Logistics Systems and Analytics

1.11.2023

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Case study

Warehouse Management: converting shop-floor operations to data in problem solving

About my background

Work experience

• Logistics Consultant, Kapiten Oy	Own business	2023->
• Chief Operations Officer, Nordic Sports Brands	Online Retail Business	
• Chief Logistics Officer, Nordic Sports Brands	Online Retail Business	
• Senior Manager, Supply Chain Development, Konecranes	Manufacturing Industry + Service	
• Global Process Owner (Logistics & Warehouse mgm), Konecranes	Manufacturing Industry + Service	
• Project Manager, Jatke	Construction Industry	
• Manager, Distribution Center Europe, Metso Minerals	Service Industry (Metso´s biggest distribution center)	
• Service Manager, ALSO	Distribution (Biggest ICT-distributor in Finland)	
• Logistics Development Manager, ALSO	Distribution (Biggest ICT-distributor in Finland)	
• Purchasing and Logistics Manager, Kemira Safety	Manufacturing Industry (Assembly)	
• Technical Director, Desinfinator	Technology (start-up)	
• Trainee -> Quality Engineer -> Production Planner; Iittala Group	Manufacturing Industry (Process Industry)	2005

Education

• Doctor of Science -student, Aalto University (Helsinki), Industrial Engineering and Management		2022 ->
(Designing a digital platform for real-time integrated end-to-end supply chain management and control)		
• Master of Science (Tech.), Civil Engineering, Tampere University of Technology		2021
• Master of Science (Tech.), Industrial Engineering and Management, Tampere University of Technology		2007

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Content

1. Targets for the lecture

2. Supply Chain & Warehousing – Processes and Terminology

3. Real-life case-example

4. Key takeaways

5. Discussion & Questions

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Targets for the lecture

- Recap of the basic supply chain processes

- Seeing real-life case-example

- Understanding situational awareness

- The importance of data in decision making

- How to get the data – some tools / examples

- How to convert reality / shop-floor operations to data

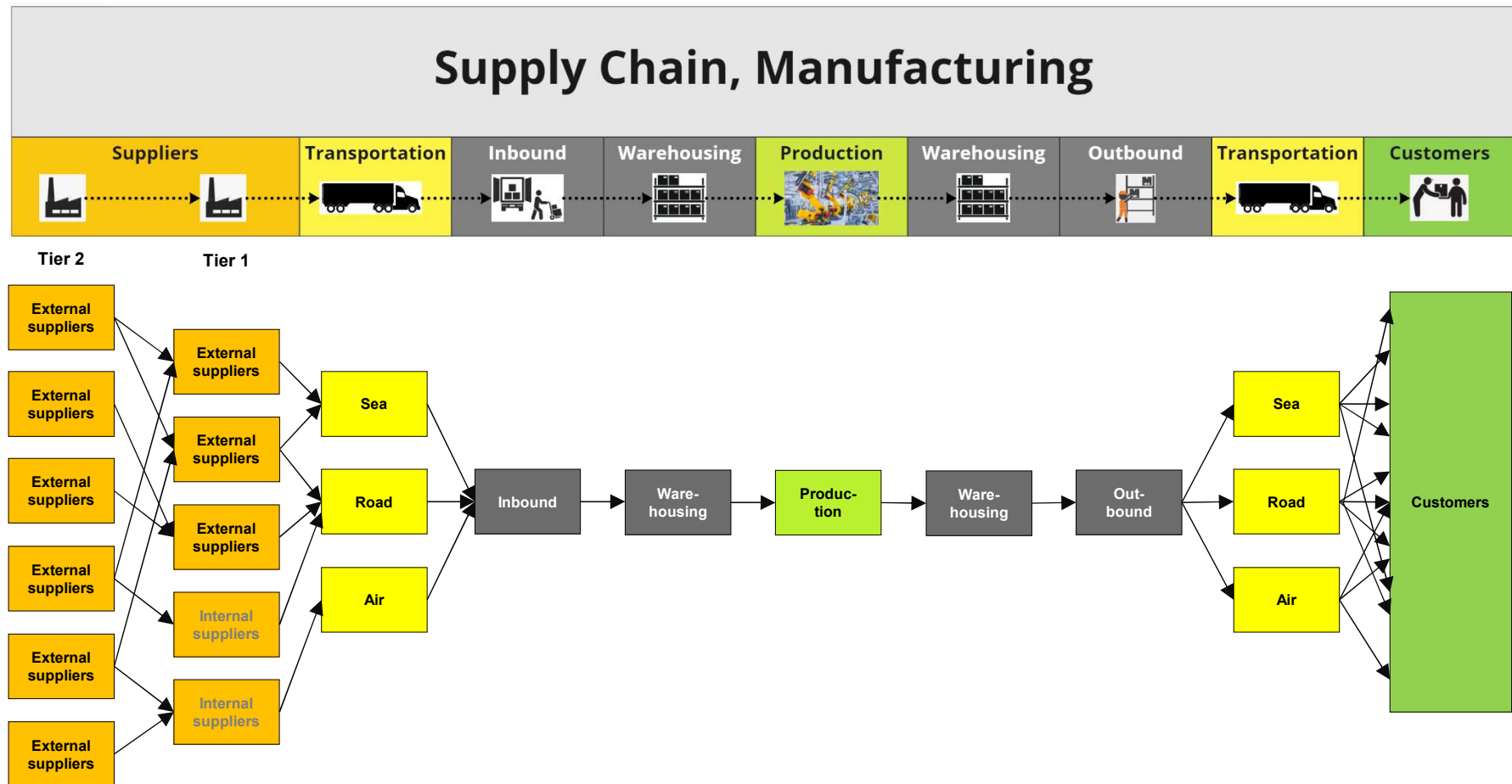- Overview of some problem-solving methods

