

Industry 4.0 – the connected factory

Date: March 27th ,2018
by: Georg Frey



Woodworking Network

discover opportunities! 

Lignum Consulting – a short introduction

Consulting, Planning and Organization
for the International Wood and Furniture Industry

discover opportunities! 



Who we are

- We are an independent engineering office, working industry-specific for the international wood and furniture industry.
- We focus on the technical, organizational and operational consulting of our clients.
- We create value for wood and panel processing companies, by transforming and aligning business processes. We work hands-on, from concept to project realization.
- Our team of innovators has extensive industry knowledge and experience required for successful project implementation.
- A typical profile of our consultants includes an apprenticeship in cabinetmaking, an engineering degree in wood and panel processing, a degree in business and extensive work experience throughout all levels of an organization.
- Founded in 2003, today we employ a team of 25 in our offices in Kupferzell (Germany), Cary, NC (USA) and Sao Bento do Sul, (Brazil).

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

Examples of our work

- Strategic development of organizations
- Plant planning and re-organization.
- Layout and work place design in alignment with the manufacturing-organization concept.
- Machine specifications and implementation / run-off support
- Design of process and information flows
- Introduction of lean production principles, resulting in material flow acceleration, lead time reduction and inventory reduction.
- Development and implementation of performance measurement systems for controlling and production support.
- Product value engineering and product variations management.



Industry 4.0

Are you ready for the connected factory?

discover opportunities! 



cloud computing

smart products

Industry 4.0

big data

Digitalization

Internet of Things

Connected Factory

Data Integration

Factory of the future

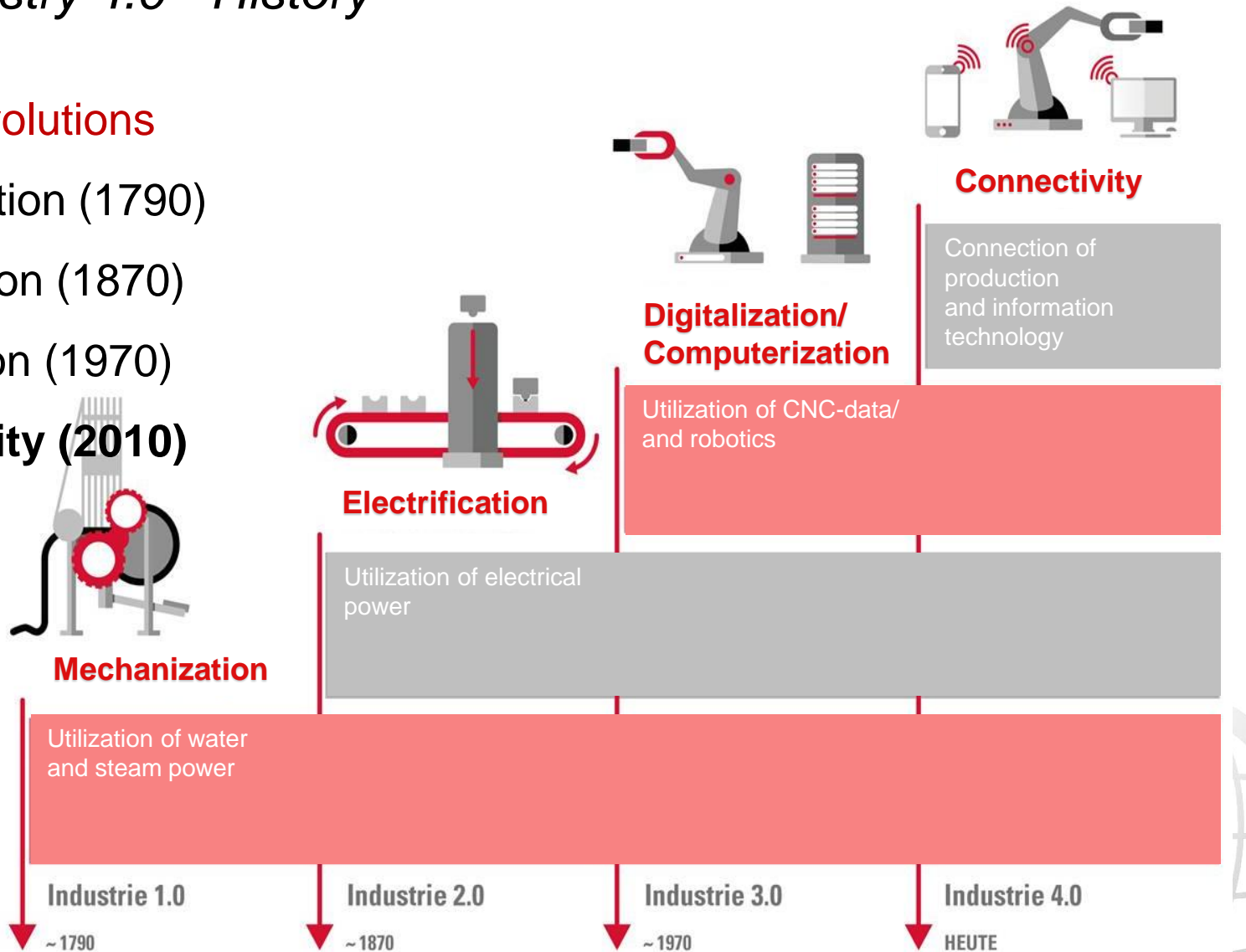
Advanced manufacturing



Origin of Industry 4.0 - History

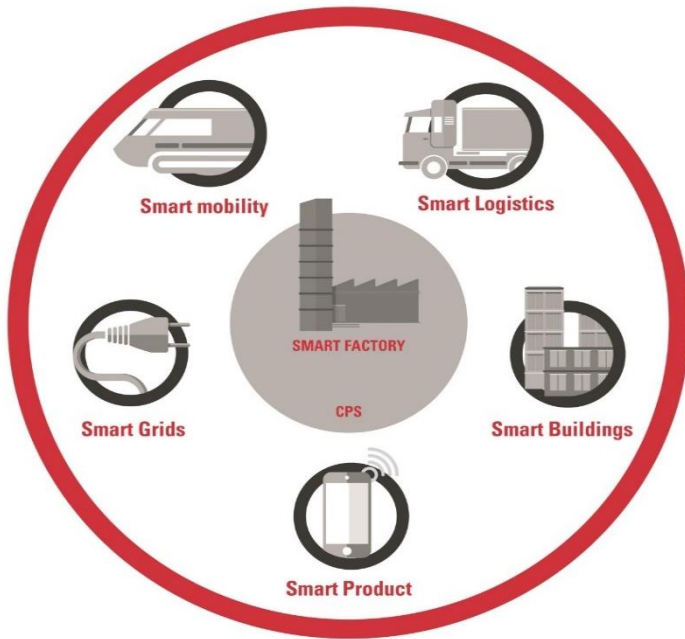
Industrial Revolutions

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



What is “Industry 4.0”?

