Industry 4.0 – The Connected Factory

The next industrial (r)evolution

WMS 2017 Conference

Toronto

Date: November 4, 2017
Presented by: Sepp Gmeiner

discover opportunities

LIGNUM CONSULTING

Who we are

- We are an independent engineering and consulting firm, specialized in the wood and furniture industry.
- We focus on technical, organizational and operational consulting.
  - Manufacturing processes
  - Layout and facility planning
  - Lead-time reduction
  - Cost reduction
- We create value for wood and panel processing companies by transforming and aligning business processes. We work hands-on, from concept to project realization.
  - Lean Manufacturing
  - Quality Systems
- Our team of innovators has extensive industry knowledge and experience required for successful project implementation.
- With offices in Toronto, North Carolina, Germany and Brazil we serve our clients world-wide.

⇨ The leading experts for the wood- and panel processing industry


Economy
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Internet
Data
cloud computing
Products
Implementation
Market
Industry 4.0
Internet of Things
Smart
Human
Application
Cooperation
Big Data
Business
Supplier
Digitalization
Connected Factory
Services
Management
Advanced manufacturing
Solutions
Data Integration
Utilization
Technology
Employees
Future
Cloud
Information


Economy
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Connected Factory
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Advanced manufacturing
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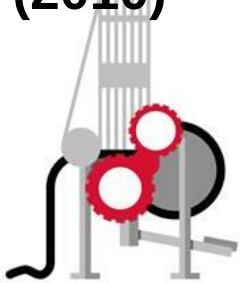
Data Integration
Utilization
Technology
Employees
Future
Cloud
Information

