Hogeschool van Arnhem en Nijmegen

Planning and Control in High-Variety/Low-Volume Companies

- learning from the past on our way to the future -

- Jannes Slomp -

Lectorate Lean/World Class Performance

Research projects:
- Several RAAK & KIEM projects
- International projects
- Company specific projects

Area: Lean and QRM. Focused on the improvement of processes.

Mission: Developing and discovering new knowledge in the area of lean and QRM. Linking knowledge development, higher eduction and practice.

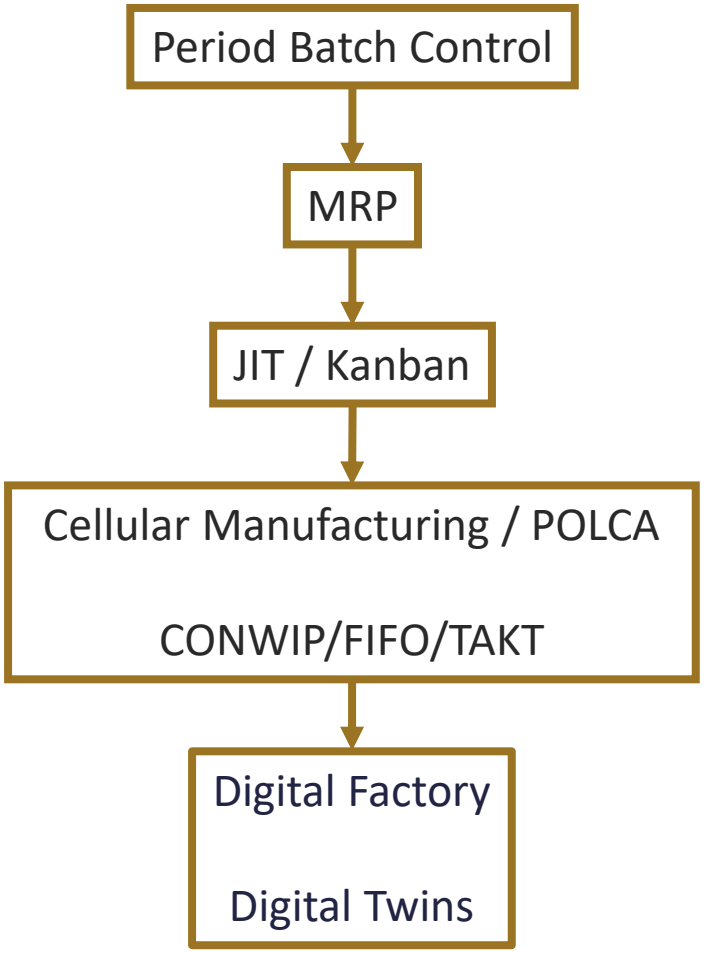
About 14 fte (divided among 25 persons, 1.7 fte professor)

More that 70 partner companies (manufacturing companies, consultancies and service organizations). Annual contribution: 2350 Euro.

Activities: Assessments, workshops, master classes, symposia and conferences.

Teaching at university:
- Semester program on Operations Management (S4) and Smart Industry (S6)
- Minor World Class Performance (120 students per year)
- Master Lean Engineering
- Thesis projects

“History” of Lean Production Control



….and what does it mean for the future of your planning and control activities?

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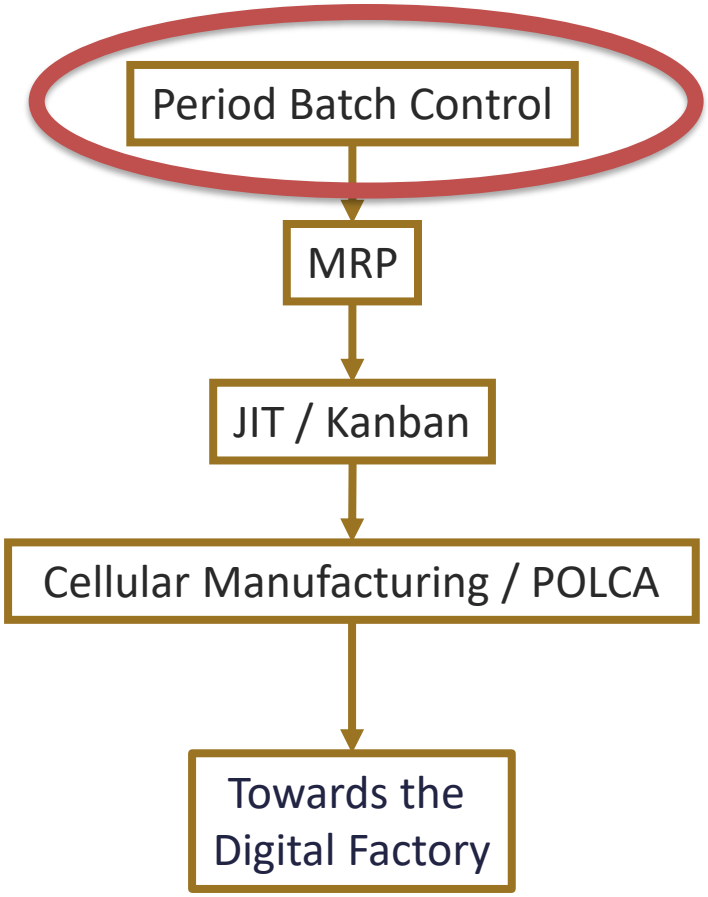

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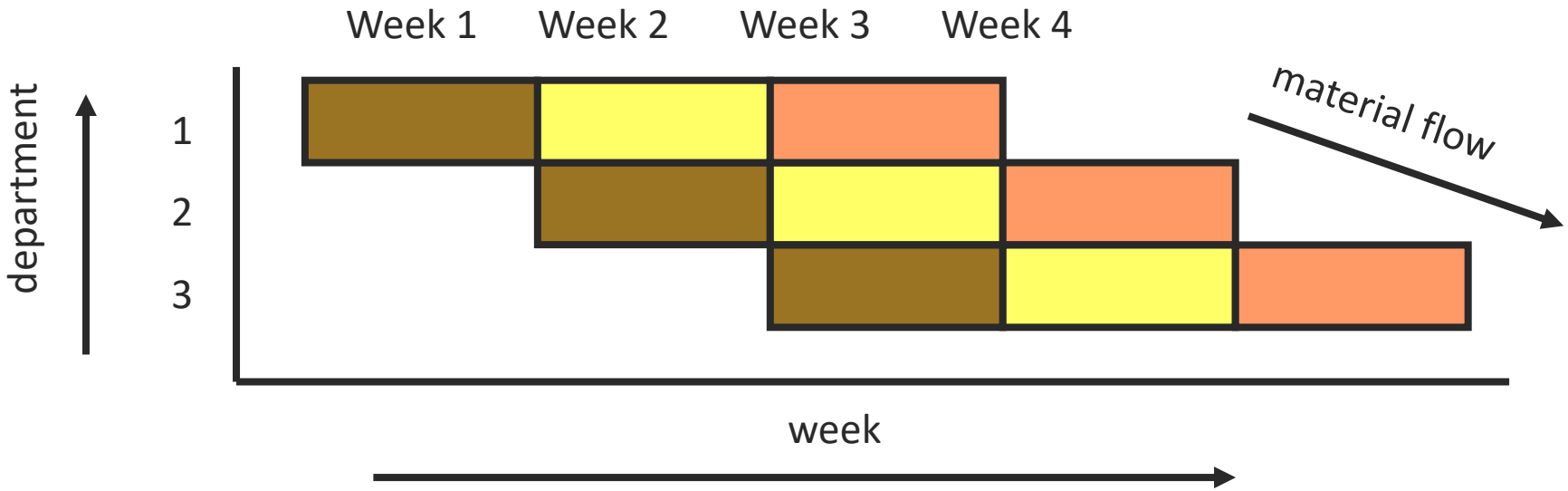
“Traditional” Manufacturing Organization

Department 1 : part manufacturing
Department 2 : pre-assembly (e.g. welding)
Department 3 : final assembly

Many firms produce partly on stock, partly on order

Period Batch Control



What are advantages and disadvantages of PBC?

Advantage:

- Simple, transparant system

Disadvantage:

- Pushes all processes in the same periodical framework
- Unbalans during the periods in each department

Principle: fixed lead times support accountability and increases control options at the workfloor.