Internet of services



Internet of things

Vision:

Connectivity of manufacturing technologies more customized, flexible and faster

Factories → **Smart Factory**

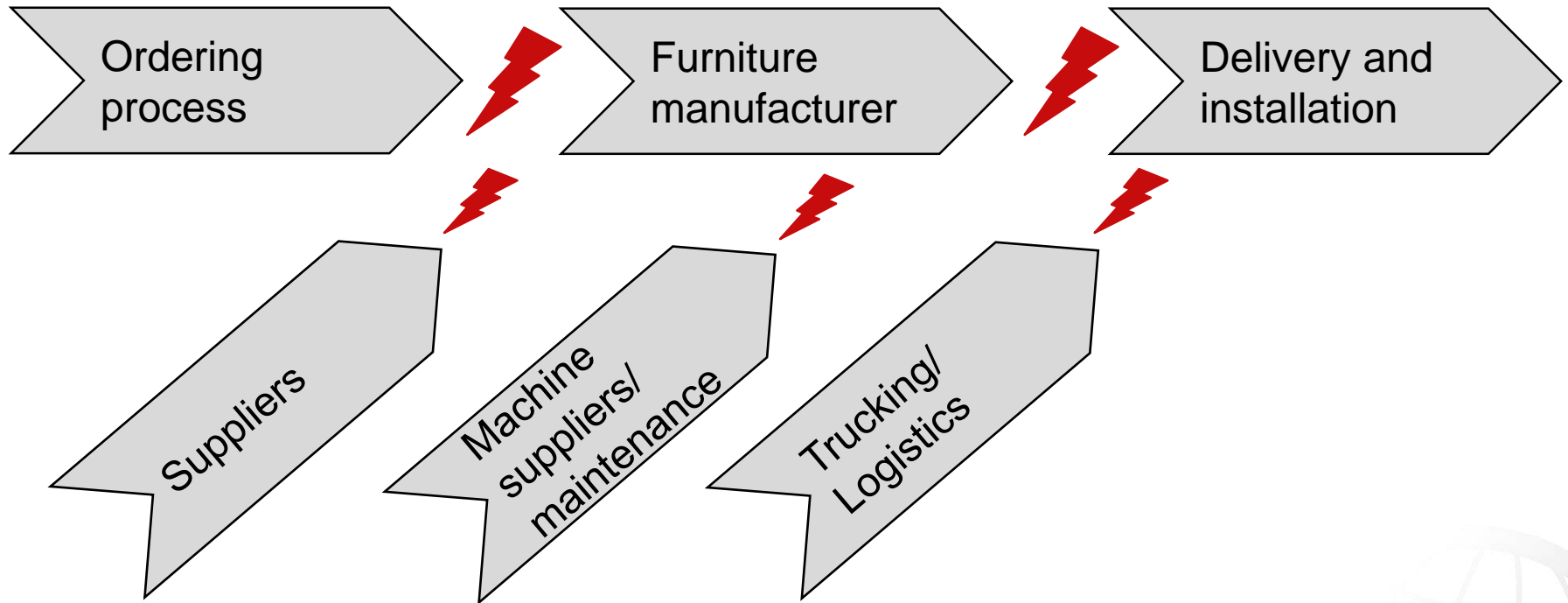
Products → **Smart Products**

Products and Machines communicating

For us...

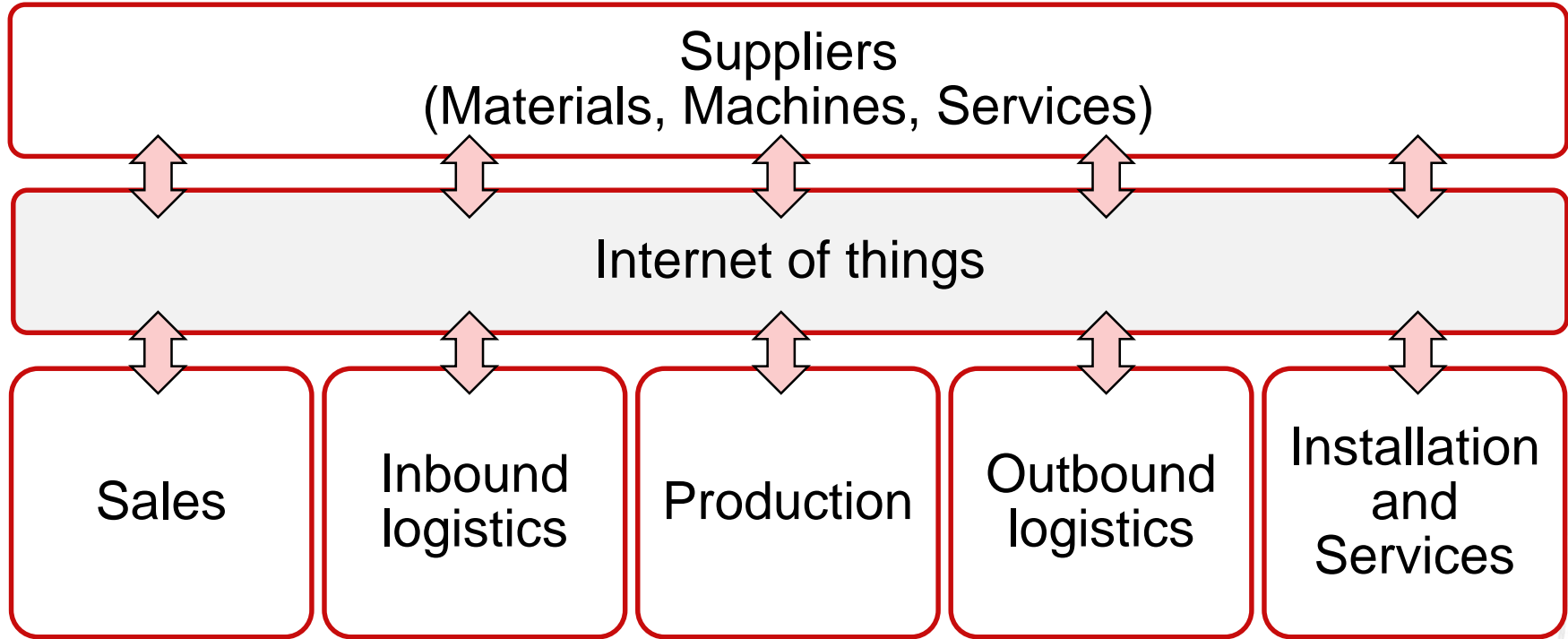
...the fusion of production, logistics and information technologies

