Bosch Production System

Lean Logistics Implementation in TTPO

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Bosch Termotecnologia SA

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Bosch Termotecnologia SA

1977 – Foundation of Vulcano

1983 – Brand Vulcano was created

1988 – Robert Bosch acquires majority of shares

1992 – European leader in water heaters

1993 – Installation in Aveiro of R&D department

1996 – Start production of boilers

2002 – Bosch worldwide responsibility for water heaters

2007 – Name change to BBT TERMOTECNOLOGIA PORTUGAL SA

2007 – Start production of solar panels

2008 – Name change to BOSCH TERMOTECNOLOGIA PORTUGAL SA

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BOSCH

Key Indicators	2004	2005	2006	**2007**
Sales (Mio. €)	194	207	230	235
Exportations (% sales)				
Water Heaters	76	77	80	81
Boilers	91	90	92	92
Production (Tsd units)				
Water Heaters	974	1.021	1.049	1.203
Boilers	133	124	132	166
Nº Workers	1.008	1.001	1.078	1.133

Nº1 Water Heater Manufacturing Company in Europe

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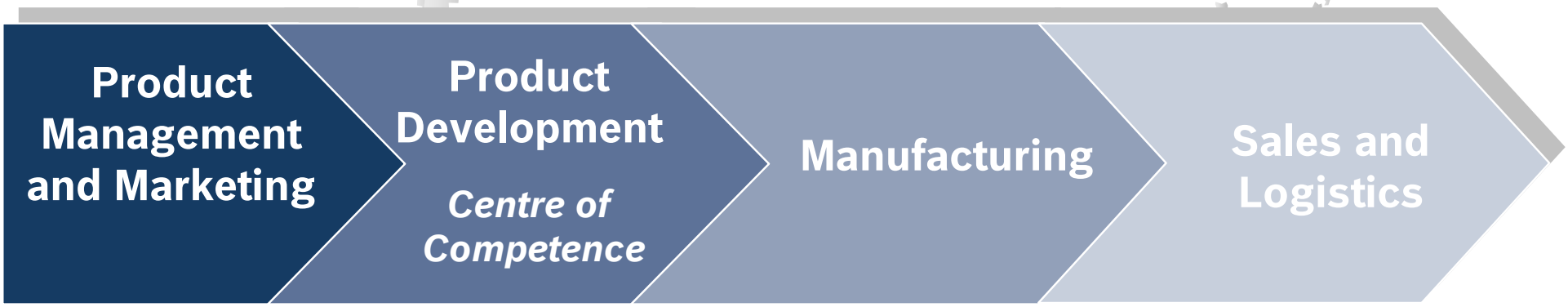
Centre of Competence for “Water heating”

- Product Management and Marketing
- Product Development
- Manufacturing
- Sales and Logistics



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Water Heater Basic Segment

W125/135
5L

AS0
6/7/10/13L

Water Heater Comfort Segment

Compact
11/14/18L

Outdoor
10/13/16L

Celsius
11/14/17L

800 different Gas Water Heater Models

Water Heater High Output Segment

World 1
24L

World 2
27/30L

Domestic Boilers

GZT1
24kW

GZT1 HRD
30kW

120 different Boiler Models

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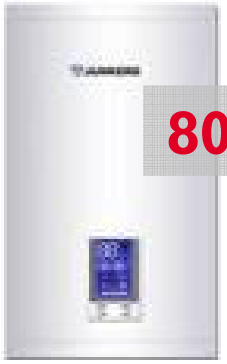
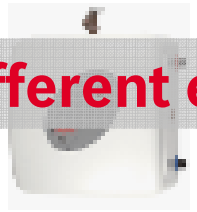
Electric Storage Tank