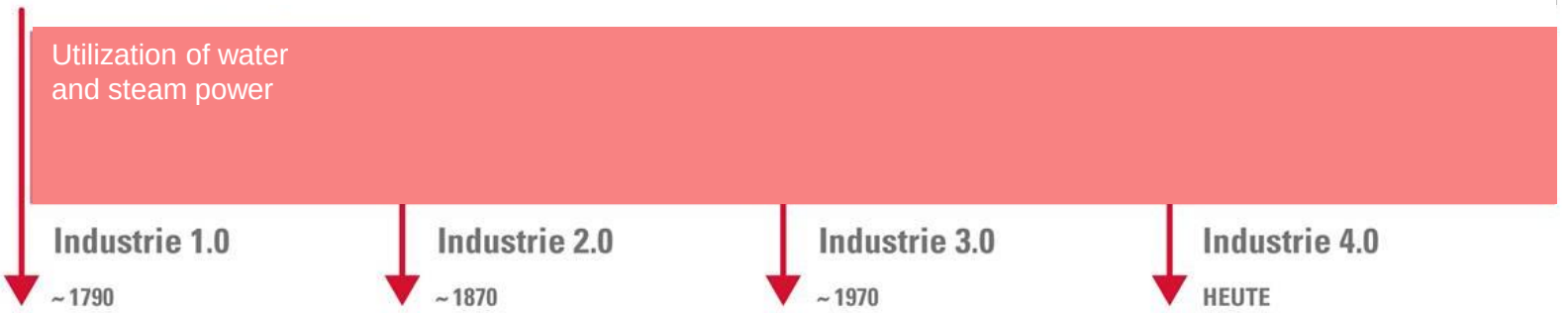
Origin of Industry 4.0 - History

Industrial Revolutions

1. Mechanization (1790)
2. Electrification (1870)
3. Digitalization (1970
4. **Connectivity (2010)**



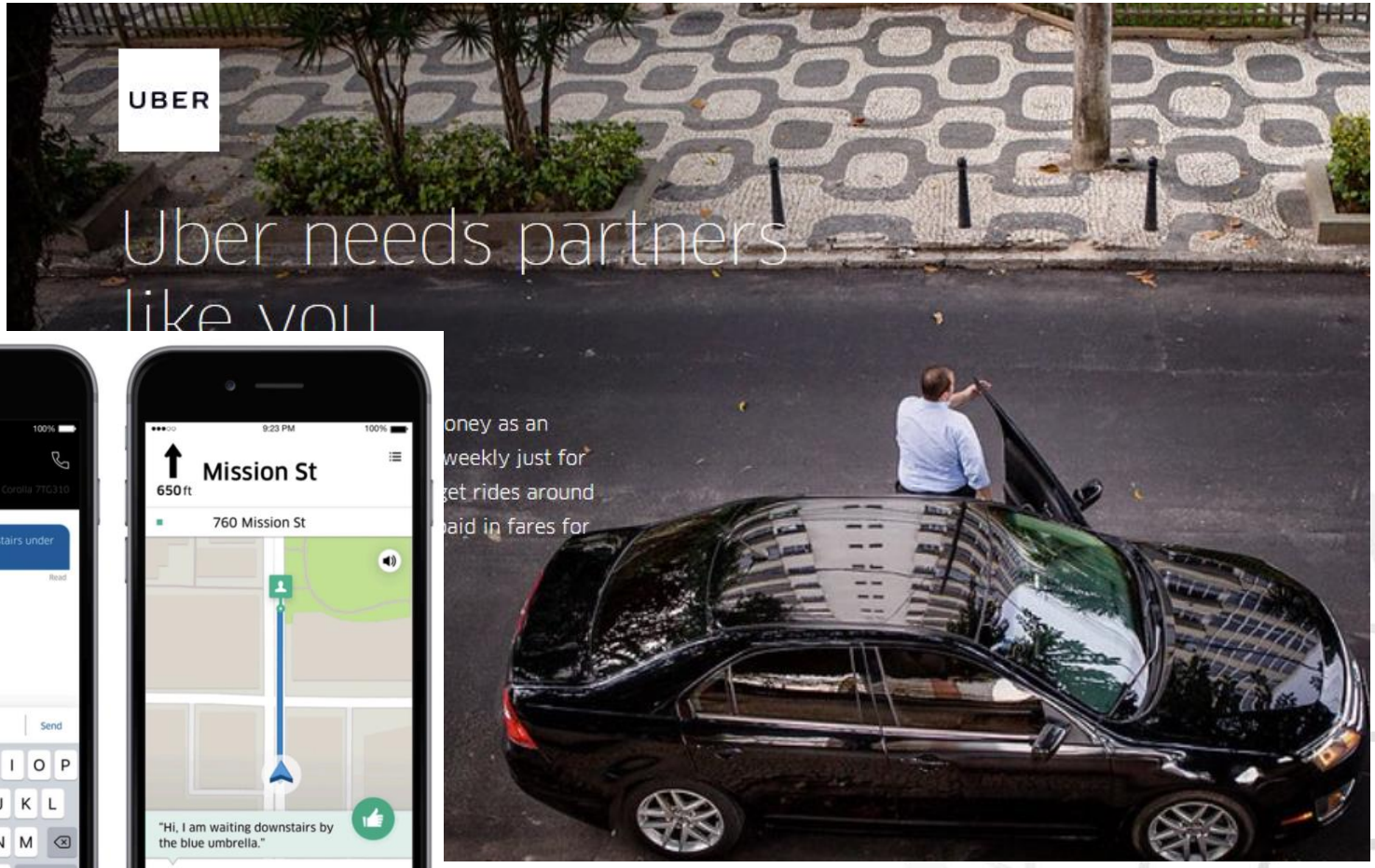
Mechanization

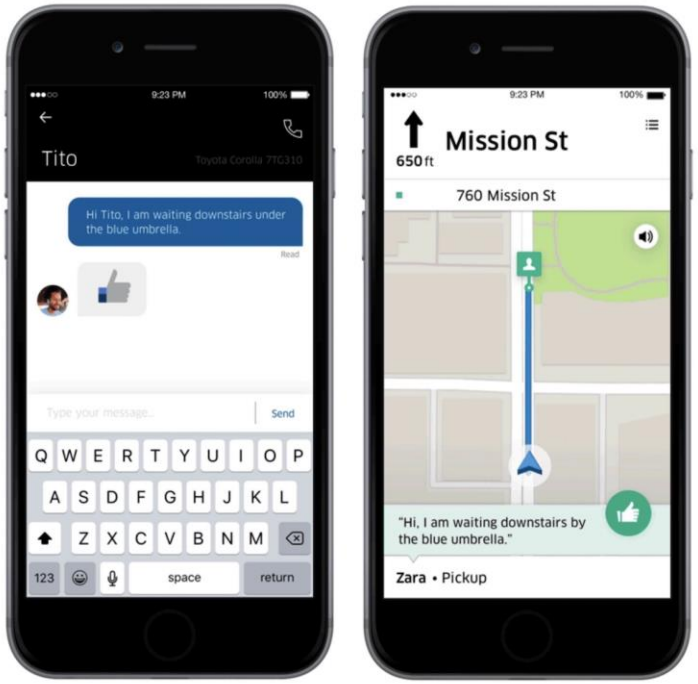


Revolution or Evolution

Game Changer Uber

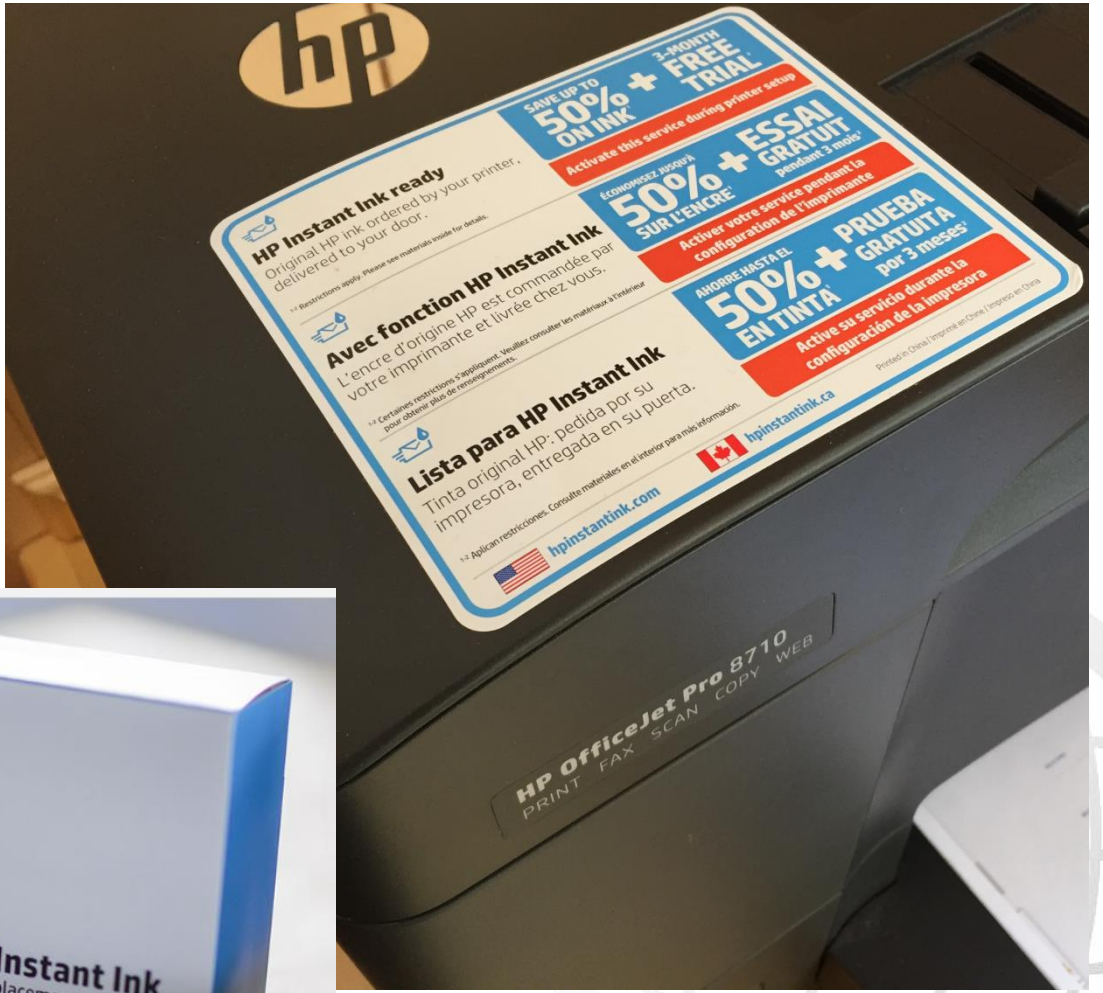
- Car
- Smartphone
- GPS
- Internet





Printer- Ink replacement

- Printer reports usage of ink by being connected to the internet
- HP mails replacement cartridges and return envelope for empty one
- Manufacturer by-passes retailer



40 per cent of Canadian jobs could be lost to automation, McKinsey chief says

The head of the federal government's economic growth council urges focus on key areas as technology puts jobs, livelihoods at risk over next decade

February 6, 2017
by The Canadian Press

Dominic Barton said two out of every five jobs will disappear in the next decade or so due to automation

- **40% over a decade is 3 - 4% annually**
- **Not necessarily manufacturing jobs**

Sustainability

Industries

Aerospace

OTTAWA—The head of the government's economic growth advisory council says governments need to craft "new social contracts" with Canadians to avoid deepening income inequality over time.

Purchasing online

..just the beginning

Massuni beta

Showroom Inc.

wayfair.ca

amazon.ca

⇨ Less Importance of Brick & Mortar Stores

…..closer to our Industry

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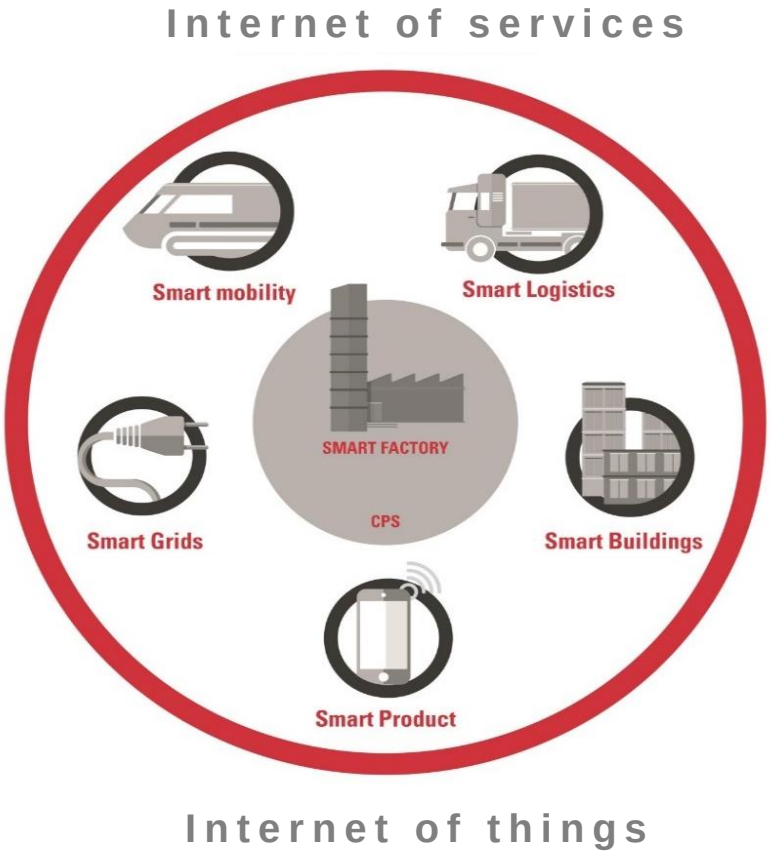
- Print your complete product list and review.

Start Planning

Need help with ordering your kitchen? Click here

What is "Industry 4.0"?