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 or Architect/Designer



Graphical Order Planning, Visualization



Applications in the furniture industry

**Delivery Date
Order Submission**



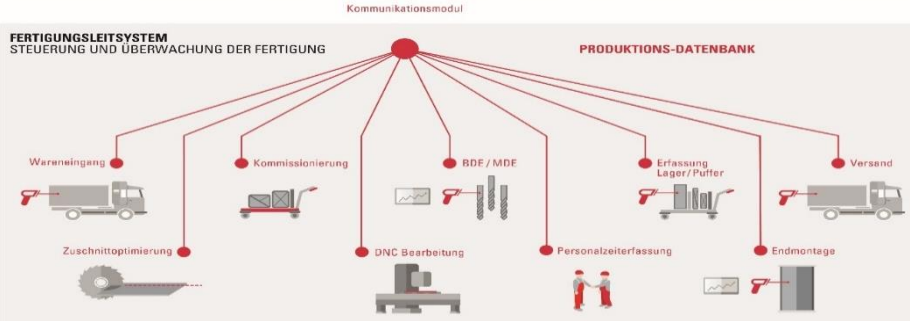
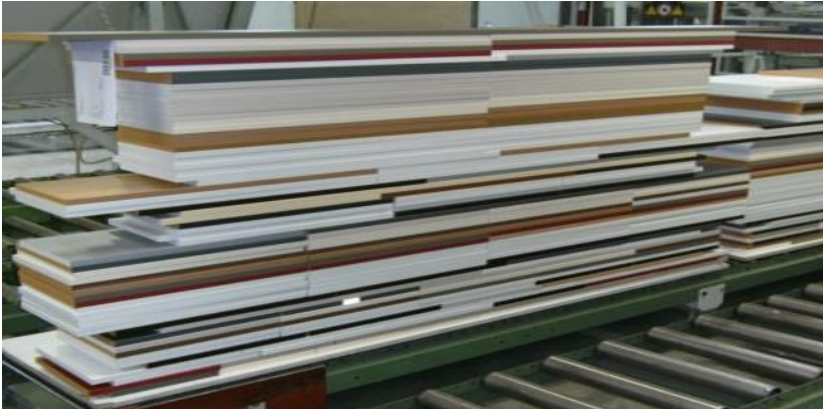
**Demand Generation, Supplier
Visibility**



