

True or False??

Increase of productivity by 70%

Reduction of inconsistency in documents 95%

Reduction of collisions by 100%

Reduction of bid price by 30%

Reduction of faults on site by 90%

Reduction of cost of FM by 20%

ØG-DDB: Measuring profit by using Open BIM – tools from “Det Digitale Byggeri”

Research project financed by “Danish Building and Property Agency”
“Danish Ministry of Climate, Energy and Building” 2009-2013

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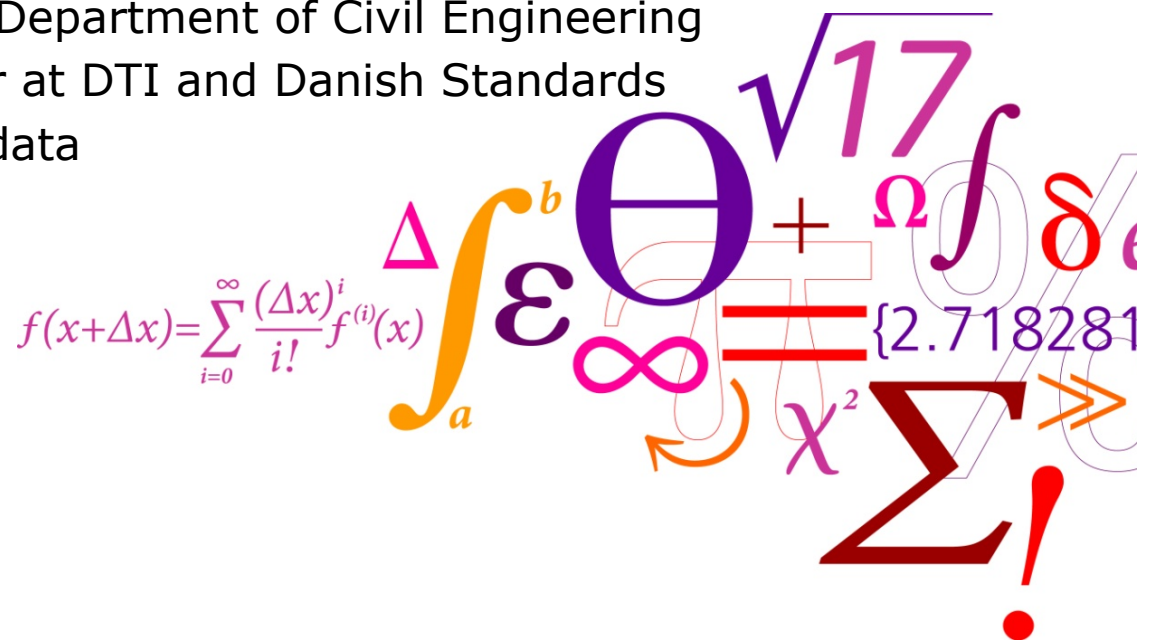
Peter Hauch, architect maa, Arkidata



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Klima-, Energi- og Bygningsministeriet

DTU Byg

Institut for Byggeri og Anlæg



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Morten Steffensen, Danish Building and Property Agency

Agenda

- **The project – background and challenges**
- **The ØG-DDB Manual - method and tools**
- **The outcome of the 4 cases**
- **Other interesting findings**
- **Five minutes for questions**

The material result of the project

Måling af økonomiske gevinster ved Det Digitale Byggeri
Et forskningsprojekt finansieret af Erhvervs- og Byggestyrelsen
ØG-DDB Projektgruppen ved DTU Byg, april 2012

ØG-DDB Teknisk Rapport

Afrapportering af projektet: Måling af økonomiske gevinster ved Det Digitale Byggeri (byggeriets digitalisering)

Forfattere:
ØG-DDB projektgruppen består af:
Flemming Vestergaard, DTU Byg
Jan Karlsbø, DTU Byg
Peter Hauch, Arkidata
Jan Landbrecht, TI og DS
Jan Mouritsen, CBS, Department of Operations Management

Udgiver:
DTU Byg, Danmarks Tekniske Universitet
Klima-, Energi- og Bygningsstyrelsen

Måling af økonomiske gevinster ved Det Digitale Byggeri
Et forskningsprojekt finansieret af Erhvervs- og Byggestyrelsen
ØG-DDB Projektgruppen ved DTU Byg, april 2012

Metodemanualen ØG-MM

Casestudievejebogen

Forfattere:
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ØG-DDB Projektgruppen ved DTU Byg, april 2012

Case01:

BIM hos mindre arkitektrådgiver

Casebeskrivelse

Forfattere:
ØG-DDB projektgruppen består af:
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ØG-DDB Projektgruppen ved DTU Byg, april 2012

Case03:

BIM hos driftsherre og byg- og driftshererrådgiver

Casebeskrivelse

Forfattere:
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ØG-DDB Projektgruppen ved DTU Byg, april 2012

Case02:

BIM hos større ingeniørrådgiver

Casebeskrivelse

Forfattere:
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Flemming Vestergaard, DTU Byg
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Peter Hauch, Arkidata
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Et forskningsprojekt finansieret af Erhvervs- og Byggestyrelsen
ØG-DDB Projektgruppen ved DTU Byg, april 2012

Case04:

BIM hos større entreprenør

Casebeskrivelse

Forfattere:
ØG-DDB projektgruppen består af:
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Jan Karlsbø, DTU Byg
Peter Hauch, Arkidata
Jan Landbrecht, TI og DS
Jan Mouritsen, CBS, Department of Operations Management

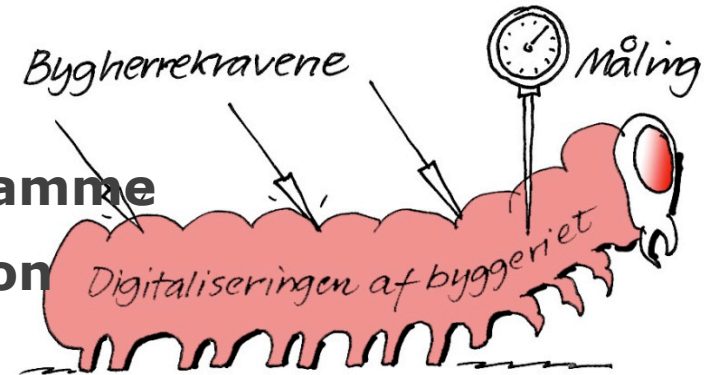
Udgiver:
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Homepage?
Blog?
English version?