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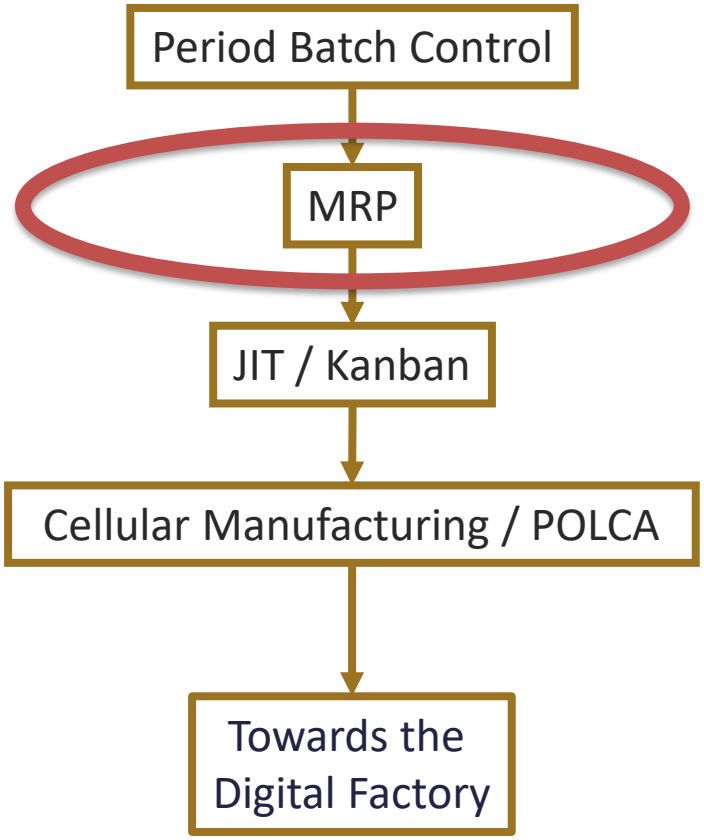

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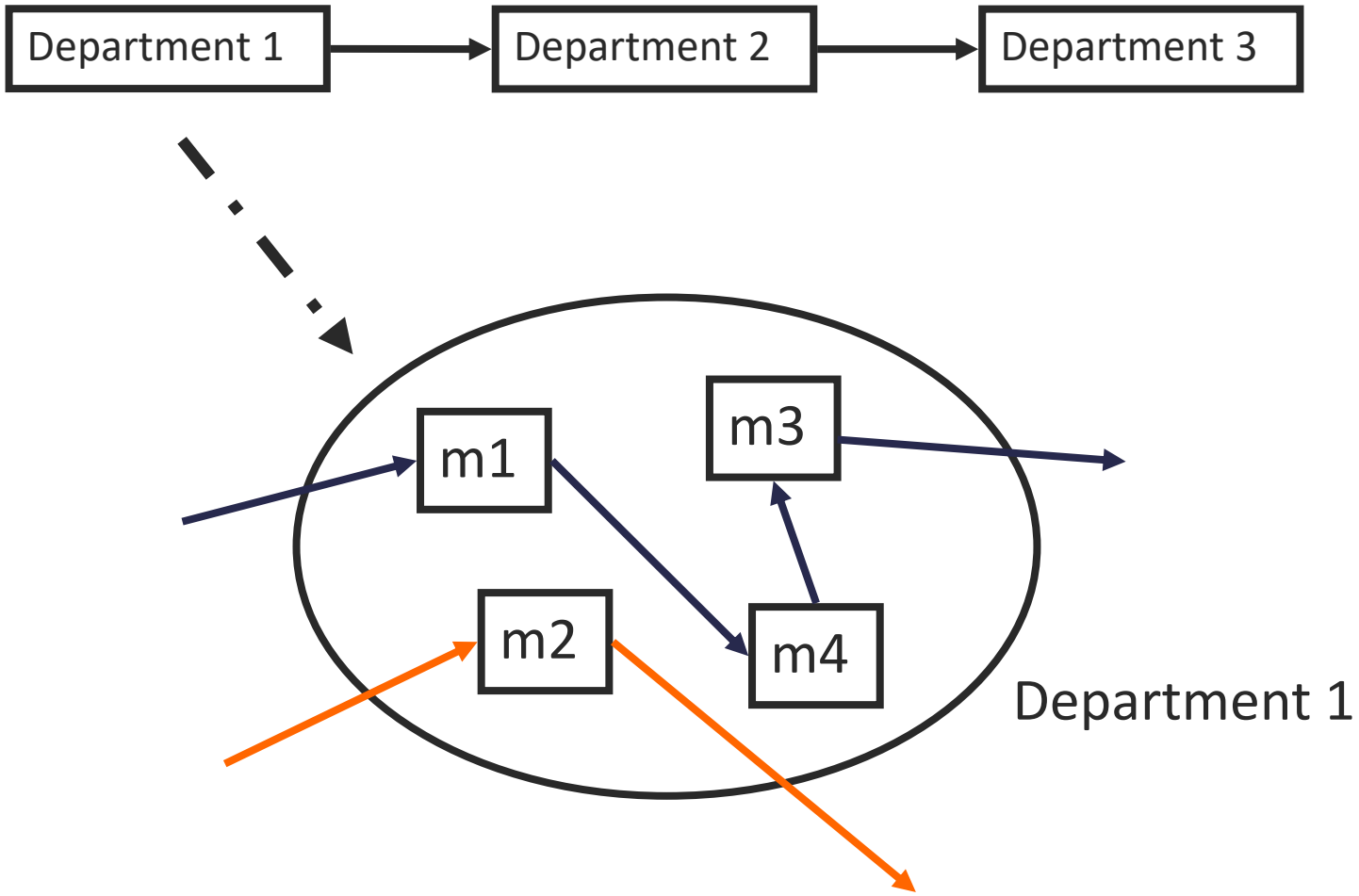
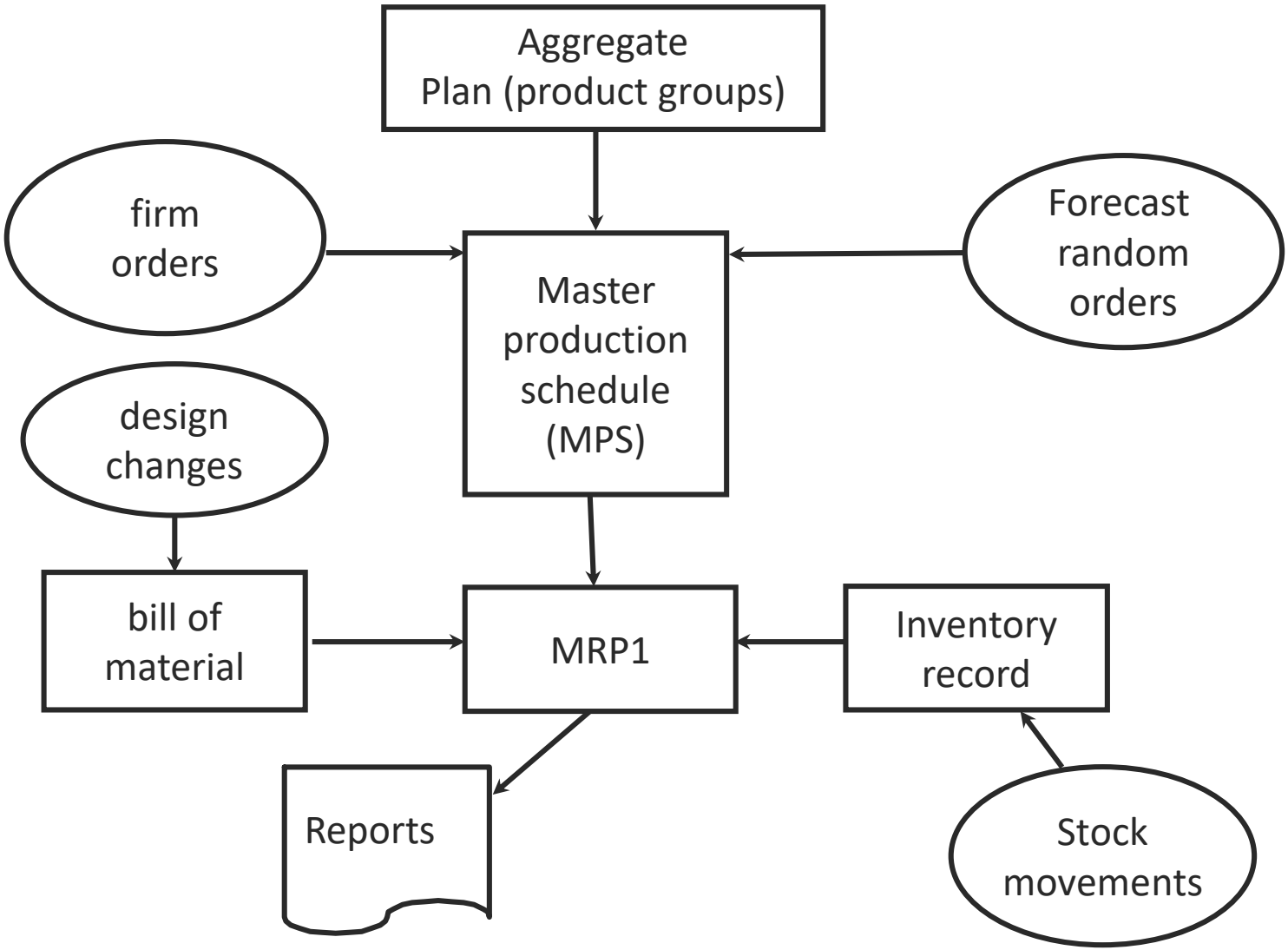
Material Requirement Planning (MRP)



