

BIM is profitable

Measuring the economic benefits of Digital Construction

**Project funded by the Enterprise and Construction Authority
2009-2012**

Jan Karlshøj, from the project by :

Flemming Vestergaard, associate professor at DTU, Civil Engineering

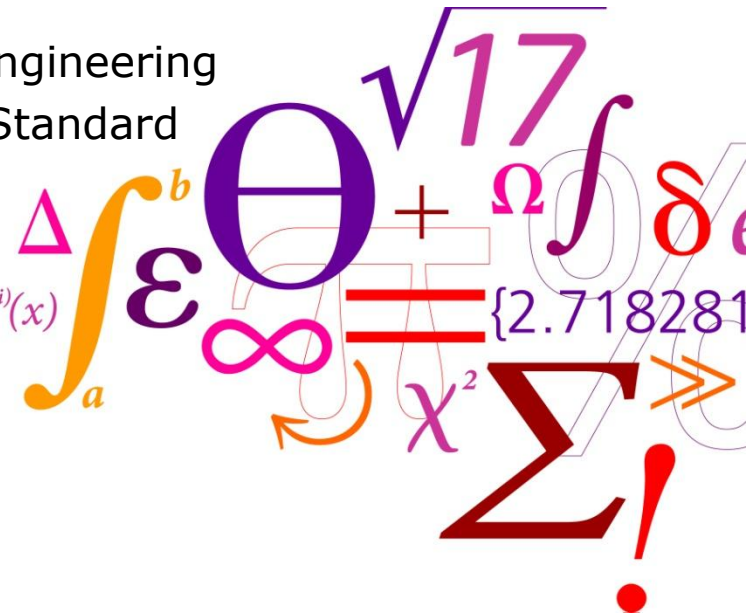
Jan Mouritsen, professor at Copenhagen Business school, Department of Operations Management

Jan Karlshøj, associate professor at DTU, Civil Engineering

Jan Lambrecht, project manager DTI og Dansk Standard

Peter Hauch, architect, Chief Consult, arkidata

$$f(x+\Delta x) = \sum_{i=0}^{\infty} \frac{(\Delta x)^i}{i!} f^{(i)}(x)$$



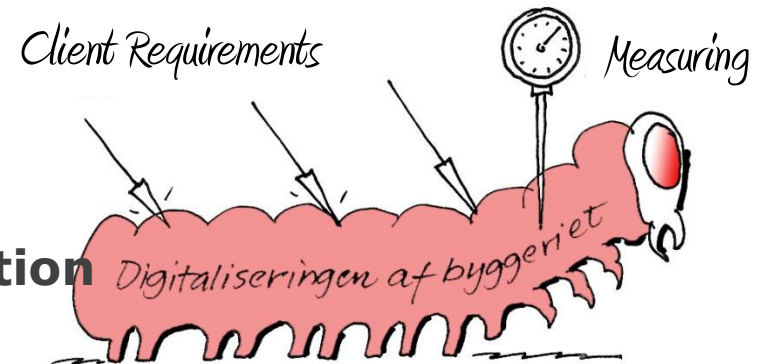
Agenda

- **Project background**
- **ØG-DDB method**
- **The results from 3 out of 4 cases**
- **Summary of preliminary results**



Project background

- **Digital Construction**
 - **Client Requirements and ICT regulation**
 - **Best Practice**
 - **Implementing Network**
-
- There are economic gains from the use of ICT / BIM
 - Gains are spread between processes and actors
 - Are difficult to localize and quantify
 - Need for more thorough description of the magnitude of gains and costs
 - DECA / COWI report and billion € 2.3
 - This project is part of the effort to identify earnings and cost potential of BIM