Background and Challenges

- **DDB – the Digital Construction Programme**
 - **The Government PBO-ICT-specification**
 - **Bedst Practice in Construction**
 - **Implementation Network**
-
- **There are economical benefits using ICT/BIM**
 - **The benefits are widely distributed among processes and agents**
 - **The benefits are difficult to localize and to quantify**
 - **There is a need to identify and calculate cost and benefit/profit**
 - **Cowi-report and the famous 17 billion.dkr.**
 - **This project is an attempt to identify cost and benefits by using BIM**



Measuring cost and profit in construction 1

- **We have no tradition for historic cost- and profit statistics in the industry**
- **We have no tradition for historic cost- and profit statistics within the companies in the industry**
- **Cost and profit within ICT and BIM are widely spread**
- **You must study cost and profit within the value chain**
- **The market effect evens all difference**

Measuring cost and profit in construction 2

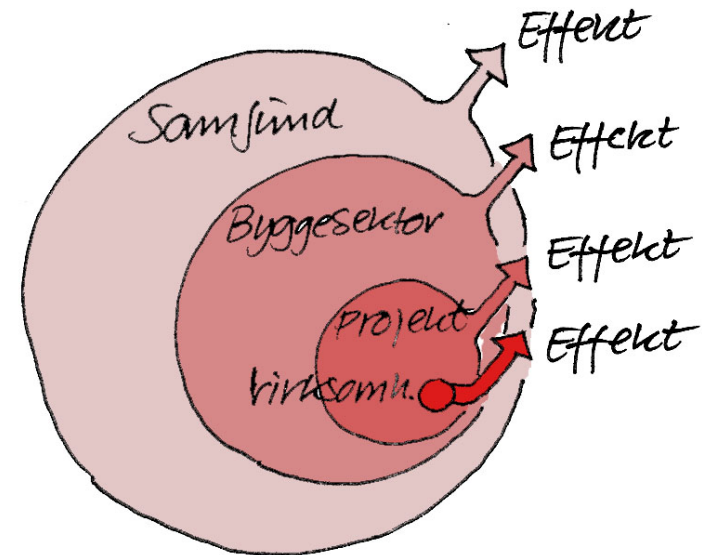
- **Measuring cost and profit within cases and projects in real life**
- **Objectivity**
- **Exact measurement – when possible**
- **Estimates supported by experience, cross-check and structured documentation**

- **We specify “the context” and the “conditions”**
- **We want it to be possible to reproduce our results**
- **We want others – including companies – to be able to compare and to benchmark**

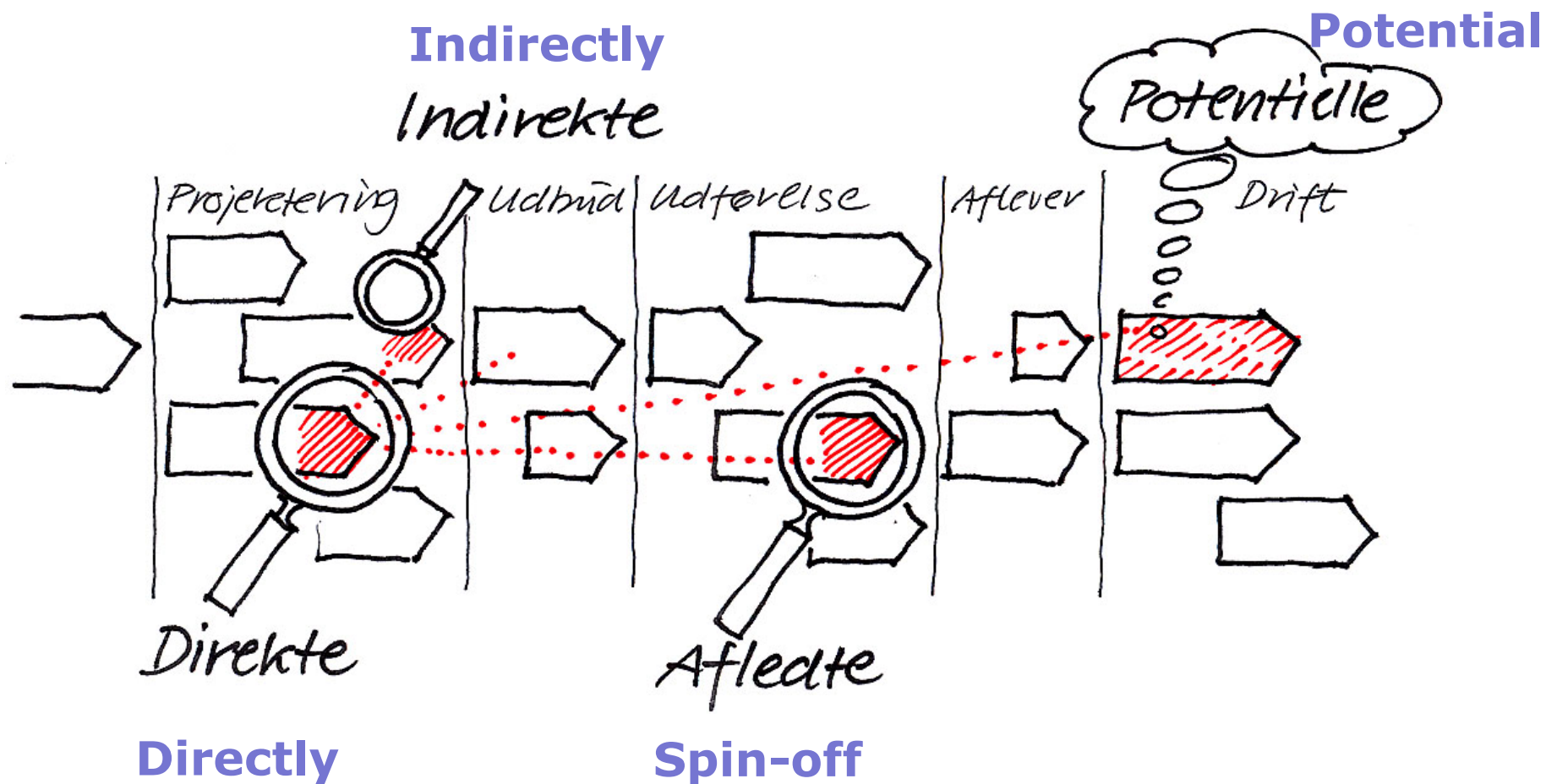
Target levels

We look at all elements of the value chain – inside out

- The company system in the industry
- The Company level
 - decides on BIM-strategy,
 - decides on development of methods, tools, qualifications and collaboration within projects
- Project level
 - government PBO-ICT-Specification related to projects
 - collaboration with others take place within projects
 - ICT/BIM-setup is decided within the project