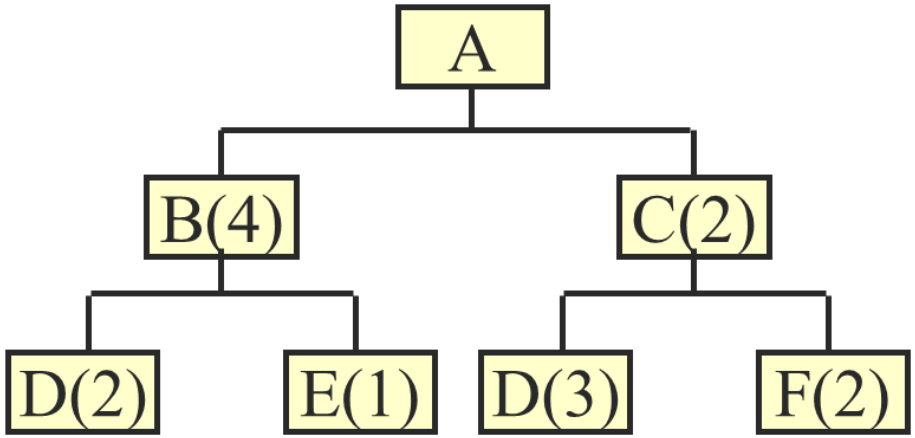
MRP



Source: www.brunel.ac.uk/~bustcfj/ops/mrp.ppt

MRP Scheme

	Week:	1	2	3	4	5	6	7	8	9	10
A	Required										60
LT=2	Order Placement								60		
B	Required							20	240		
LT=2	Order Placement					20	200				
C	Required								100		
LT=1	Order Placement							100			
D	Required					55	400	300			
LT=3	Order Placement		55	400	300						
E	Required					20	200				
LT=4	Order Placement	20	200								
F	Required							200			
LT=1	Order Placement						200				



Part D: Wk 5, 40 + 15 spares

Repeat for all components ==> final MRP

What are advantages and disadvantages of MRP?

Advantage:

- All information is in the computer; starting point for optimization
- Supports coordination

Disadvantage:

- MRP asks for discipline
- Poor in capacity planning
- Long planned lead times
- System nervousness

Principle: don't think that an information system can solve the mess on the work floor! Be careful to implement 'optimal' rules in het system (e.g. optimal batch sizes).

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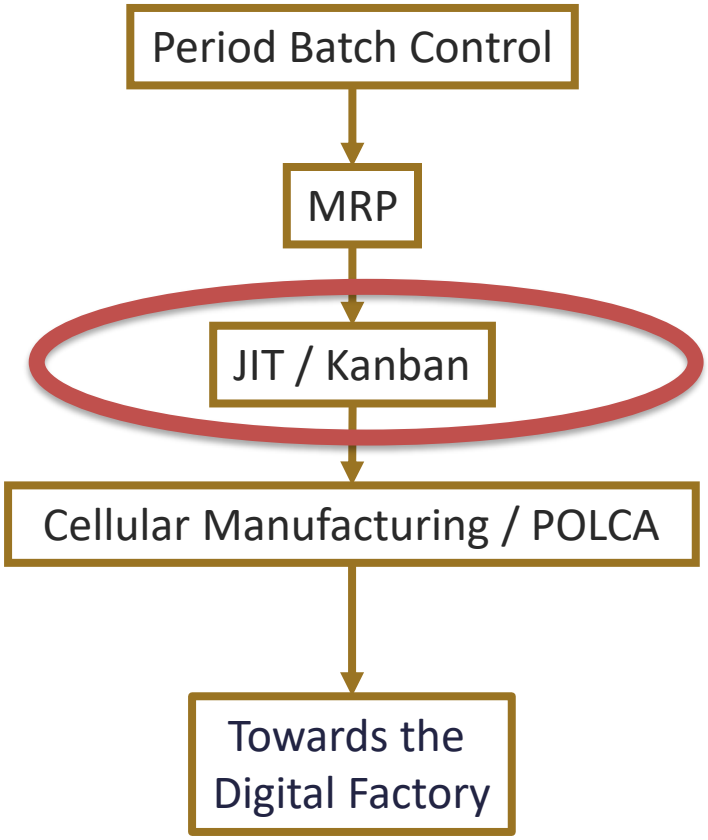

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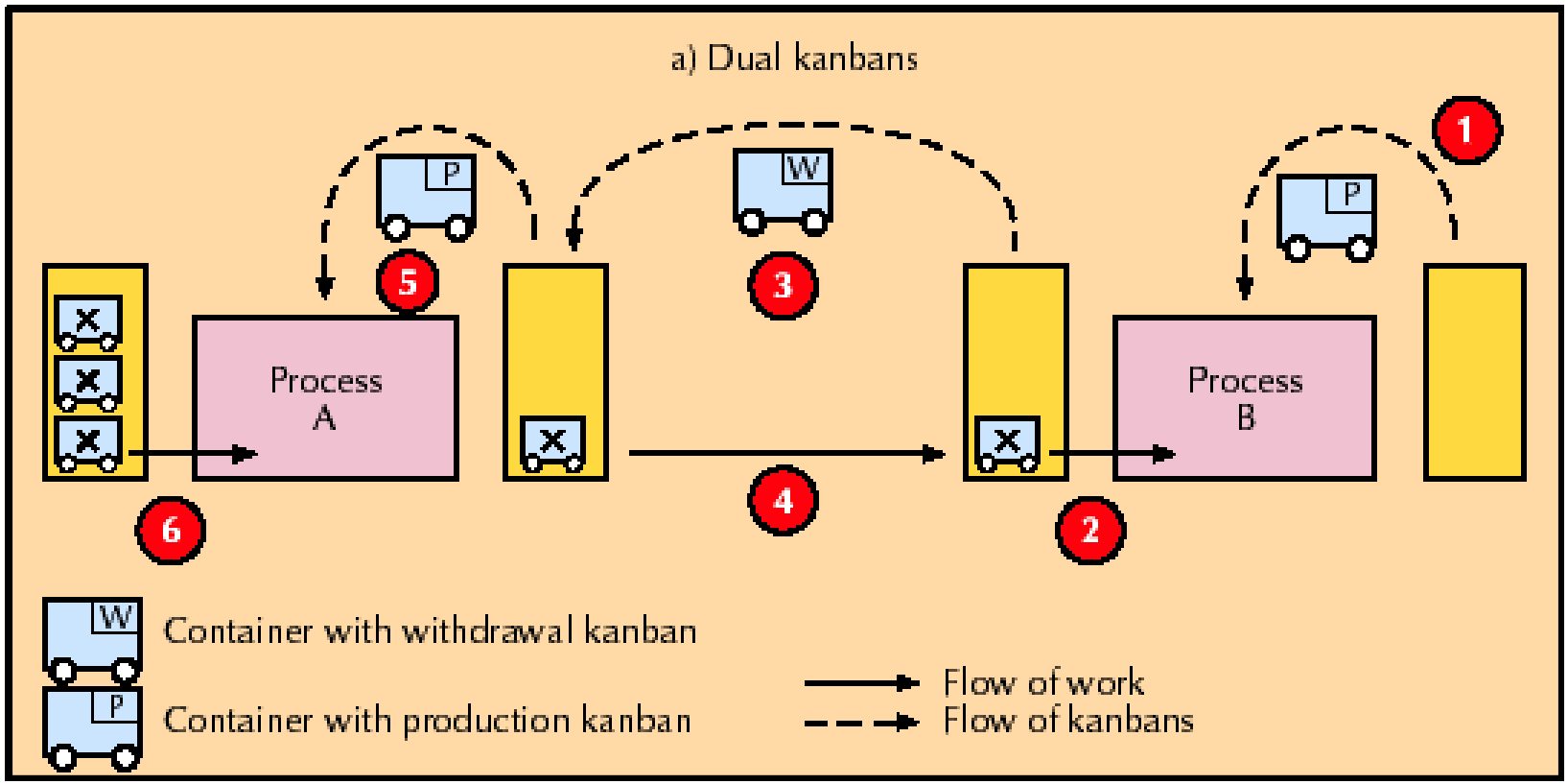
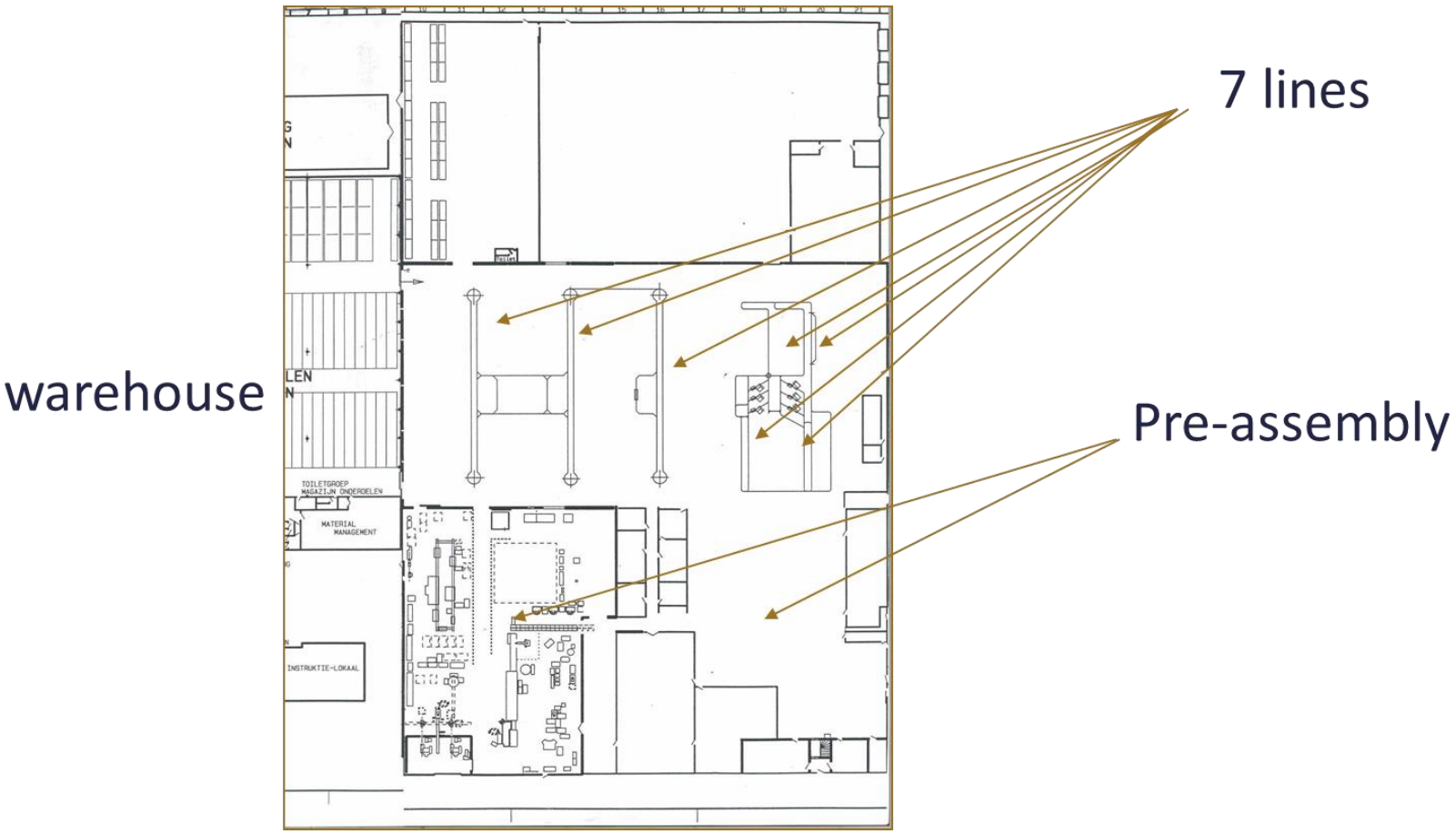
Kanban / Just in Time