Remarks for the material

- *A lot of material have been simplified – no sources available*

- *Many of the terms in this presentation are used in different ways in different companies*

- *Some pictures are limited, and some data have been removed to protect the identity of parties involved*

- *Some of the content have been created from my own experience, you are free to questions these*

Supply Chain & Warehousing

Main processes & Terminology

Supply Chain Process

Supply Chain, Manufacturing

| Suppliers | Transportation | Inbound | Warehousing | Production | Warehousing | Outbound | Transportation | Customers |

Tier 2   Tier 1

External suppliers → Sea, Road, Air → Inbound → Ware-housing → Produc-tion → Ware-housing → Out-bound → Sea, Road, Air → Customers

Intralogistics

Intralogistics is the art of optimizing, integrating, automating, and managing the logistical flow of information and material goods within the walls of a fullfillment or distribution center (intralogistics-as.com)
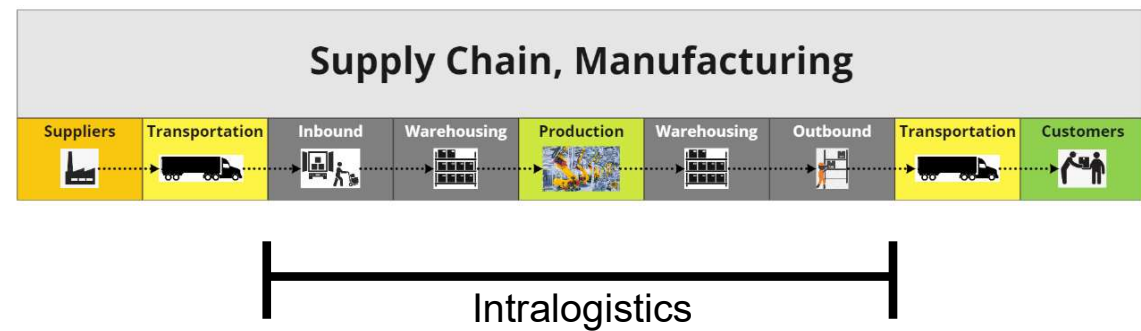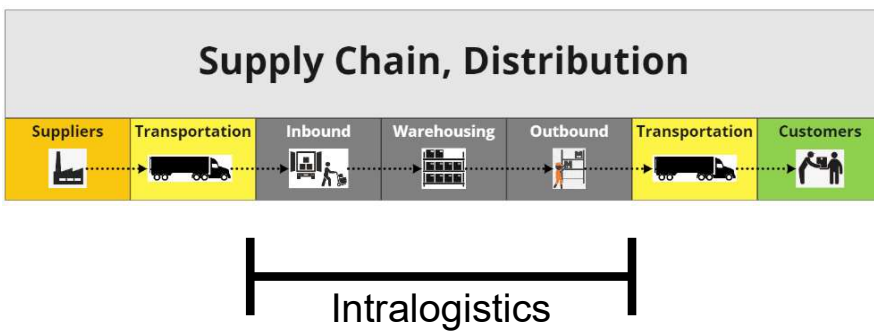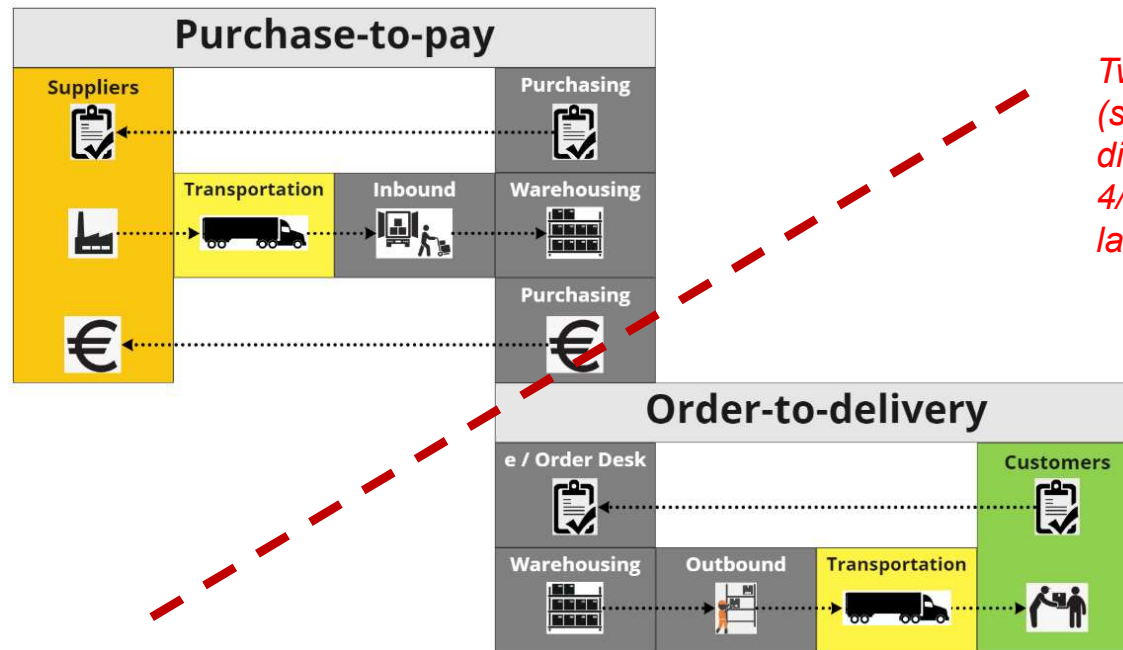