Vision:

Connectivity of manufacturing technologies more customized, flexible and faster

Factories ➔ **Smart Factory**

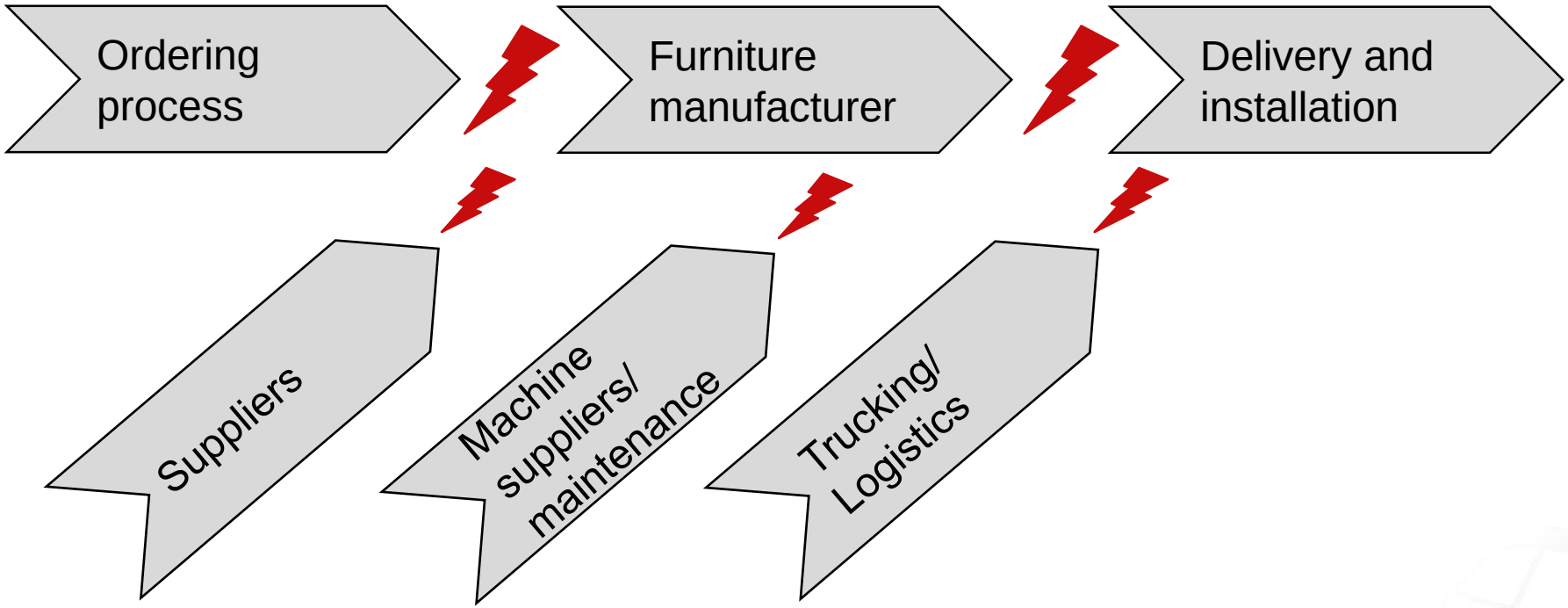
Products ➔ **Smart Products**

Products and Machines communicating

For us…

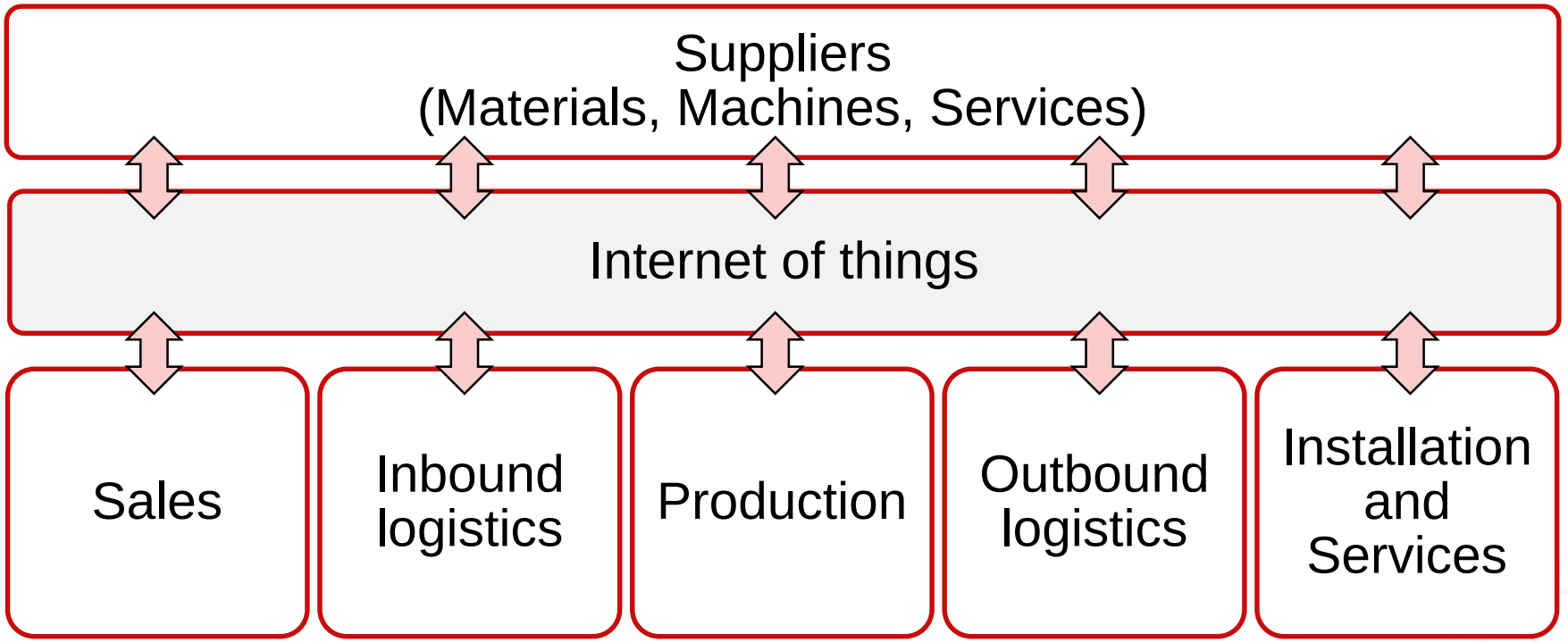
…the fusion of production, logistics and information technologies

