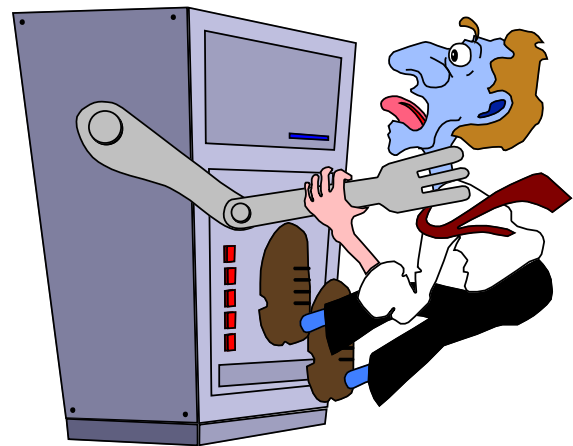




IT support for Lean Production



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1



Content

- *Lean, the basics*
- *The role of IT in business*
- *ERP.... this afternoon*
- *MES*
- *Advanced IT technology*
- *Conclusions*

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2



What does a Lean Process look like?



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What did you see?

- ***This is really FAST food for the customer***
- ***Continuous flow one by one***
 - ◆ All processes organized to match flow speed (TAKT)
 - ◆ All process actors trained to perfection according to standard work methods
 - ◆ No quality errors or rework
- ***When something goes wrong***
 - ◆ The whole system stops to avoid neglecting the issue
 - ◆ One is forced to solve the problem in order to improve the system, if not it will continue to bother everyone
 - ◆ This is the secret to Continuous Improvement!

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From PUSH to PULL in 1 month's time!



7 sept 2009



29 sept 2009

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Lean concepts are emerging all over organisations

- ***FLOW and STANDARD WORK are such strong concepts they can now be found in***
 - ◆ Production companies (of course)
 - ◆ Hospitals (E.R. intake, bed management)
 - ◆ Theme Parks, such as Disney (FastPass, crowd flow)
 - ◆ Car dealers (car repair)
 - ◆ Insurance companies (account processing)
 - ◆ Army (refurbishing men, tank maintenance)
- ***Lean is considered to be a necessity for production to survive in Western Europe (Factory of the Future)***

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6



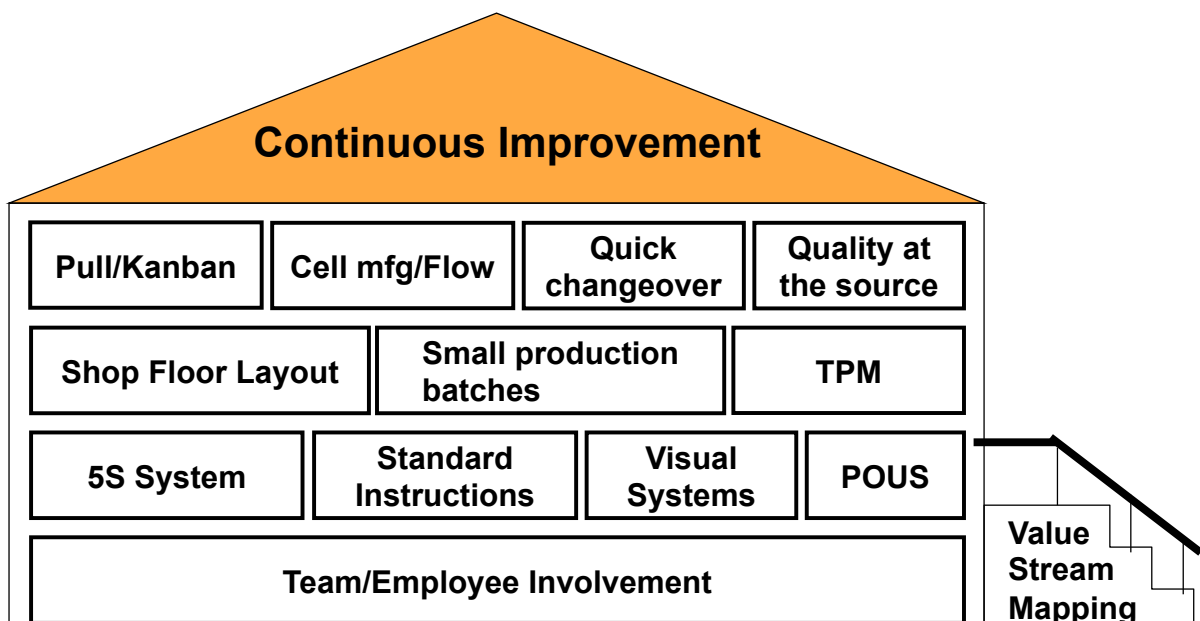
Lean Thinking in 5 steps

1. Specify the value that the customer wants
2. Identify the value stream & eliminate waste in it
3. Make the product flow
4. Let the customer pull
5. And strive for perfection every day!

