[integrate]

DISCRETE EVENT SIMULATION

A PRACTITIONERS POINT OF VIEW

Integrate, June 2017

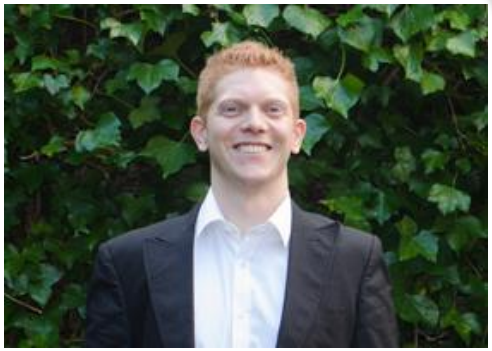
Agenda

[integrate]

- What is Integrate?
- How do we work with simulation?
- Simulation tool - Enterprise Dynamics®
- Cases from real life
- Recap and round-off

Me..

- Dan Knudsen
  - Master of Science and Technology in Engineering - Operations and SCM (Civilingeniør)
  - Integrate since 2013



What is Integrate?

[i n t e g r a t e]

Behind Integrate

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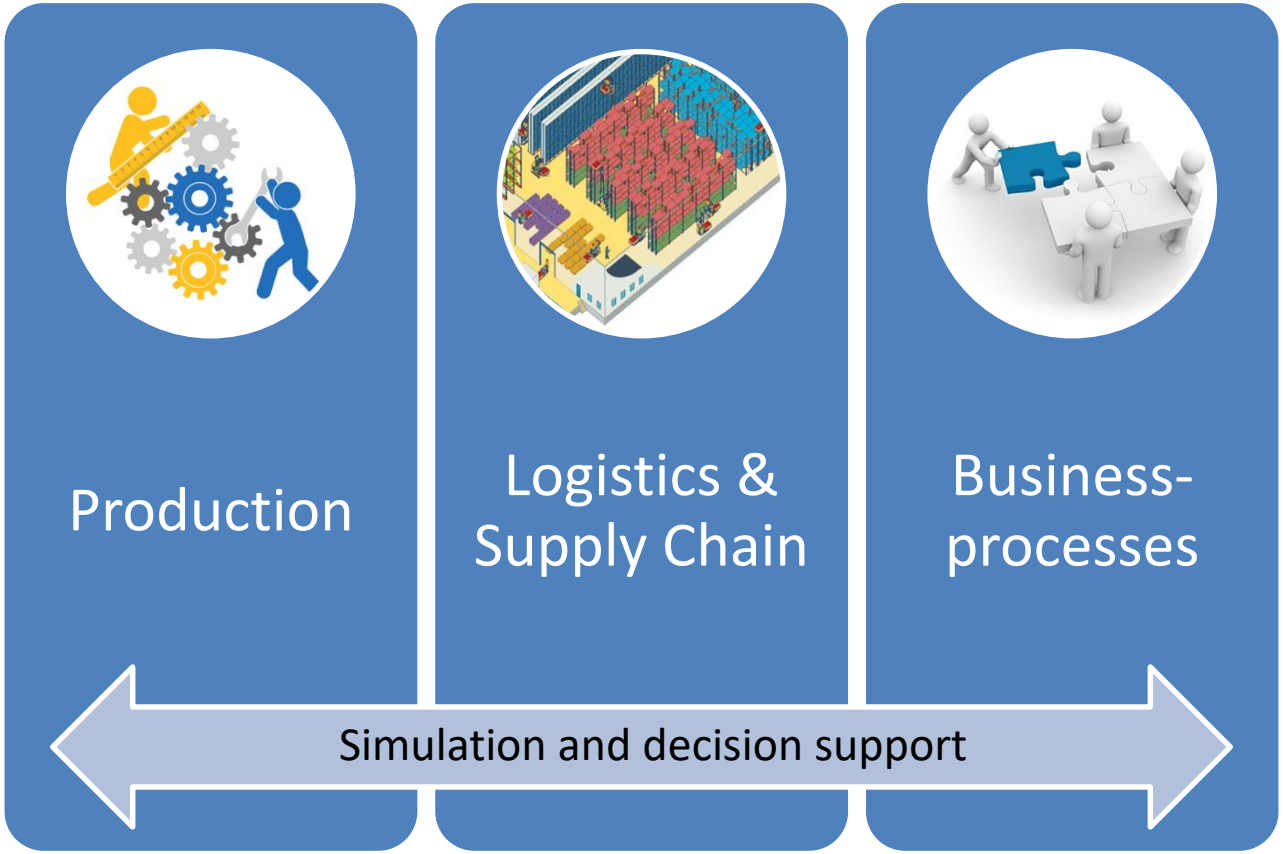
Process- and business optimization and development



Simulation and decision support

[integrate]

Enterprise Dynamics®
Logistic Simulation Software

Business services

- Consulting
- Development of applications
- Teaching
- Distribution of software

AALBORG UNIVERSITY
DENMARK

UCN

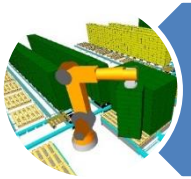
AARHUS UNIVERSITY

Simulation and decision support

[integrate]

Enterprise Dynamics®
Logistic Simulation Software

ED-Partner



Proof of Concept

Proof of performance

Supply Chain simulation

Health Care simulation

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Test the effects of Strategic Energy planning