Current situation – often fragmented processes



⇨ Often disjointed with many interfaces and sources of inefficiencies

The vision – integrated processes along the value chain



⇨ Connected processes along the value chain

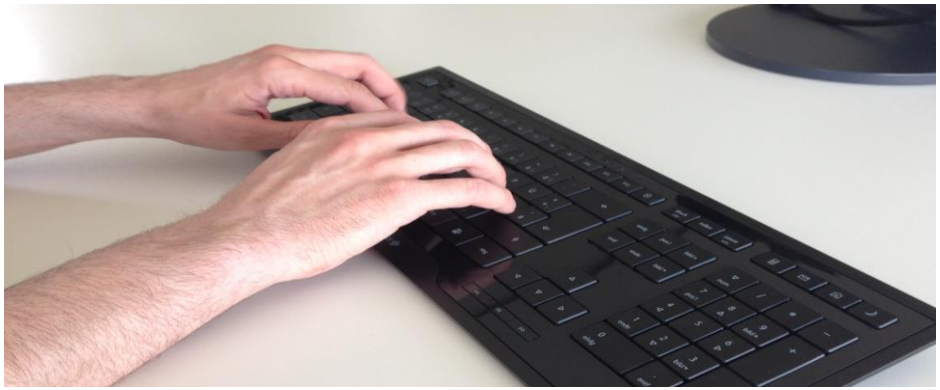
Applications in the furniture industry

End Customer

Graphical Order Planning, Visualization

Applications in the furniture industry

Delivery Date
Order Submission

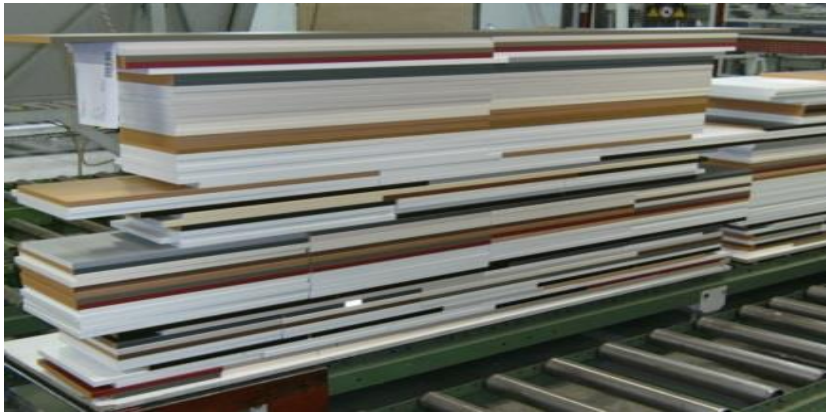


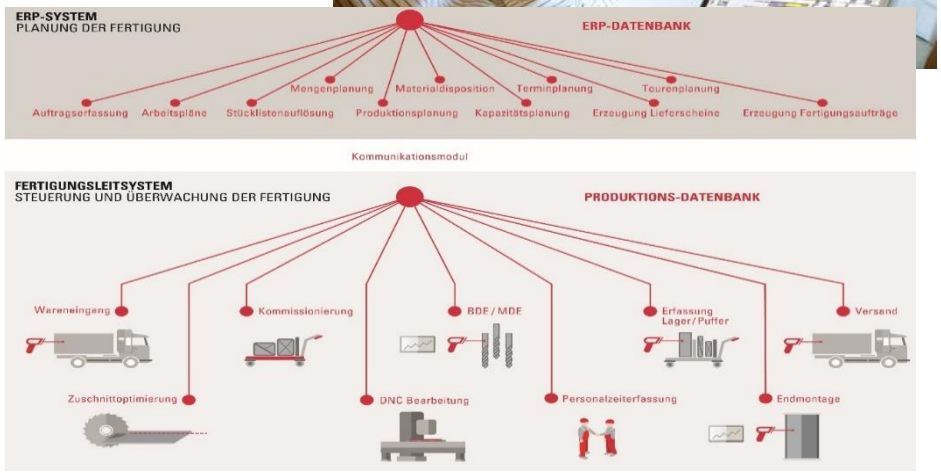
Demand Generation, Supplier Visibility

Applications in the furniture industry

Mfg. Execution System real time manufacturing information

Cumulating Sequencing

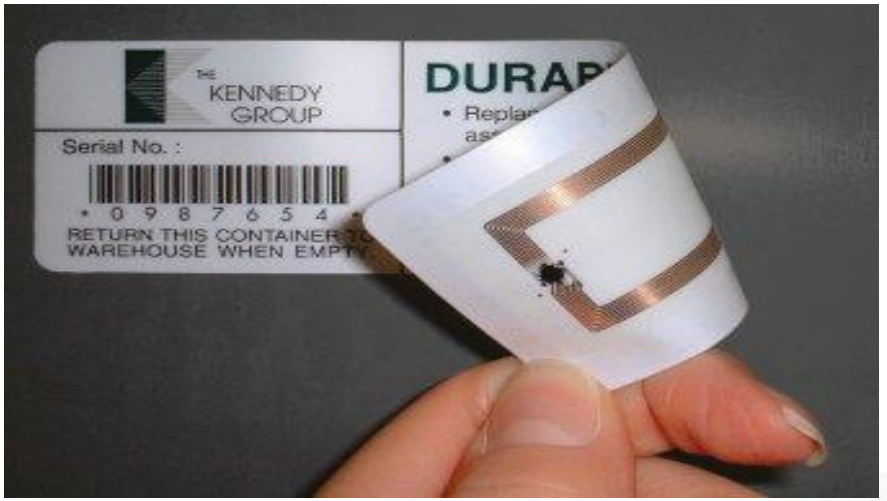




Applications in the furniture industry

Material Provision
Logistic Train System

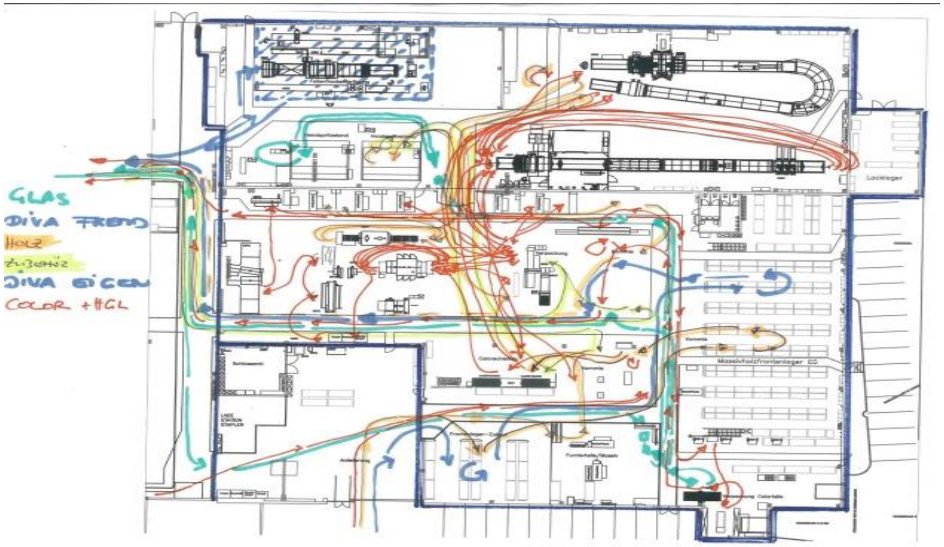
Part Identification
Barcode / RFID



Applications in the furniture industry

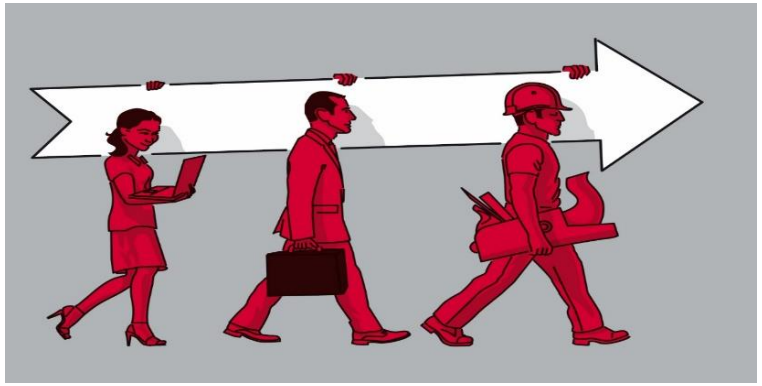
Material Flow Synchronization

Machine Availability
Wear / Maintenance



Applications in the furniture industry

Flexible Employees
Flexible Production



Order Progression
Control

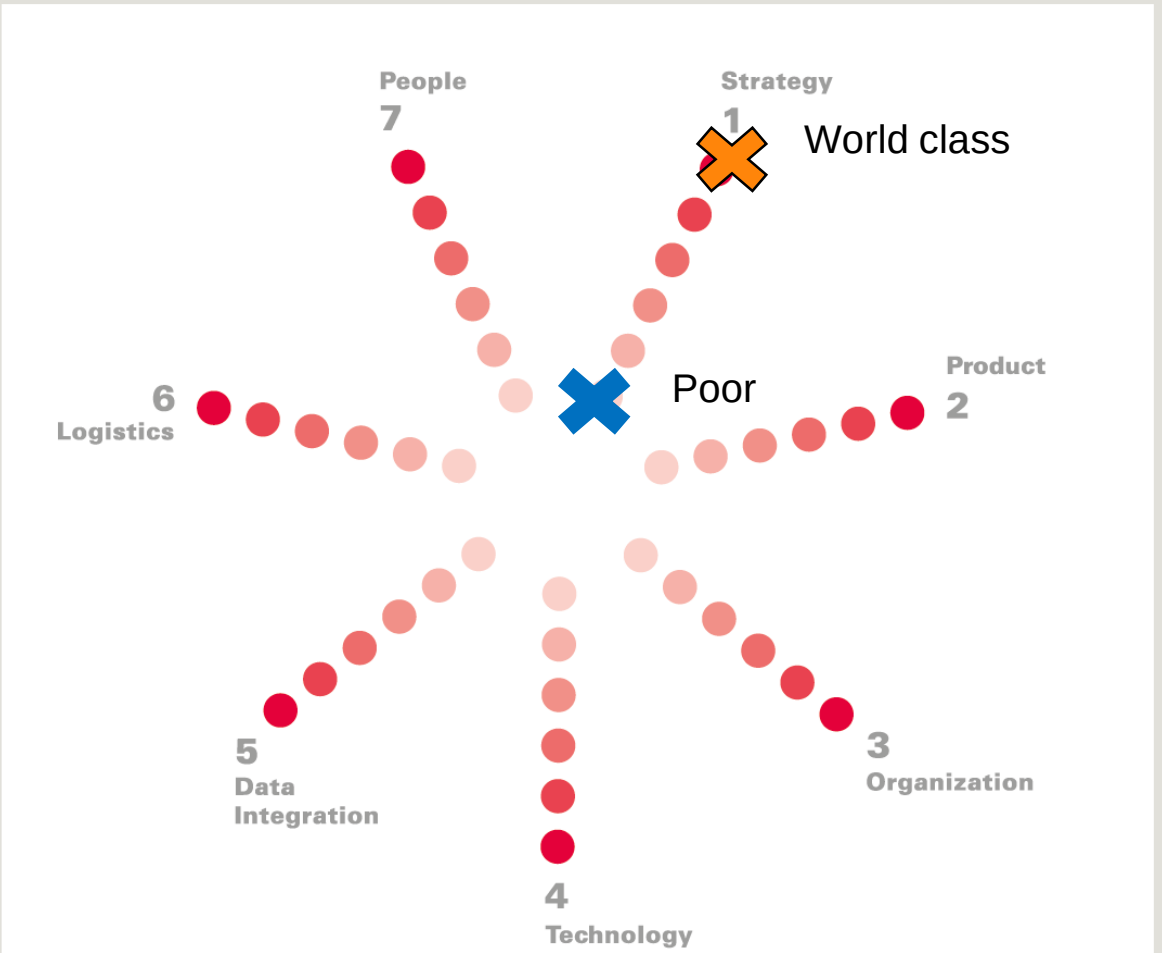
Why? - Connected Factory

…manufacturing is more customized,
more flexible,
faster and more reliable…

…continuously enhance the entire process chain

…from order configuration at the POS &
Order Processing, to Production, to Assembly and Installation…

ARE YOU READY FOR THE CONNECTED FACTORY ?
YOUR COMPANY PROFILE VISUALIZED



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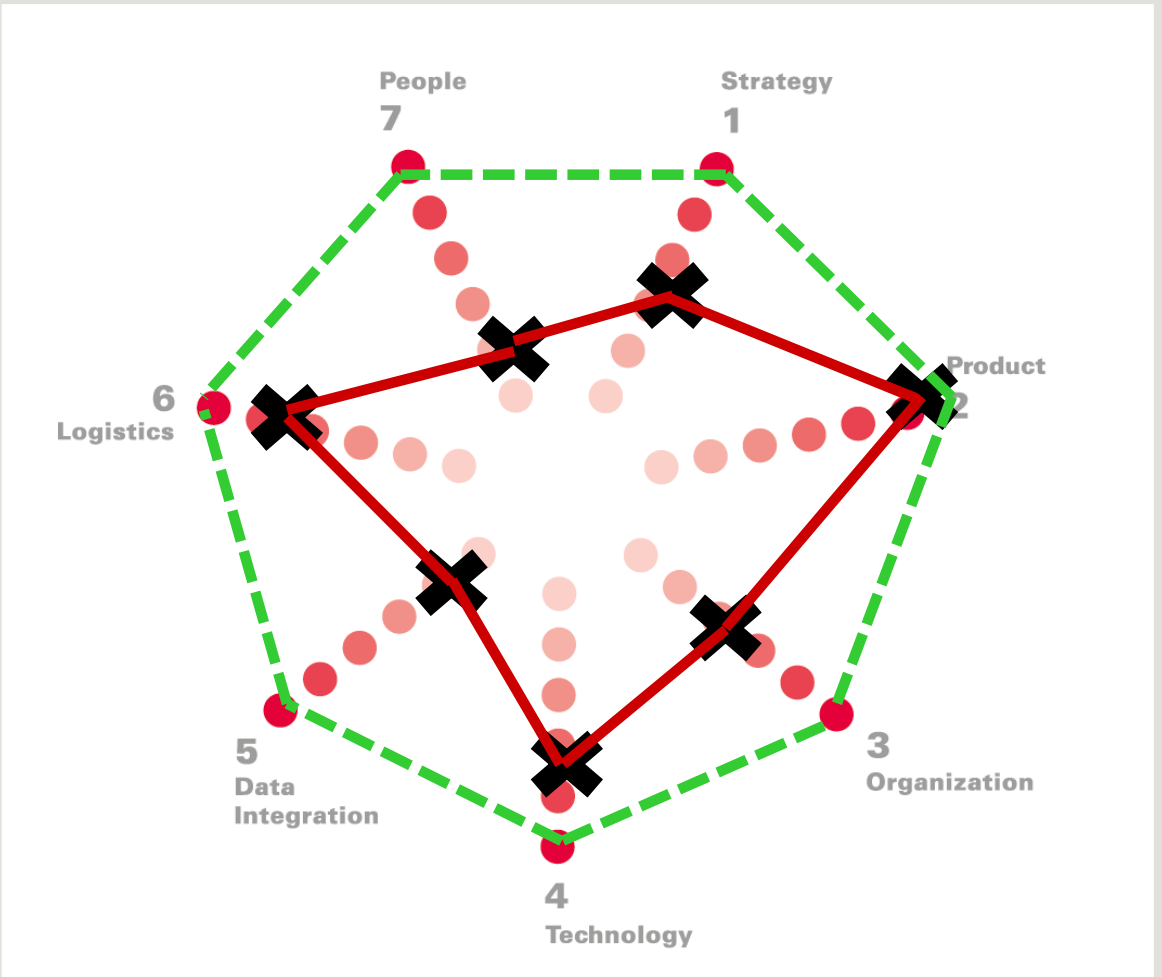