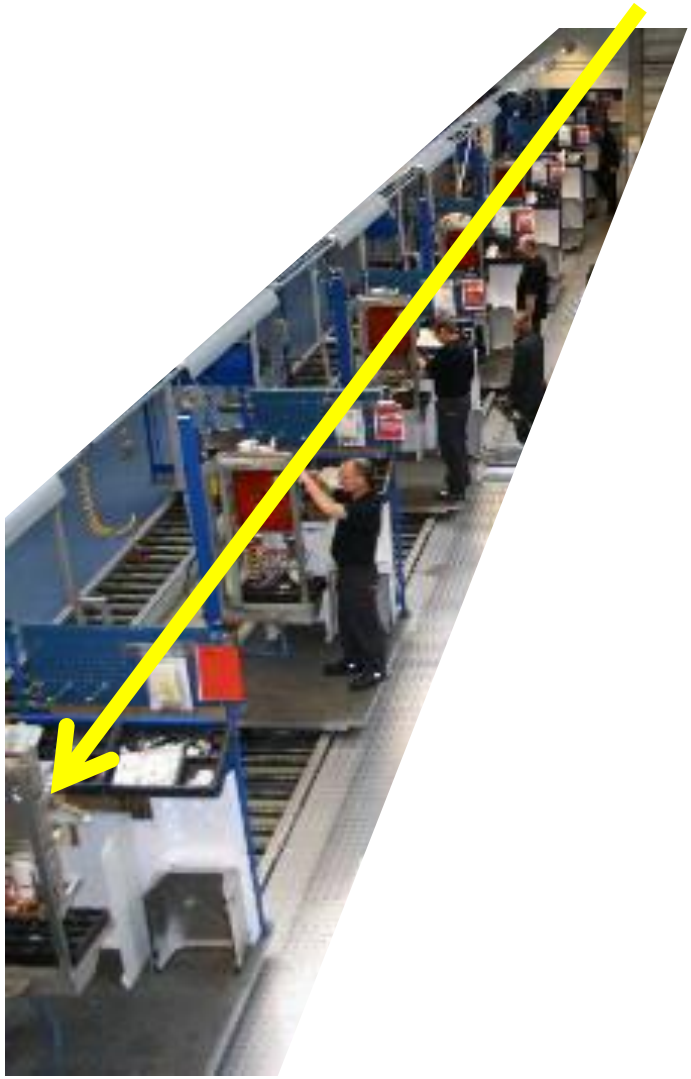
Source: www.sonoma.edu/users/a/atkint/bus316spring/rtchap11.ppt

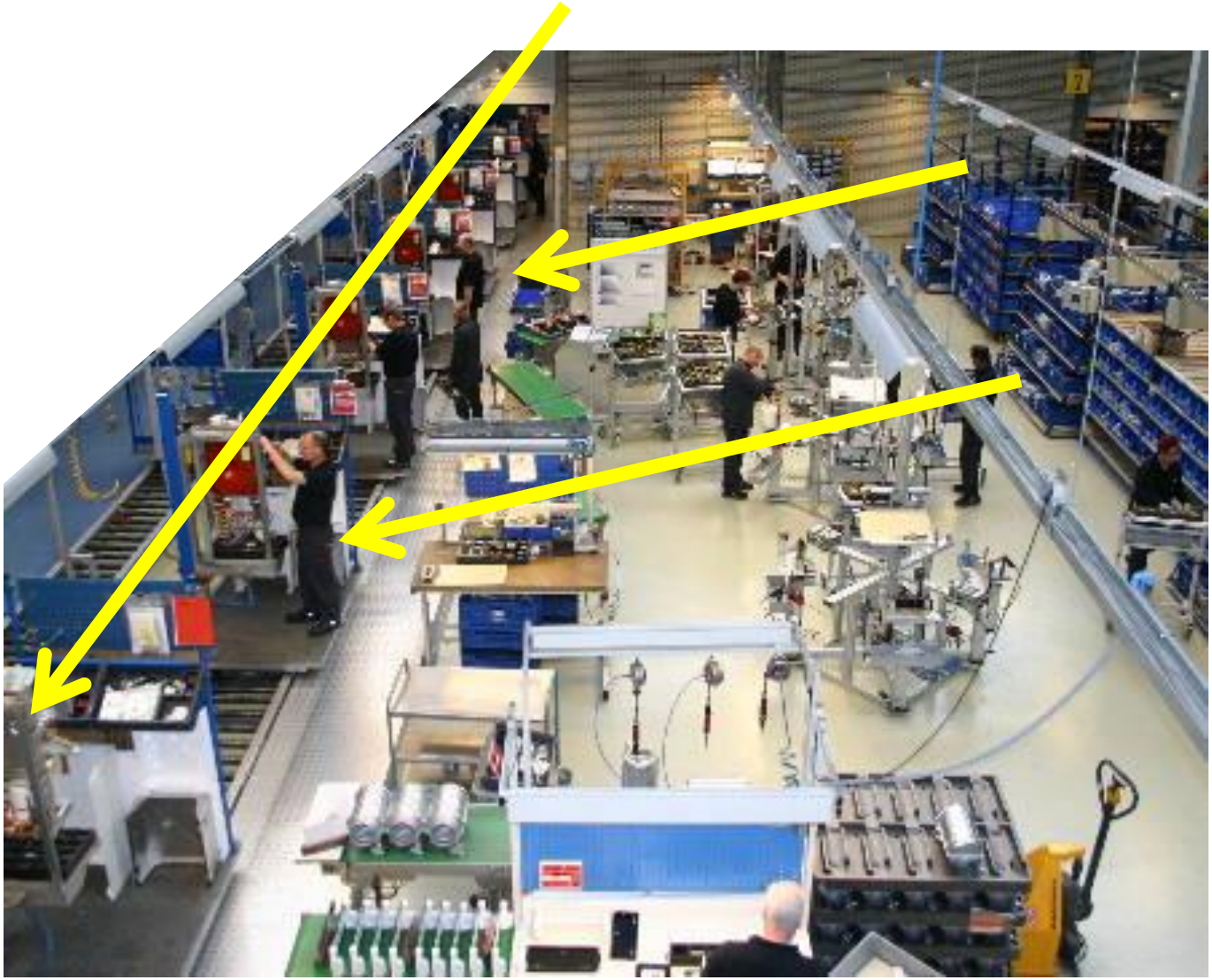
Nefit Buinen: mix flexibility in the line

Old situation



New situation





What are advantages and disadvantages of a lean (flow) system

Advantage:

- Simple, transparant system
- Short lead times, flexibility

Disadvantage:

- Limited applicability. Needed are:
  - a stable demand (capacity requirement)
  - a repetitive manufacturing proces
  - standardized products (standardized processing!!)
- Difficult to cope with changes in product specifications, product mix changes and exceptions.