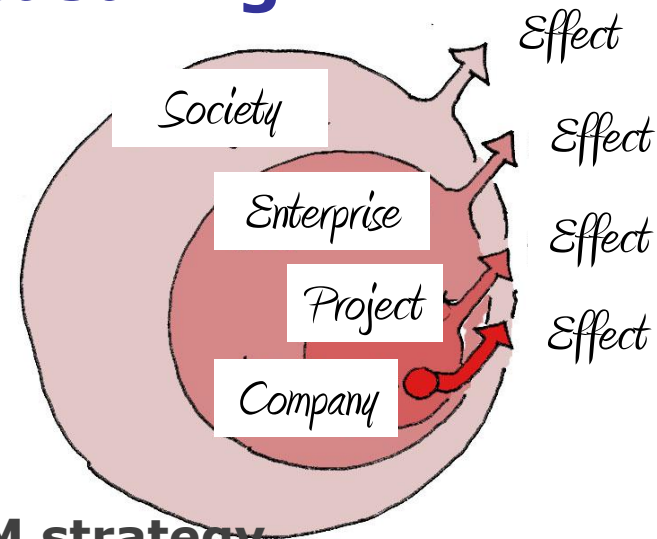
Measuring the economic benefits

- **No tradition of historical earnings and cost statistics in the industry**
- **No tradition of historical economic statistics in enterprises and projects**
- **Costs and benefits are spread**
- **Gains can only be seen in a value chain process**

- **We try through case studies to provide data for assessing the effects of ICT**
- **We describe the context and prerequisite requirements**

The different levels of measuring

We look at the entire value chain

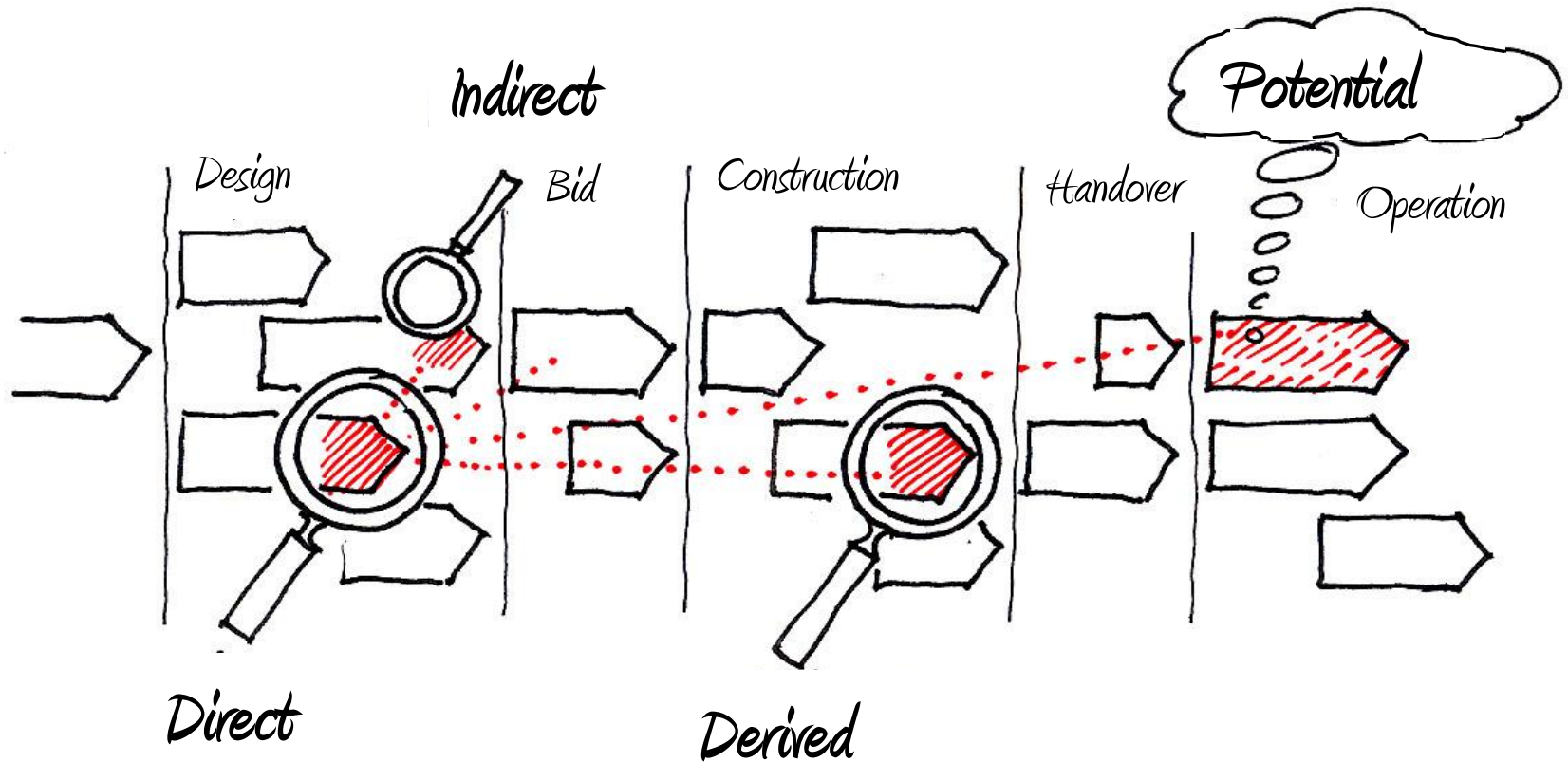


- **Corporate level**
 - decisions are made about BIM strategy
 - Implementation of the working method, etc.