Important to identify two key elements:
1) Physical material flow
2) Information flow
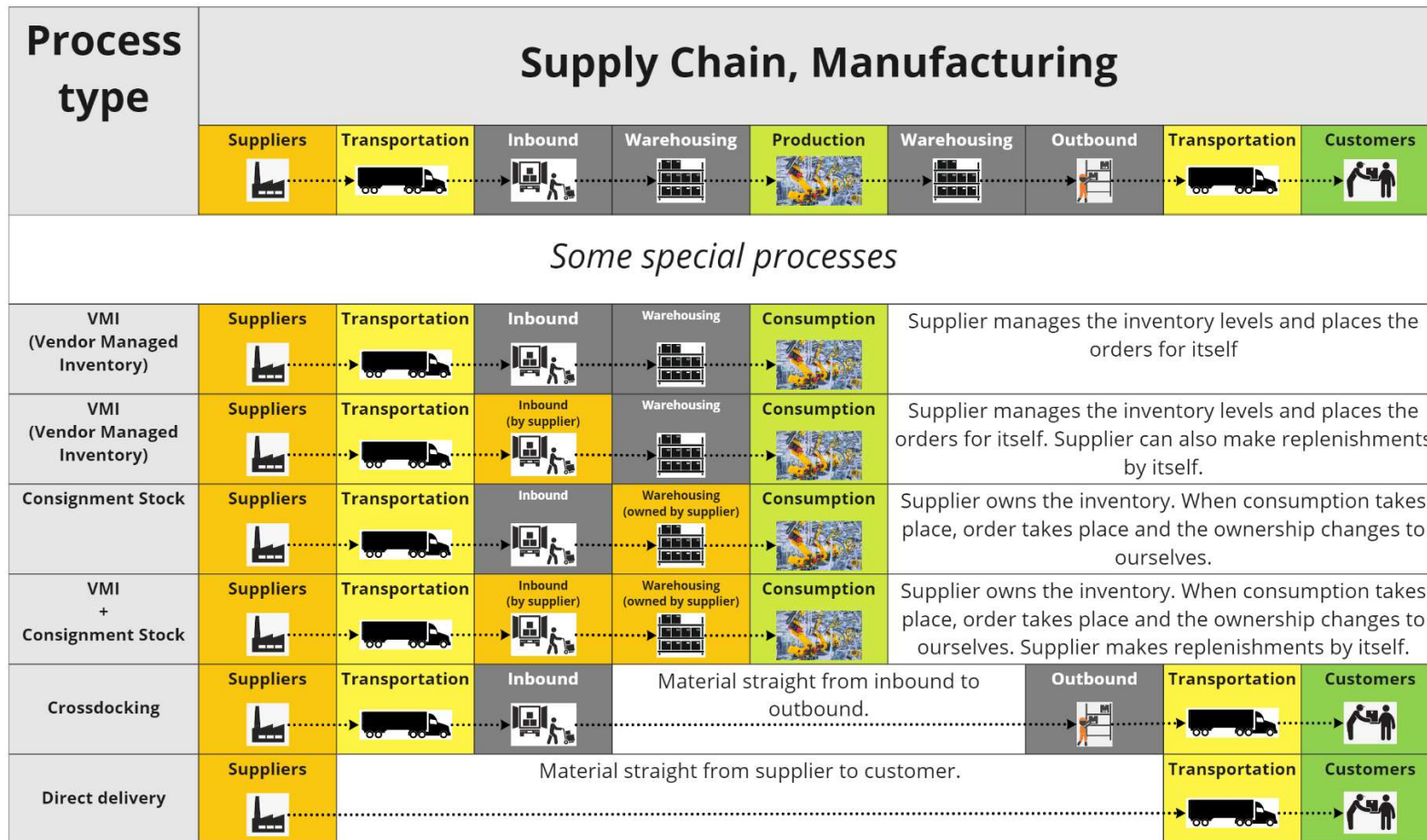
Main processes in Supply Chain