Principle: Don’t say too fast that flow-manufacturing is not possible in a particular situation

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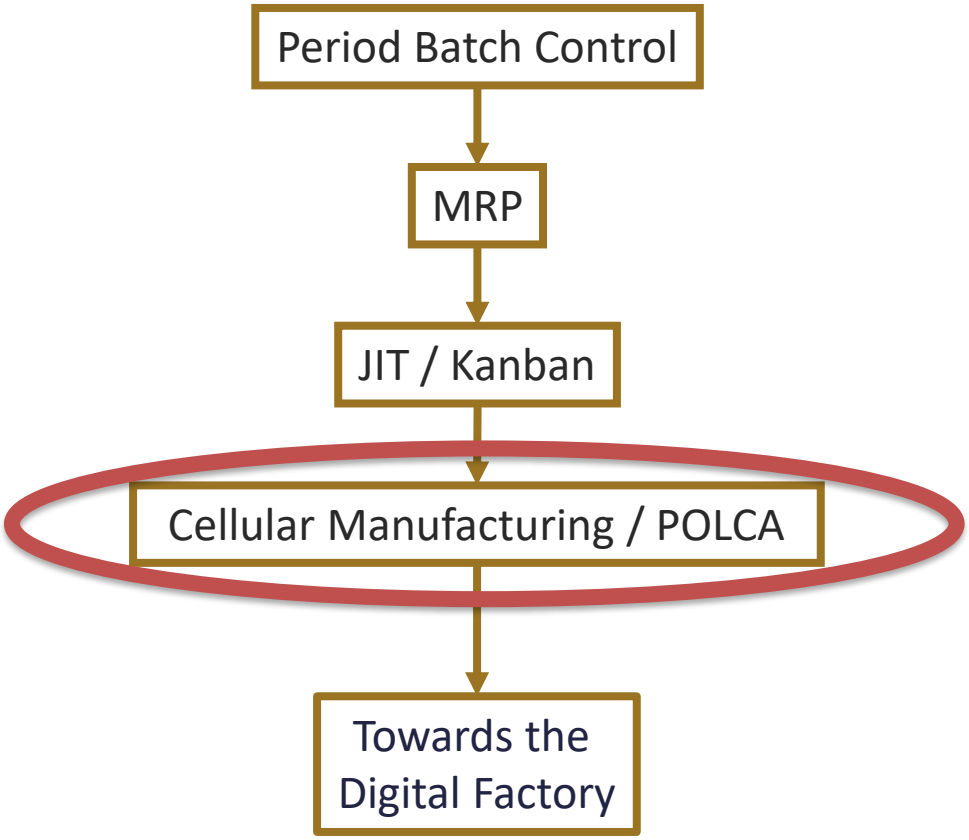

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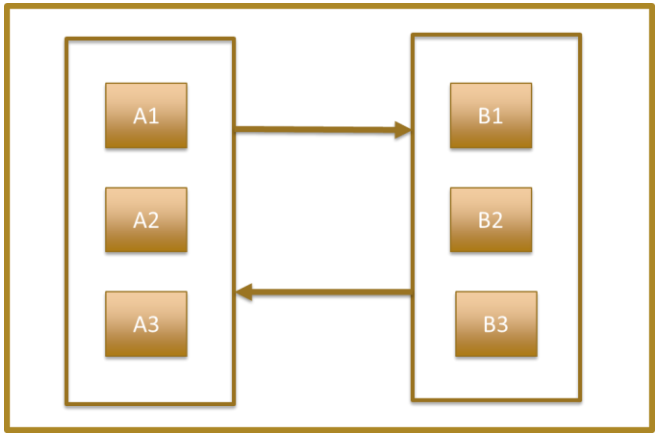
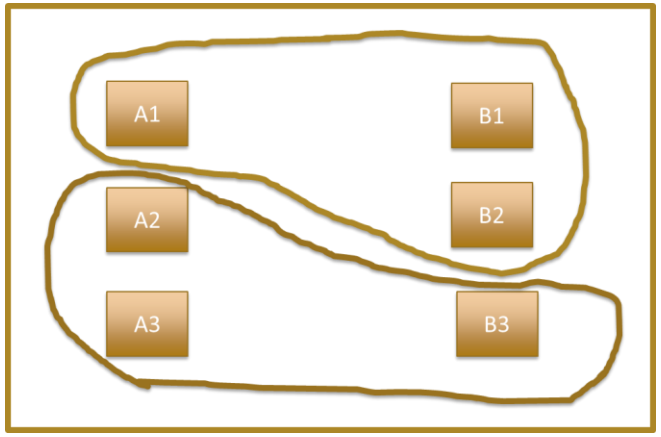
Key Question: how to organize the workfloor?

Functional (or process) layout



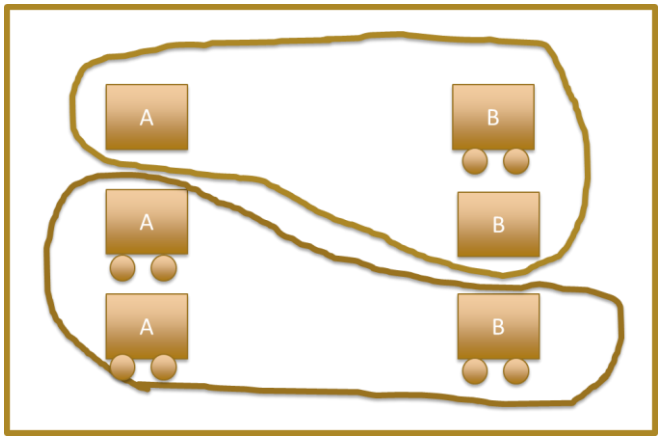
Cellular (or product) layout



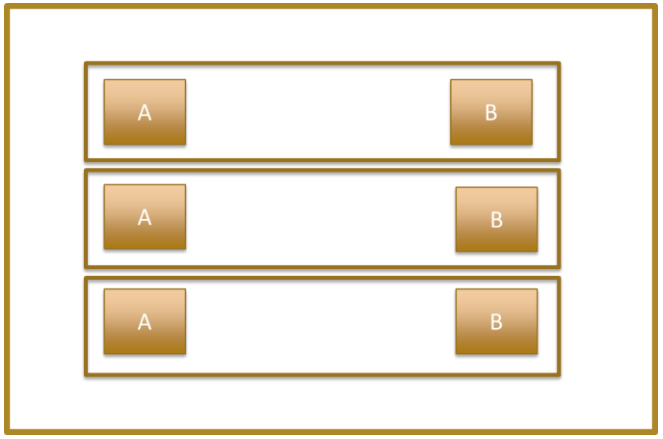
Principle: the workfloor organization has a strong impact on options for planning and control

Variants of the Cellular Layout

Dynamic layout

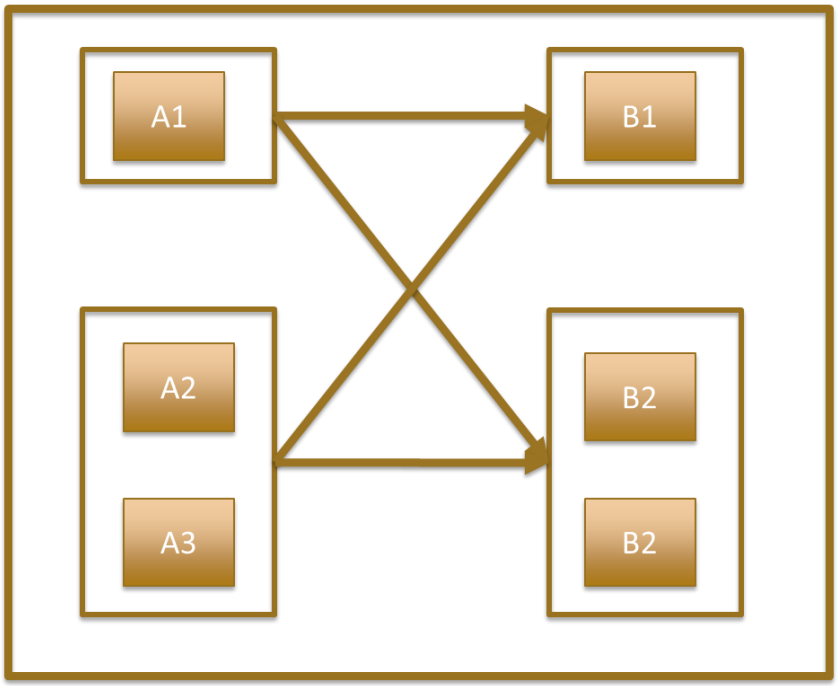


Fractal layout



Principle: When developing a planning and control system, also develop alternative layouts (workfloor organizations)

Hybrid, Modular Layout (or POLCA layout)