*How can IT now support this?
Or is IT a mere obstacle?*



Lean supporting techniques are very simple and manual





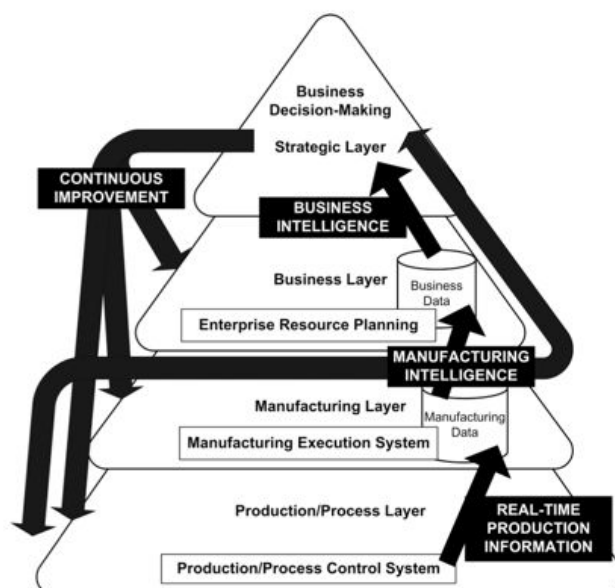
Problems solving drives improvement, but also manual



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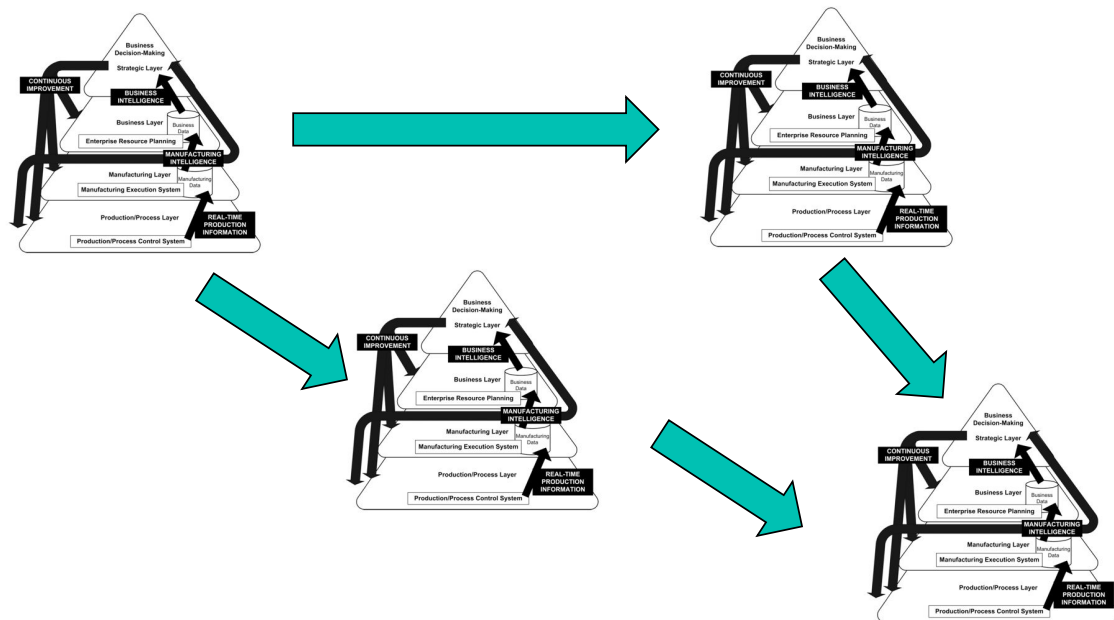
IT functions in a business context



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But remember: you are not alone in your supply chain



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11



Basic roles of IT in business

- **Automational:** Eliminating human labor from a process
- **Disintermediating:** Eliminating intermediaries from a process
- **Tracking:** Closely monitoring process status and objects
- **Intellectual:** Capturing and distributing intellectual assets
- **Sequential:** Changing process sequence, or enabling parallelism
- **Geographical:** Coordinating processes across distances
- **Informational:** Capturing process information for purposes of understanding
- **Analytical:** Improving analysis of information and decision making