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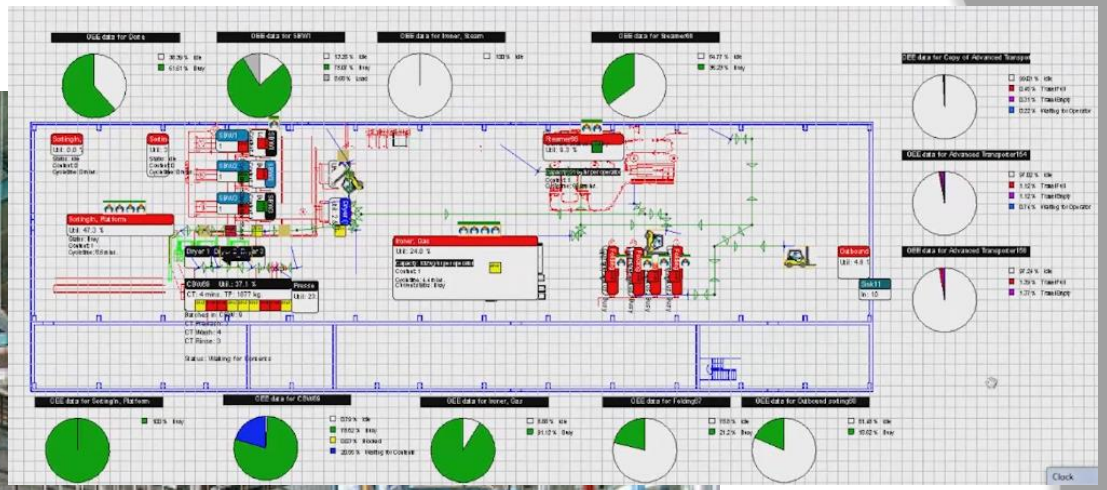
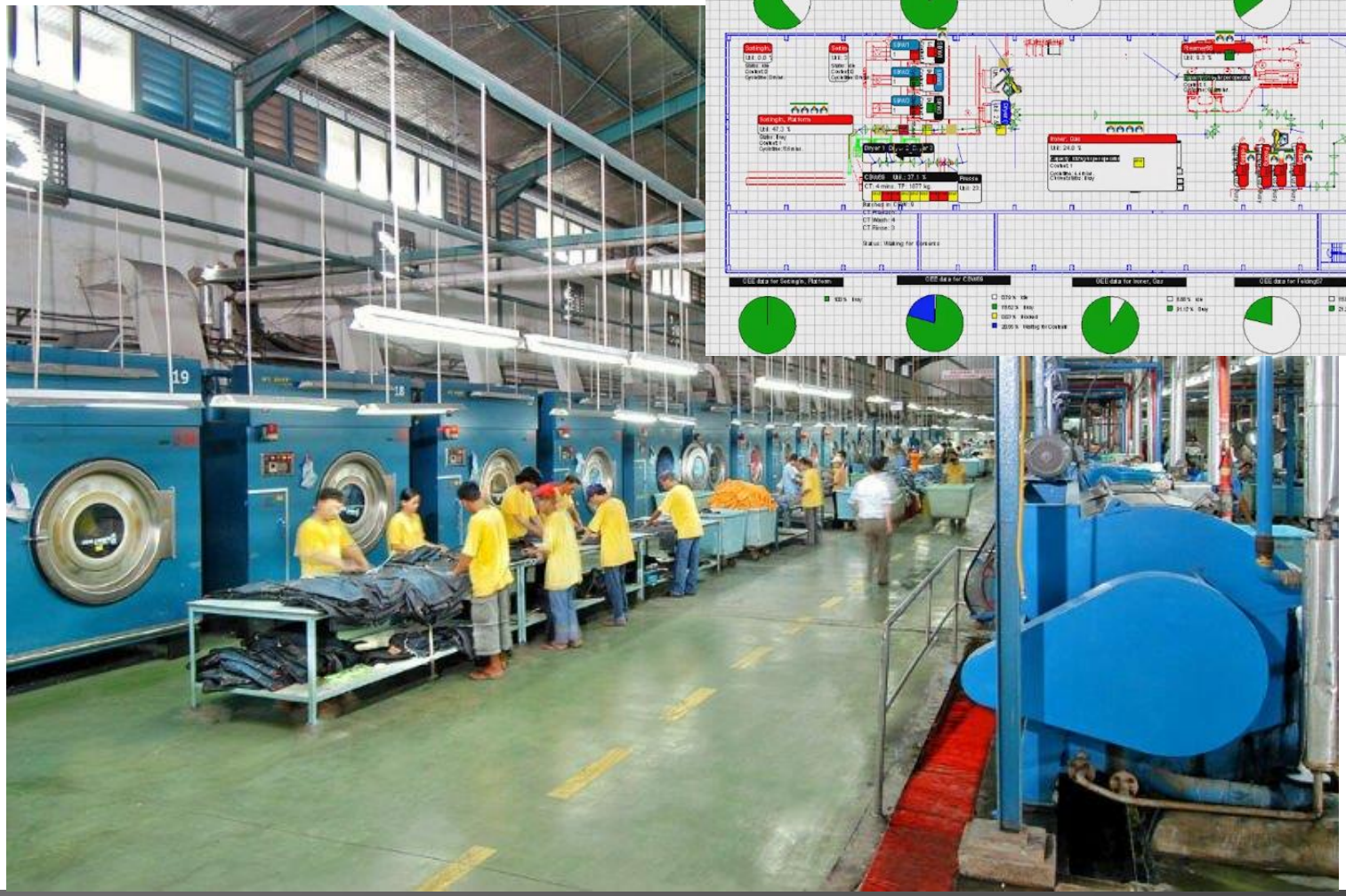
Optimize consumption of utilities electricity, gas, water, heat within production





Supply Chain Simulation

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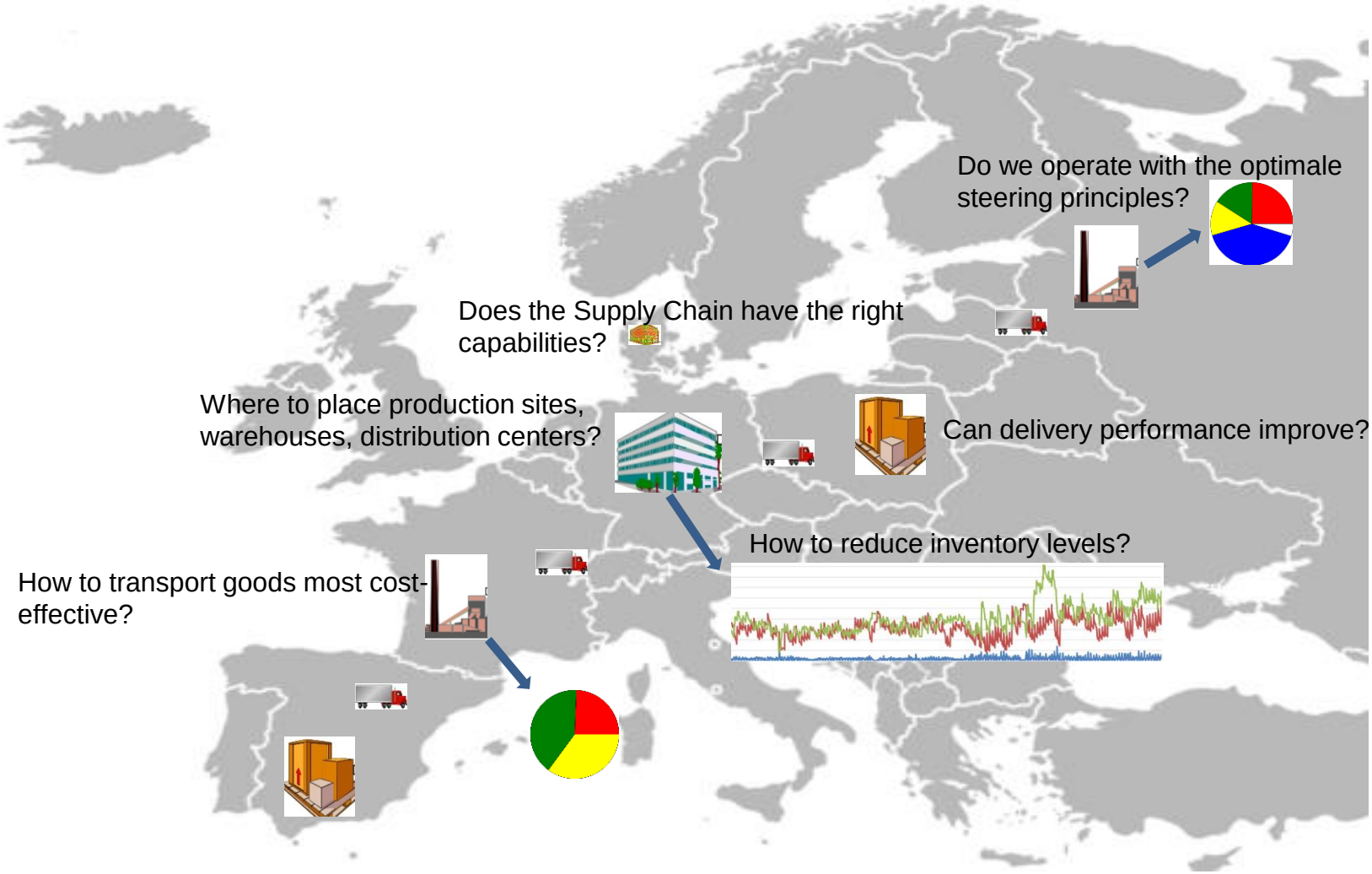
Effective, efficient and risk free decision support and impact analysis