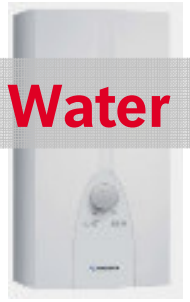


HS / HE

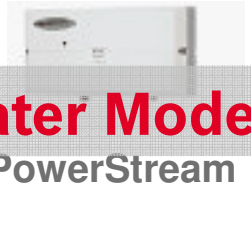


Mini Storage Tank

Electrical Water Heaters and Showers



S / HE



PowerStream

Electrical Shower

80 different electrical Water Heater Models

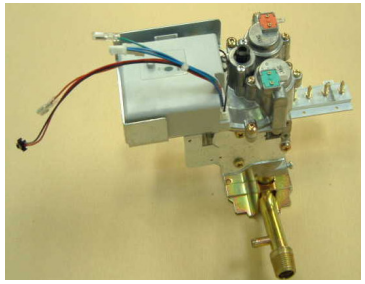
Solar Technology

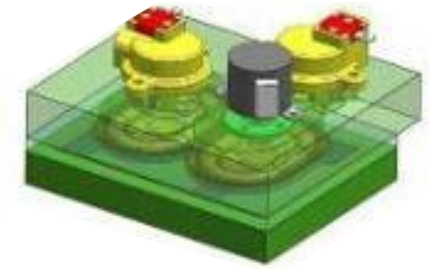
Solar Collectors

Comfort Solar Kit

Supply for all Europe

Gas Valve