Identifying profit - type of benefit 1



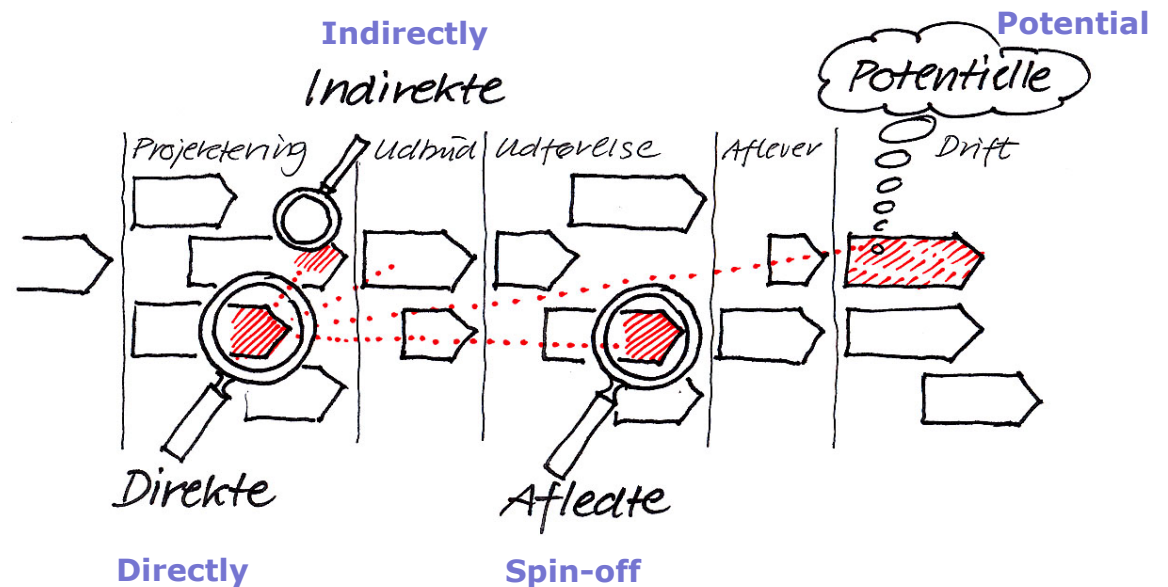
Identifying profit - type of benefit 2

Increase of productivity directly or indirectly

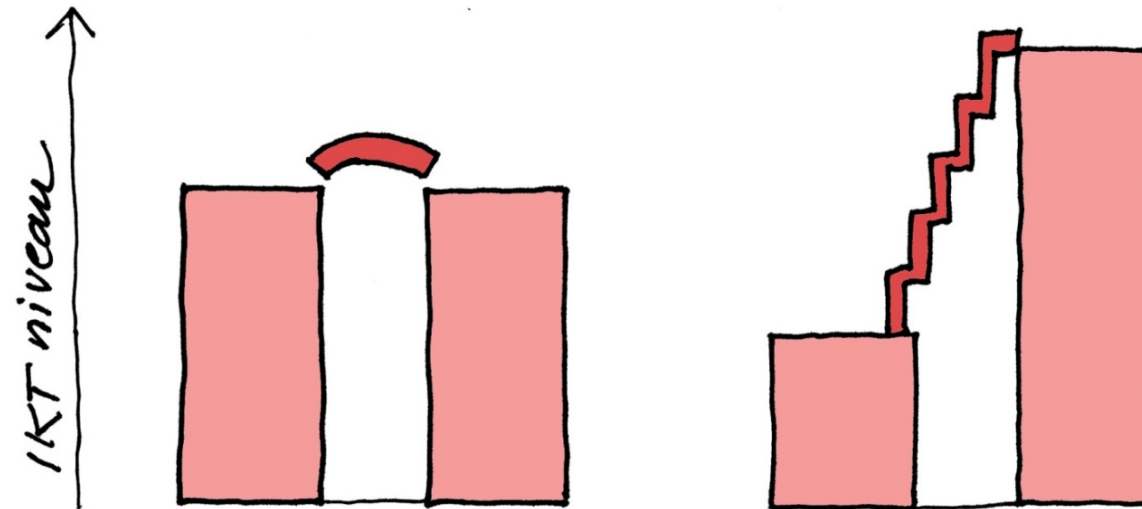
Increase of quality – in the project, in the process or in the result

Financial – cost of production, cost of product

Collaboration internally and/or externally



Level of information – level of ICT/BIM



- **The potential is dependent of the level of ICT/BIM with all parties working in the project**
- **And of the level of information exchanged**
- **Internally as well as externally**

ICT-concept – Effect levels

IKT-konceptets anvendelse
(dataudveksling mellem værktøjer)

coupled
decoupled

Inter – between partners
Intra – between processes within one company

IKT-konceptets anvendelse
(organisatorisk domæne)

		Koblet	Dekoblet
IKT-konceptets anvendelse (organisatorisk domæne)	Inter	4	3
	Intra	2	1

- **One process within one company**
- **Integration between processes within one company**
- **Process involving several companies (ie. Project web)**
- **Integration involving several processes within several different companies**

Chains of conditions – risc-valuation

Conditions

Forudsætninger

Standarder
Metoder
Værktøjer
Konkretiseringsniv.
Kompetencer
Virksomhedstyper
IKT-niveau
Investeringer
Forretningsområder
Organisationstyper
Arbejdsdeling

Processes

Aktiviteter

Modellering
Konsistenskontrol
Dataudtræk
Tegningsgenerering
Simulering
Visualisering
Udveskling
Kommunikation
Kvalitetskontrol
...

Effects

Effekter

Direkte	<i>Virksomh.</i>	<i>Projekt</i>	<i>Bygge felter</i>	<i>Samfund</i>
Direct				
Indirekte				
Indirect				
Afledte				
Spin-off				
Potentielle				
Potential				

- Technology, standards, work method, ICT/BIM-level
- Competence, company, participants within the project
- Company relations and level of integration in the project
- Laws and regulations, performance specifications, contracts

ØG-DDB Manual

Detailed specification – “How to do Manual”



A detailed specification of the method used meant for others to use.

Available for all within the sector – organisations, **companies**, research etc.

More cases and more benchmarking.

ØG-DDB Manual

List of Contents



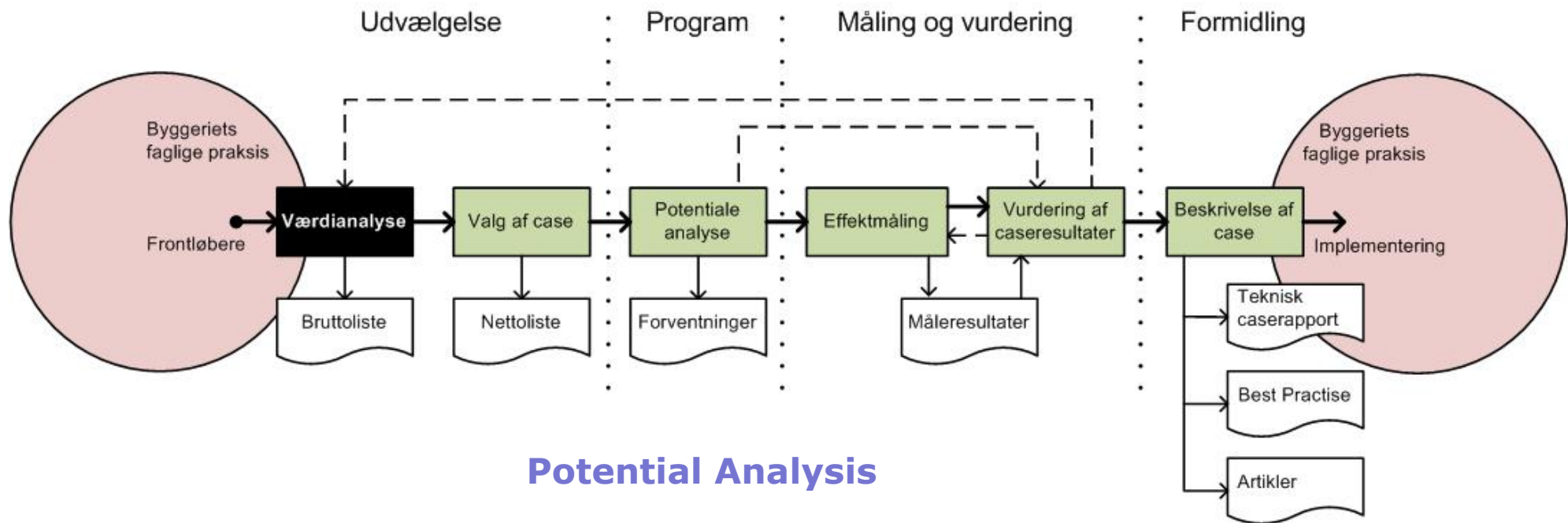
- Story board for a case study
- Value analysis
- How to choose the case
- Potentials
- Expected findings
- Measuring the effects
- Checklists and schemas
- Excel spreadsheets
- Evaluating the results
- QA
- Describing the case