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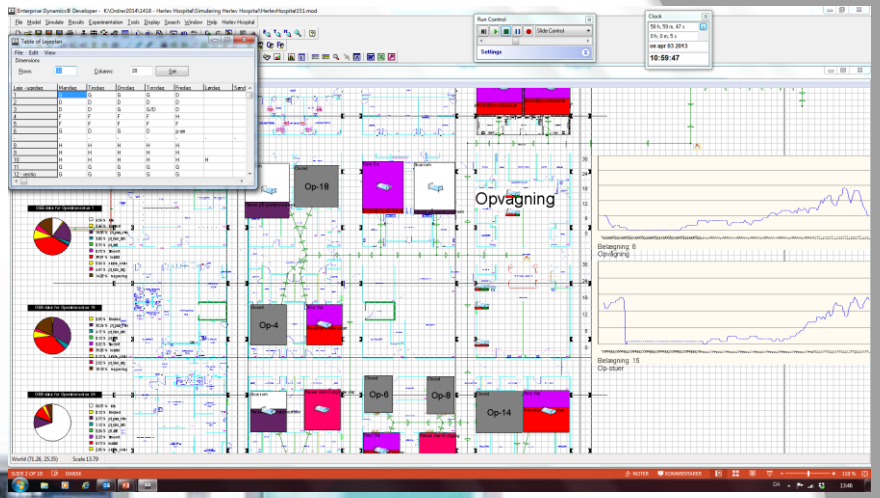
Impact analysis and Optimization of operating areas



Market focus and specialties

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Industry

- LEAN and continuous improvement
- Logistics optimization
- Optimization of business processes
- Simulation & decision support

Food

- LEAN and continuous improvement
- Logistics optimization
- Optimization of business processes
- Simulation & decision support

Logistics, warehouses, supply chains

- Logistics optimization
- Simulation & decision support

Healthcare

- Simulation & decision support

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HOW DO WE WORK WITH SIMULATION

Integrate, June 2017

Statistical simulation

- Expected output per hour
- Costs per product
- Production planning
- Etc.

Methods

- Models in MS Excel
- ERP
- Mapping of different situations (flow)
- Paper, pencil, basic calculator

Why simulation / calculation?

Is it for any use?

Case – Production of trailers

[integrate]

A: Shafts and wheels are mounted on the frame (robot)
B: Floor is mounted on the frame (robot)
C: Assembly of sides on the frame (robot)
D: Roof is mounted on the trailer (robot)
E: Final assembly and quality test (Manuel)

No buffers between processes

A: 15 min. +/- 1 min.
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E: Average 18 min. spread 3 min.

Robot breakdowns once per hour and repair time 6 min. each time(A-D)

Case – Production of trailers

[integrate]

- New contract agreements are coming up.
- Which leads to a longer contract period regarding the delivery and amount of trailers.
- Capacity in production is unknown and a realistic estimate on the weekly production is enquired.
- **YOU** are the new production manager:
  - Make an estimate of how many trailers you and your production team is able to deliver each week!
    (40 working hours)

Case – Production of trailers

[integrate]

- How many trailers can you produce ?

Example on calculation:

What is the bottleneck?
3 pr. hour in 40 hours = 120 trailers.
1 breakdown for 6 min pr. hour (10 %)