Supply Chain, traditional Process

Suppliers → Transportation → Inbound → Warehousing → Outbound → Transportation → Customers

"P2P"
Source-to-pay "S2P"

Purchase-to-pay

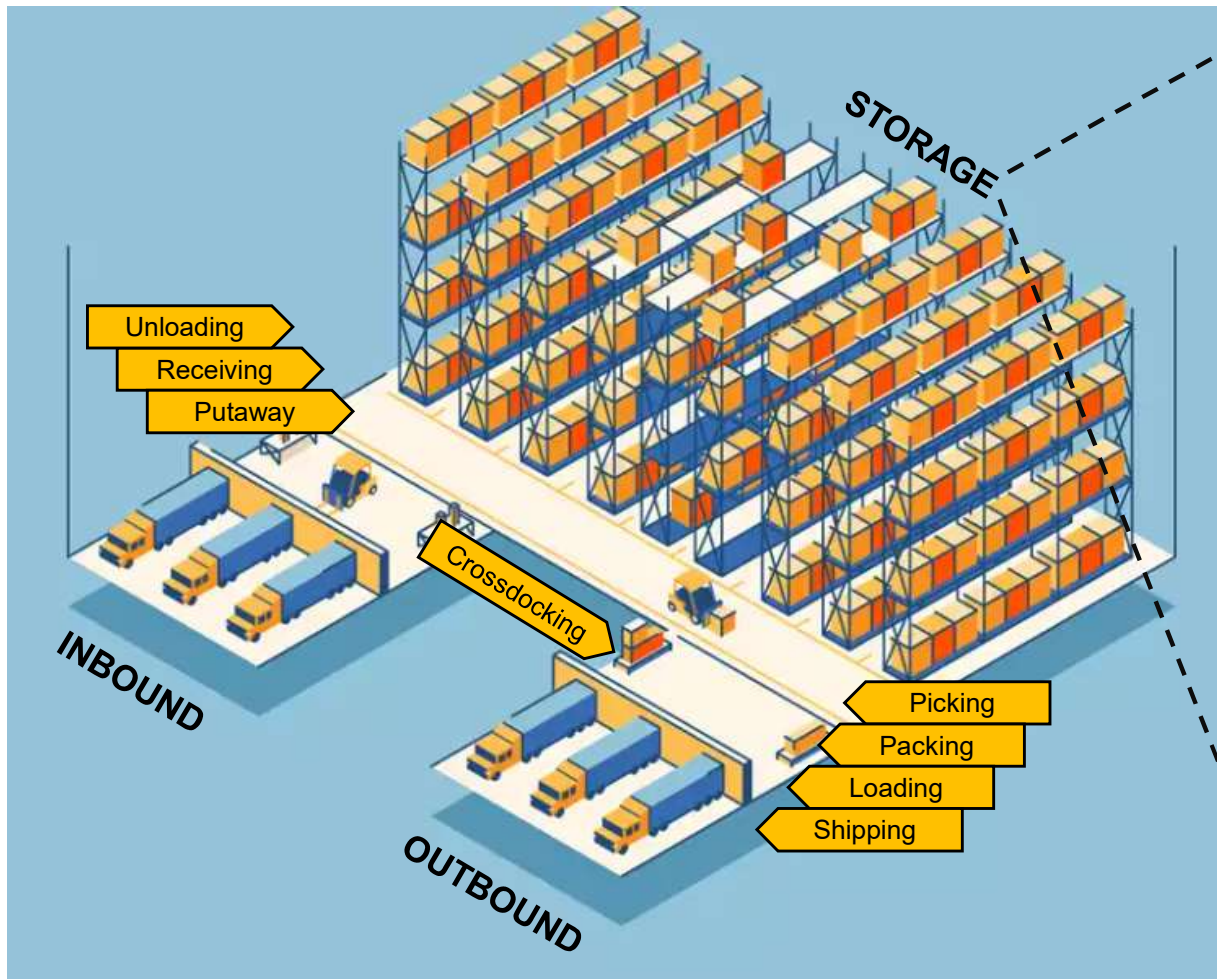Suppliers — Purchasing
Transportation — Inbound — Warehousing
Purchasing

Two independent processes (some exceptions – > e.g. direct-delivery, crossdocking, 4/5PL, VIM, consignment, these later)

Order-to-delivery

e / Order Desk — Customers
Warehousing — Outbound — Transportation

"OTD"
Order-to-invoice
Order-to-cash "O2C / OTC"