Applications in the furniture industry

**Mfg. Execution System
real time manufacturing
information**

**Cumulating
Sequencing**

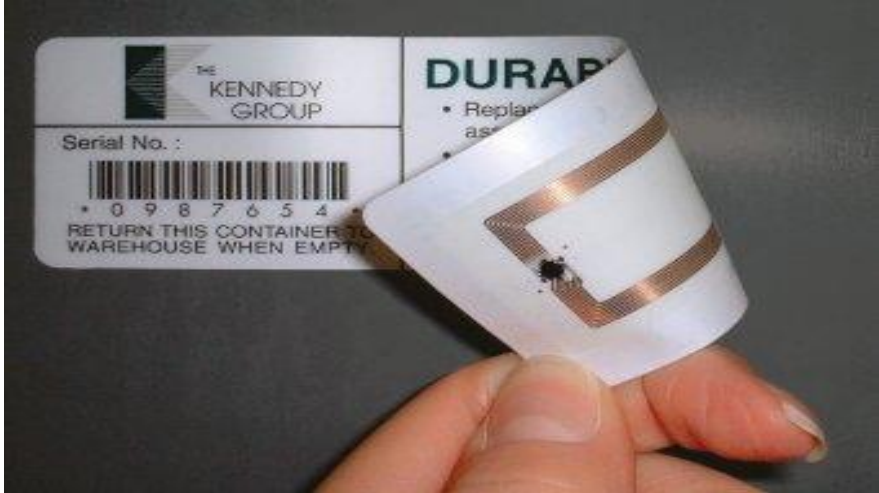


Applications in the furniture industry

**Material Provision
Logistic Train System**



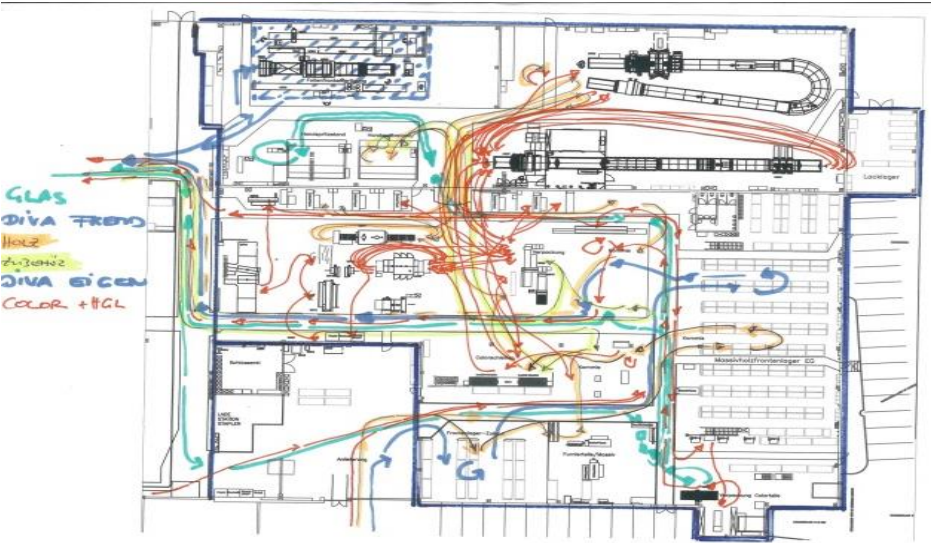
**Part Identification
Barcode / RFID**



Applications in the furniture industry

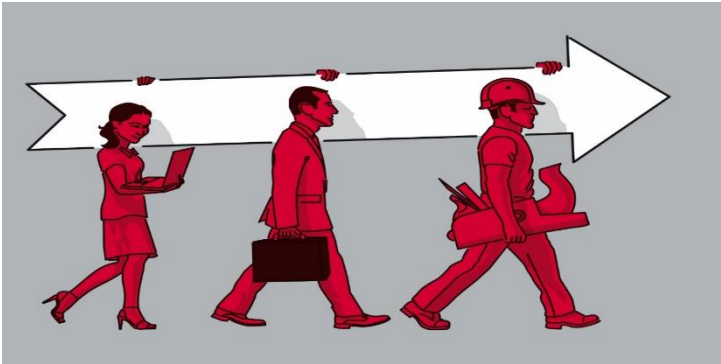
Material Flow Synchronization

**Machine Availability
Wear / Maintenance**



Applications in the furniture industry

**Flexible Employees
Flexible Production**



**Order Progression
Control**



Why? - „Connected Factory“

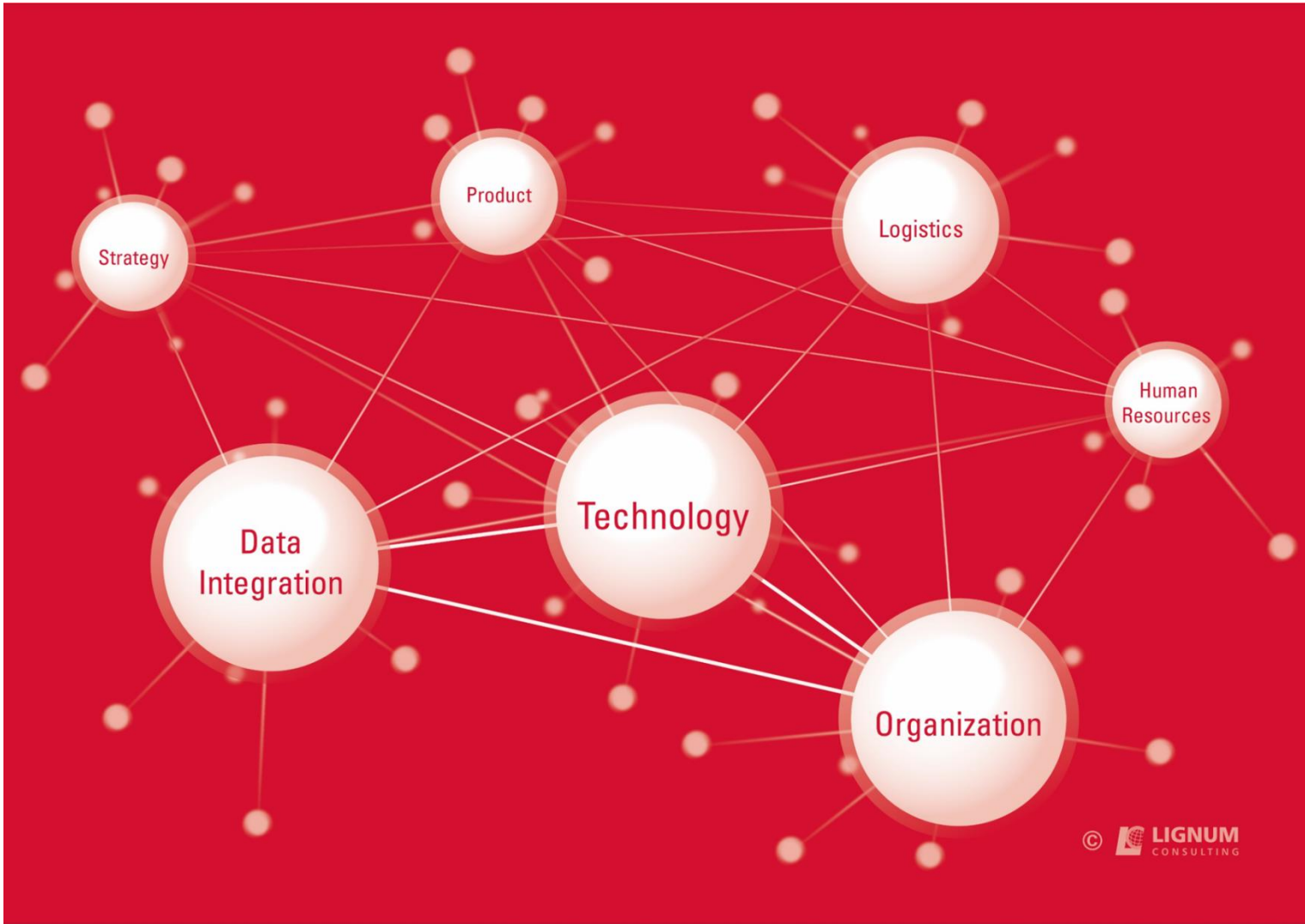
...to manufacture more customized, more flexible, faster and more reliable...

...to continuously enhance the entire process chain

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



The 7 key Elements to the connected factory



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Are YOU ready for the connected factory?

Rate yourself and create your company profile.



discover opportunities! 

The process

- We will walk together through the 7 key elements of the connected factory.
 - Meanings, questions and examples
- Based on examples you can rate your company in each topic.
 - Use your own judgment (the idea is to generate potential for discussion & improvements)
- Mark your rating on the form
 - Center – poor to Outside – excellent
- Connect the marks with a straight line
 - This will help to visualize your profile
- Write down your company name, industry and contact
 - Or if you like do it anonymously
- Write down your key topics/issues
 - Where do you see the biggest need for improvement.
- Take the original document with you – for discussions with your team.
- Leave the carbon copy and we'll provide you with your rating against the rest of the participants.

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

Contact

Opportunities

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The process - create your company profile

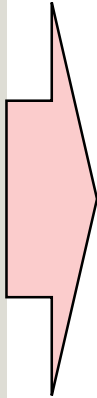
ARE YOU READY FOR THE CONNECTED FACTORY? YOUR COMPANY PROFILE VISUALIZED

7 People
1 Strategy
2 Product
3 Organization
4 Technology
5 Data Integration
6 Logistics

Contact

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

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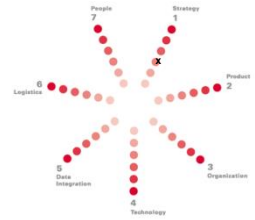
Contact

ACME Custom Kitchens
100 Employees

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Strategy

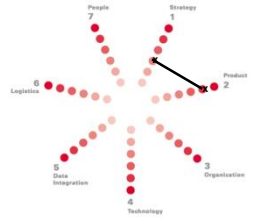


Key Questions: Is your company strategy aligned towards the connected factory?

- 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 company to the next level?

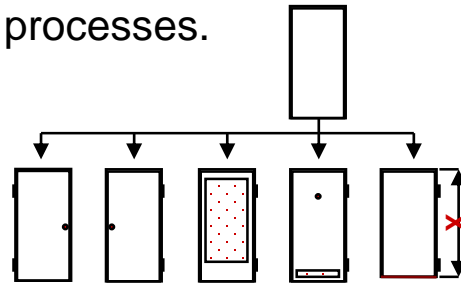


Product

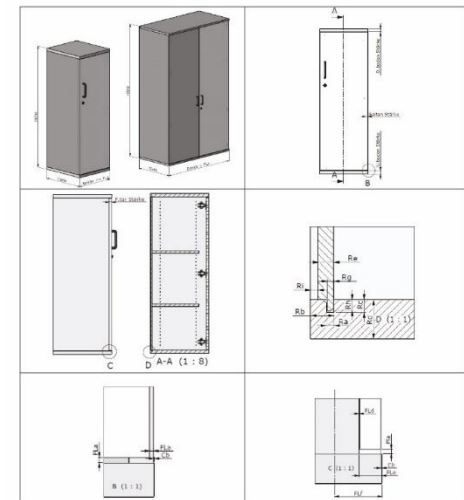


Key Questions: Is your product offering in alignment with your market needs and internal capabilities?