Udviklings- og implementeringsomkostninger		Type af omkostning (direkte, indirekte, afledt og potentiel)	Omkostninger (DK)	
			Engangsbeløb	Pr. år
A	Udviklingsindsats			
	1. Udvikling/tilpasning af IKT-konceptet		kr 0	
	2. Ekstra udviklingspersonale		kr 0	
B	Ny hardware			
	1. Computere, printere, kommunikationsudstyr		kr 0	
	2. Andet		kr 0	
C	Ny software			
	1. Softwareindkøb		kr 0	
	2. Andet		kr 0	
D	Brugertræning			
	1. Uddannelse/træning		kr 0	
E	Implementering			
	1. Organisatoriske ændringer			
	2. Arbejdsræssige ændringer			
	3. Udarbejdelse af manualer etc.			
	4. Installation			
F	Andet:		kr 0	
			kr 0	
Driftsomkostninger				
A	Soft- og hardware vedligeholdelse			
			kr 0	
B	Datavedligeholdelse			
C	Opgraderinger			
D	Leje af software og hardware			
E	Helpdesk			
F	Andet:			
Totalomkostninger (Udvikling+implementering+drift)				
			kr 0	
			kr 0	
			kr 0	
			kr 0	
			kr 0	
			kr 0	

Story board – and Toolbox

Select Case

Measure, Evaluate and QA



Potential Analysis

Present and Communicate

ØG-DDB Manual – Spreadsheets examples



Dokumentnavn: Effektivisering, Værdianalyse
 Dokumenttype: Værktøj
 Dokumentansvarlig: Caseansvarlig
 Draft udfyldt af: Navn: Navn, Virksomhed
 Date: ????-??

ØG DDB
 EBST

IKT-koncept beskrivelse

Virksomhedstype	Virksomhedsstørrelse	Projekttype	BIM hovedaktiviteter	Samarbejdsrelationer	Integration	Modelrepræsentation	Bygherrekrav	Målgruppeniveau	Værdi							
										A	B	C	D	E	1	2
Arkitekt	Byggherren	Investor	Bygherren	Bygherren	Bygherren	Bygherren	Bygherren	Bygherren	Bygherren							
Byggherren	Byggherren	Byggherren	Byggherren	Byggherren	Byggherren	Byggherren	Byggherren	Byggherren	Byggherren							
Byggherren	Byggherren	Byggherren	Byggherren	Byggherren	Byggherren	Byggherren	Byggherren	Byggherren	Byggherren							

Delprocesser

Generelt

Programmering

Design

Projektering

Dokumentnavn: Effektivisering, 3D arbejdsmetode
 Dokumenttype: Værktøj
 Dokumentansvarlig: Caseansvarlig
 Draft udfyldt af: Navn: Navn, Virksomhed
 Date: ????-??

ØG DDB
 EBST

Potentialeliste
 Gevinstbeskrivelse
 Generelt:

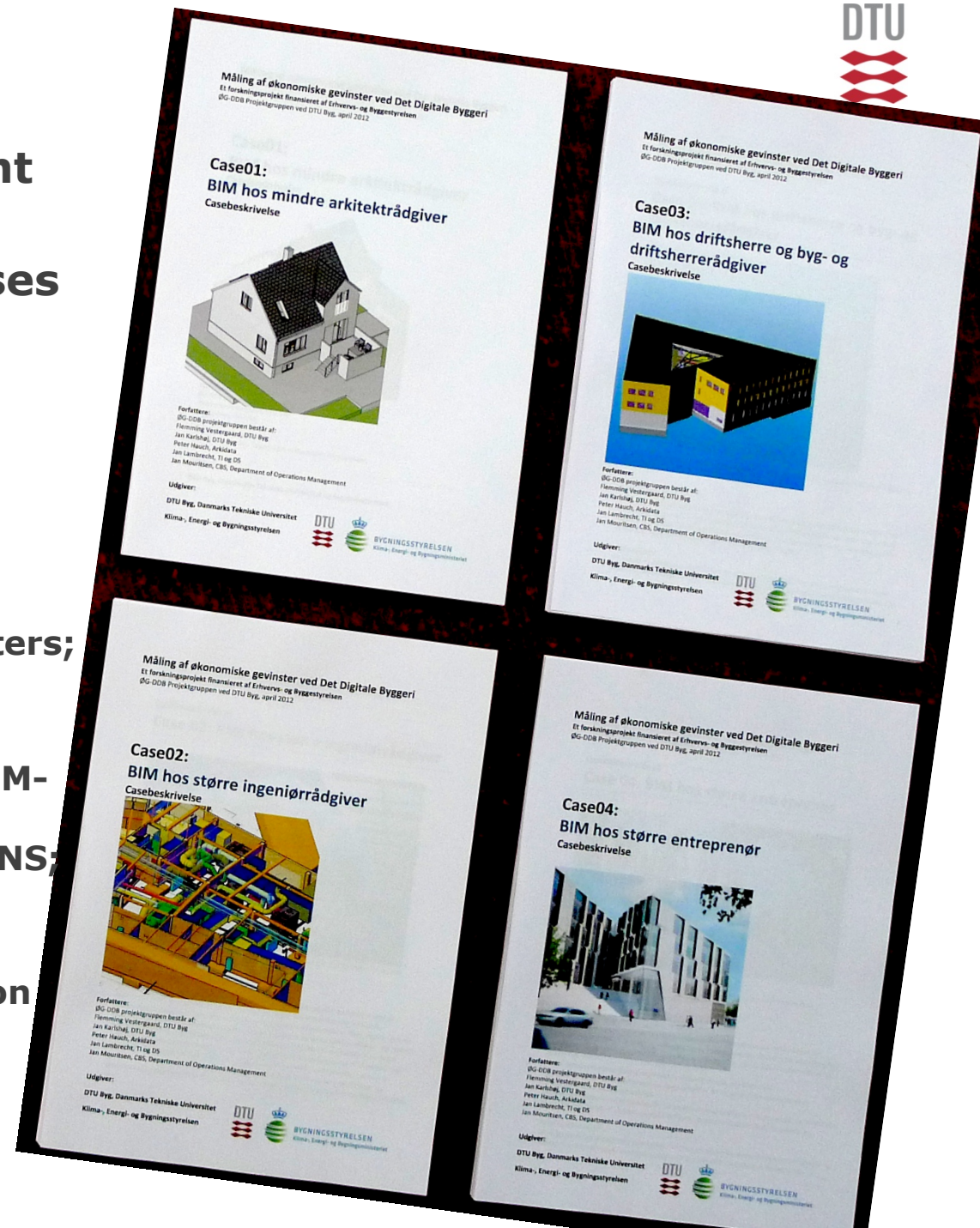
Gevinstbeskrivelse	Type	Måleparameter (evt. alternativ)	Målgruppe
Samarbejde Større arbejdsglæde gennem et integreret samarbejde mellem projektets virksomheder og deres medarbejdere. Bedre projektd udvikling og forbedrede arbejdsprocesser ved 3D arbejdsmetode. Kortere procesider.	Ikke finansiel	eller estimat på en produktivitetstremgang	alle parter
Projektledeelse Færre fejl grundet bedre konsistens i projektmaterialet. Større pålidelighed af projektmaterialet gennem 3D modellering, concurrency.	Finansiel	eller estimat på en produktivitetstremgang	alle parter
Risikostyring Bedre kvalitet af projektdokumentationen – og af informationerne. Bedre beslutningsstøtte via adgang til flere informationer.	Finansiel	et måling på tidsreduktion måling/estimat på sparet tid ved fejrtretning og færre konflikter og stop på byggepladsen	alle parter
Kommunikation Forbedret 'risk management', reduktion i usikkerheder. Bedre kommunikation mellem aktørerne i værdikæden. Bedre overblik og transparens i projekt og proces.	Ikke finansiel	eller estimat på tidsreduktion i de enkelte processer (vil kunne måles ved konkrete processer - se under faserne)	alle parter
Økonomi Forbedret 'risk management', reduktion i usikkerheder. Bedre kommunikation mellem aktørerne i værdikæden. Bedre overblik og transparens i projekt og proces.	Ikke finansiel	eller estimat på tidsreduktion i de enkelte processer (vil kunne måles ved konkrete processer - se under faserne)	alle parter
Branding Bedre mulighed for at udvikle nye, modelbaserede forretningsområder. Afløring af procesresultater til tiden. Forbedret mulighed for innovation, grundet IKT-værktøjer og 3D arbejdsmetoder.	Ikke finansiel	estimat på en tidsreduktion	alle parter
Human resources Branding som teknologisk ledende i 3D og BIM. Forbedret mulighed for større kompleksitet i bygningsdesignet.	Ikke finansiel	estimat på en tidsreduktion	alle parter
Programfasen: Bedre mulighed for at fastholde og rekruttere innovative medarbejdere.	Ikke finansiel	eller estimat på tidsreduktion i de enkelte processer (vil kunne måles ved konkrete processer - se under faserne)	alle parter
	Ikke finansiel	registrering af opfyldelse af afleveringsaftaler eller estimat på tidsreduktion i processer	alle parter
	Ikke finansiel	underbygget ved fastholdelse af kunder samt tiltrækning af nye	alle parter
	Ikke finansiel	vurdering på skala	alle parter
	Ikke finansiel	rådgivere, udførende og bygherre	alle parter