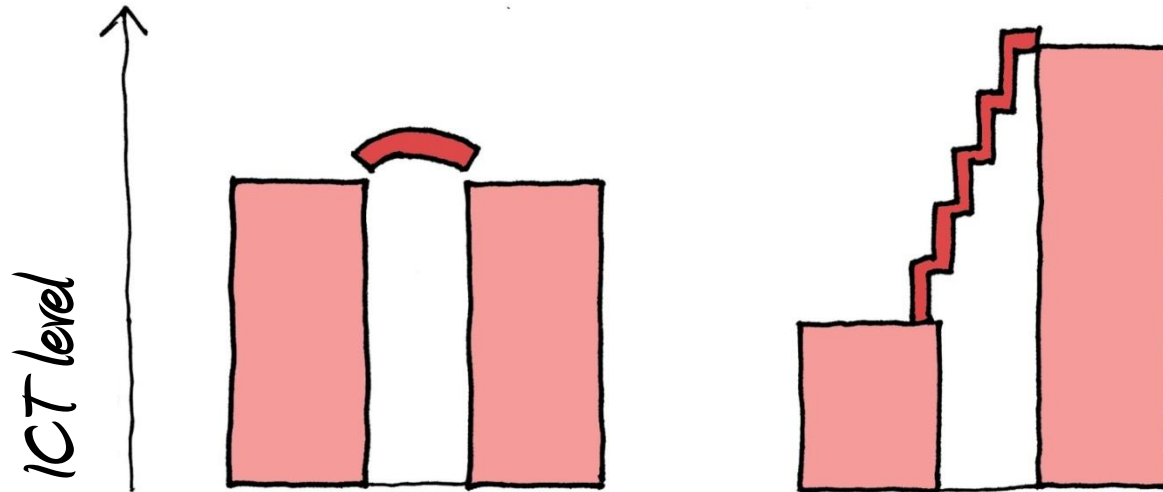
- **Project level**
 - interesting due to client requirements
 - Integrated forms of cooperation

- **Enterprise system**

Identification of benefits and types of benefits



Depth of information



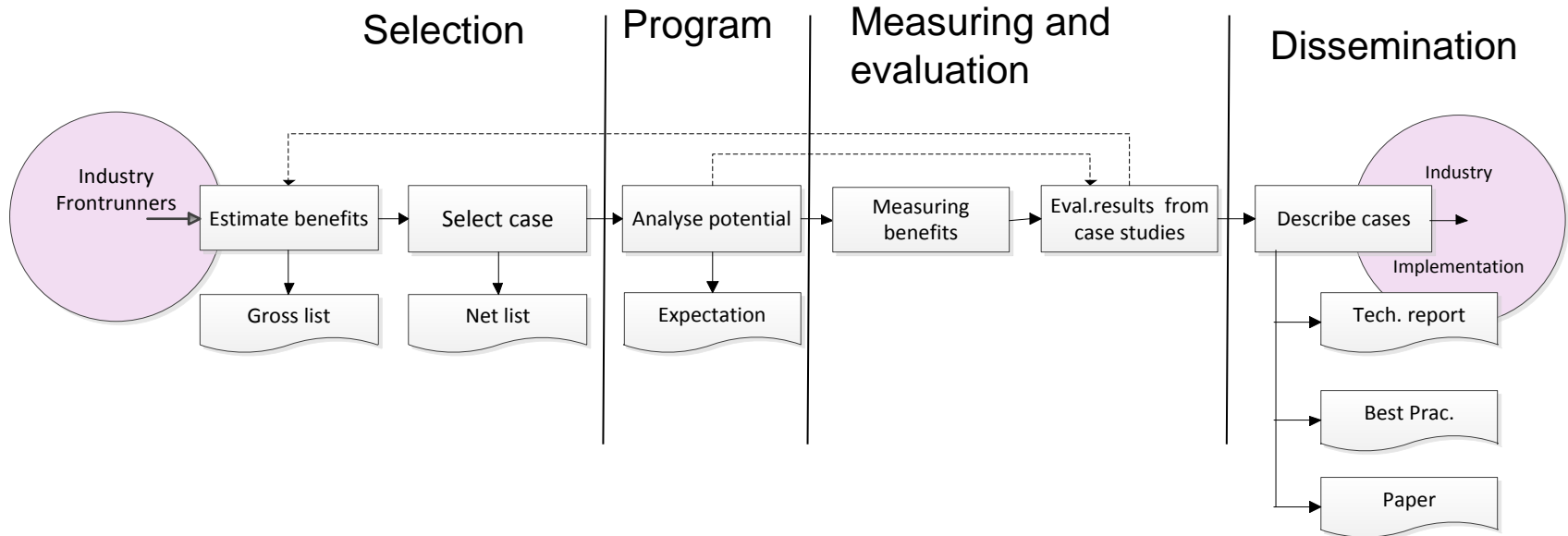
- **The potential depends on the ICT level of all parties**
- **Internally and externally**