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Some special procsses

Process type	Supply Chain, Manufacturing								
	Suppliers	Transportation	Inbound	Warehousing	Production	Warehousing	Outbound	Transportation	Customers
				Some special processes					
VMI (Vendor Managed Inventory)	Suppliers	Transportation	Inbound	Warehousing	Consumption	Supplier manages the inventory levels and places the orders for itself			
VMI (Vendor Managed Inventory)	Suppliers	Transportation	Inbound (by supplier)	Warehousing	Consumption	Supplier manages the inventory levels and places the orders for itself. Supplier can also make replenishments by itself.			
Consignment Stock	Suppliers	Transportation	Inbound	Warehousing (owned by supplier)	Consumption	Supplier owns the inventory. When consumption takes place, order takes place and the ownership changes to ourselves.			
VMI + Consignment Stock	Suppliers	Transportation	Inbound (by supplier)	Warehousing (owned by supplier)	Consumption	Supplier owns the inventory. When consumption takes place, order takes place and the ownership changes to ourselves. Supplier makes replenishments by itself.			
Crossdocking	Suppliers	Transportation	Inbound	Material straight from inbound to outbound.			Outbound	Transportation	Customers
Direct delivery	Suppliers	Material straight from supplier to customer.						Transportation	Customers

Warehouse & terminology

STORAGE

Unloading
Receiving
Putaway

INBOUND

Crossdocking

OUTBOUND

Picking
Packing
Loading
Shipping

Typical manual storage types
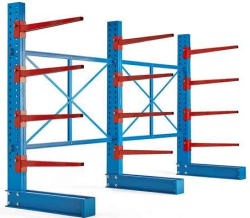
Pallet racks

Shelves

Floor storage

Cantilever racks

Small bins

Mezzanine solutions

And a lot of special types…
Note: also outside storages!

Internal processes

IT / system processes

Main picture: *https://www.bigrentz.com/blog/warehouse-layout*

Discussion & Questions

Case example 1:

Major issue with company´s 3PL operator

(some pictures limited, and some data removed to protect the identity of parties involved)

Bacground of the case

The background

- The case is about one major site/factory (1000+ people) of a global industrial company

- The company has a 3PL operator with a short history

Problem statement

- The 3PL operator is not performing (not reaching SLA) and hurting dramatically the company´s daily operations
    - Production lines on hold because no materials
    - Customers waiting for deliveries

- The 3PL has no business case as the operations are roughly 2-times the work estimated -> they claim more money

- -> Situation has to be solved immediately: 1) operative issues, and 2) commercial issue

Go and see the 3PL operations!

What is going on?

Everything is messed up!

This should be solved today!

Why are they not performing!?

Someone should be fired!

We are losing tons of money every day!

Johnny is our best performer!

Sarah is not performing!

Sarah knows what to do!

It is their fault!

It is the 3PL fault!

Johnny can not perform!

Johnny do not what to do!

George knows what to do!

George is an idiot!

Call Jack!

Jack has not even seen a warehouse!

………..!

Sidenotes

- Just the typical case – everyone is shouting and a lot of opinions

- Everyone seems to know what is wrong and what to do

- *-> What are the facts?*

- *-> How to approach the issues?*

The facts & data

- The 3PL is working extremely low-efficient, they have almost double the workforce calculated -> almost double the costs

- The backlog has been app. 2000 lines on last weeks, which means roughly 4 days workload

- The backlog had been recognized as the most important KPI (reflects directly to company´s own production & customer deliveries)

Performance issue no. 1: backlog

- Why there is backlog at the warehouse

  - The tasks can not be performed in time

    - Why?

      - The putaway is too slow

      - The picking is really slow

        - Why?

          - The materials can not be found

          - There are materials on the way

            - Why?

              - The materials do not have a dedicated location

                - Why?

                  - There is too many materials in one location

                    - Why?

                      - Materials have to be stored somewhere, no other place to put them

                        - **-> HYPOTHESIS: THE WAREHOUSE IS TOO FULL**

                          - Is it?

                          - Any data?

                          - Go and get it!!!

Sidenotes

Hypothesis: the 3PL warehouse is too full

- How to define full?

- What is capacity / definition of capacity?

- How to measure this?

- What kind of data is needed?

- Which tool for problem solving?

- How do get the data?

Converting shop-floor operations & situation to data

One way to start defining the capacity / fill-rate in overloaded situation:

"First right" means, that the material is placed in the planned location based on your putaway strategy (kg, dimensions, active/reserve location, ABC/XYZ, handling type etc). This means, that you can <u>locate & pick the material without moving anything or wasting time finding this</u>.

The fill-rate: Data & Analysis

A: 11 red & 24 green
-> 68,6 % first right

B: 22 red & 8 green
-> 26,7 % first right
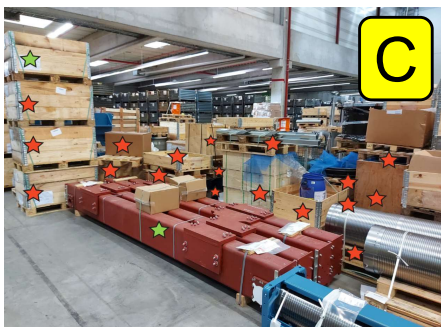
C: 18 red & 2 green
-> 10,0 % first right
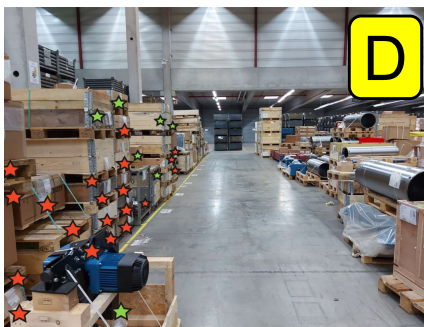
D: 20 red & 7 green
-> 25,9 % first right