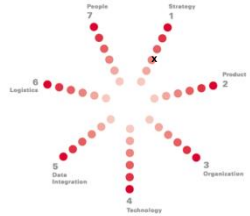


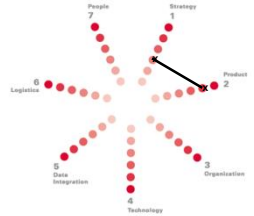
Strategy



Key Questions:

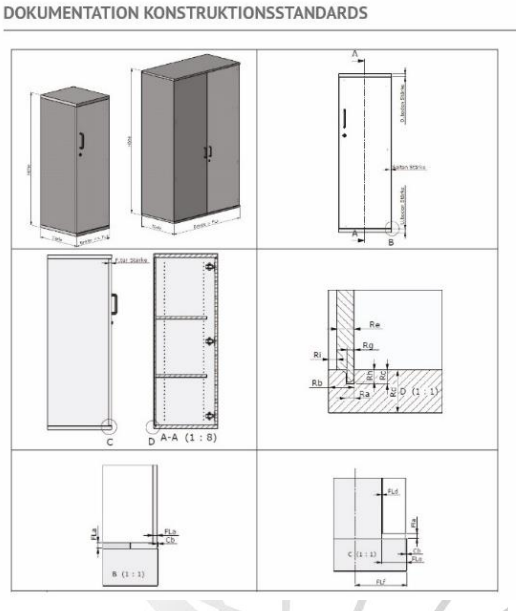
- Is your company strategy aligned towards the connected factory?
- Are the investments and projects in alignment with the requirements for the targeted position in the market? - e.g. flexibility & speed.
- Is the goal to become more automated/integrated a clearly defined company target? – communicated to all employees
- Is capital planning not only done for machinery investments, but also for investments in training, organization/processes and systems?
- Is the company willing to invest in automation and systems, even if longer payback times are required?
- Is the company willing to invest in people who can take the company to the next level?

Product

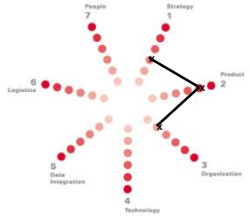


Key Questions:

- Is your product offering in alignment with your market needs and internal capabilities?
- Is your product construction rule-based and can it be handled by product configurators?
  - No manual intervention required to generate product data.
- Do you have standardized construction principles to keep the internal complexity low?
  - Product data model and manufacturing processes
- Is your product designed to fit your manufacturing processes?
  - Avoid additional/manual processing outside the defined processes/ manufacturing capabilities of the main processes.
  - Do processes get updated to match the changing market requirements
- Do product platforms get used to generate variants and keep the internal stock at a minimum and simplify order processes.