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The four cases

- 4 groups with engagement and BIM-competence
- Front-end/higher end cases

1. Tværsnit: Small architects firm specializing in; renewal of one family house; 1.8 Mill. Dkr.
2. Ramboll: Major Engineering Consultant; Ramboll Headquarters; 100 Mill. Dkr.
3. Archiwise and UCC: BOC and BIM-coordinator, Building Owner/ Facility Manager; UCC Campus NS; 65 Mill. Dkr.
4. MT Hojgaard: Major Construction Company; KPMG Headquarters CPH; 1 Bill. Dkr.



The four cases – Value chain



Detailed design
Tender process
Production planning
Delivery
FM
Disposal

	Program	Design	Projektering	Udbud	Produktions forberedelse	Produktion	Aflevering	Drift og vedligehold	Bortskaffelse
Case01	Light	Dark	Dark	Dark	Light	Light	Light		
Case02		Light	Dark	Dark	Dark	Light	Light	Light	
Case03			Light	Dark	Dark	Dark	Dark	Dark	
Case04		Light	Dark	Light	Dark	Dark	Dark		

The four cases – Process and Activity



Coordination
 Consistency control
 Data exchange
 Simulation
 Data analysis
 Drawing prod.
 Visualisation

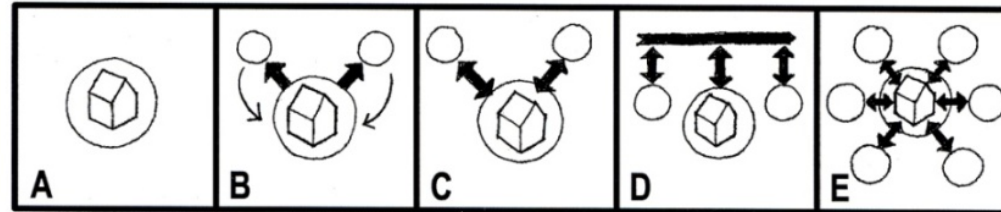
	Modellering	Koordinering	Konsistens kontrol	Udveksling	Simulering	Dataudtræk	Tegnings generering	Visualisering
Case01	Dark Red	Light Red	Light Red	Light Red	Light Red	Light Red	Dark Red	Dark Red
Case02	Dark Red	Dark Red	Dark Red	Dark Red	Dark Red	Dark Red	Dark Red	Dark Red
Case03	Dark Red	Dark Red	Dark Red	Light Red	Dark Red	Dark Red	White	White
Case04	Dark Red	White	Light Red	Light Red	White	Light Red	Dark Red	Dark Red

The four cases – Model level



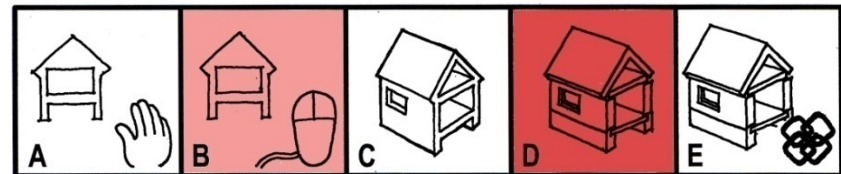
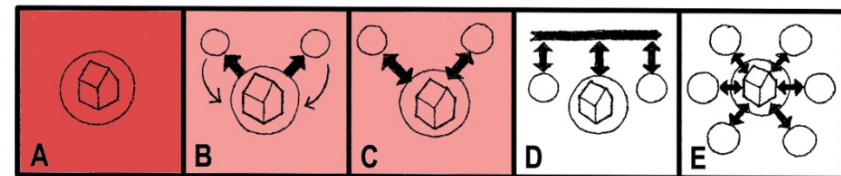
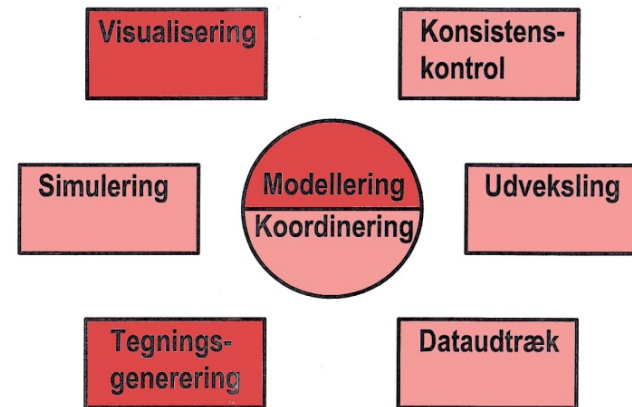
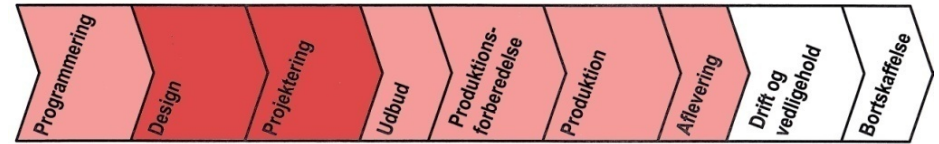
	A	B	C	D	E
Case01					
Case02					
Case03					
Case04					