ICT concept and level of Impact

	Connected	Disconnected
Inter	4	3
Intra	2	1

- **A process in a company**
- **Integration between multiple processes within a company**
- **A process between several companies (ex. Project bank)**
- **Integration between different processes in several companies**

Measuring method



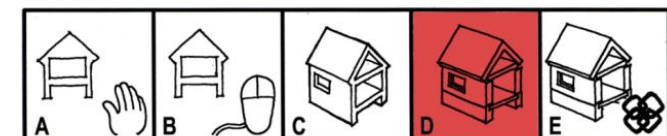
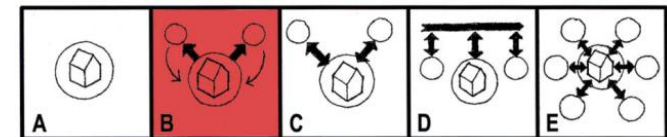
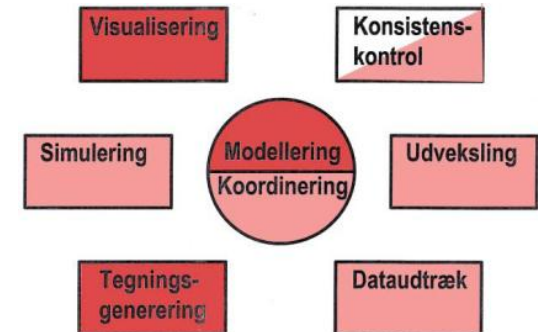
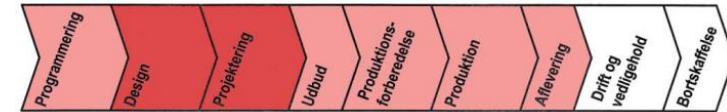
The four cases

- **4 main groups with commitment and skills in BIM**
 - **technological front-end cases**
 - **supplemented with processes from other cases in the portfolio**
- 1. Small architectural company** (Tværsnit Arkitekter, Refurbishment of single-family home)
 - 2. Large Engineering Company** (Rambøll, RHO)
 - 3. Owner and operator and client advisor** (University College UCC as client and Archiwise as BIM coordinator)
 - 4. Large Contractor** (MT Højgaard, KPMG domicile)

Case 01: Small architectural company

Description of the ICT concept

- Coordination of project decisions and engineering solutions
- Coordination with other partners in the project (proprietary exchange with another party (potentially IFC))
- Communication with the client through visualizations of the model (deliverable: rendered 3D images, and potentially building model for viewing)
- Generation of traditional drawing materials directly from the building model with a less extensive finishing
- Simulation of energy level on estimates using the building model and object information
- Digital supply of quantities, drawings and parts lists are generated from the building model. Understanding the bid
- Control and communication solutions in the performance by building model



Case01: Measuring of effects

Gains and costs estimated at the project level for the main consultant

Cost:

Architect	€	1,837
Engineer	€	1,378
Contractor		
Client	€	1,170
Total funding:	€	4,385

Rationalisation gains (direct):

Architect	€	2,015
Engineer	€	1,690
Contractor	€	0
Client	€	22,685
Total:	€	26.390