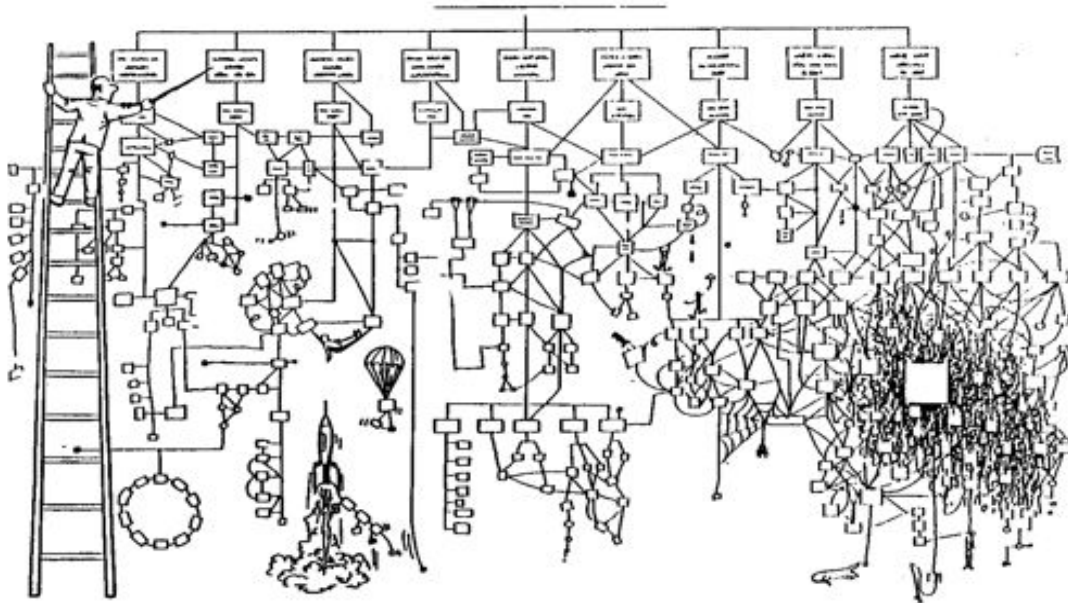
Source: Davenport, 1993.

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12



Processes in a typical company

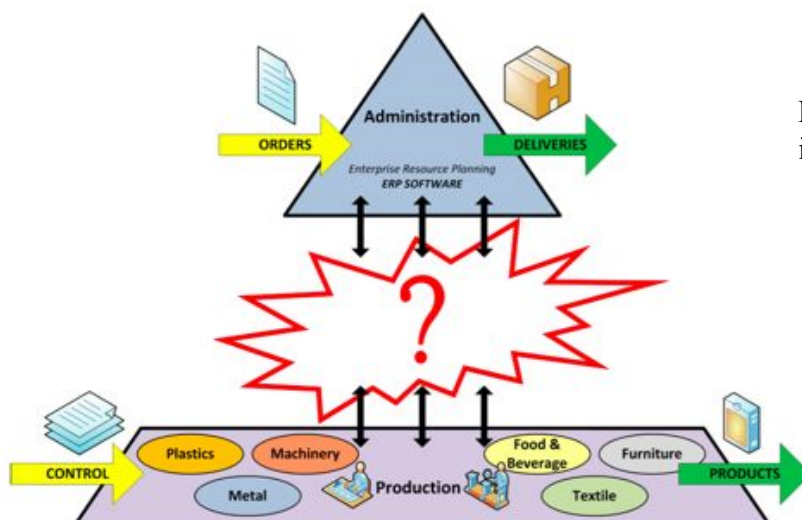


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In many companies this is the current situation



Management thinks
it is in control

The shop floor
tries to cope

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What does the user really want?

■ *Fast, incremental implementation*

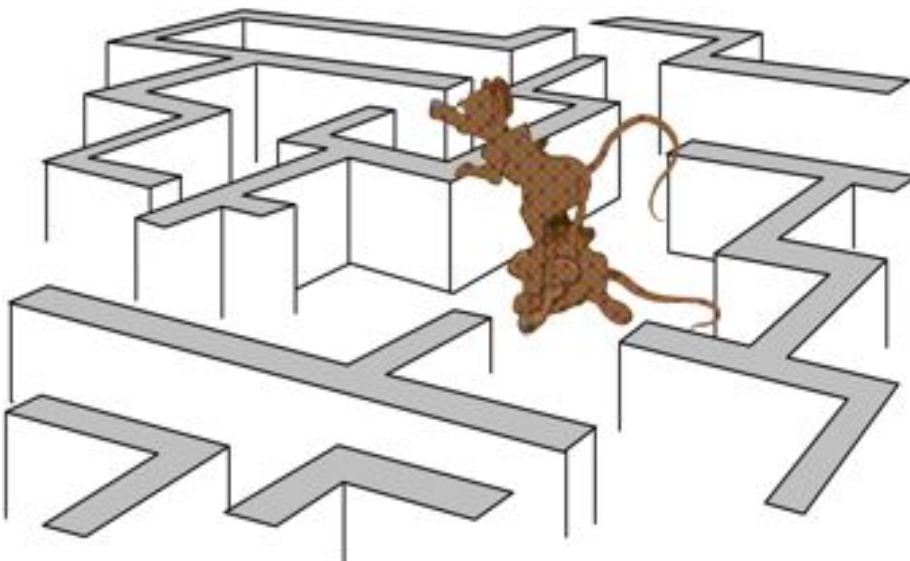
- ◆ maximum 6 months per “wave”
- ◆ investment should last more than 5 years
- ◆ package evolves with the business
- ◆ system no longer a millstone