E: 30 red & 6 green
-> 16,7 % first right
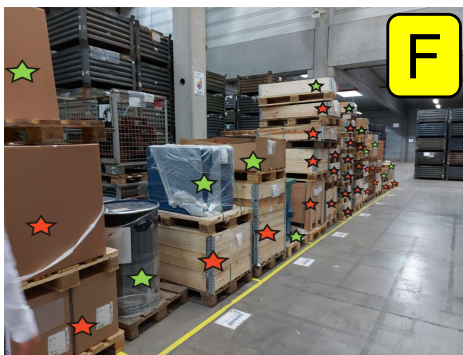
F: 26 red & 12 green
-> 31,6 % first right

G: 45 red & 15 green
-> 25,0 % first right
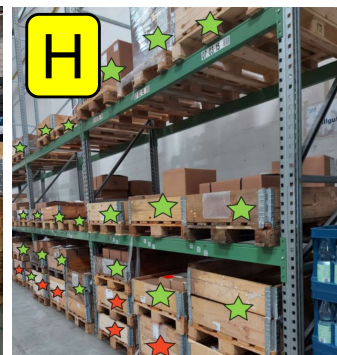
H: 7 red & 21 green
-> 75,0 % first right

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SUMMARY
- Pallet Racks: 63 locations: 71,4 % "First Right"
- Floor: 175 locations: 25,1 % "First Right"
- Special Boxes: 36 locations: 16,7 % " First Right"
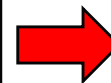
-> "First Right" is between 20-25 %
-> -> The capacity utilization is 400-500 %
-> -> -> The Warehouse is absolutely too full!

TASK

What is the capacity of this room? (2 minutes)

Too full?

Source: https://racksandrollers.com/blog/how-can-warehouse-space-and-congestion-be-managed-properly/

Source: https://www.wimmoi.org/corporate-campaigns/

Sidenotes

- Fill-rate vs. efficiency

- Why too high fill-rate decreases efficiency?

- Fill-rate issue in putaway

- Fill-rate issue in picking

- Fill-rate issue in daily operations

So, what to do, what is the plan?

Fill-rate & Efficiency

Fill rate %		Efficiency%		Efficiency%
150 %				100 %
140 %				90 %
130 %				80 %
120 %				70 %
110 %				60 %
100 %				50 %
90 %		Fill rate %		40 %
80 %				30 %

Performance

TIME
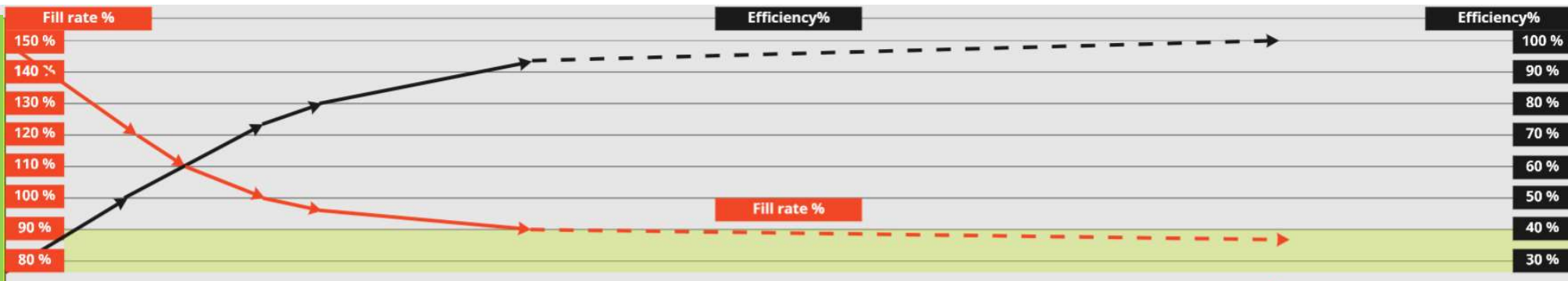
SEPTEMBER					OCTOBER				NOVEMBER				DECEMBER					January				February			
Week 35	Week 36	Week 37	Week 38	Week 39	Week 40	Week 41	Week 42	Week 43	Week 44	Week 45	Week 46	Week 47	Week 48	Week 49	Week 50	Week 51	Week 52	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9

XXX € Plan

Implemented & loaded

PROJECT NN — Label: 104

Implemented

PROJECT NN — Label: yyy

Implemented

PROJECT NN — Label: 105 / Label: 10-12 / Label: 777

Implemented

PROJECT NN — Label: 109

Implemented

PROJECT NN — Label: 10-13 / Label: 10-14

PROJECT NN — Label: XXX

PROJECT NN

Main task is to solve the main issue

- **Main issue: the warehouse is too full!**

- **In order to solve this quickly, there are two dimensions**
    - Move 1000+ pallets to other warehouse (no/slow movers)
    - Create 2000+ pallet (equivalent) locations

- **Creating 2000+ locations needs new lay out desing & plan**

Sidenotes

- Get the data!