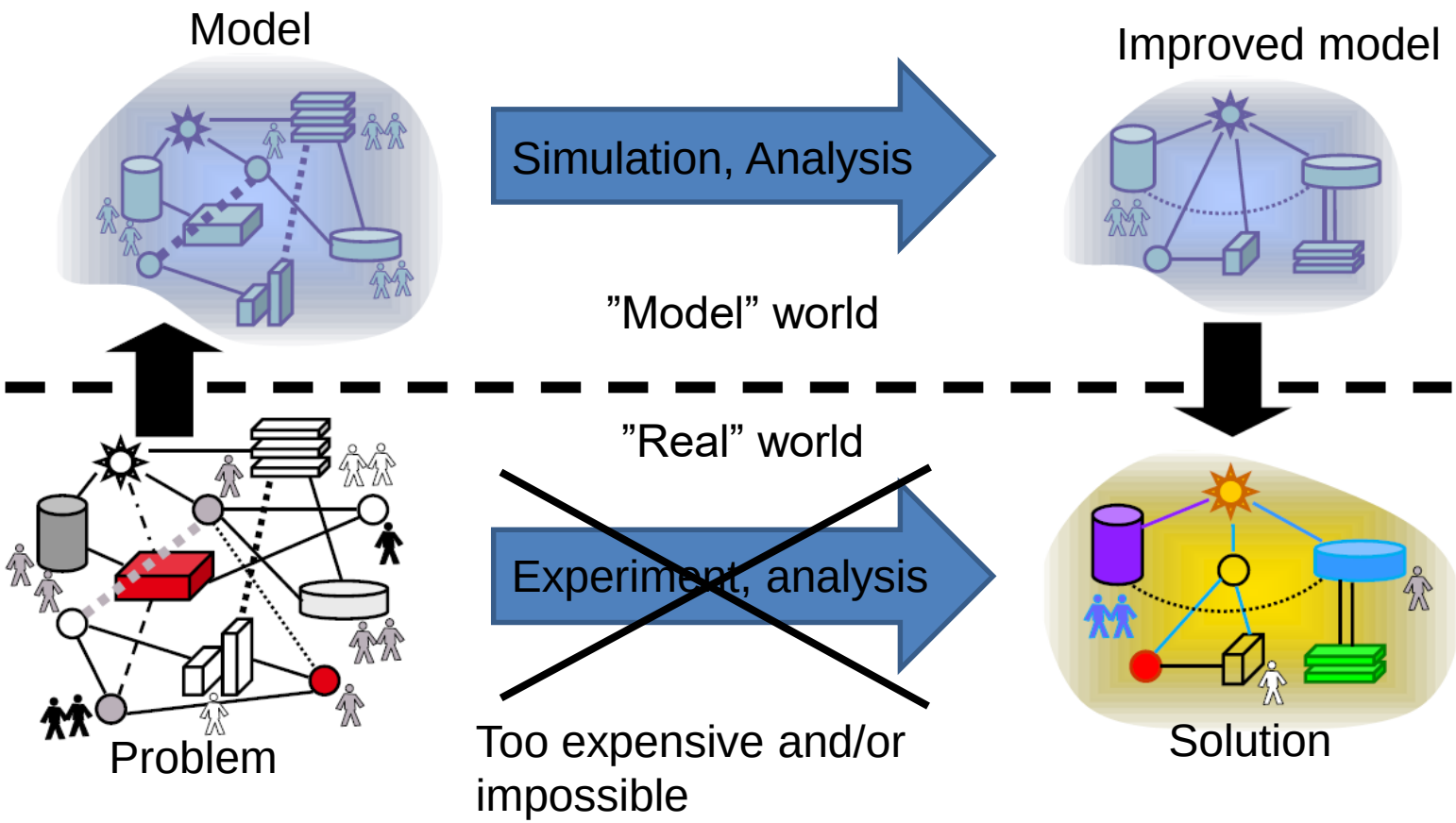
120 trailers – 10% = 108 trailers

Is this answer good enough to agree on a long term contract ?

Why dynamic simulation?

Dynamic simulation is a particularly powerful tool to decision support when testing different configurations of a system

Dynamic simulation incorporates time – meaning that it is the behavior of the system over time and not a snap that is analyzed.



Why dynamic simulation?

[integrate]

Dynamic simulation complement static data analysis

- Static data analysis = looking in the rear view mirror
- Dynamic simulation = Looking out the windscreen

- Both are preconditions for optimal and safe movement and development!

Visualization

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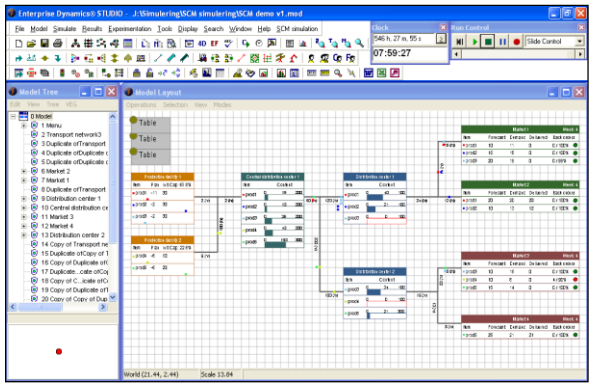
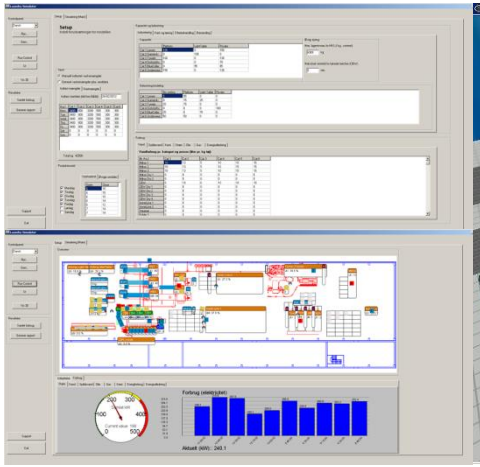
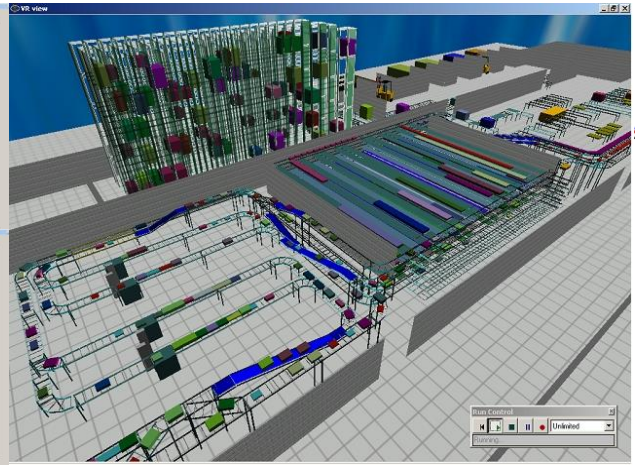
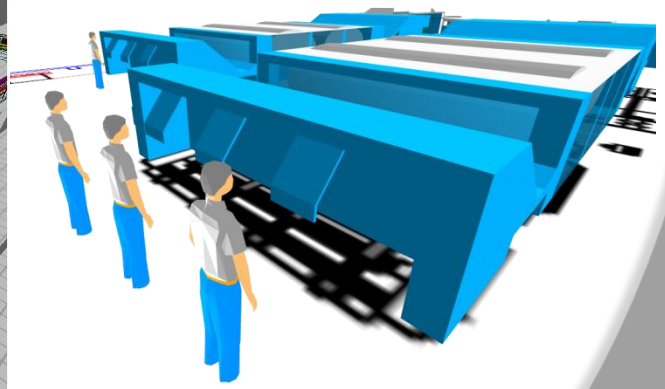
Dynamic simulation do as standard feature 2D and 3D visualization, which to a very high degree support an improved mutual understanding of the system under analysis.









Why dynamic simulation?

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Simulation does NOT deliver the definitive truth! BUT, the value of knowledge based test scenarios are often a significant improvement compared to the alternatives – gut feelings, assumptions and statistical calculations.

The establishment of a mutual picture of the “system” creates a united basis for objective decisions.

Dynamic simulation is a strong and powerful tool for ”What if” scenarios and decision support to all elements in system.