■ *Systems at the size of people*

- ◆ easy to use on all levels
- ◆ efficient training tools
- ◆ simulation of scenario's possible
- ◆ system intelligent enough to take over routine matters



The complexity of ERP systems blocks user driven improvements





Which systems hold the most promise?

■ *MES (Manufacturing Execution Systems)*

- ◆ close to the workflow (Gemba)
- ◆ both manufacturing and logistics processes
- ◆ captures process data
- ◆ allows for control of automated processes

■ *Workflow systems*

- ◆ easily reconfigurable, integrating other data formats
- ◆ support process documentation (standard work)
- ◆ generate relevant process performance measures



Process flow (swim lane) model in workflow systems





ISA95: standard functions for a MES system



Based on MESA (Manufacturing Enterprise Solutions Association, 1992) standard functional model from 1997



The MES functions according to ISA95

■ **Resource Management**

- ◆ includes machines, materials, equipment, personnel
- ◆ both current data and history is registered

■ **Detailed scheduling**

- ◆ allocates resources needed on a time scale
- ◆ can be extended with scheduling logic, priority rules, ...

■ **Dispatching**

- ◆ sends work order data (id of order, batch, lot, ...) to resource queues
- ◆ allows for realtime rescheduling/redispaching

■ **Definition Management**

- ◆ defines all raw materials, intermediate products and end products and their relation (process models)



MES functions (cont'd)

■ *Execution Management*

- ◆ all control logic to initiate production steps, often automatically linking machines

■ *Data collection*

- ◆ from all resources, both automatically and manual registrations

■ *Tracking*

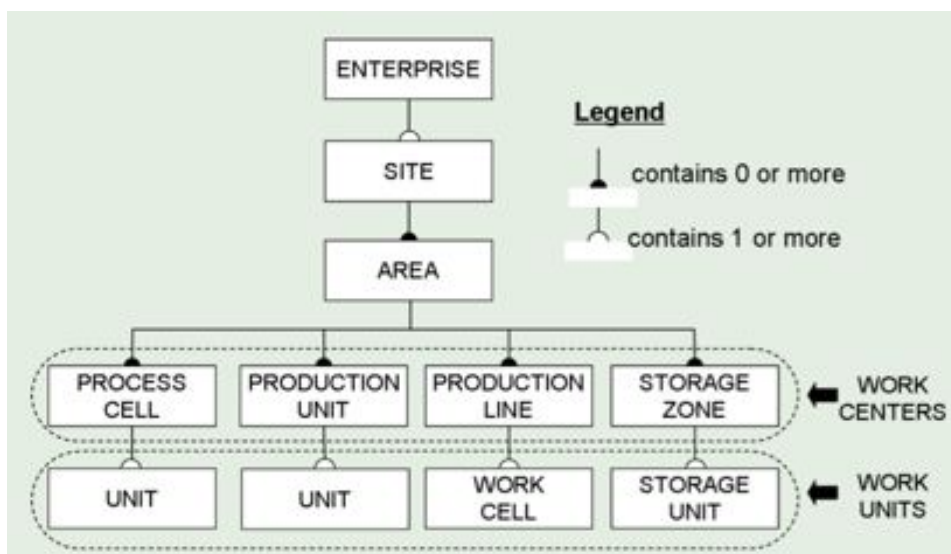
- ◆ building up the genealogy of product through its production steps