- The truth is always on the shop-floor!

- Go-look-see!

- What is issue / effect / cause / root-cause?

Creating new locations: Categorizing & lay out 1/2

3PL statement:
"we have so many heavy pallets that pallet rackings not helping"

↓

What the data says?

↓

Graphical Summary of Weight
Summary Report

Distribution of Data
Examine the center, shape, and variability.
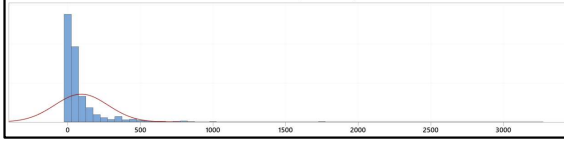
Descriptive Statistics
N 9873
Mean 93,351
StDev 183,84
Minimum 0
5th percentile 1,025
25th percentile 10,005
Median 32,5
75th percentile 100,03
95th percentile 399,6
Maximum 3252,1

↓

9873 Pallet receivings analysed ->
Only under 2,1 % of received pallets are over 625 kg -> Pallet racks are OK!

So, what kind of pallets we have?
And how much?

↓

Go and see!!

Creating new locations: Categorizing & lay out 2/2

The new lay out

Categories for storage

Main Category	Specs.	Sub-Category	Example	Solution
Small items	Max 20 kg	Small items		Small bin Shelves
XXX Boxes	Max 1000 kg	XXX Boxes		XXX up to 3
EUR-Pallets	Over 625 kg	E2 Under Heavy		Floor
		E3 Over Heavy		Floor
	Under 625 kg	E2 Under Light		Pallet racks "E2"
		E3 Over Light		Pallet racks "E3-E5"
"Over" EUR-range	W&D over EUR	Big-Size Pallets		"Deep" Pallet racks
	W over EUR, over 625 kg, H under 1m	Long & Heavy		Floor / Cantilever HEAVY DUTY
	W over EUR, under 625 kg, H under 1m	Long & Light		Cantilever
	W over EUR, H over 1m	Special		Floor

Pallet Rack: floor level
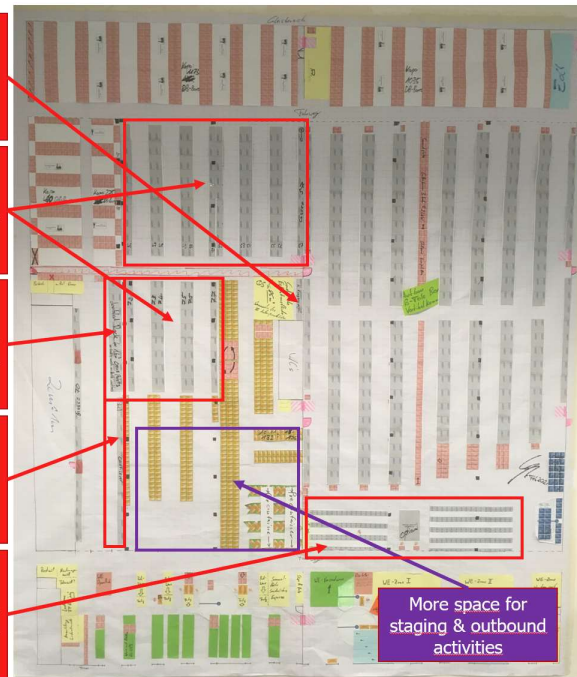
Re-organize to lower piles

New cantilever racks (light)

New pallet racks

New extra-deep pallet racks

New cantilever racks (heavy)