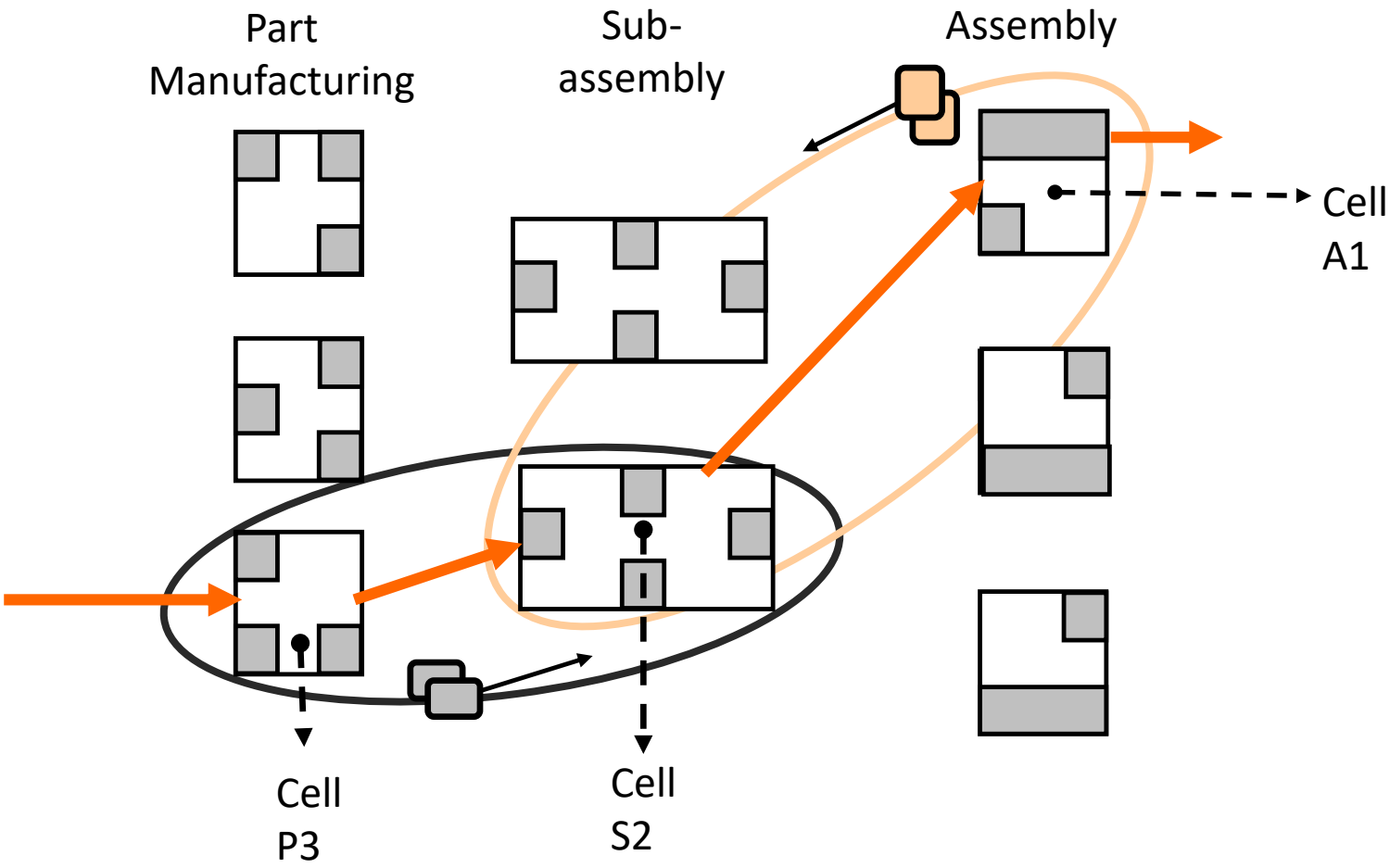


Principle: Think in modules, each cell has its own characteristics and internal control principles, interfaces are standardized.

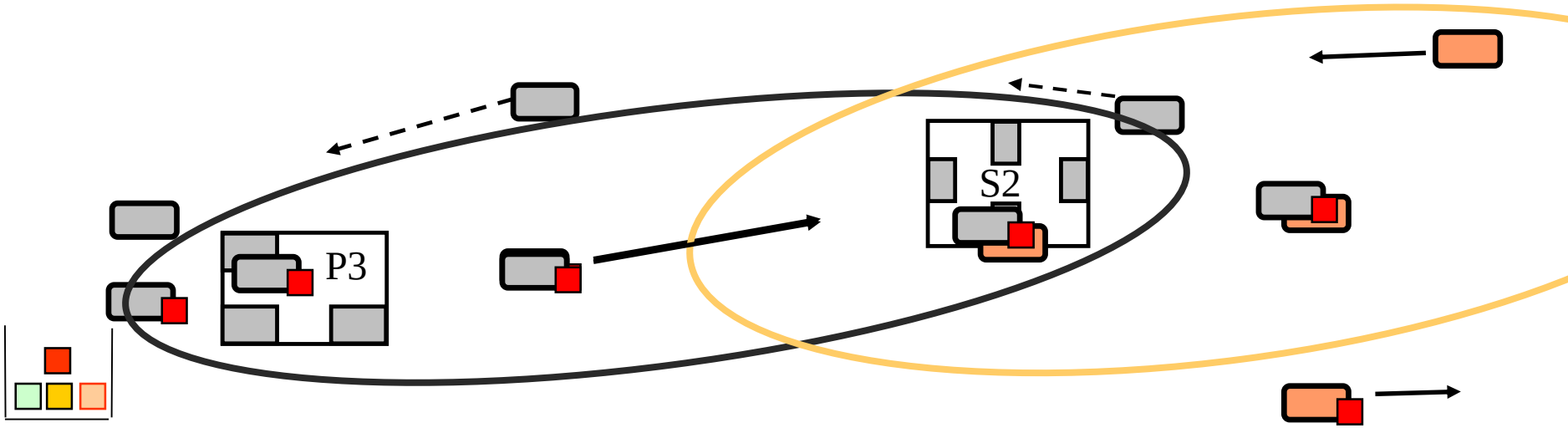
POLCA
(= a coordination system between dependent cells)