■ *Performance Analysis*

- ◆ translating data into meaningful Key Performance Indicators



ISA95 equipment model





MES opportunities

to overcome
common pitfalls
that harm
continuous
improvement

Adapted from: CDC Factory

Nr	Pitfall	Possible role of MES
1	Lack of a clear business goals	Set and follow up the companies KPIs. Align operational and business metrics.
2	Failure to recognize that CI also requires a change management effort	Give support for standard operational changes and impose the improved way of working.
3	Failure to involve factory floor personnel	Empower operators by providing continuous feedback on their performance based on the critical data they enter.
4	Failure to enable real-time visibility and transparency	Real-time data collection to ensure that the right people are able to take the right actions at the right time.
5	Failure to take action	Inform operators by providing continuous feedback on production performance. Provide everyone with the appropriate tools, so the right people are able to take the right actions at the right time.
6	Losing control	The information made available needs to be relevant, to the point and appropriate to each employee's role. Information overload and application complexity can get everyone caught up in the details and lose sight of what is truly important. Try to avoid over-automation.
7	Lack of continued executive sponsorship	Continuously keep the system up to date, to be able to trigger new improvements. An outdated system loses reliability and credibility and will no longer be used at full potential.
8	Deploying inappropriate technology	Always go for real-time and right information quality, not quantity. Do not select a solution based on the technology itself, but rather the value it can add to MOM.
9	Failure to employ a practical and simple implementation	Technology is just an enabler. Train operators in using continuous improvement methodology and MES itself. Standard tools and techniques can be integrated within MES to provide practical support.
10	Take the path of least resistance	Limit administrative obligations by automating information flows. Make sure the operators only have to input critical information that can not be gathered in another way.

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23



MES support for Lean methods within ISA95 scheme



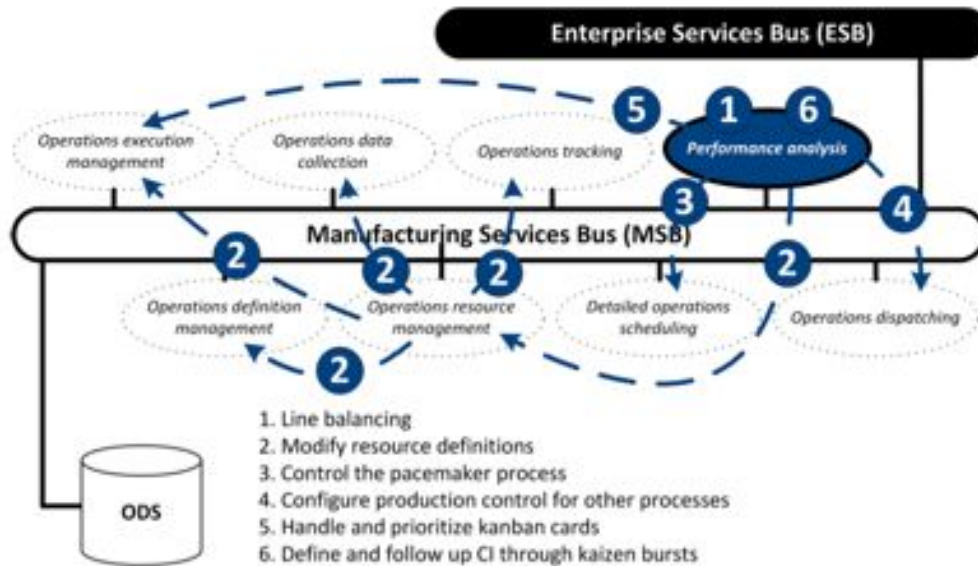
Source: J. Cottyn, H. Van Landeghem, 2012

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24



Change Management: Introducing PULL in ISA95 scheme



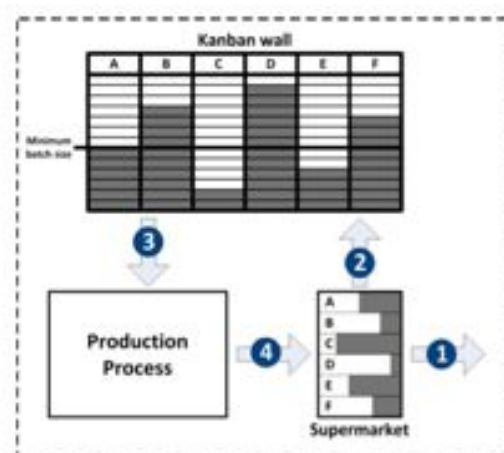
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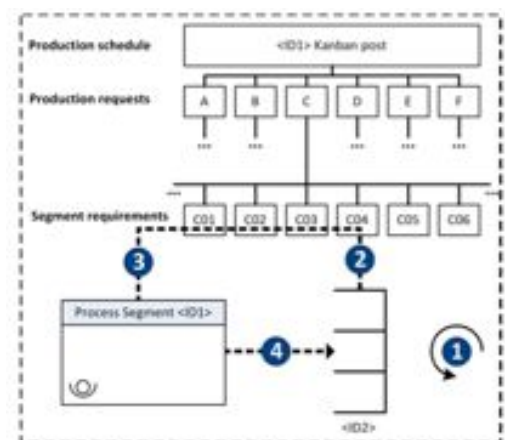
25



New container constructs are needed to implement pull logic using standard ISA95 objects