Simulation from the beginning

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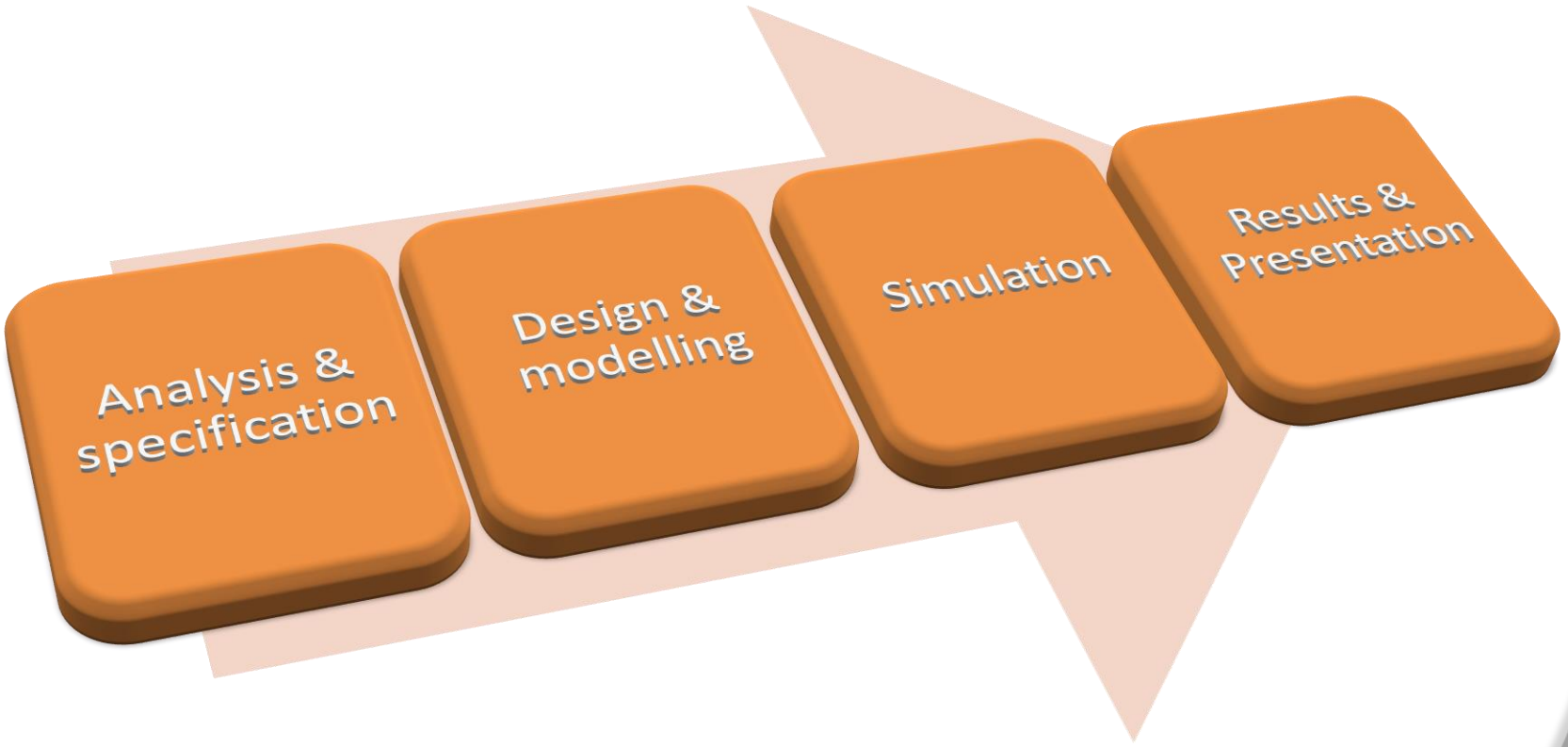
"Simulation is the process of designing a model of a real system and conduction experiments with this model for the purpose of either understanding the behavior of the system and/or evaluating various strategies for the operation of the system."



Typical approach and procedure

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1 Analysis & specification

2 Design & Modelling

3 Simulation/handover

4 Results/handover/education

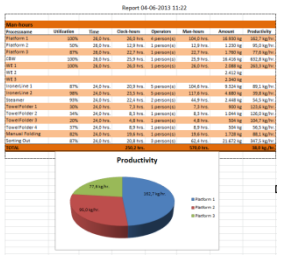
Understand system and assignment:
Real world system is analyzed. Requested solution is specified.

Develop and build solution:
All standard processes are available in ED library - drag and drop into model. Very specific needs are developed and build from scratch.

Experiment/simulate:
- Capacity
- Work force
- New technologies
- Efficiency
- Transport/logistics
- Scarce resources
- Various control systems
- Etc.

Evaluate performance:
- Delivery-performance
- Inventory levels
- Efficiency
- Capacity utilization
- Supply Chain performance
- Etc.

Maximum overview - Minimum risk



Preconditions

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- Precise problem statement
- Level of detail – (Need or Nice to know?)
- Reliable data – (garbage in →garbage out)
- Communication and presentation of results
- Don’t misinterpret simulation – (read results correctly)

A good model..

[integrate]

- Include only elements which directly relates to the problem on hand
- Is valid and accurately reflects the system
- Delivers meaningful results
- Is “fast” and “cheap” to build
- Is easy to modify and expand
- Is convincing
- Is reusable

Simulation tool – Enterprise Dynamics®

Simulation in ED – Production of trailers

[integrate]

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Now – Time for a break!

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HOW DO YOU USE SIMULATION TO DEVELOP AN INNOVATIVE SUPPLY CHAIN?