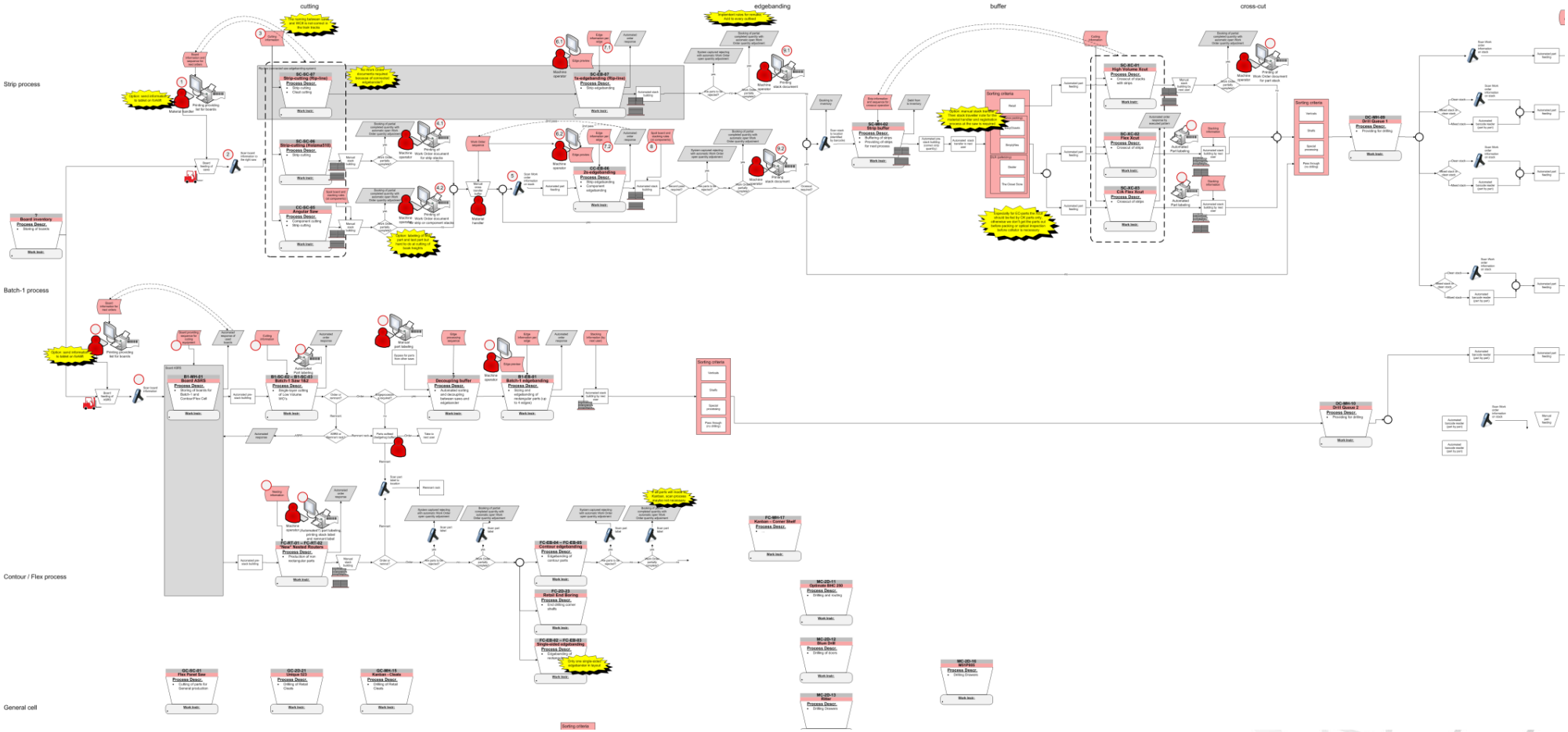
Organization



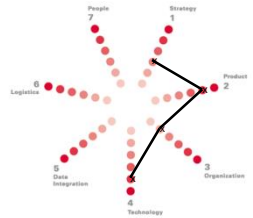
Key Questions:

- Is your organizational model defined and can it be used to drive integrated processes.
- Does your business model support all sales channels and product groups?
  - Do you have the right type of manufacturing methodology for your business?
- Do you have defined and documented processes for the main business functions.
  - Ie: production (defined routings for all parts), defined organizational loops for part families or processes, such as re-work. Or do you rely on tribal knowledge to process orders?
- Does your production information fully support and align the manufacturing processes?
  - Do operators have to modify or enhance provided information to get to the information they really need?
- Do you have scheduling rules in place?
  - Does the system provide a sequence for the operators or are people choosing their own priorities?
- Do you have functioning continuous improvement processes in place?
  - 5S, Safety, Cost reduction, tool management, etc.

Organization - Example: Defined processes and information flows



Technology



Key concept:

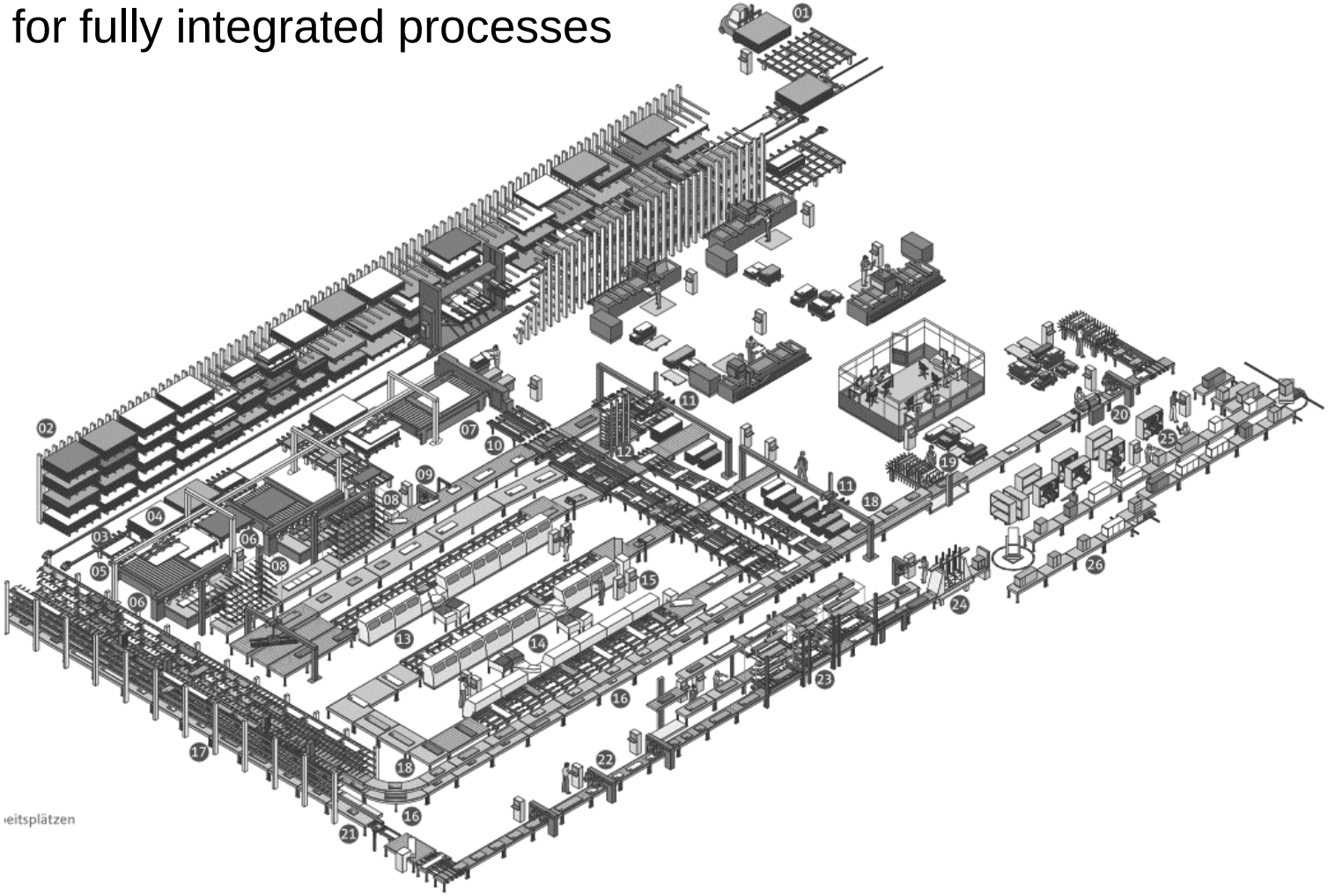
Develop the ideal level (not necessarily highest possible level) of integration of the main equipment based on the process requirements.