The four cases – Data exchange and Collaboration



	A	B	C	D	E
Case01					
Case02					
Case03					
Case04					

Case01: BIM at the smaller architects



Case01: Financial findings – summary



Benefits and cost at the project level by all participants

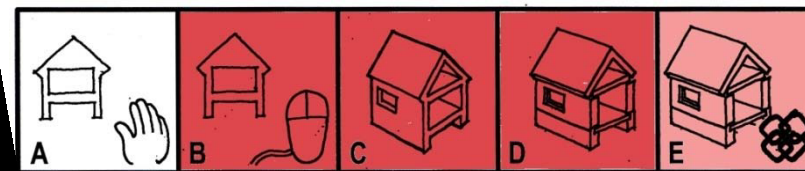
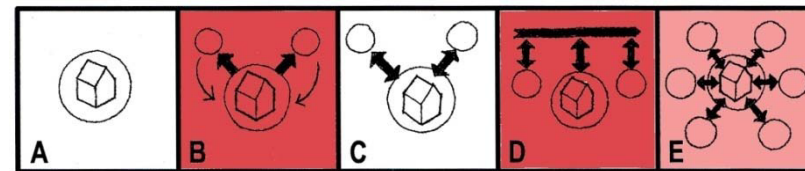
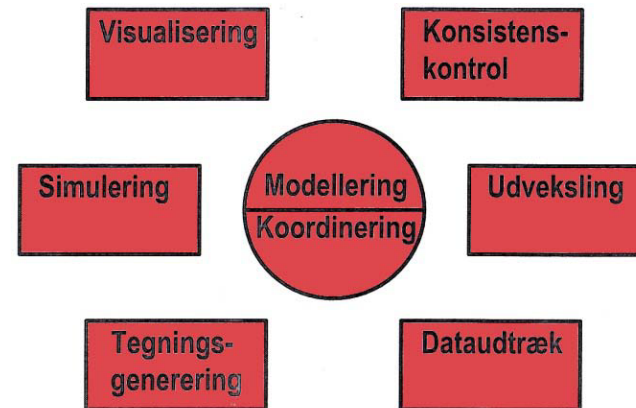
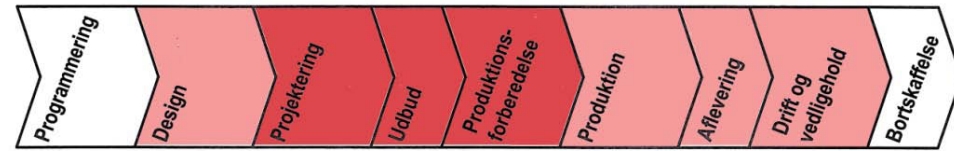
Projektniveau: Samlede gevinster og omkostninger for aktørerne	Gevinst, Omkostning og resultat finansielt	Gevinst værdiasat ikke finansielt
Samlet projekt (byggesum: 1.800.000)		
Gevinster		
Arkitekt	15.500	A
Ingeniør	13.000	A
Entreprenør	0	B
Bygherre indløst	183.500	A
<i>Gevinster total</i>	212.000	Meget højt
Omkostninger		
Arkitekt	16.311	
Ingeniør	12.350	
Entreprenør	0	
Bygherre	9.000	
<i>Omkostninger total</i>	37.661	
<i>Netto resultat</i>	174.339	Meget højt

Case01: Other findings – summary



- **For the two smaller consultants there are benefits by using BIM. Even though the fee is the same as normal there are benefits that comfortably outbalances the cost.**
- **The BIM-method resulted in a more consistent project, better communication, better flow, less faults and no claims – all in all less time and trouble for the consultants.**
- **The high project quality resulted in a better economic result for the contractor and a 10% reduction of the contractors bid price. We can conclude, that both the building owner and the contractor benefitted from the spin-off of the 3D model.**
- **The model was used as the basis for simulation of energy consumption. The result of this is a low-energy house. The building owner will benefit from this during a long period of time – and so will society.**

Case02: BIM at the major engineering comp.



Case02: Financial findings – summary



Benefits and cost by using design models

Hovedproces 1: Projektledelse og projektering med brug af fag- og fællesmodeller									
Delprocesser	Gevinst- type	Hovedrådgiver	Fagrådgivere	Fagentreprenør	Bygherre	Driftsherre	Brugere	Gevinst målt i kr. eller procenter	Gevinst- niveau for ikke finansiel le effekter
Hovedrådgiver:									
Bedre kommunikation med samarbejdspartner	Direkte								A
Mindre behov for fysisk kommunikation	Direkte								C
Mere konsistent projektmateriale, reduktion af fejl, eksempel: dørentreprise	Direkte							350.000	
Hurtig ændring og opdatering af projektmat.	Direkte								B
Automation ved generering af ståltegninger	Direkte							40.000	
Hurtig afvikling af projekteringsteamet	Direkte							3.767.500	
Medarbejderinvolvering	Indirekte								A
Bedre motivation	Indirekte								C
Bedre procesforståelse gennem BIM	Indirekte								A
Aflevering til tiden, delvis BIM	Indirekte								A
Bedre indeklima grundet simulering af bygningsfysiske egenskaber	Afledte								A
Mulighed for større kompleksitet i bygningsdesign	Afledte								B
Målte gevinster total								4.157.500	Højt
Omkostninger									
Årlige afskrivninger								50.000	
Driftsomkostninger								189.000	
Målte omkostninger								239.000	
Netto resultat		Direkte						3.918.500	

Case02: Financial findings – summary



Benefits and cost in production planning and logistics by Ventilation Contractor

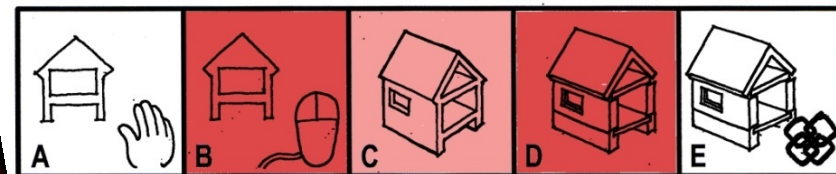
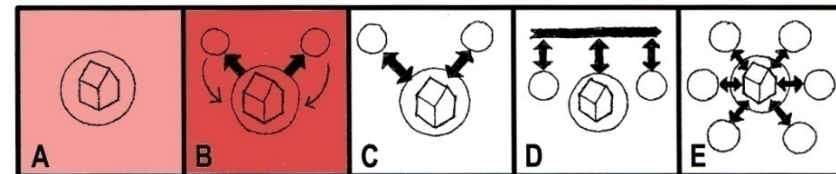
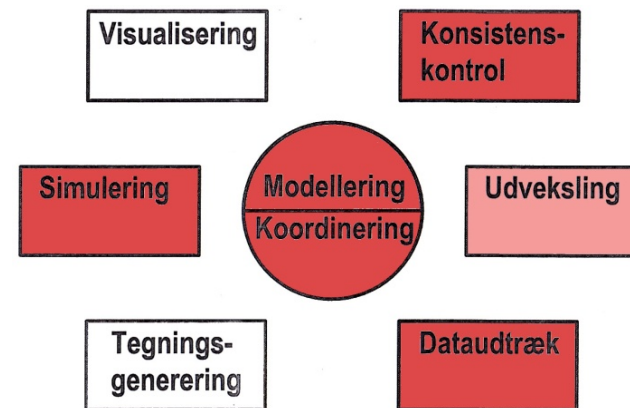
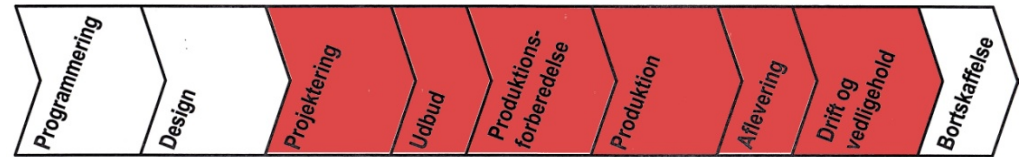
Hovedproces 2: Udbud/tilbud og produktionsforberedelse									
Delprocesser	Gevinst- type	Hovedrådgiver	Fagrådgivere	Fagentreprenør	Bygherre	Driftsherre	Brugere	Gevinst målt i kr. eller procenter	Gevinst- niveau for ikke finansielle effekter
Hovedrådgiver:									
Tidsreduktion ved bedre koordinering mellem fagmodeller	Direkte								B
Informationsoverførsel til stålleverandør	Direkte							15%	
Fagentreprenør, Ventilation (entreprisenum: 36 mio. kr.)									
Reduktion i tilbud til supplerende arbejde	Afledte								IM
Reduktion i tid ved koordinering af fag	Afledte							3.240.000 15 %	
Fagentreprenør, VVS									
Reduktion i tid og spild ved digital materialebestilling	Afledte							20-25 %	
Fagentreprenør, El									
Hurtigere overblik over projektet									B/C
Målte gevinster total								3.240.000 15-25 %	Højt
Omkostninger									
Hovedrådgiver									Registreret under hovedproces 1
Fagentreprenør, Ventilation								133.333	
Fagentreprenør, VVS								0	
Fagentreprenør, El								0	
Målte omkostninger ialt								133.333	
Netto resultat	Afledte							3.376.667	