Kanban Pull Logic



- ① When a container is pulled from the supermarket then the attached kanban card is removed from the <ID2> kanban post and
- ② added to the kanban post of its attribute Location (<ID1>).
- ③ The operator of production process <ID1> selects the product with the highest priority from the kanban wall.
- ④ Each produced container is associated with its kanban card and moved downstream towards the kanban post of its attribute Location (i<ID2>)

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26



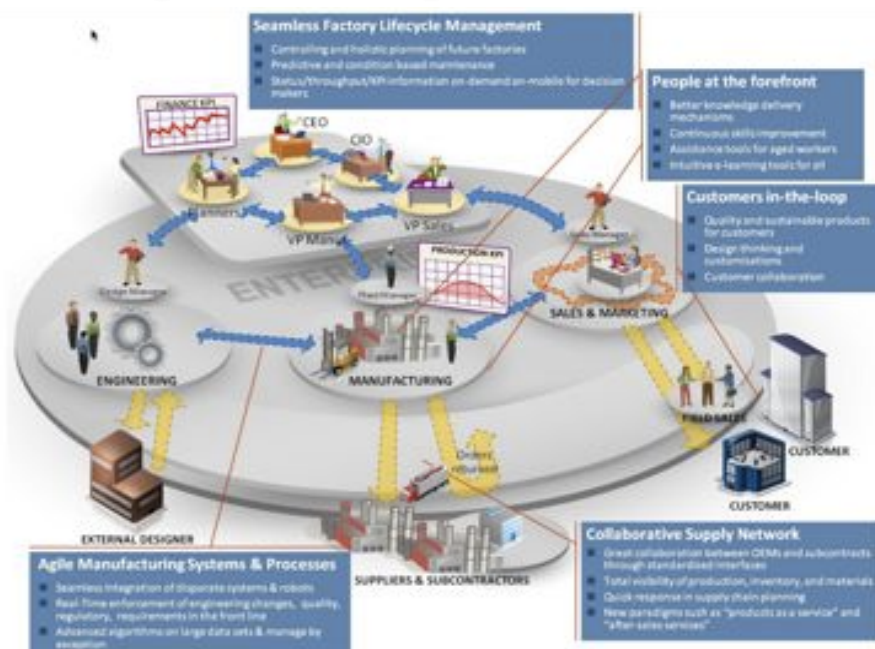
Advanced use of IT technology

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27



Manufacturing 2.0 roadmap

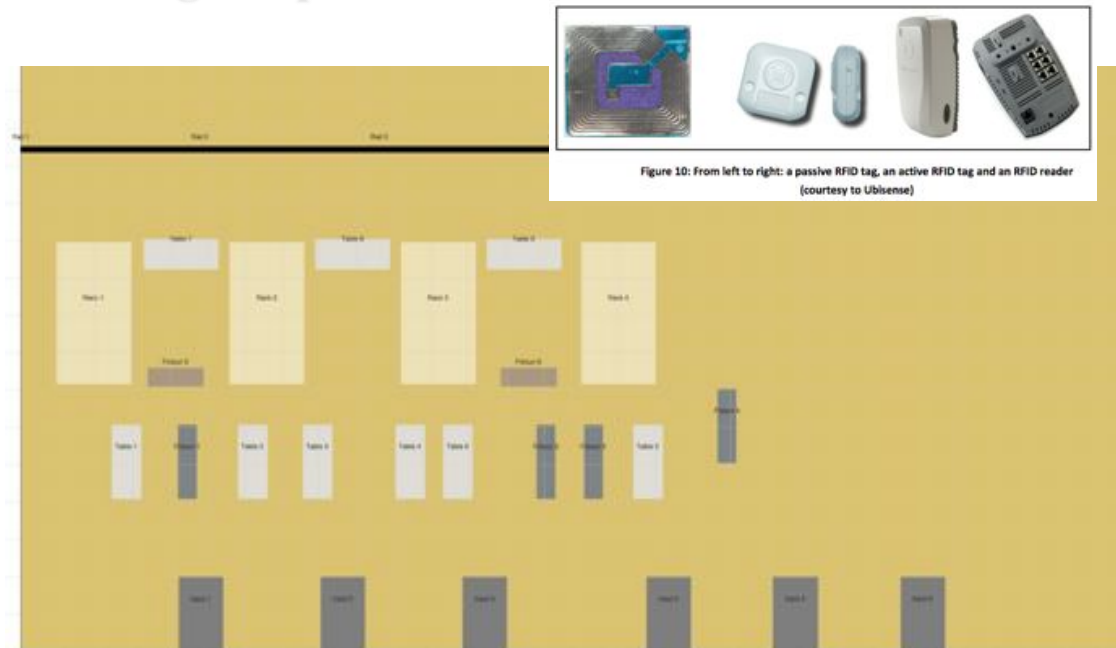


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Source: ActionPlanT, Factories of the Future, 7 FPA EU