AALBORG PORTLAND

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Case – Aalborg Portland A/S

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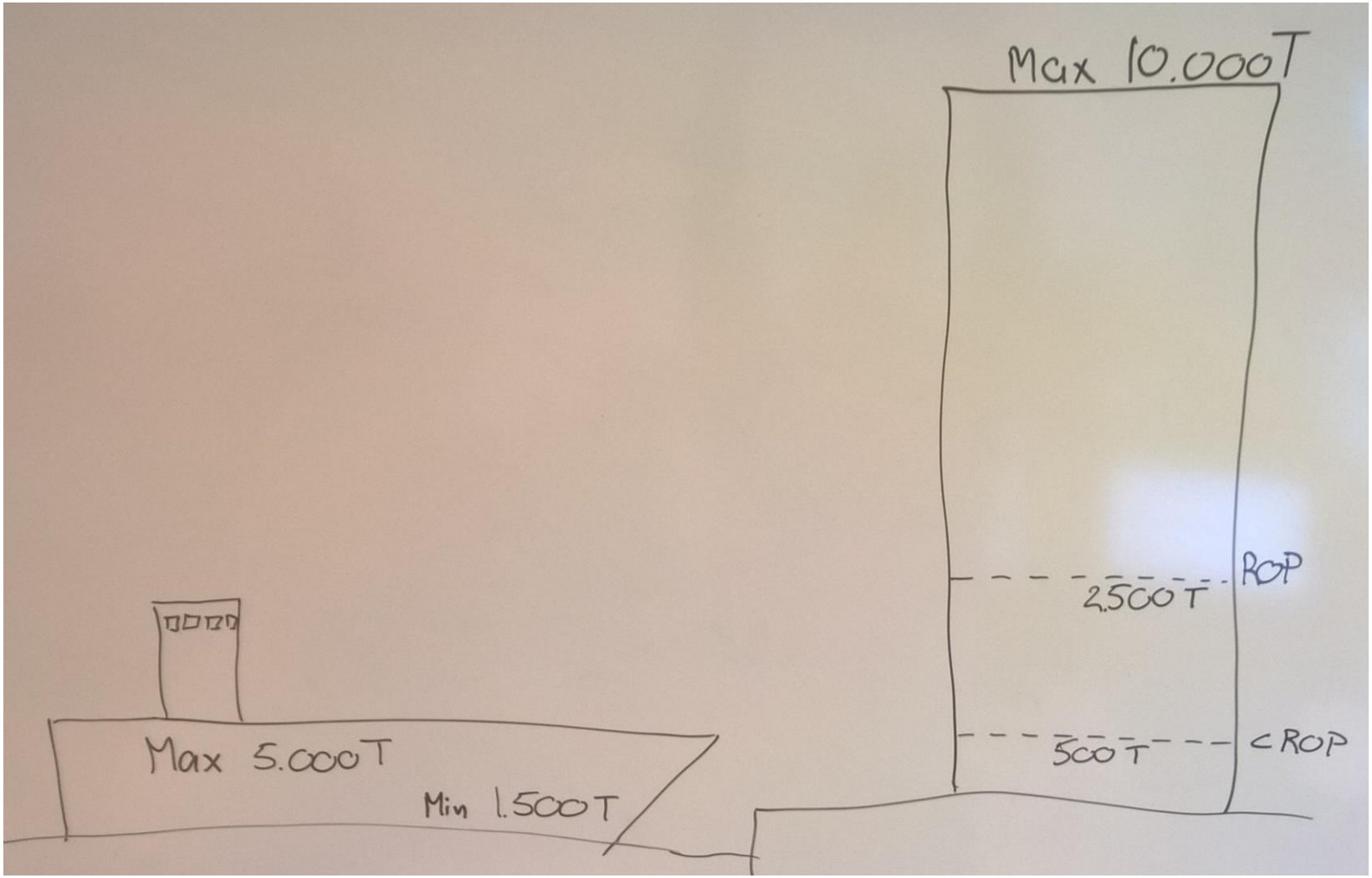
- Supply Chain Visibility
  - Develop a tool to analyze and evaluate the utilization of the ships for cement bulking
- All siloes and ships in Europe
- Demand in the model is based on forecast and is easy to change
- Dynamic ship allocation

Case – Aalborg Portland A/S

[integrate]

- How does the supply chain operate?



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HOW SIMULATION SUPPORT DECISIONS REGARDING HOW INNOVATIVE PRODUCT DEVELOPMENT AFFECT THE SUPPLY CHAIN?

GRUNDFOS

Integrate, June 2017

Case – Grundfos A/S

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- Selection of components and material quality from component production centrally to assembly sites globally
- Particular focus on security of supply and inventory levels
- Demand in the model is based on a full year sales and production data – and can easily be changed!

Case – Grundfos A/S

[integrate]

- Data input controlled via database
- Adjustment of inventory controls
- Trim of MRP-profiles

Faktorer til justering af lagerparametre i modellen

Company_Code	Factor_ROP	Factor_OQ	Factor_WH_QTY	Factor_Calc_ROP	Factor_SB_QTY
BGA	1,70625	1,25	1,1375	1	1,25
BGC	1,25125	1,25	1,1375	1	1,25
GBJ	1,47875	1,25	1,1375	1	1,25
GBR	1,47875	1,25	1,1375	1	1,25
GBW	1,1375	1,25	1,1375	1	1,25
GBW	1,25125	1,25	1,1375	1	1,25
GIN	1,25125	1,25	1,1375	1	1,25
GIN	1,25125	1,25	1,1375	1	1,25
GJK	1,25125	1,25	1,1375	1	1,25
GMH	1,5	1,25	1,1375	2,3	1,25
GMR	1,47875	1,25	1,1375	1,2	1,25
GMU	2,1				
GMU	2,5				
GMX	1,1375				
GPA	1,1375				
GPC	1,6				
GPK	1,5925				
GSI	1,1375				
GTW	0,511875				

MRP Type	MRP Type Description	Disponeringsprincip	Disp_type
#		SS	SS
DR		ROP	ROP
ND		SS	SS
PD		SS	SS
PE		SS	SS
Z2		SS	SS
Z4		SS	SS
PE		SS	SS
PE		SS	SS
DR		ROP	ROP
Z3		ROP	ROP