- Is your product construction rule based and can 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 min. and simplify order processes.

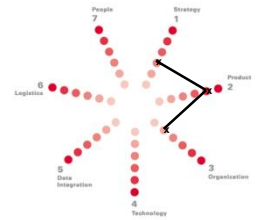


DOKUMENTATION KONSTRUKTIONSTANDARDS

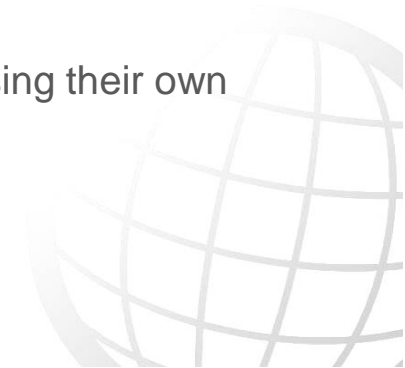


Organization

Key Questions: Is your organizational model defined and can be used to drive integrated processes.

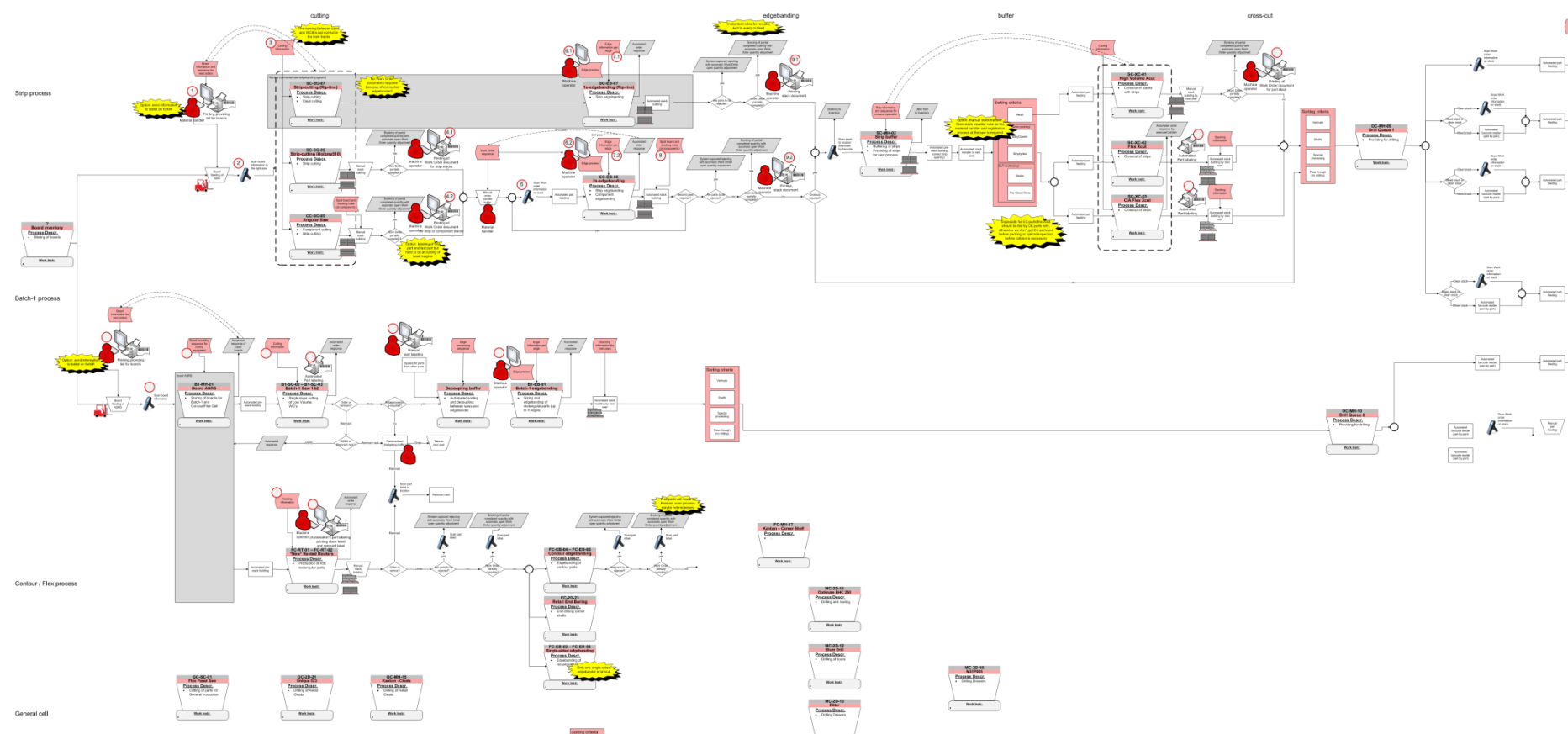


- Does your business model support all sales channels and product groups?
 - Do you have the right type of manufacturing methodology for your business?
- Do you have defined and documented processes for the main business functions.
 - E.g. production (defined routings for all parts), defined organizational loops for part families or processes, such as re-work. Or do you rely on tribal knowledge to process orders?
- Do 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 process in place?
 - 5S, Safety, Cost reduction, tool management, etc.

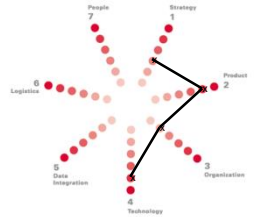


Are you ready? – rate yourself

Organization - Example: Defined processes and information flows



Technology



Key concept:

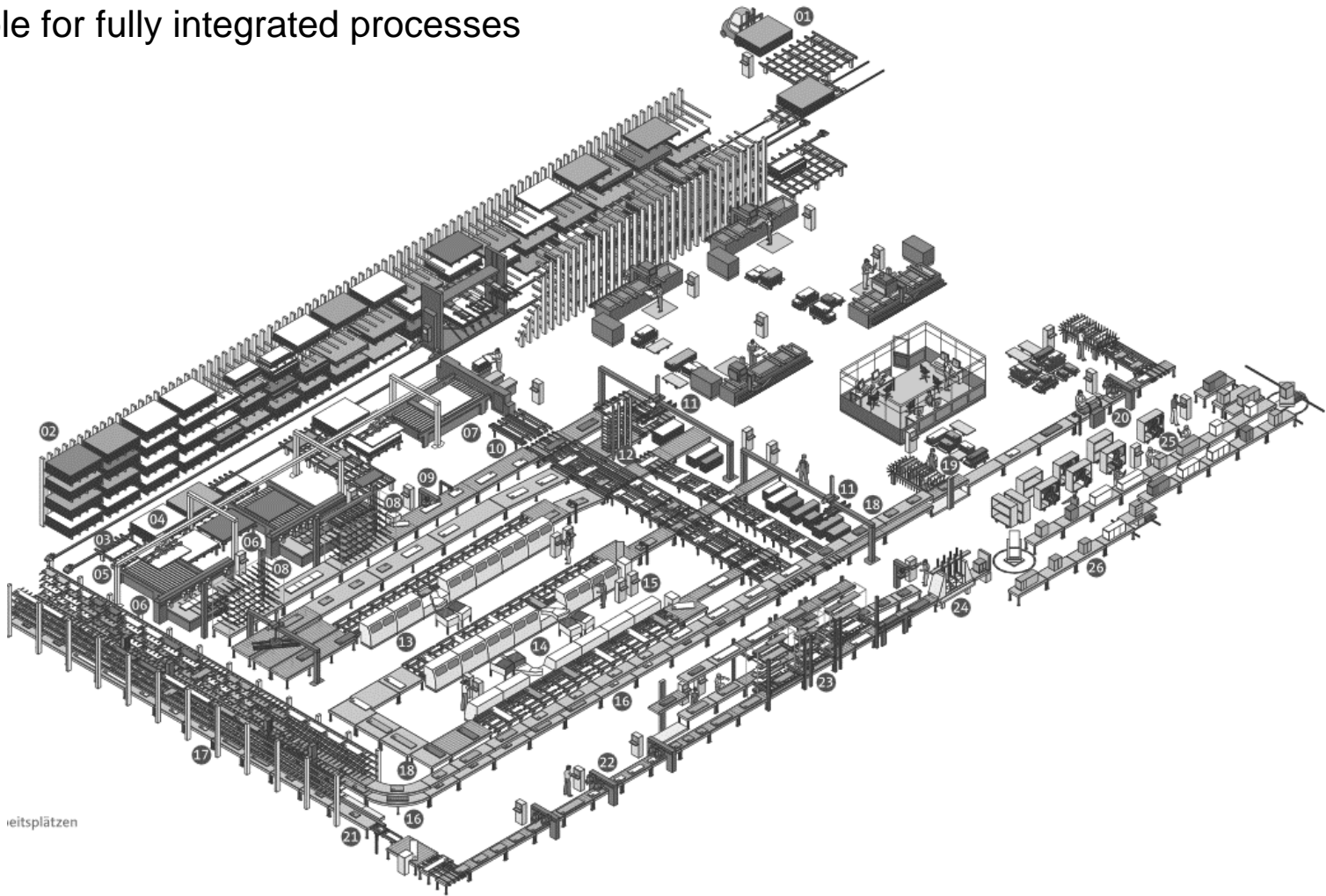
...Develop the ideal level (not necessarily highest possible level) of integration of the main equipment based on the process requirements.

- Is the equipment ready to be data-driven/ integrated?
 - Or is the equipment more standalone, depending on operator input?
- Is there an automation/integration strategy in place (growth plan in steps)?
 - “Growing into automation”. 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



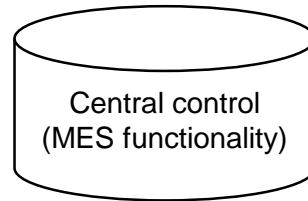
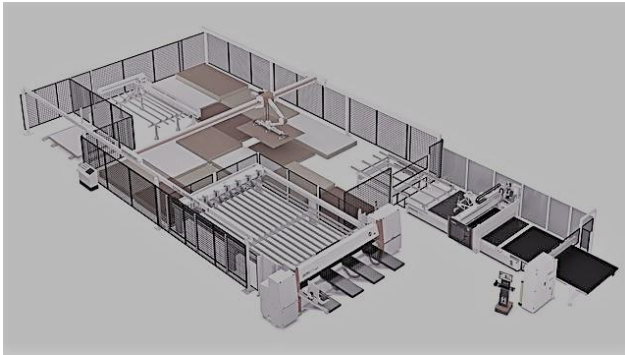
beitsplätzen

Source: 3tec

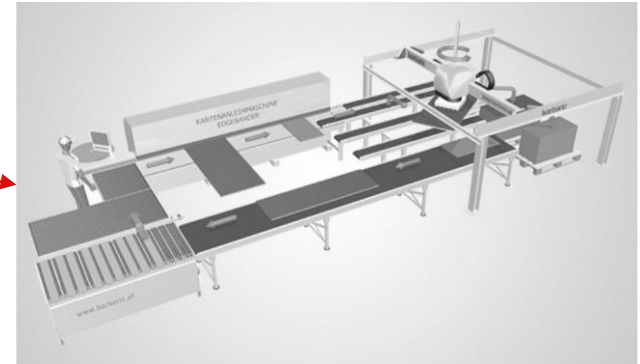
Automated production islands for flexible production needs

- Examples for automation custom shops
- MES driven for synchronized production flow (same data drives all processes)
- Material handling with flexible carts

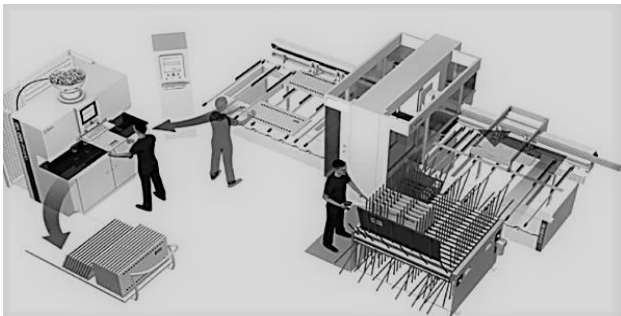
Integrated board storage / Saw / Nesting