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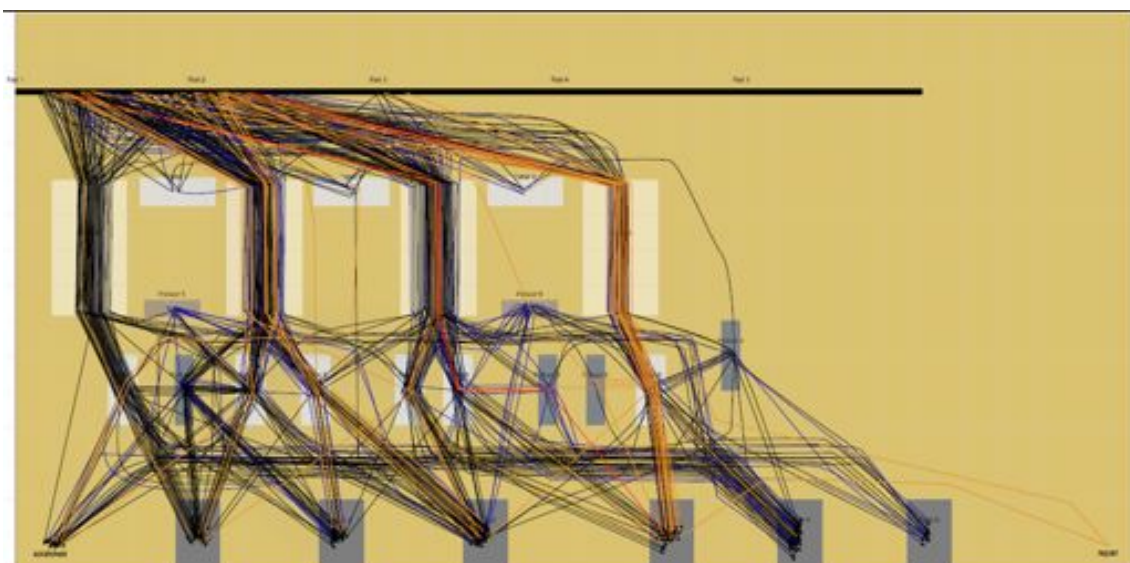
RFID tags on parts allow to generate spaghetti-diagram



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29

Spaghetti-diagram



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30

Simulation model, using tag registrations



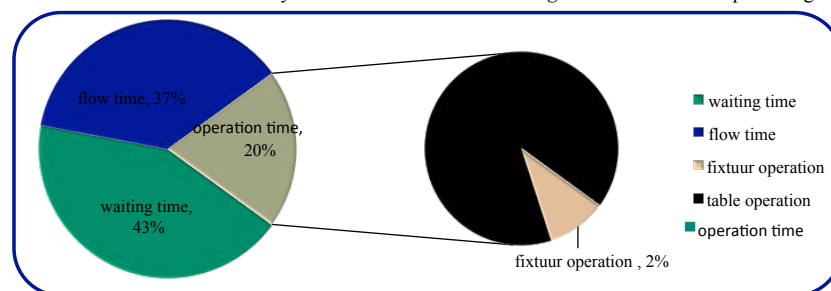
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31

Results – Time Analysis (Total Flow)

Table: Statistical event duration analysis

Figure: Event duration percentage



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Real-time data on logistic vehicles from RFID data