Case02: Other findings – summary



- **It was possible to carry out the BIM-modelling within the same economy as normally. There is a benefit even if you only communicate through traditional documents – because they are of a higher standard.**
- **Ramboll played several roles within the project and could benefit within several areas. A major win was the faster closing down of the project team worth 3.8 Mill. Dkr.**
- **There are benefits to pick up for all contractors in the case. But there is a greater benefit the more you invest and collaborate with others based on the model.**
- **The Ventilation contractor reduced coordination cost by 3.5 Mill. Dkr., reduced the time spent on site by 15-20% and reduced flow stop by 85–90%.**
- **Finally the model was used when tendering the cleaning- and service-contract, resulting in a 30% price reduction.**

Case 03: BIM at BOC and BIM consultants



Case03: Financial findings – summary



Benefits and cost at the project level by Building Owner

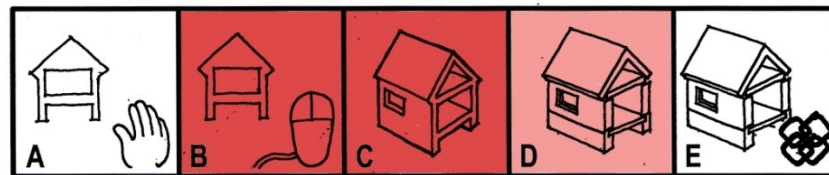
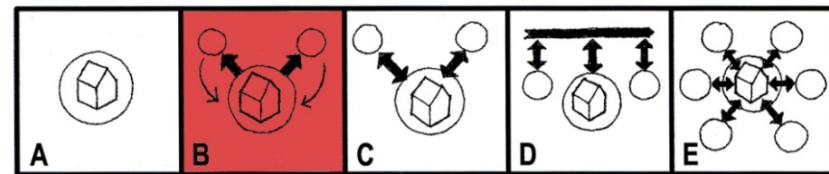
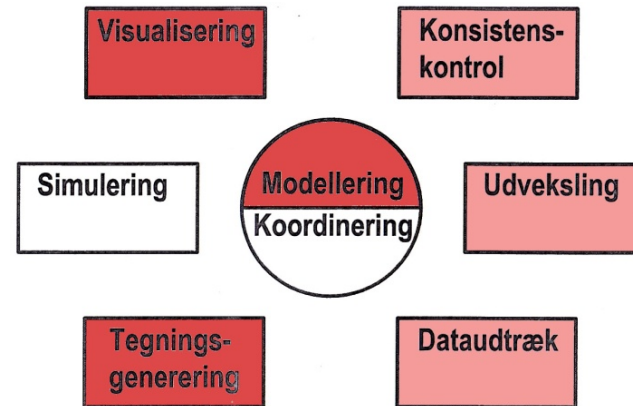
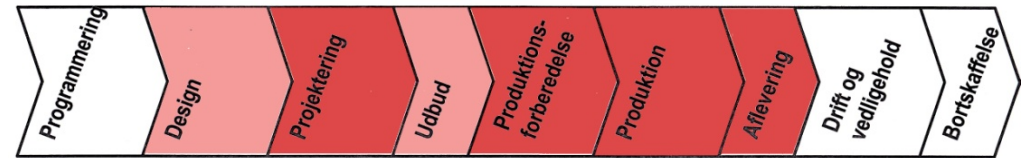
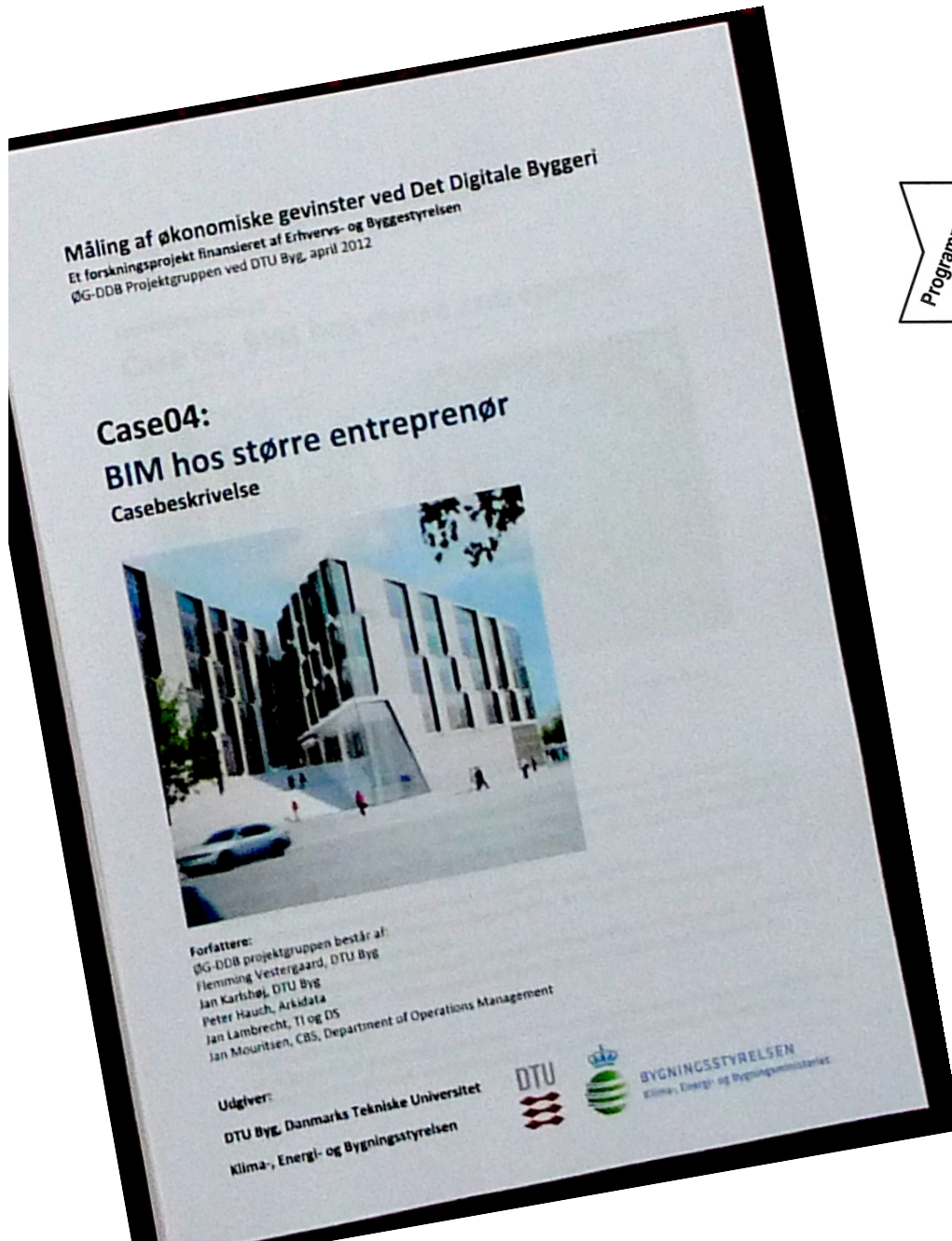
Samlet resultat for by- og driftsherre for finansielle gevinster										
Delprocesser	Gevinst- type	Projektlede	Rådgivere	Entreprenør	Bygherre	Driftsherre	D&V-	Brugere	Gevinst målt i kr.	Gevinst- niveau for ikke finansielle effekter
Byg- og driftsherre (anlægssum 65 mio. kr.)										
Hovedproces 1 Bygherrerådgivning under projektering med brug af styringsmodel	Direkte								1.450.000	Højt
Hovedproces 2 Udbud/tilbud og produktionsforberedelse	Direkte								7.560.000	-
Hovedproces 3 Udførelse på byggeplads	Direkte								307.000	Højt
Hovedproces 4 Aflevering og drift og vedligehold	Direkte								*9.000.000	Højt
Målte gevinster for driftsherren total	Direkte								18.317.000	Højt
Omkostninger										
Samlede omkostninger for IKT-konceptet									938.000	
Samlet nettoresultat for driftsherren									*17.379.000	