CNC controlled edgebanders



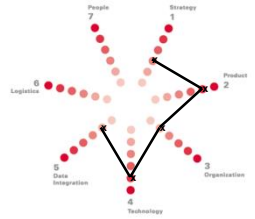
CNC Drilling/routing/doweling



Box on demand



Data integration



Key concept

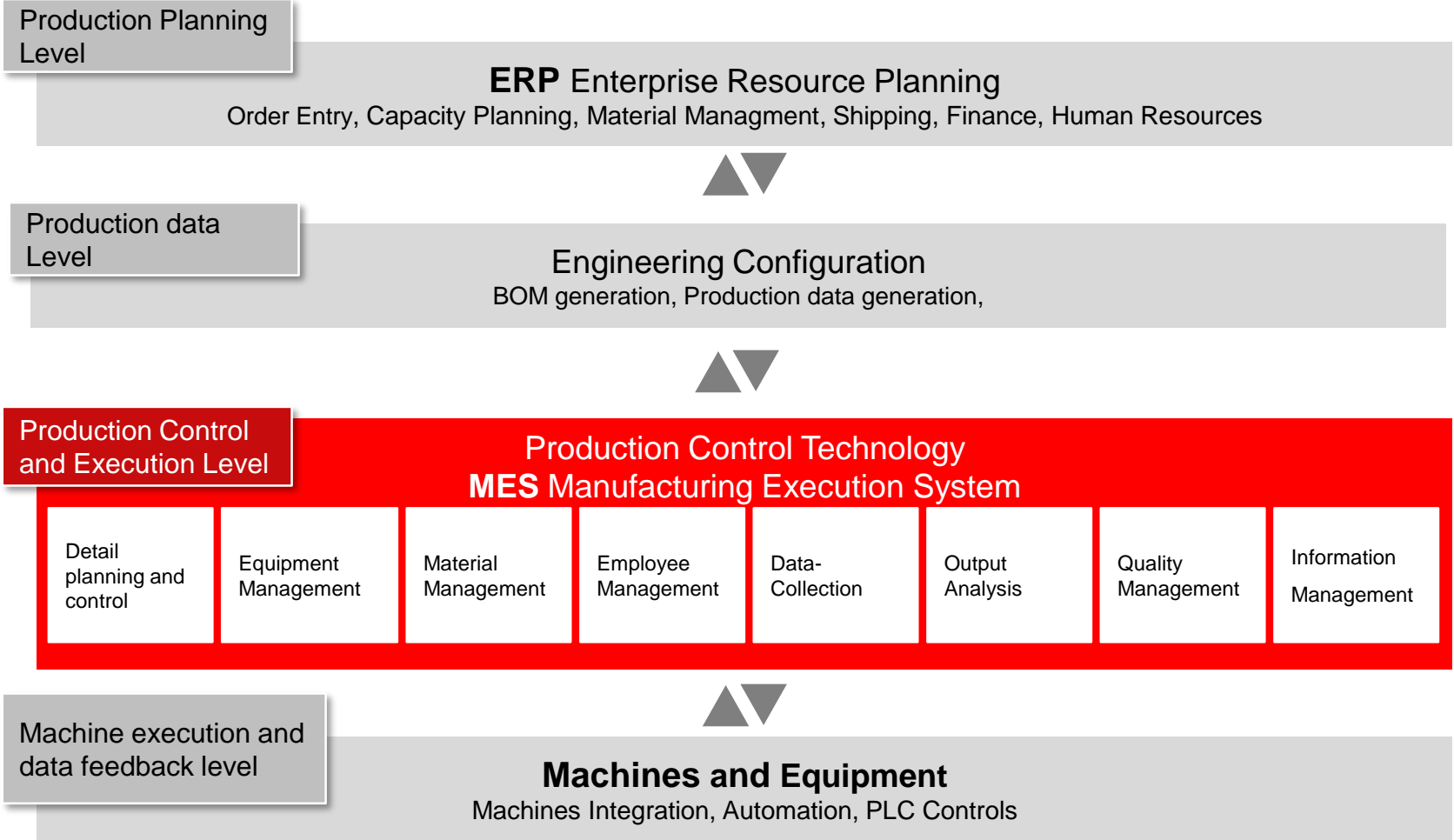
- Be it fully automated or with people who bridge the media breaks amongst the applications, today it is important to establish a seamless data integration throughout all system layers.
- It's important to look at the entire process chain, today's as well as tomorrows, from order generation to product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

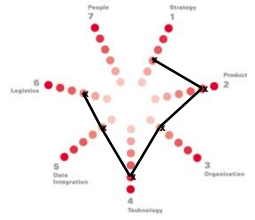


Data Integration



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

(internal)Logistics



- Key Questions: Are your logistics process 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 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