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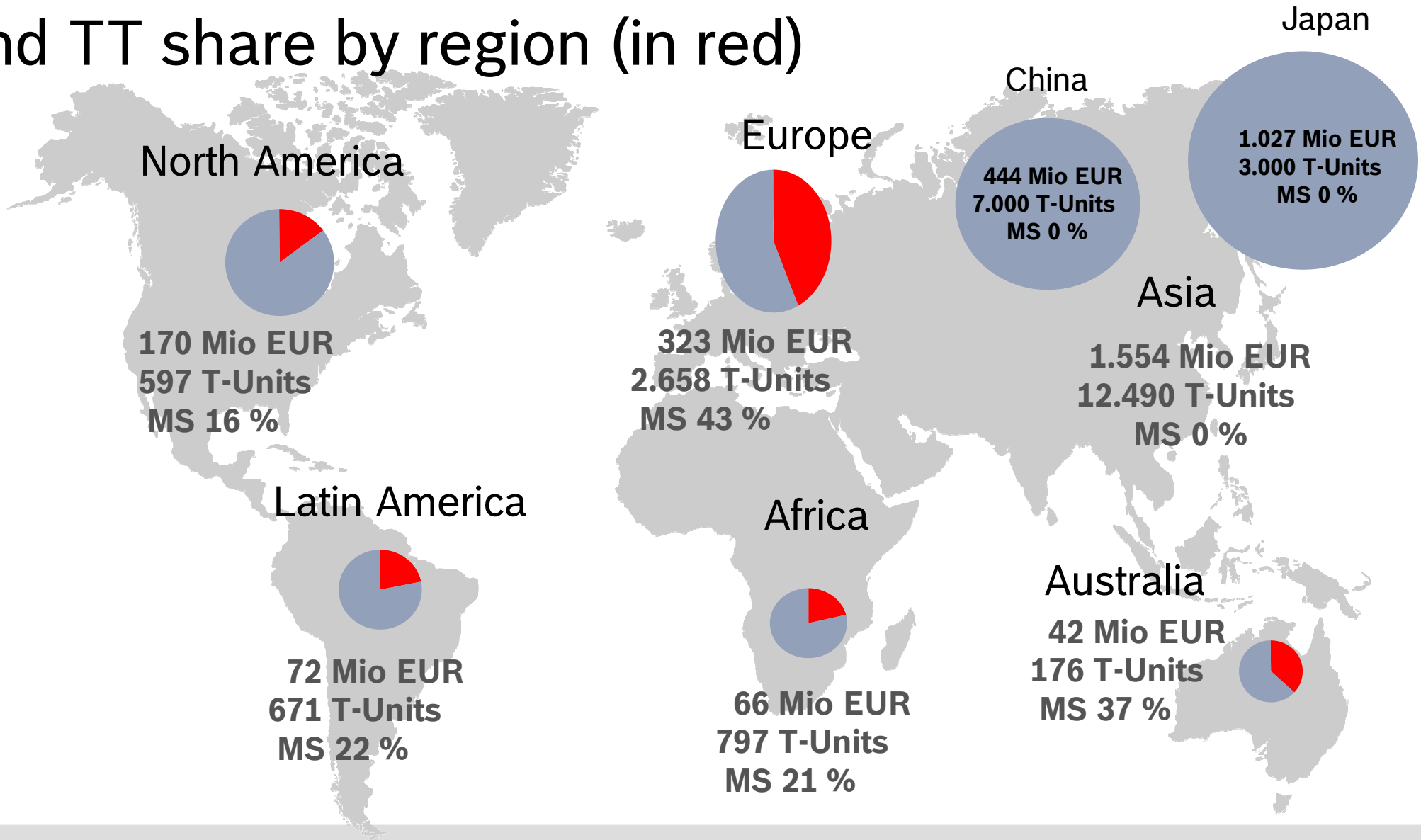
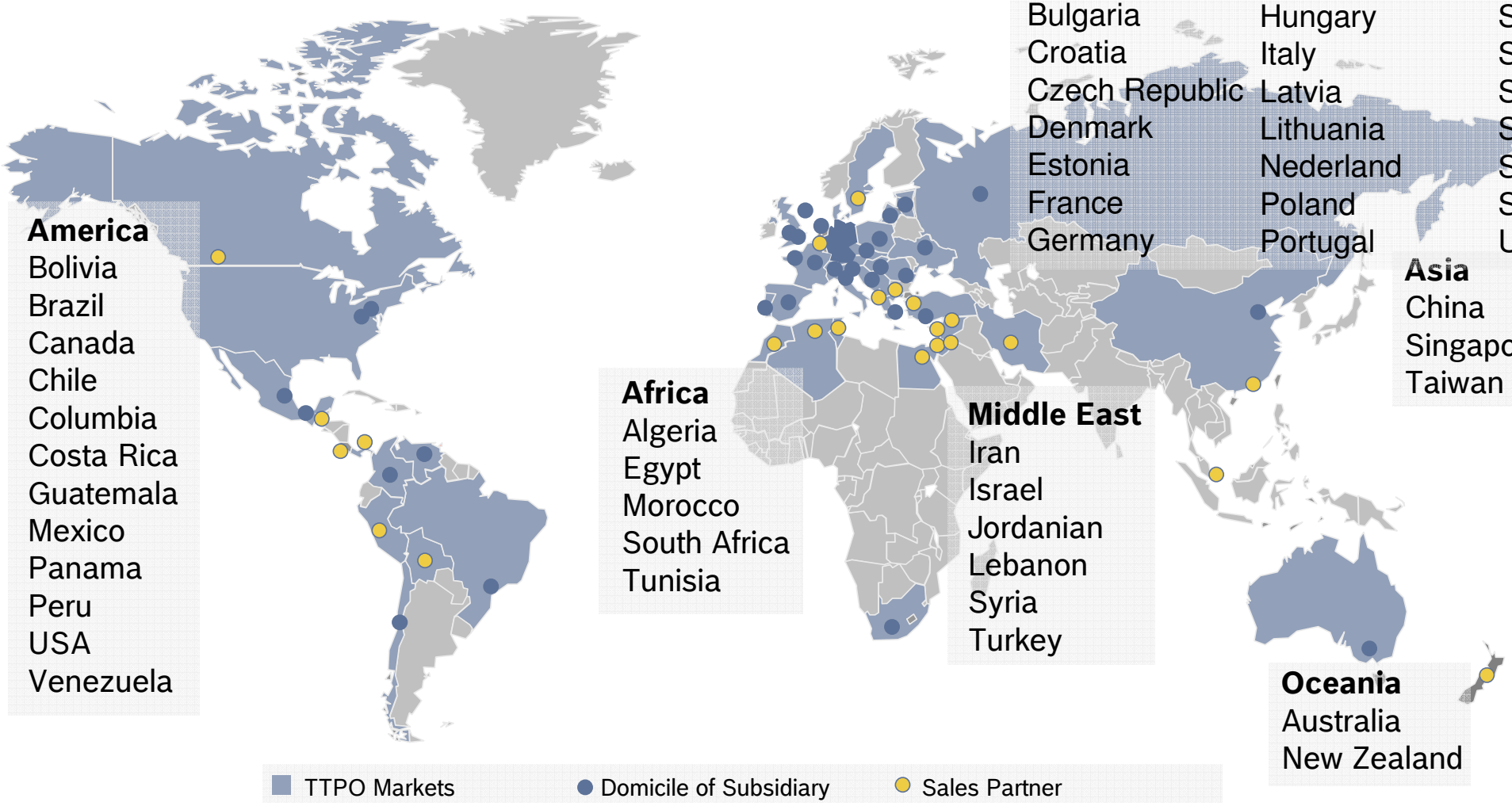
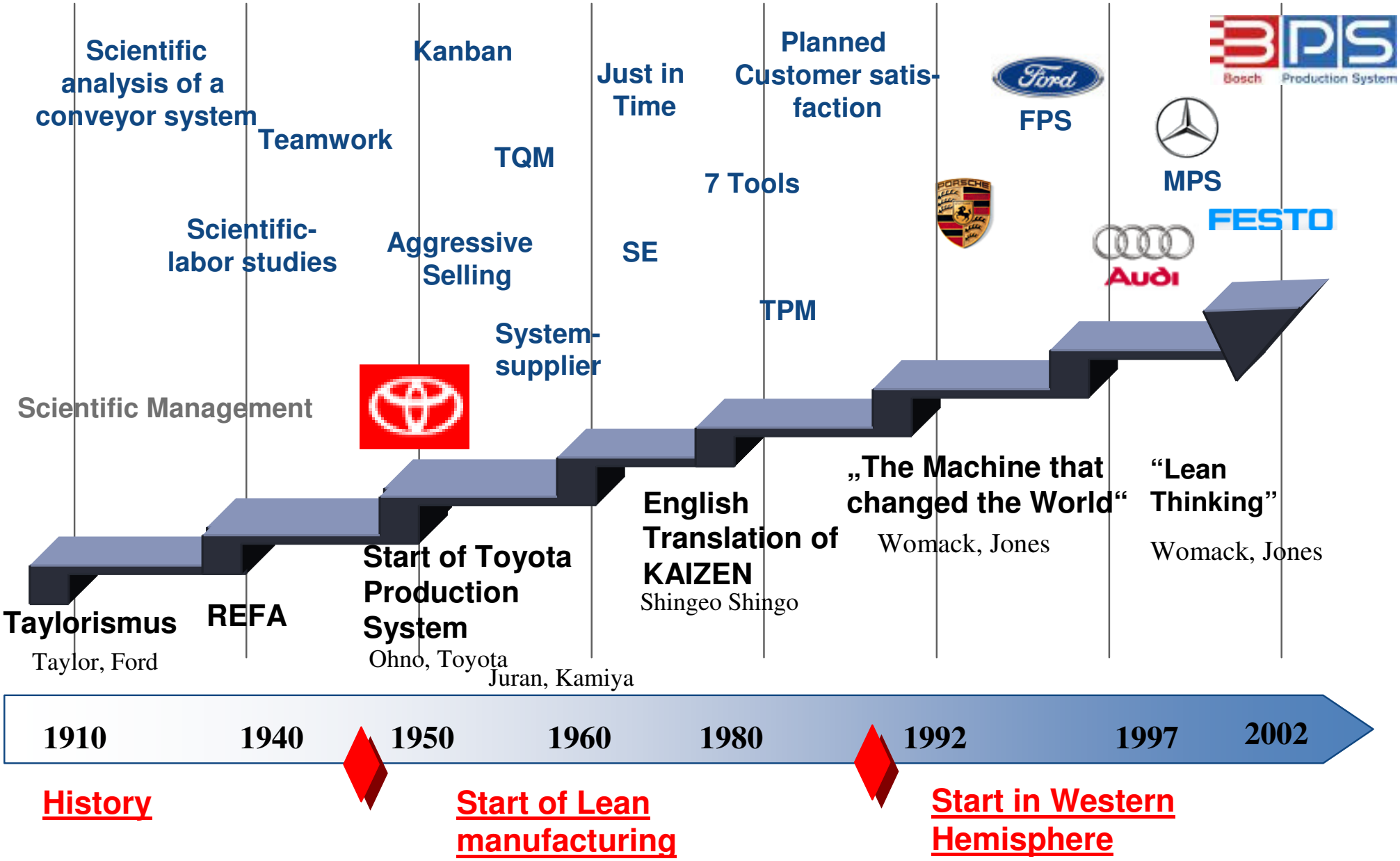
GWT Market Volume V-Ist 07 (Value and units) and TT share by region (in red)