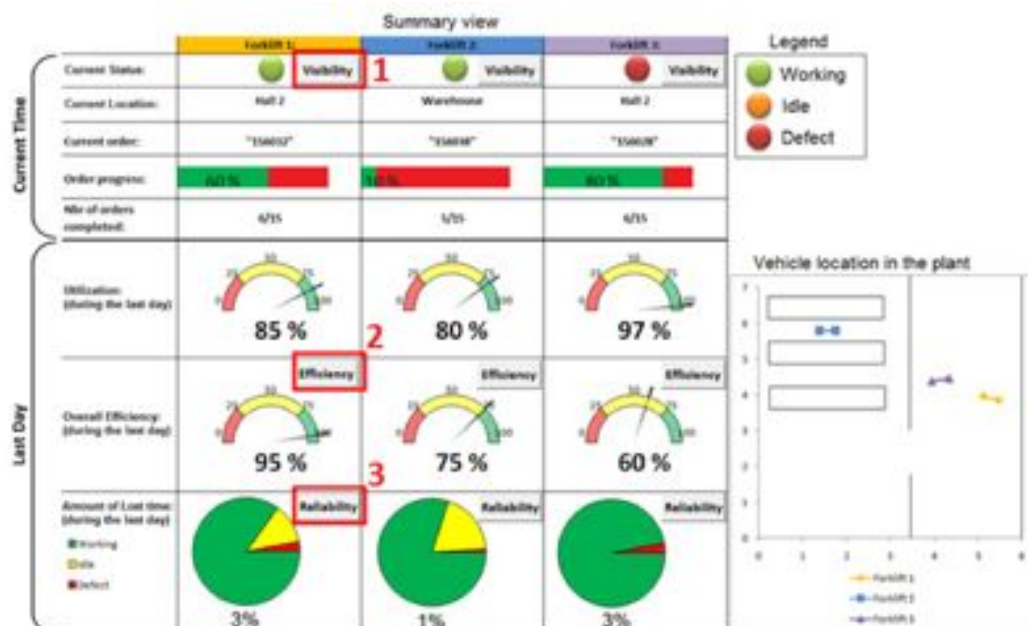


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Source: Master thesis, UGent, 2011.

33

Tracking all vehicles: visualize waste

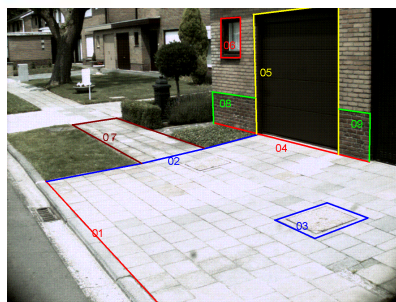
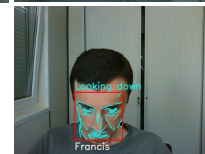
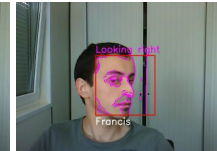
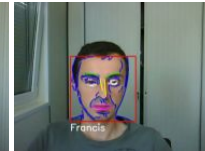
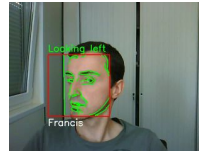
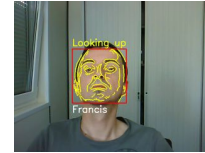
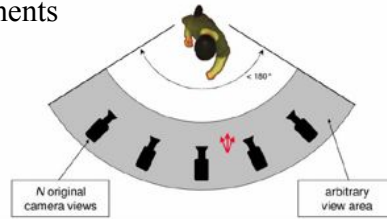


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34

Use of camera arrays and image analysis software

People postures and movements



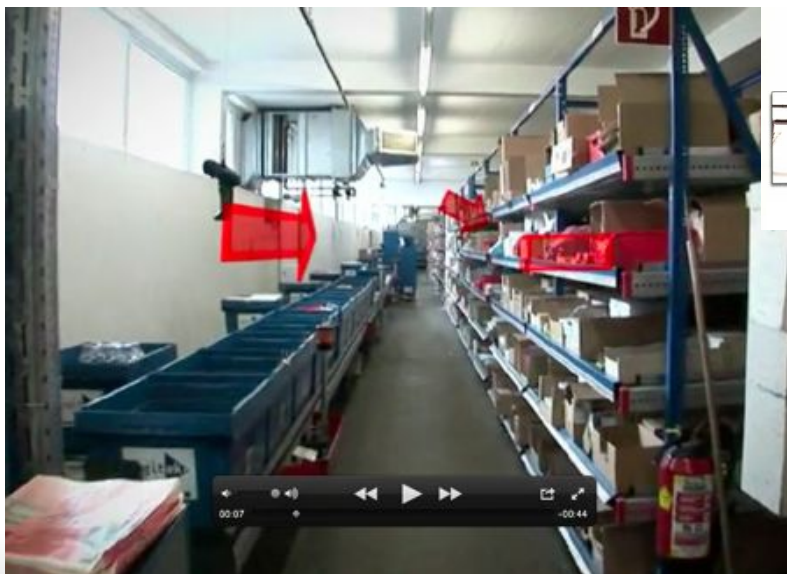
Operator ergonomics

Layout and material flow
reconstruction

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IT support for production steps using wearable computer



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Source: KNAPP gmbh

36



What can Lean expect from ICT?

- ***Capturing process knowledge***
 - ◆ supporting fact-driven problem solving at the “Gemba”
- ***Supporting Visual Management displays***
 - ◆ linking all hierarchical levels in a company
 - ◆ focus attention (back) to the operational processes
- ***Measuring lead times using RFID tags***
 - ◆ the main objective of Lean: reduce lead time
- ***Distributed information through portable devices***
 - ◆ ex. DAISSY system Volvo Cars
- ***Collaborative systems to share process knowledge***



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37



For further information

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