Key Questions:

- Is the equipment ready to be data-driven/integrated?
  - Or is the equipment more standalone, dependent on operator input?
- Is there an automation/integration strategy in place (growth plan in steps)?
  - Growing into automation by building in “manual processes” that will be automated over time as the organization learns to deal with automation.
- Are the supporting functions in place to run the automated equipment on high performance?
  - Pro-active Maintenance management; On-line support from machine suppliers; Engineering support; Tool and materials management; Data support.
- Is technology/data used to guide operators?
  - Use of laser positioning of hardware vs. jigs and fixtures?

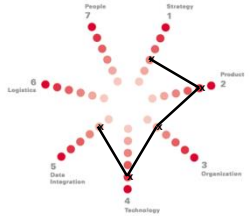
Technology

- Example for fully integrated processes



Source: 3tec

Data integration



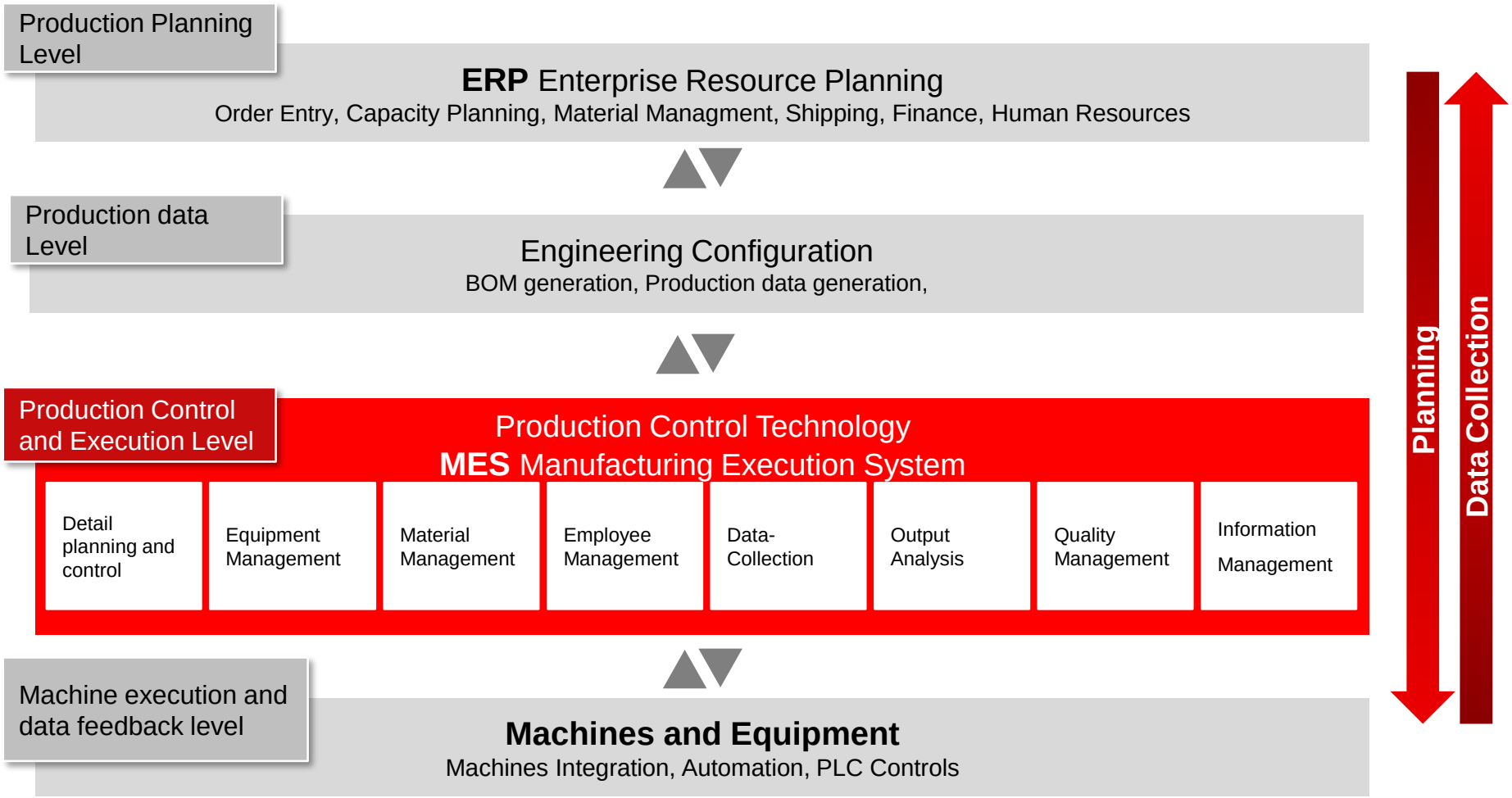
Key concept

- Be it fully automated or with people who bridge the media breaks amongst the applications, today it is important to establish a seamless data integration throughout all system layers.
- It's important to look at the entire process chain, today's as well as tomorrow's, from order generation to product and process data generation all the way through to the machine integration

Key questions

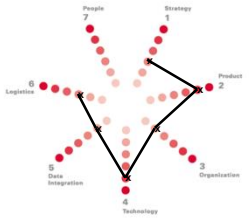
- Can the data model be used to generate product and process data?
- Are the functionalities of the different software layers (ERP, MES, Machine data) clearly defined and system components used at their strength?
- Do the systems provide all required information with the least amount of data entry effort?
- Is there a interconnected, integrated, automated data flow from dealer to factory to final consumer?

Data Integration



⇨ The Data Integration provides the largest challenge for most manufacturers!

(internal)Logistics

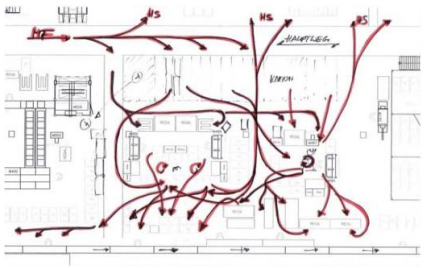


Key Questions:

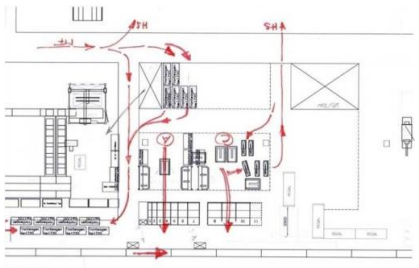
- Are your logistics processes geared to be data driven?
- Does the applied technology and equipment for material logistics and transport match the business requirements?
  - Warehouse management systems (WMS), Automated storage and retrieval systems (ASRS)
  - Pick by light/voice, Self-guided vehicles, Logistic carts, RFID's
- Are all material and inventory locations clearly identified and can they be used for data driven processes?
  - No material request forms to be filled out manually, etc.
- Does the layout design accommodate self-guided vehicles or logistic trains?
  - Clear, wide aisles, large enough turning points, no dead-ends.
- Does your IT support automated logistics processes?