Case03: Other findings – summary



- **There are benefits within all processes. The major benefit in the design phase is the better and more consistent project with much less faults and deficiencies – representing a benefit worth 1.2 Mill. Dkr. , a 250.000 Dkr. reduction on establishing the basis for FM.**
- **The major benefit was a 15% reduction of the tender price equivalent to 7.56 Mill. Dkr.**
- **Closer follow up the economy reduced mortgage by 307.000 Dkr.**
- **The FM-body calculates a reduction of FM-costs by 15% equivalent to 7.56 Mill. Dkr. In a 15 year perspective this gives a calculated value of today at 9 Mill. Dkr.**
- **The case seems to confirm that the BO-FM can profit very much by insisting on the use of BIM – from programming to FM.**

Case 04: BIM at the major contractors



Case04: Financial findings – summary



Benefits and cost at the project level by the engineering shop

Samlet resultat for hovedentreprenør og ingeniørrådgiver for finansielle gevinster										
Delprocesser	Gevinst-type	Hovedentrepren	Hovedrådgiver	Rådgivere	Entreprenører	Bygherre	Driftsherre	Brugere	Gevinst målt i kr.	Gevinst-niveau for ikke finansielle effekter
Hovedentreprenør/rådgiver (samlet byggesum 1 mia. kr., konstruktionsrådgivning 6 mio.kr.)										
Hovedproces 1 Projektering med brug af fagmodeller	Direkte								0	Højt
Hovedproces 2 Udbud/tilbud og produktionsforberedelse	Direkte								80.000	Middel
Hovedproces 3 Udførelse på byggeplads	Direkte								750.000	Højt
Målte gevinster for hovedentreprenøren total	Direkte								830.000	Højt
Omkostninger										
<i>Samlede omkostninger for IKT-konceptet, hovedentreprenør/rådgiver</i>									*506.333	
Samlet nettoresultat for hovedentreprenøren/rådgiver									*323.667	

Case04: Other findings – summary



- **The total cost of this “low-end” BIM implementation sums up to 1 Mill. Dkr. including training, development of object library, new processes etc. This must be considered as an investment to be distributed between several projects.**
- **If we distribute the cost between three projects it is 333.333 Dkr. for each project. Already the second time the concept is in use there is a benefit of 300.000 Dkr. on a similar project.**
- **The contractor has within his design engineering shop implemented a BIM-based practise to improve and reduce the cost of one of his major functions – shop drawing production. This pays back even after being used only twice, and even without realising an enormous potential within calculation, bidding, production planning, production flow etc. etc.**
- **A step-by-step implementation of this kind can pay off – but you will not be able to realize the full potential of BIM.**

Cross case summary 1

- on implementation

- **You can do a step-by-step transformation from document based collaboration to BIM.**
- **Start with simple, model based processes like generation of drawings and collision- and consistency control.**
- **You can benefit from these low-end implementations at each step.**
- **Those cases representing the most intensive use of the BIM-model in most processes also show the best results.**

Cross case summary 2

- on user response



- **All those who have implemented BIM-like technology and -methods will never go back.**
- **BIM-methods give a better coordination between disciplines and more valid data.**
- **BIM? - is no longer a question of IF – but WHEN.**
- **The Government PBO-ICT-Specifications bring us in the right direction.**
- **BIM and the following change in processes has a positive impact on collaboration and on the climate within the project.**

Cross case summary 3

- is the cost frightening?



- **A stepwise upgrade from CAD to BIM can balance over a very short period of time and within few cycles.**
- **Start sub optimizing your well-known key workflows.**
- **BIM- and document based workflows can coexist within the company and the project, but it minimizes potential.**
- **The cost is on lifting qualifications and developing and implementing new workflows and collaboration – not on ICT-tools.**
- **Size is no big deal. The smaller company can easily do a total implementation – but so can a small department.**

Cross case summary 4

- focus on data-exchange and reuse of data



- **The more times you use and reuse BIM-data (where it gives a meaning and adds value for the user) the more you - and others - benefit.**
- **Those participants who are aware of their possibility to reuse data from the model to support their own processes are those that benefit the most.**
- **It is a challenge to your creativity and knowledge to figure out how to reuse BIM-data in your workflow, how to change your workflow and maybe even move into new business areas. This counts for both the manager and for the man I the shop and on site.**

Cross case summary 5

- everybody is a winner – it is a win-win

- **The benefits are bigger within the project than within the company.**
- **The more you invest in competence, new workflows and in collaboration – the more you benefit.**
- **Even sub optimizing a single process can be a winner.**
- **Productivity boosts with each repetition.**
- **Your partners in the project that do not invest in ICT/ BIM will also benefit – but less than you.**
- **Keep and recruit valuable employees through BIM**

Cross case summary 6

- Who will harvest?



- **The direct and indirect benefits reflect the cost within the company, and the benefits are often caused by automation.**
- **The spin-off benefits you find within the project where the cost is unevenly distributed. Some sow others reap.**
- **Someone has to take the initiative – and the initial cost.**
- **Integration and interdisciplinary collaboration is not in the way of getting a hand on the benefits – on the contrary – it can open up for the even bigger win.**

True! – depending on - - -

Increase of productivity by 70%

Reduction of inconsistency in documents 95%

Reduction of collisions by 100%

Reduction of bid price by 30%

Reduction of faults on site by 90%

Reduction of cost of FM by 20%

Why doesn't everybody do it?

Questions?

Thank you!

Se an extended version of the slideshow at
BuildingSMART.NO

In two weeks time you will also find the reports there.

Contact: hauch@arkidata.dk

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