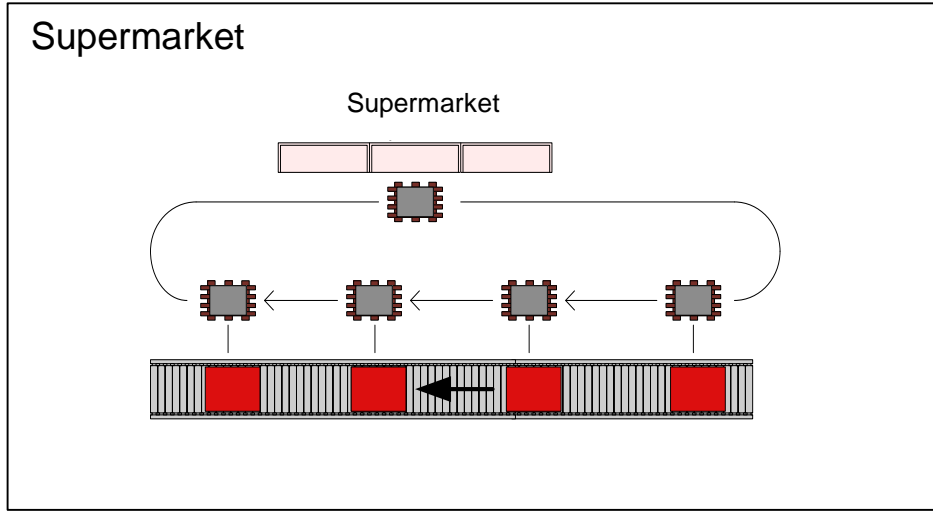
Automated Guided Vehicle, AGV

source: dpm source: swisslog

Material staging

flat vertical

(internal)Logistics - examples



Order Picking Systems

Pick-by-light

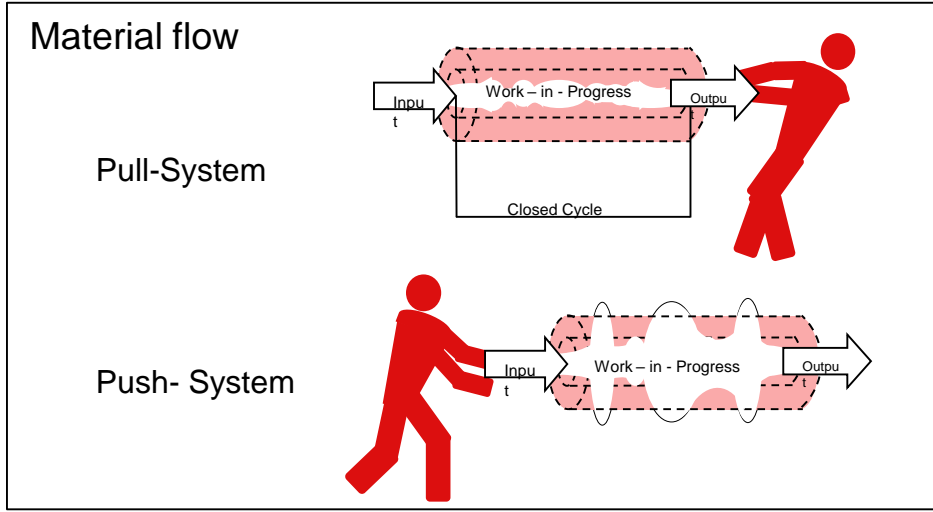
Quelle: swisslog

Pick-by-voice

Quelle: fmi TUM

Pick-by-vision

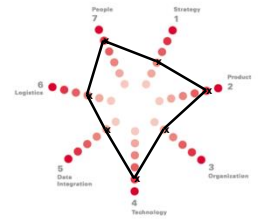
Quelle: fmi TUM



Kanban

Lieferant: MusterAbt. XY Lieferanten-Nr: CH-3038-01-IN	Verbraucher: Montage XY Lageplatz: LP 08 Lageplatz Eingang
Bezeichnung: Musterteil 22mm blau Artikelnummer: 0034008 	
Behälter-Nummer: 47 	Inhalt: 40 Stück

People



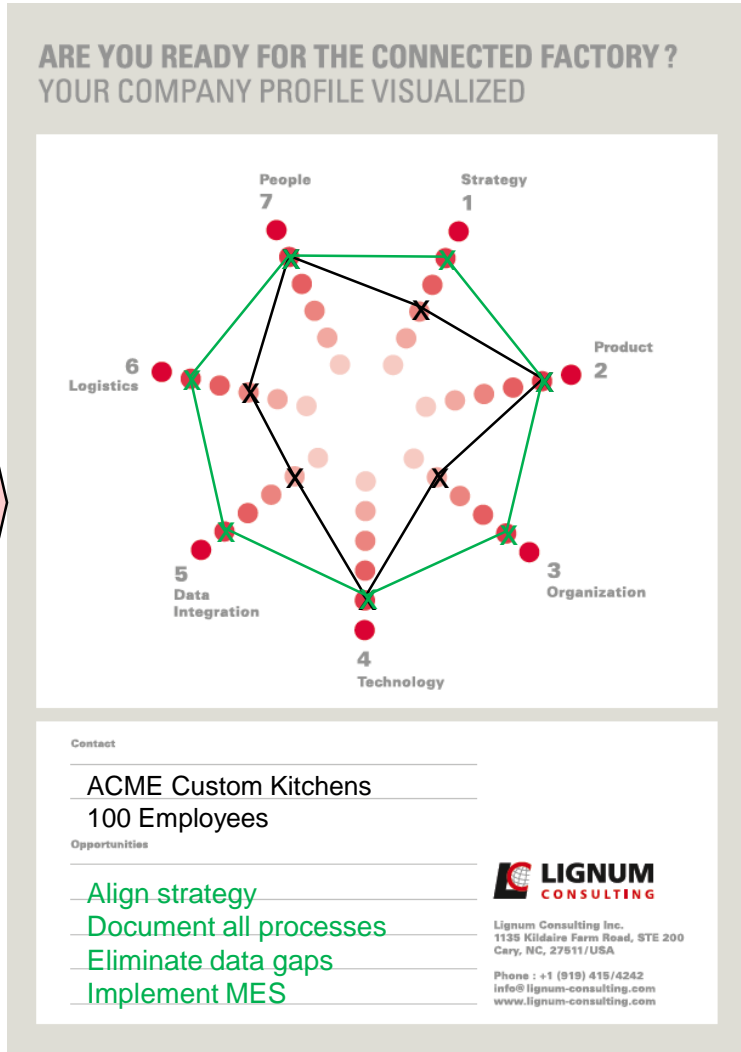
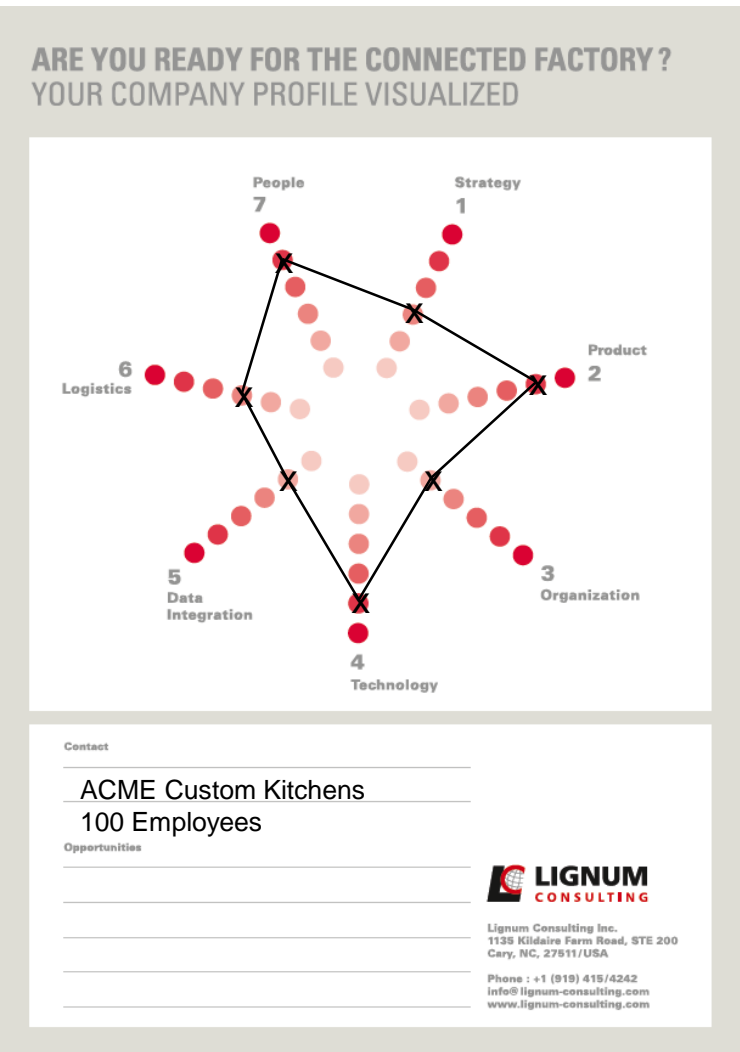
Key concept

- 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 there and it is there to stay!

- If you leave me your carbon copy, we will summarize the results for the group.
- Take the survey home and discuss with your management team.

- If you like to further discuss the approach or some aspects in more detail, please meet me later or contact us after the event.

Thank you very much for your interest and participation.



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