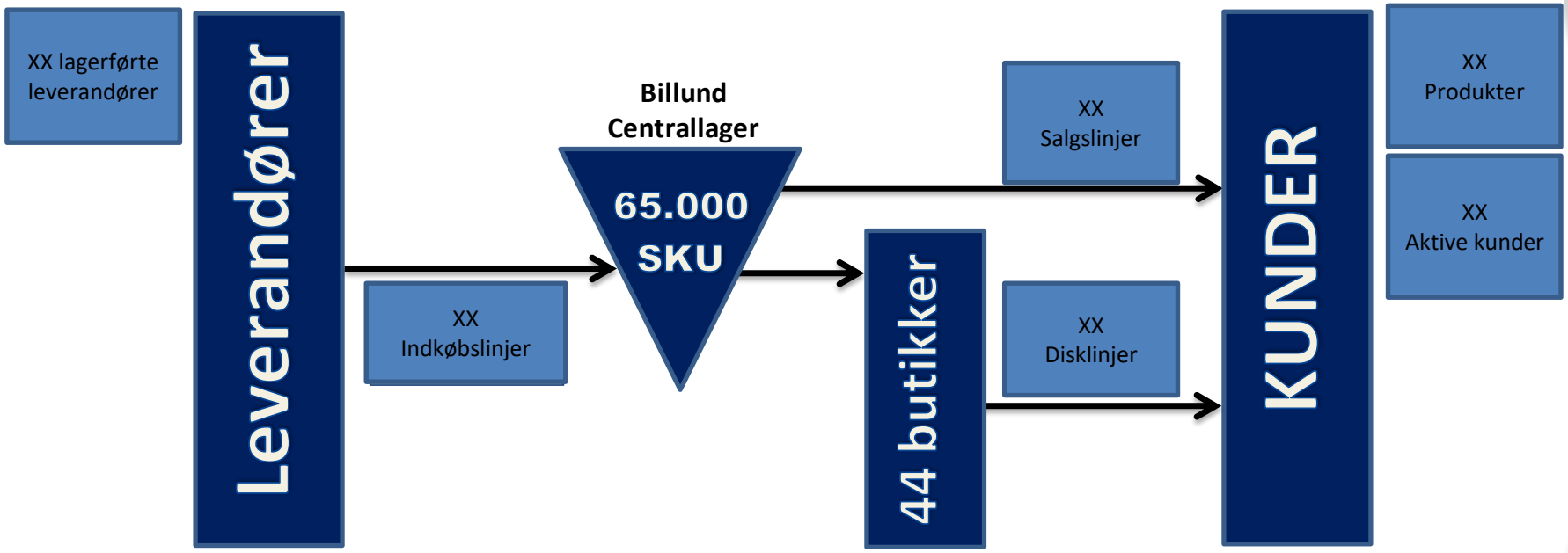
Hovedmenu | Inventory_frsp

Company_C	Plant	Plant_Comp	Material_Comp	Material_Description	Cost	WH_Qty	ROP	OQ	LEADTIME	MRP Profile	MRP_Type
BGA	BGA1	BGA1290246	290246	Staybolt painted (216mm)	17,27	132	48	1	70	SU22	DR
BGA	BGA1	BGA1290247	290247	Staybolt painted (286mm)	20,38	97	109	40	70	SU22	DR
BGA	BGA1	BGA1290248	290248	Staybolt painted (M16 X 356 m	23,47	150	136	38	70	SU22	DR
BGA	BGA1	BGA1290249	290249	Staybolt painted (426mm)	26,72	23	68	10	70	SU22	DR
BGA	BGA1	BGA1290250	290250	Staybolt painted (496mm)	29,96	32	82	15	70	SU22	DR
BGA	BGA1	BGA1290251	290251	Staybolt painted (566mm)	33,06	64	41	10	70	SU22	DR
BGA	BGA1	BGA1290252	290252	Staybolt painted (636mm)	36,24	14	20	1	70	SU22	DR
BGA	BGA1	BGA1290253	290253	Staybolt, painted (706mm)	39,42	24	14	1	70	SU22	DR
BGA	BGA1	BGA1290254	290254	Staybolt painted (776mm)	45,69	0	14	1	70	SU22	DR
BGA	BGA1	BGA1290255	290255	Staybolt painted (846mm)	45,77	5	7	1	70	SU22	DR
BGA	BGA1	BGA1290256	290256	Staybolt, painted (916mm)	48,94	5	14	1	70	SU22	DR
BGA	BGA1	BGA1290257	290257	Staybolt, painted (986mm)	52,11	0	7	1	70	SU22	DR
BGA	BGA1	BGA1290258	290258	Staybolt, painted (1056mm)	55,21	14	14	1	70	SU22	DR
BGA	BGA1	BGA1290259	290259	Staybolt, painted (1126mm)	59,35	5	0	1	70	SU12	PE
BGA	BGA1	BGA1350179	350179	Staybolt painted (327mm)	21,63	137	143	40	70	SU22	DR
BGA	BGA1	BGA1350180	350180	Staybolt, painted (407mm)	25,18	32	27	1	70	SU22	DR
BGA	BGA1	BGA1350181	350181	Staybolt, painted (487mm)	28,94	23	14	1	70	SU22	DR
BGA	BGA1	BGA1350183	350183	Staybolt, painted (647mm)	29,01	0	14	1	70	SU22	DR

[integrate]

Vi optimerer produktion, logistik og forretningsprocesser

Case – Sanistål



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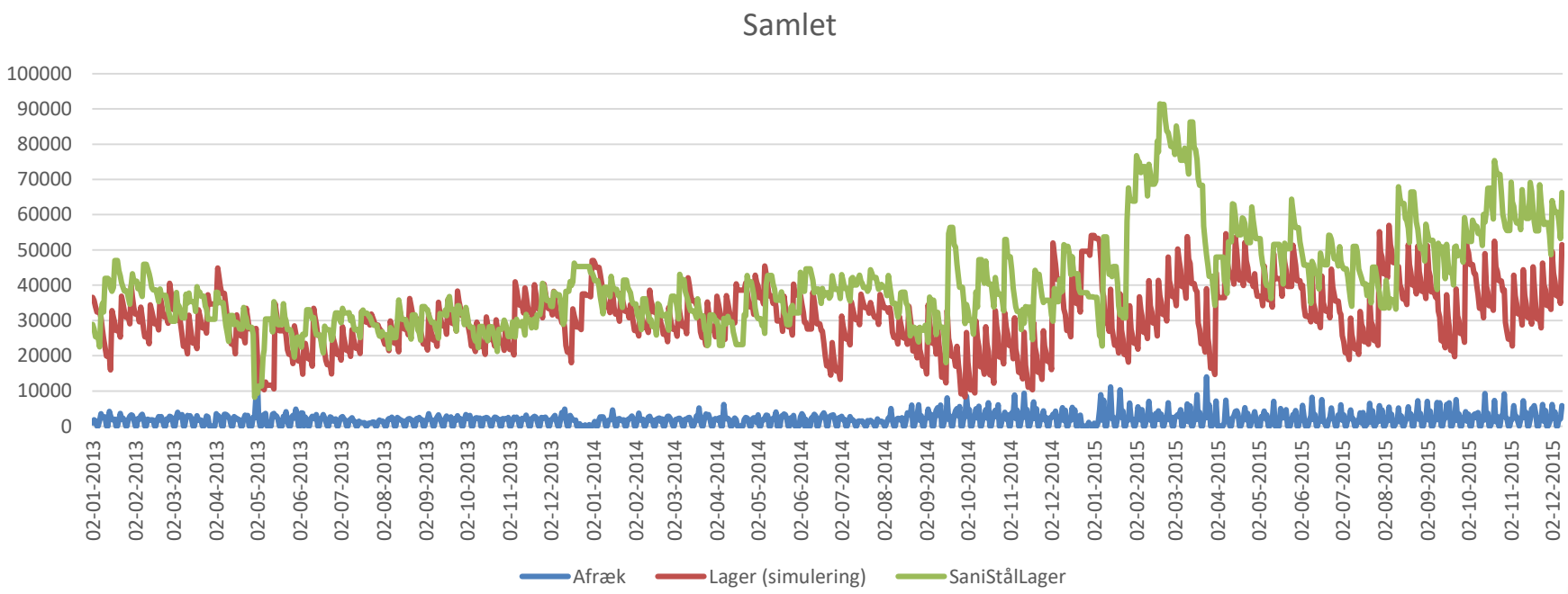
Sammenligning af aftræk. Sanistål lager og model lager



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Vi optimerer produktion, logistik og forretningsprocesser