(internal)Logistics - examples

Material flow routing



Before



After

Supply routes (Milk run)

Source: Linde

Automated Guided Vehicle, **AGV**

source: dpm

sourcee: swisslog

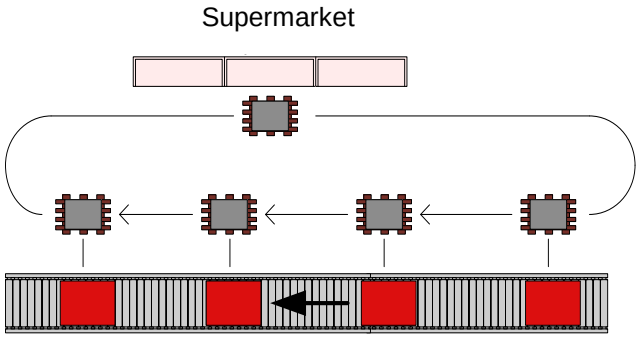
Material staging

flat

vertical

(internal)Logistics - examples

Supermarket



Order Picking Systems

Pick-by-light

Pick-by-voice

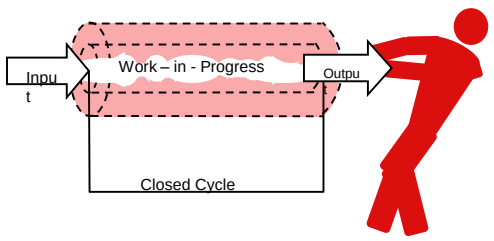
Quelle: swisslog

Pick-by-vision

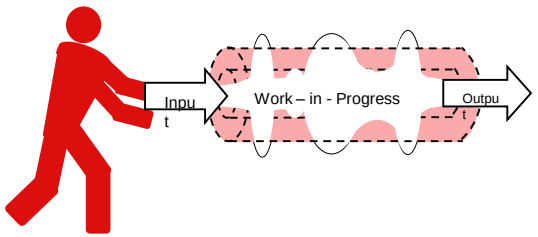
Quelle: Fml TUM

Material flow

Pull-System

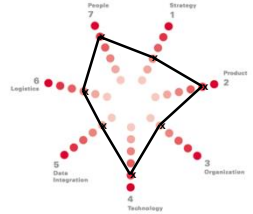


Push- System



Kanban

People



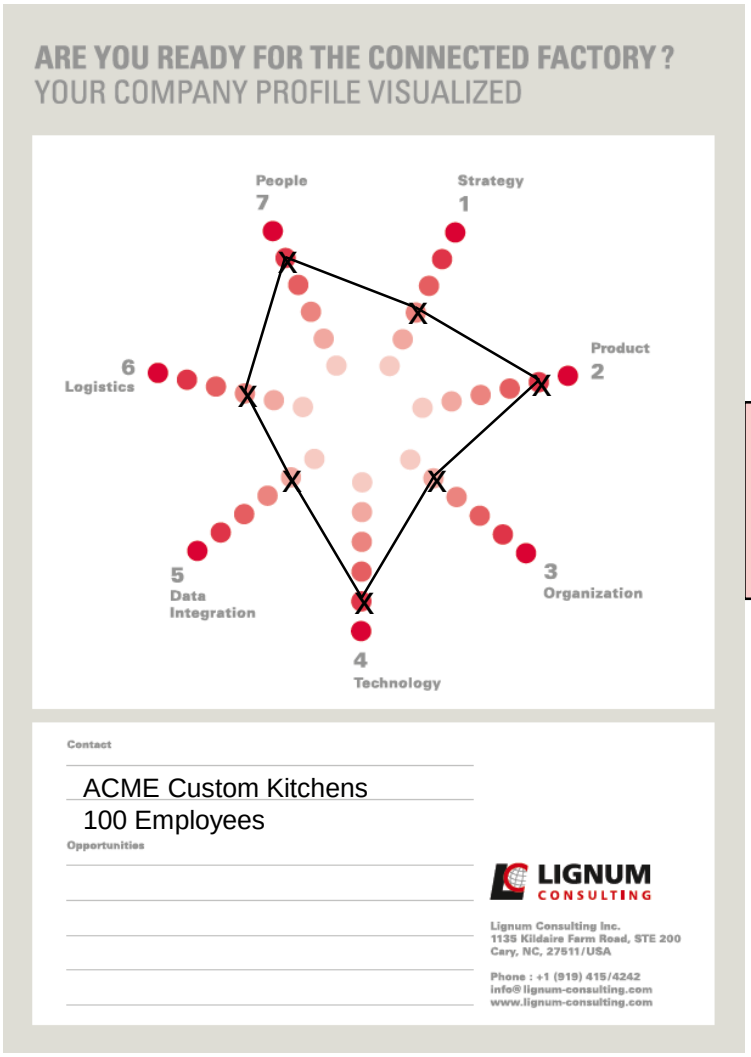
Key concept:

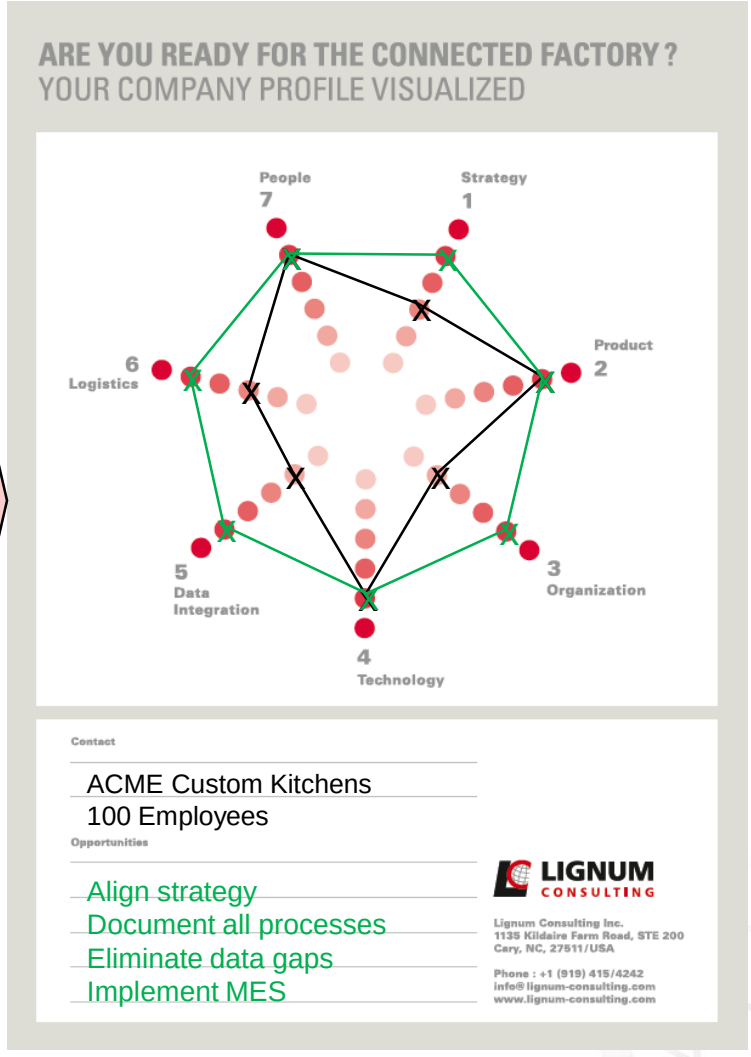
- Automation/integrated processes require less, but higher skilled and highly motivated people.
  - Turnover will be more costly.
- A shift will take place from shop-floor workers to support functions.
  - Traditional white collar vs. blue collar metrics will not work anymore.

Key questions:

- Is the company willing to hire higher skilled people and pay a premium?
- Is the company actively searching and acquiring the talent needed to drive integration?
  - Shift from “cabinet maker” to “mechatronics” - hire a different skill set
- Does the resource pool of the company provide the skills required?
- Is there a formal system in place to continuously train and educate the people instead of passing on tribal knowledge on the job?
- Are there initiatives/systems in place that keep people motivated and engaged?

The process - what needs to be done to create an even profile





Write down your key topics/issues - Where do you see the biggest need for improvement.

Final thoughts

Industry 4.0 is here and it is here to stay!

Are you becoming an early adopter, or waiting until you are behind?

- Take your survey results sheet home and discuss with your management team.
- Leave me your business card, send me an e-mail, or hand me your e-mail address on the survey, and I will forward a copy of this presentation
- I am available for more detailed and individual discussions.

Questions?

Where we are

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discover opportunities!

entdecke Perspektiven!

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