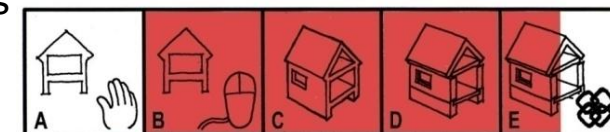
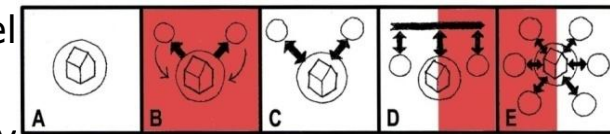
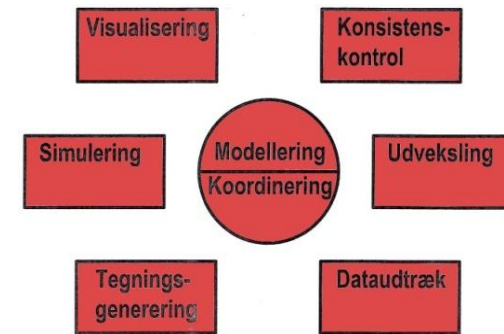
Result:

€ 22.005

Case 02: Large Engineering Company, RHO

Description of the ICT concept

- Establishment of the construction project at the project web and manage project web throughout the design process
- Project management and coordination between consultants model based
- Model Consistency Verification between domain specific models
- The design of steel, concrete and installations model based
- The simulation of the physical properties of the construction
- Simulation of office design on employee involvement
- Communication with the client by visualization of the model
- Generation of drawings from models with a less finishing
- Control and communication solutions in the performance by building models
- Delivery of 'as built' documentation in the form of drawings and building models
- Undertake tender regarding. cleaning contract supporting the digital building model
- Rebuilding / redesign already under execution



Case 02: Measuring of effects

Economic overview of ICT concept case02, engineering company

Cost:

Development and implementation	€ 6,500
Operation costs:	€ 24.500
Total funding:	€ 31,000

Rationalisation gains (direct):

Time saving by consistence project material	€ 45,500
Automation in generation of steel drawings	€ 5.200
Faster reduction of design team during execution	€ 328.300
Plus various non financially measured A-C	A-C
Total:	€ 379.000

Result:

€ 348.000

Reuse: User device and the cleaning contract.

Case 02: Measuring of effects

Economic overview of ICT concept case02, subcontractor Ventilation

Costs:

Procurement of hardware and software	€ 13,500
Implementation and upgrading:	€ 40,000
Total funding:	€ 53,500

Rationalisation gains (direct):

Reduction in time due to coordination between domains	€ 470,000*
Faster execution of subcontractor	€ 27,000
Fewer stop at site (incl. other subcontractors)	€ 27,000
Plus various not financial, measured	A-B
Total:	€ 524,000

Result:

€ 470,500

* The amount may not solely BIM

Summary of preliminary results

- **It is possible to implement a construction project using ICT-based sub-processes and tools within the same economic framework as before.**
- **Reuse of data provides gains. The more times the data reused greater productivity.**
- **Those who invest in new technology harvest gains**
- **The more you invest in relevant tools and skills the more harvest.**
- **Parties that do not use the 3D working method will also get gains. They get the benefits of better coordination and better quality of project documentation.**

Summary of preliminary results

- **There is generally good experiences with ICT implementation. All case study participants will continue in future projects**
- **The immediate gains lies in project coordination and in the later stages**
- **The largest gains are in construction and operation, where the model data used and reuse rates are increasing**
- **The early stages in which the models are created, are costly, but provides a coordinated project material for the benefit of all**
- **Potentials of BIM is not sufficiently used**
- **There are numerous possibilities for data reuse, quality assurance, simulation and data extraction not used**
- **Reasons are lack of leadership initiatives, lack of skills, lack of overview of opportunities and constraints of partners**
- **Focus not on BIM, but against the traditional processes and outputs**

Why potentials not been fulfilled

- **The partners do not have a high enough or matching level of ICT (information depth)**
- **Clients and operators are not demanding model-based data, since they not are able to handle them**
- **The are no direct demand for new business areas / services as they require an investment in the recipient (localization of gains)**
- **Lack of awareness of the potentials due to lack of skills and lack of good examples of utilization**
- **Some processes, primarily the initial, represents costs and no the gains (indirect benefits)**
- **Collaborations, performance agreements, etc. blocks the transfer of fees for the modeling (assumptions)**
- **Much of the focus on technological deficiencies in the software - Suspension of innovation**
- **Lack of standards that can transfer data from platform to platform**

Thank you