Case – Plukkelager

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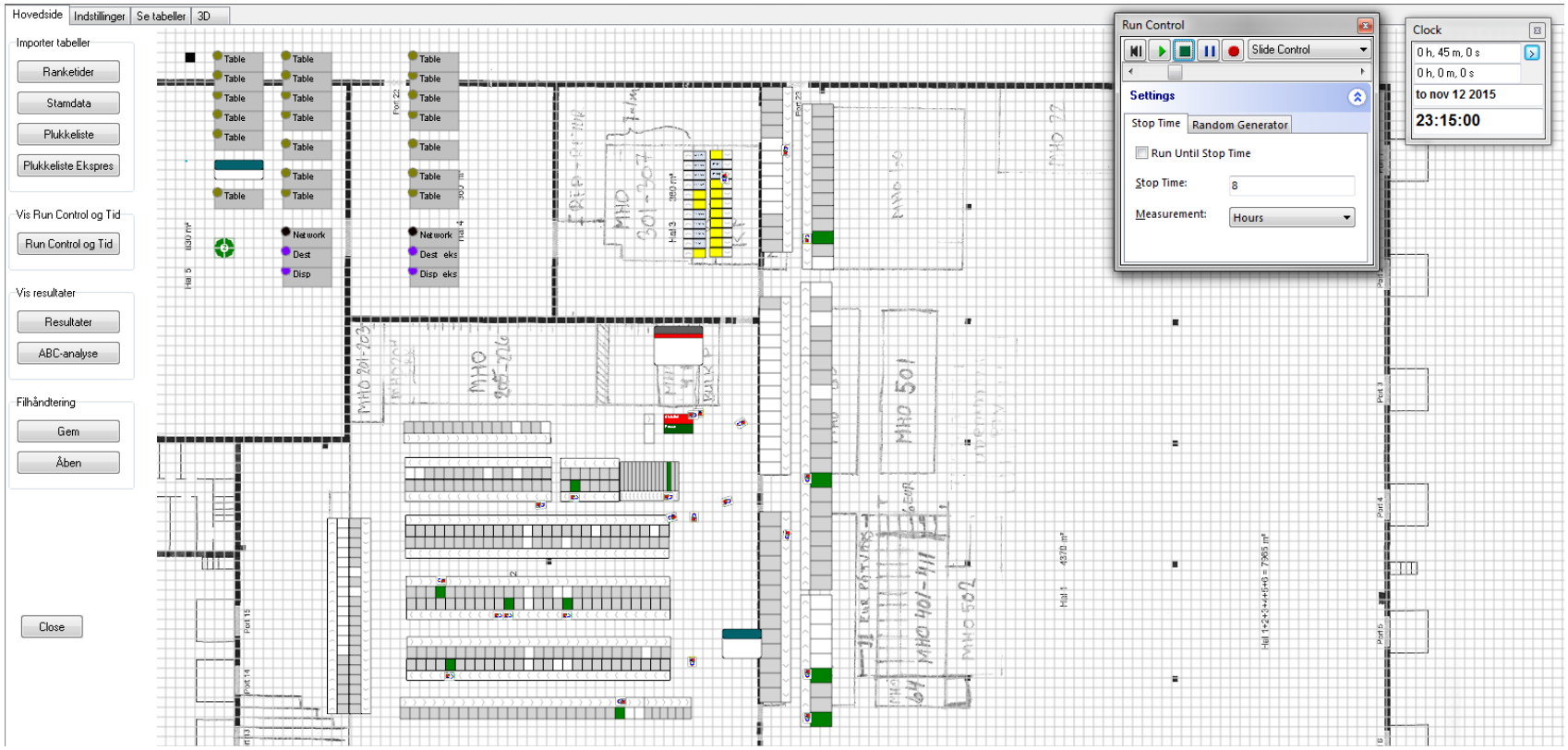
- Plukoptimering på ferskvareterminal



Case – Plukkelager

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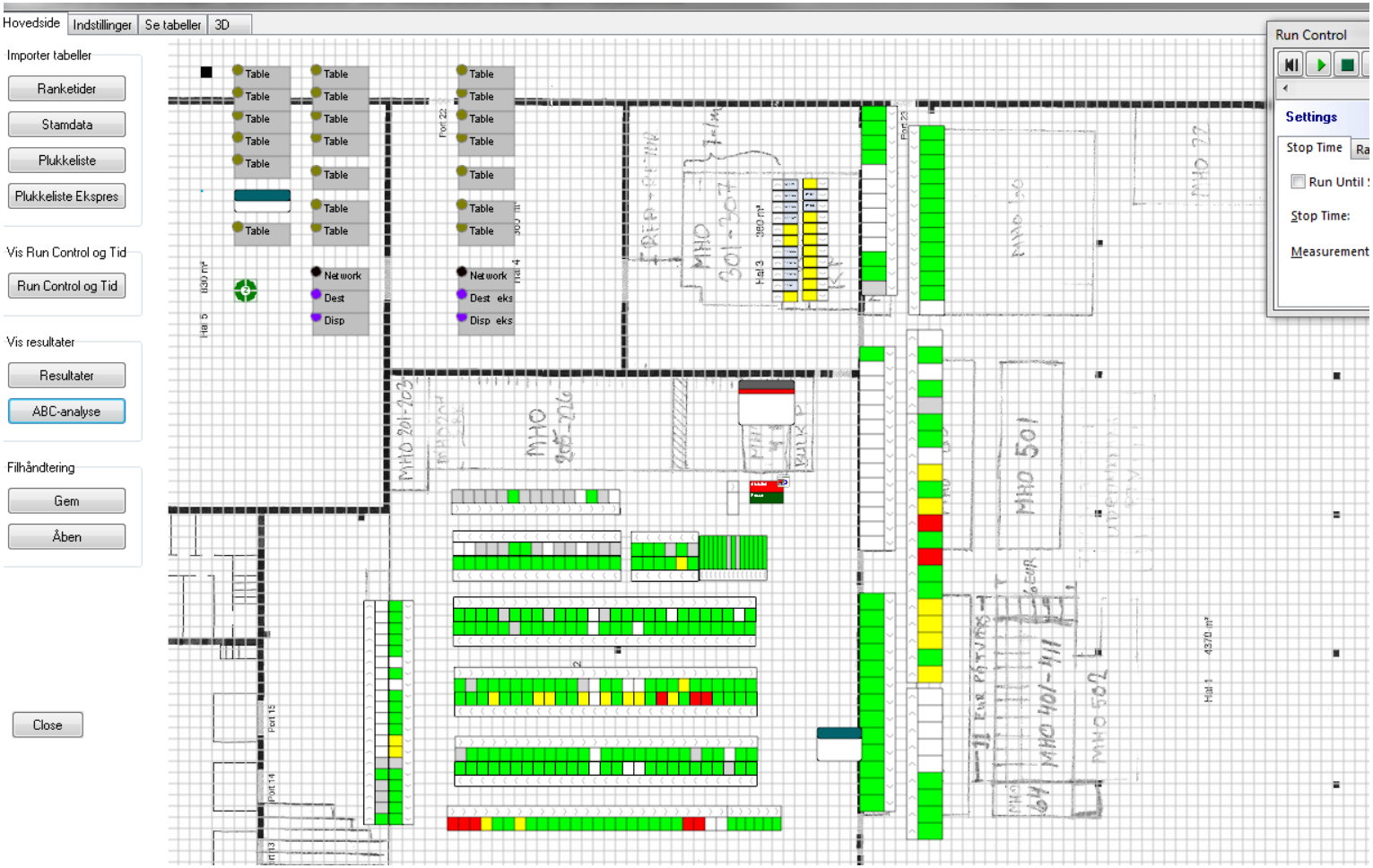
- ABC-analyse



Don’t Speculate… Simulate!

[integrate]

Vi optimerer produktion, logistik og forretningsprocesser