Paired-cell **O**verlapping **L**oops of **C**ards **A**uthorisation

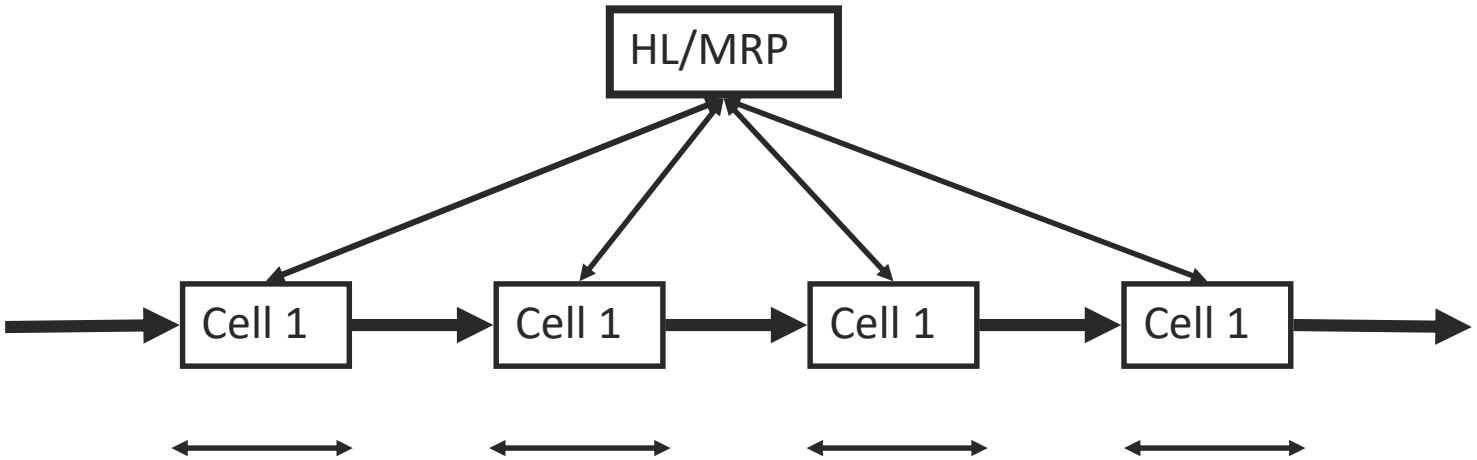
Cells / loops / cards



Pull: Autorisation cards

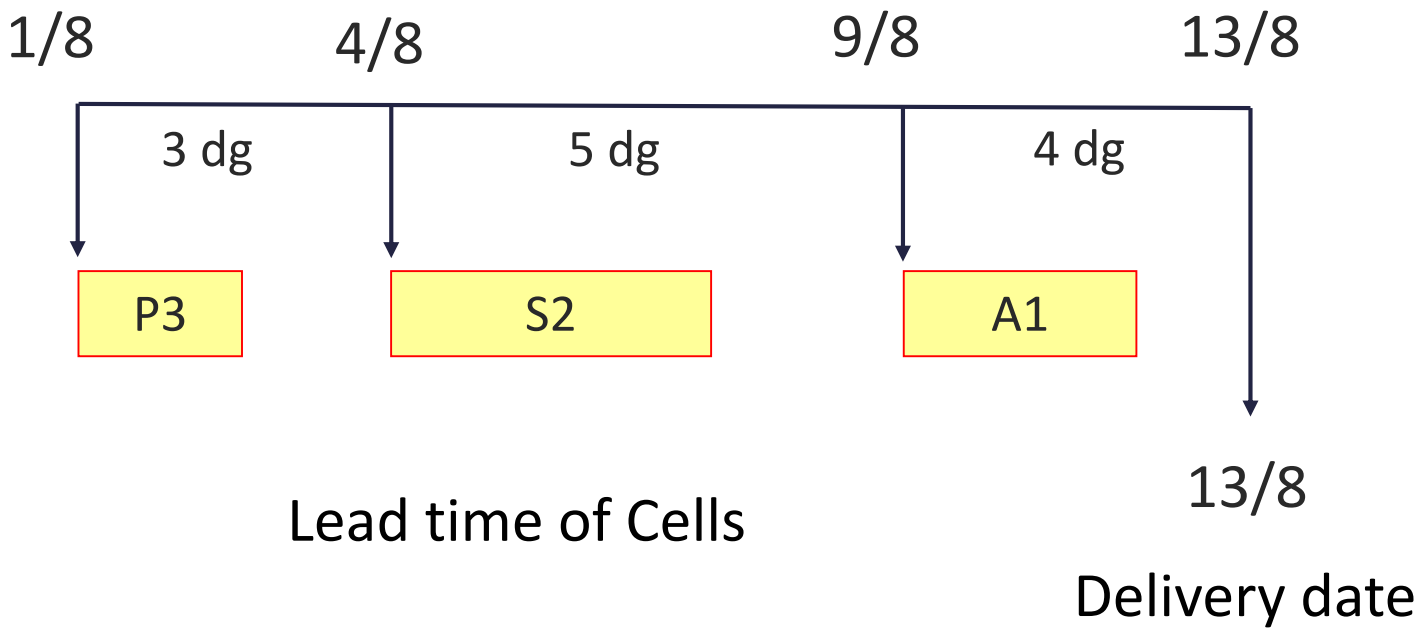


Push element: High level MRP



= cell throughput time

Autorization dates



Each product, or routing family (PF) has its own Lead Time

	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Total Lead Time
PF 1	x	x	x			T1+T2+T3
PF 2		x	x		x	T2+T3+T5
PF 3	x	x		x		T1+T2+T4
PF 4	x	x		x	x	T1+T2+T4+T5
..						.....
Lead Time	T1	T2	T3	T4	T5	

Layout design is important in POLCA control situations

What are the advantages and disadvantages of POLCA?

Advantages:

- Clear objectives (lead times and due dates) and challenges (lead time reduction – reducing of the number of cards) for each cell;
- Design according sociotechnical principles (variance control, multifunctionality, minimal critical specification). Creating responsible teams.
- Obeys own characteristics of cells.

Disadvantages:

- Risk of having too many loops. This reduces flow control.
- Traffic of cards
- Little complex

Principle: create dependent teams (with clear internal suppliers and customers)

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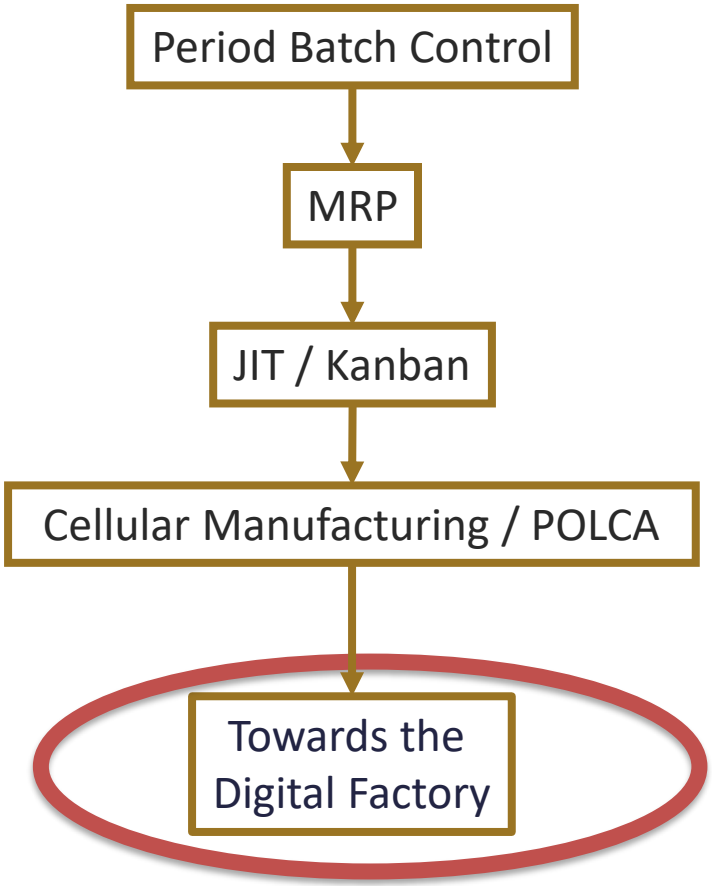

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Steps towards the (human-centred) digital factory

Create value focused, dependent, semi-autonomous teams (control units)

Digital model, simulation

Steps towards the (human-centred) digital factory

Create value focused, dependent, semi-autonomous teams (control units)

Monitor the progress of each team

Digital model, simulation

Information System, Barcode, QR code

Production Progress Screen

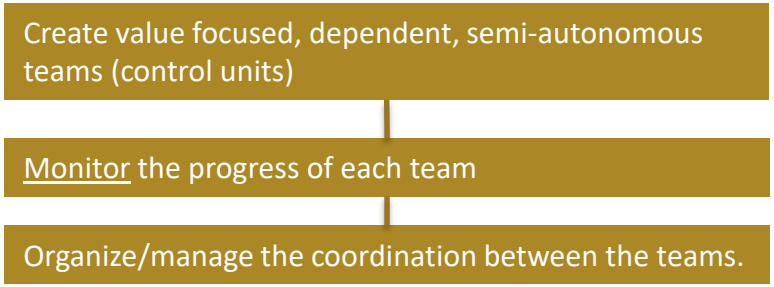
Production Progress Screen

Production progress screen					
Day	Wed	Start	06:00 am	Finished products	26
Takt time (min)	18	Stop	11:00 pm	To be produced	34
Daily production	60	Time	10:33 am	Lead/backlog	11

Nr.	Order	Time	Nr.	Order	Time	Nr.	Order	Time	Nr.	Order	Time
41	**688390**	**23:34**	54	687872	03:50	19	0	00:00	38	0	00:00
17	688140	16:36	16	688238	02:58	20	0	00:00	40	0	00:00
47	688131	15:47	3	688202	01:34	21	0	00:00	43	0	00:00
11	688184	13:17	1	0	00:00	22	0	00:00	45	0	00:00
44	688221	11:50	2	0	00:00	23	0	00:00	48	0	00:00
46	688239	10:46	4	0	00:00	24	0	00:00	49	0	00:00
29	687899	10:38	5	0	00:00	25	0	00:00	51	0	00:00
10	687873	10:34	7	0	00:00	28	0	00:00	52	0	00:00
39	688237	08:54	8	0	00:00	30	0	00:00	53	0	00:00
34	687874	08:39	9	0	00:00	31	0	00:00	55	0	00:00
50	687900	08:33	12	0	00:00	32	0	00:00	56	0	00:00
6	688405	06:34	13	0	00:00	33	0	00:00	57	0	00:00
26	688402	06:03	14	0	00:00	35	0	00:00	58	0	00:00
27	688395	04:26	15	0	00:00	36	0	00:00	59	0	00:00
42	688387	04:10	18	0	00:00	37	0	00:00	60	0	00:00