More small bin shelves

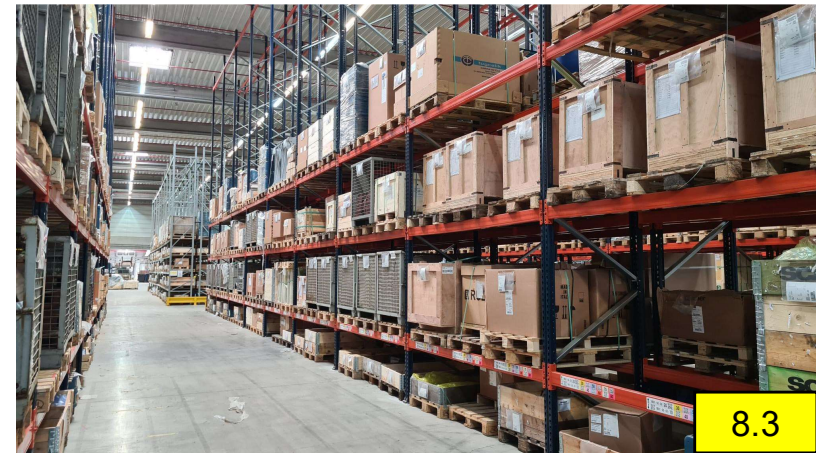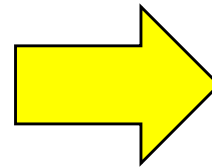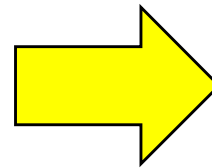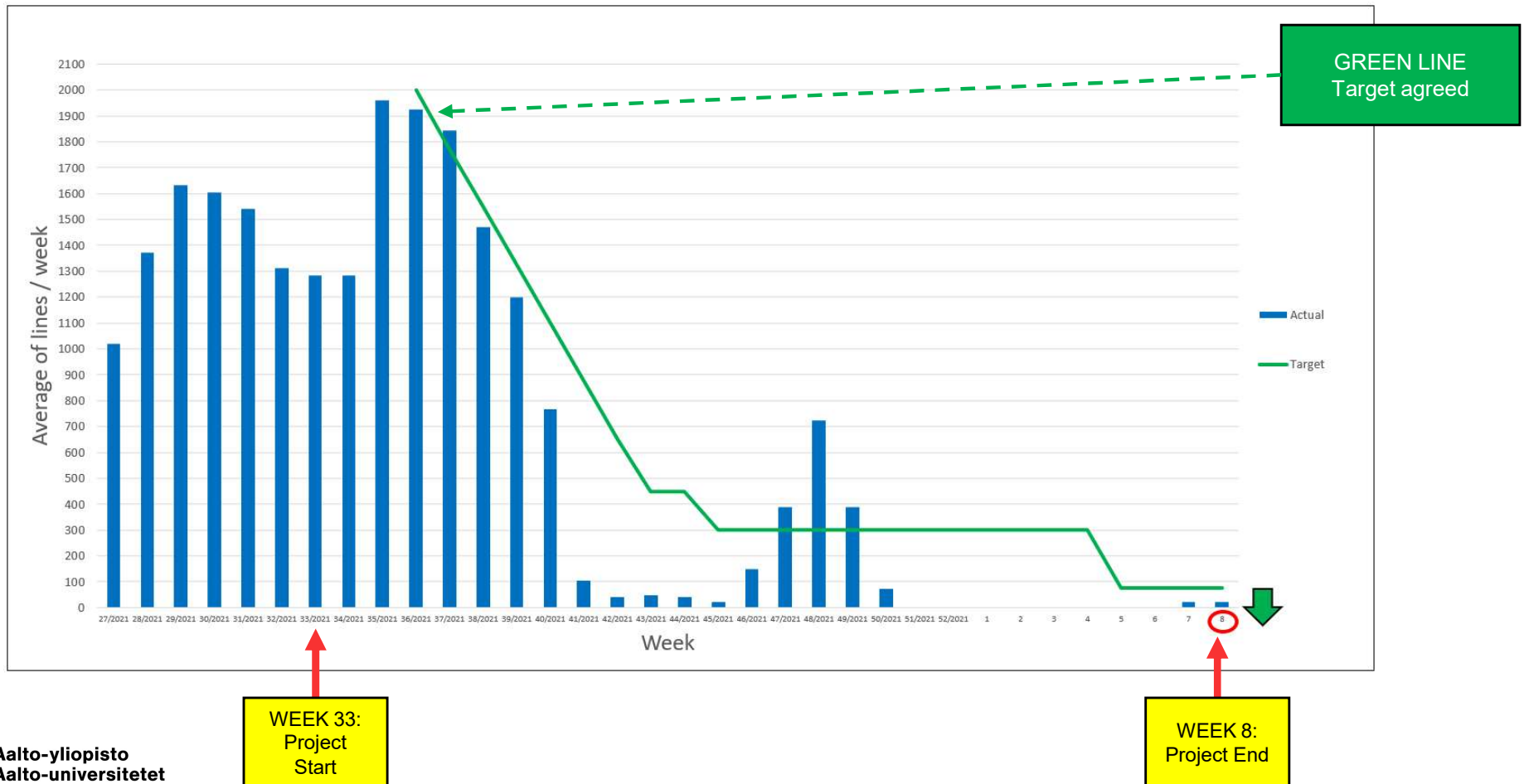More space for staging & outbound activities

Pallet Rack: floor level

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What were the results?

Some visible changes (before/after)

31.8 → 11.2

31.8 → 8.3

KPI 1: backlog at warehouse

Summary of the case

Actions

- Removing 1000+ pallets to clear the situation

- Building 2000+ pallet locations more

- Re-organizing the lay out

Results

- Roughly in 8 weeks, the backlog was in target

- The 3PL operator was able to manage the warehouse in sufficient efficiency

- The 3PL operator was able to continue the business

- Savings xxx xxx €

Key takeaways

- **What is the issue / main issue?**

- **What are the causes / root-cause?**

- **How to measure this?**

- **The truth is always on the shop-floor -> go-look-see!**

- **What is your approach?**

- **Show me the data!**

- **Analyse & visualize!**

- **Corrective actions**

- **Follow-up**

Discussion & Questions

Thank you!

If any questions / feedback, please contact:

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Back-up slides

Approach / Problem solving

- Case-study: go and follow / execute the process
    - Individual process
    - E2E-process
    - How many times? Beware of sample size (next slide example)

- Flowchart

- Pareto / ABC

- Why, Why, Why……..

- Root-cause analysis

- Fishbone

- DMAIC / DMADV

- …..