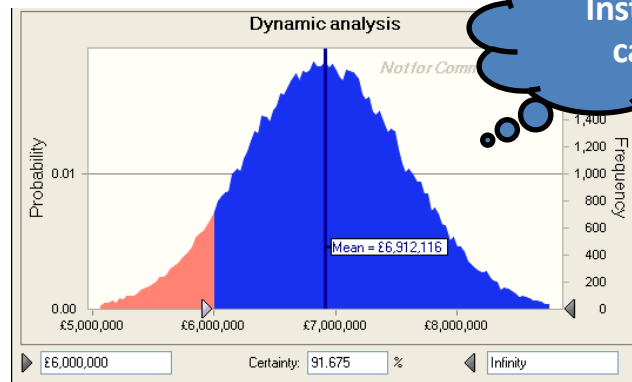- Real Options
  - Impact of phased decision

# REFINING INVESTMENT ANALYSIS USING REAL OPTIONS
## FROM THE ICT DOMAIN: POSSIBLY PHASED WIRELESS NETWORK ROLLOUT
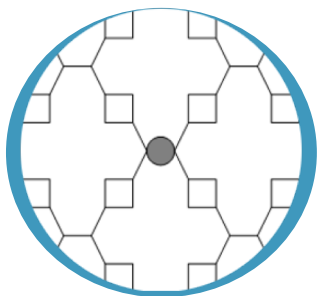
Bilateral BT

Install small cabinets
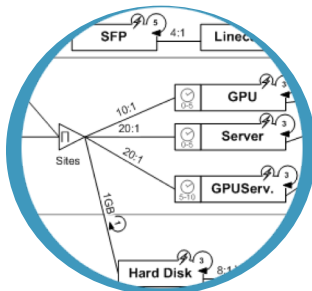


Risk on low NPV: 10%
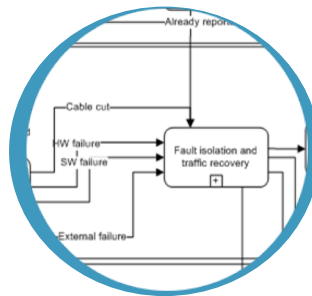


Risk on low NPV : 8%

# A SOFTWARE TOOLKIT
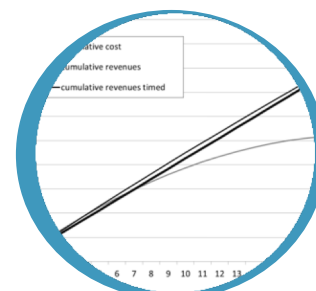## IS IMPLEMENTING OUR METHODOLOGY



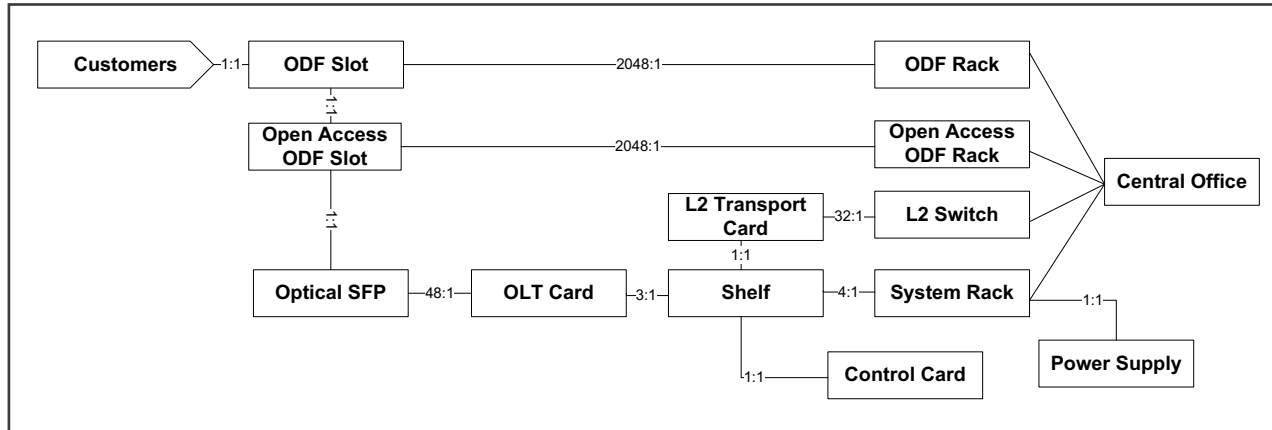Network modeling

Equipment modeling

Process modeling

Revenue modeling

# STANDARDIZED LANGUAGE AND NOTATION
## FACILITATES COMMUNICATION WITH FIELD EXPERTS

- We developed Equipment Coupling Modeling Notation (ECMN)
- We make extensive use of Business Process Modeling Notation (BPMN)

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# INNOVATIVE OUTCOMES
## FRAMEWORKS, STANDARDS, METHODOLOGIES, TOOLS

- Standardized 4-step techno-economic evaluation approach
  - Allows to understand business potential for technological innovation in a broad range of domains
  - Can be used to evaluate specific cases tailored to your needs
- Standardized languages and notations that help you to describe your solution in a uniform way and facilitate communications between different stakeholders
  - Equipment Coupling Modeling Notation (ECMN) is a FI-ware open specification
- Extensive software library of software tools
  - Telecom Research Software (TRS): Multi-layer network planning software aimed at backbone network
  - Techno-Economic Software Suite (TESS): Allows to model cost and revenue functions based on time series
  - Business Modelling and Simulation tool (BEMES): Webtool to simplify business process and equipment cost modeling
- Techno-economic research portal: http://www.technoeconomicsportal.eu/
  - gateway to generic methodologies, useful tools, frameworks and international literature.