A focus on lead/backlog to deliver output according to takt time

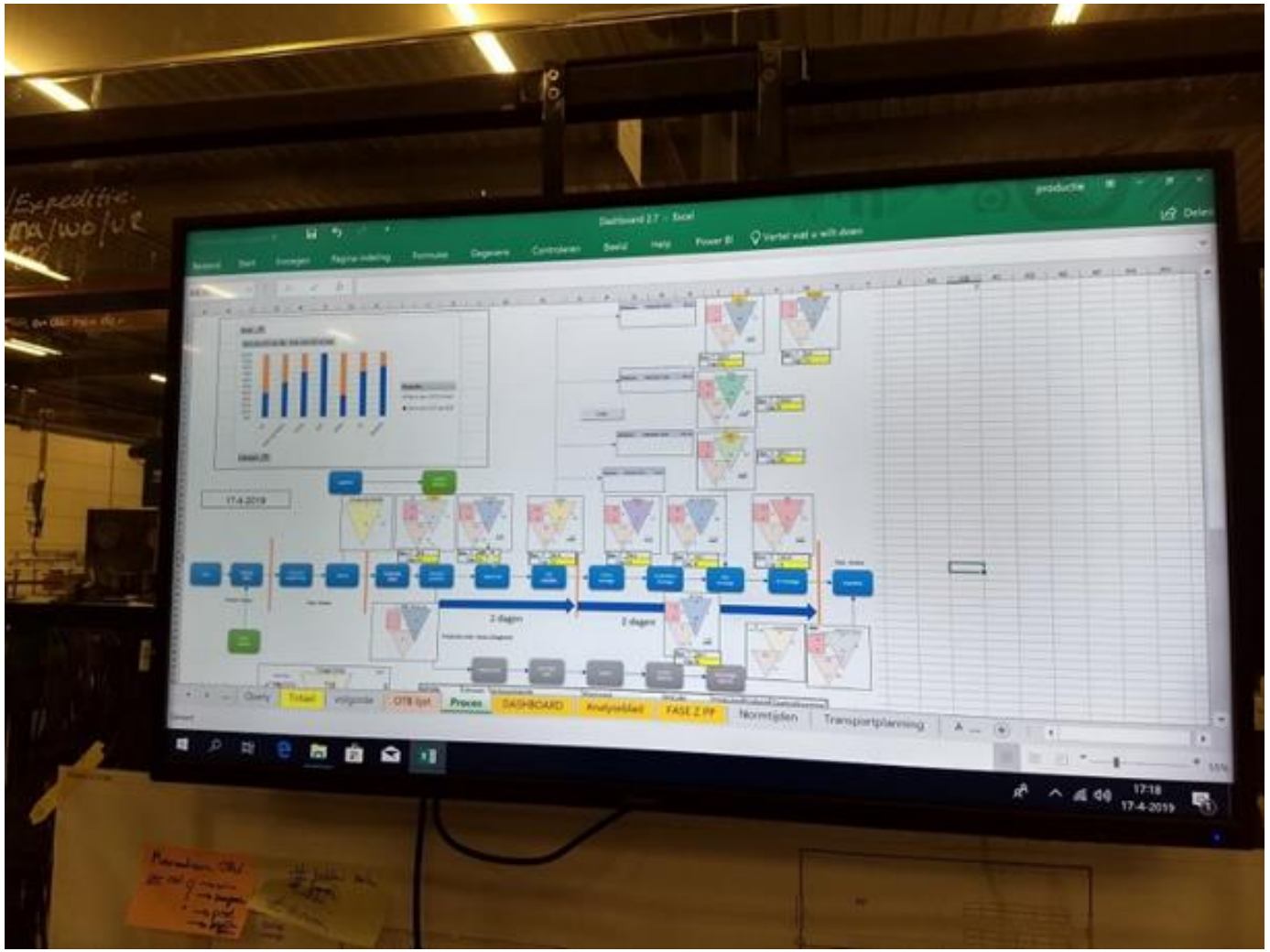
Steps towards the (human-centred) digital factory



Digital model, simulation

Information System, Barcode, QR code

Information System, rules


Dashboard 2.7 - Excel
17-4-2019
2 dagen
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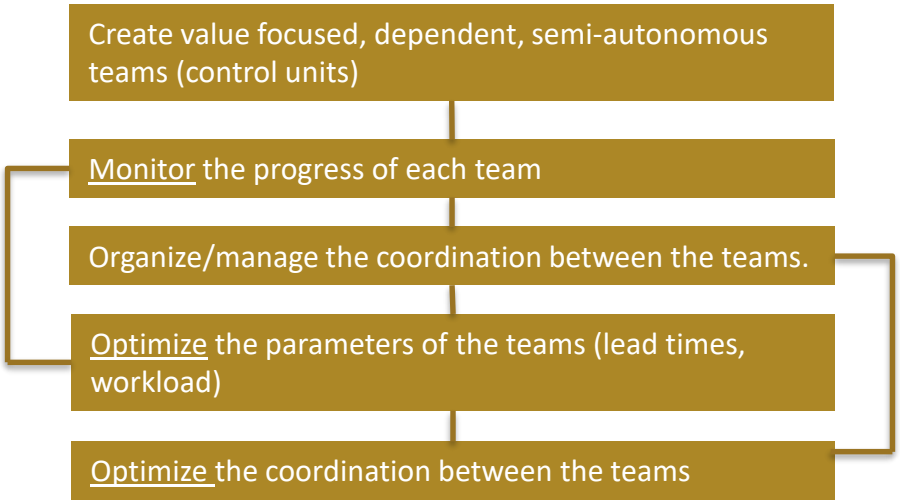
Proces
DASHBOARD
FASE 2 PP
Normtijden
Transportplanning

Steps towards the (human-centred) digital factory



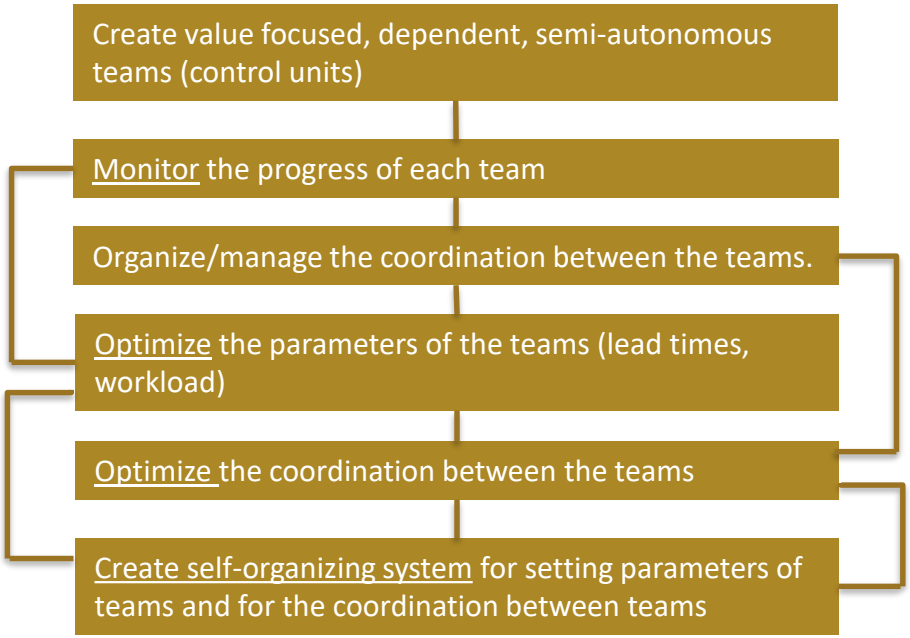
Digital model, simulation

Information System, Barcode, QR code

Information System, rules

Digital model / shadow

Steps towards the (human-centred) digital factory



Digital model, simulation

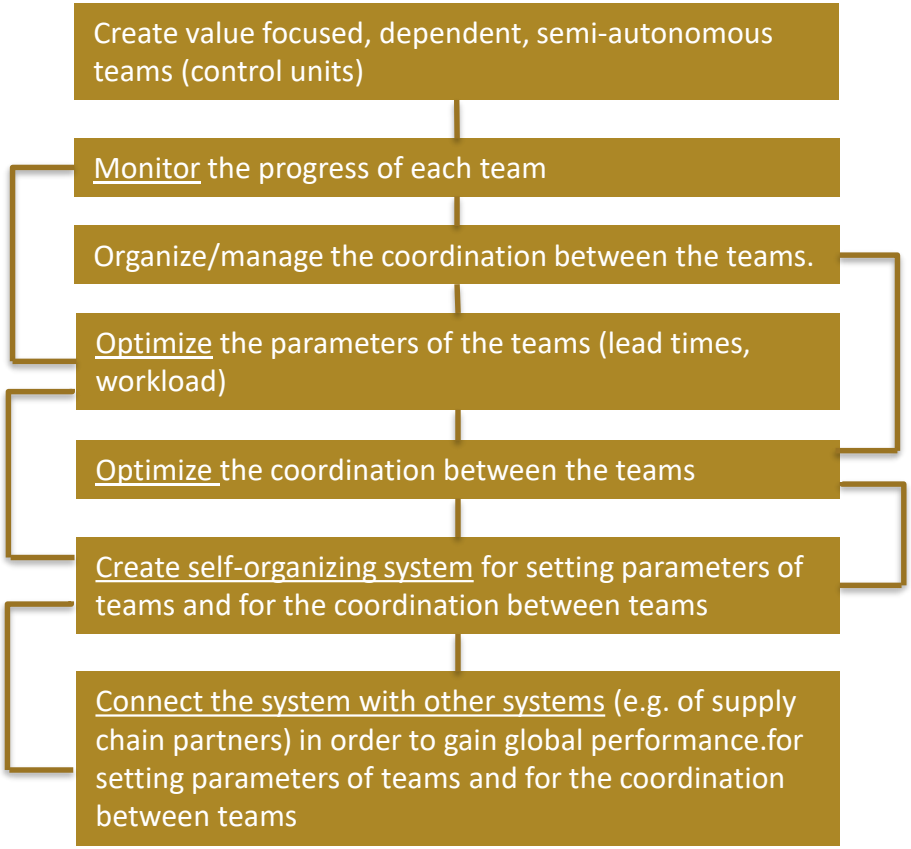
Information System, Barcode, QR code

Information System, rules

Digital model or shadow

Digital twin

Steps towards the (human-centred) digital factory



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Main message: keep it transparant and gain the acceptance of those who are involved in planning and control.

Questions, comments?