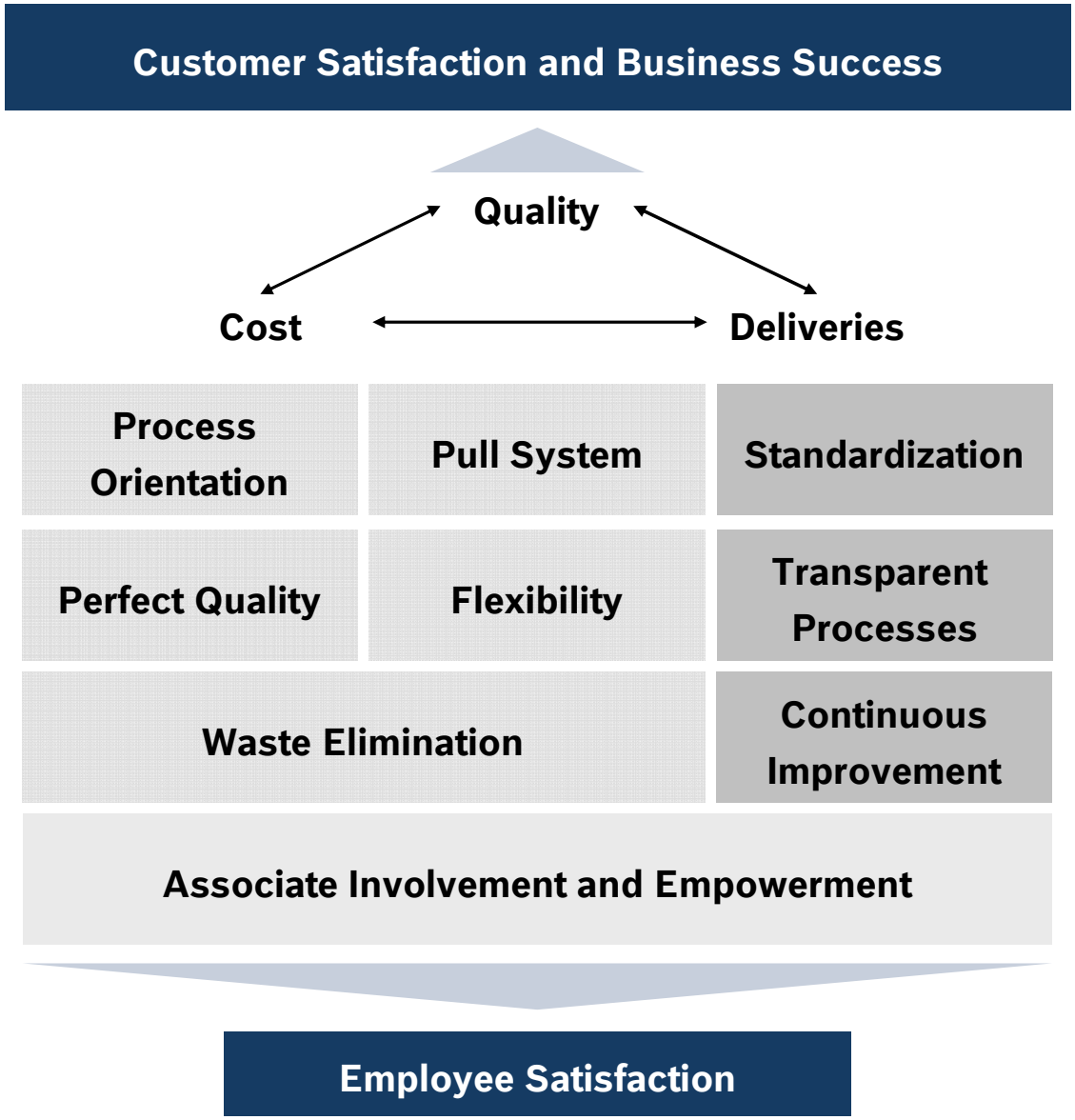
Sales in 55 different countries



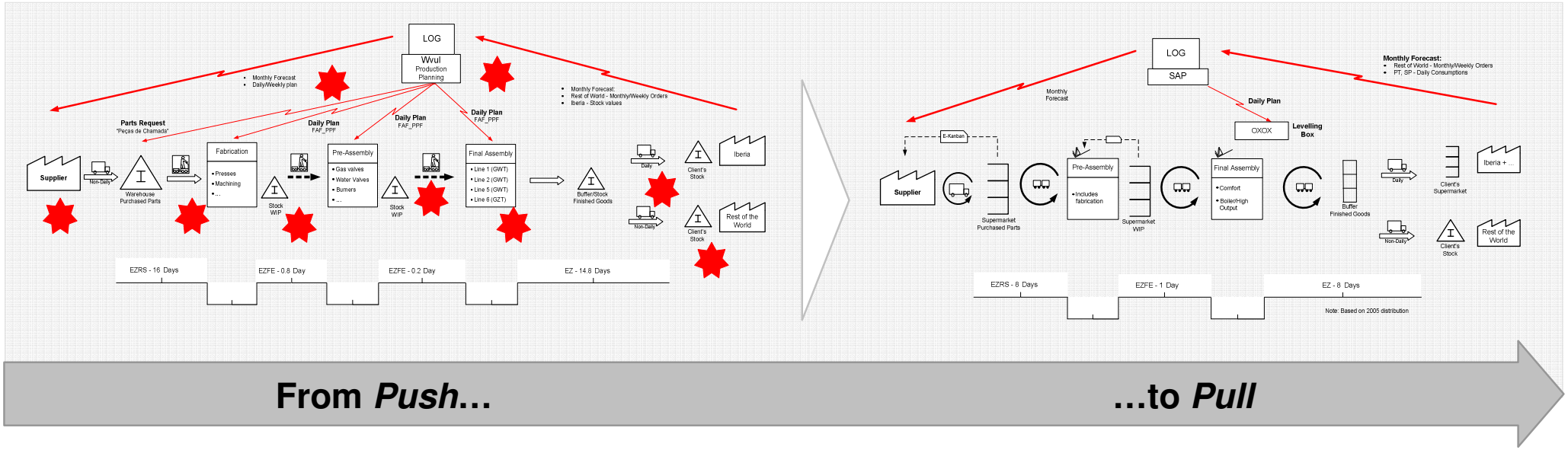
Bosch **Production System**



What is it?



BPS Strategy 2006-2012



From *Push*... **...to *Pull***

Premises

- Standardized and Flexible Processes
- Defined Material Flow
- Defined Information Flow

Goals 2010

- 100% service level
- Reduction of 50% in GEZ
- BPS Maturity – Level 4

Customer satisfaction through optimum processes, fewer costs and no waste.

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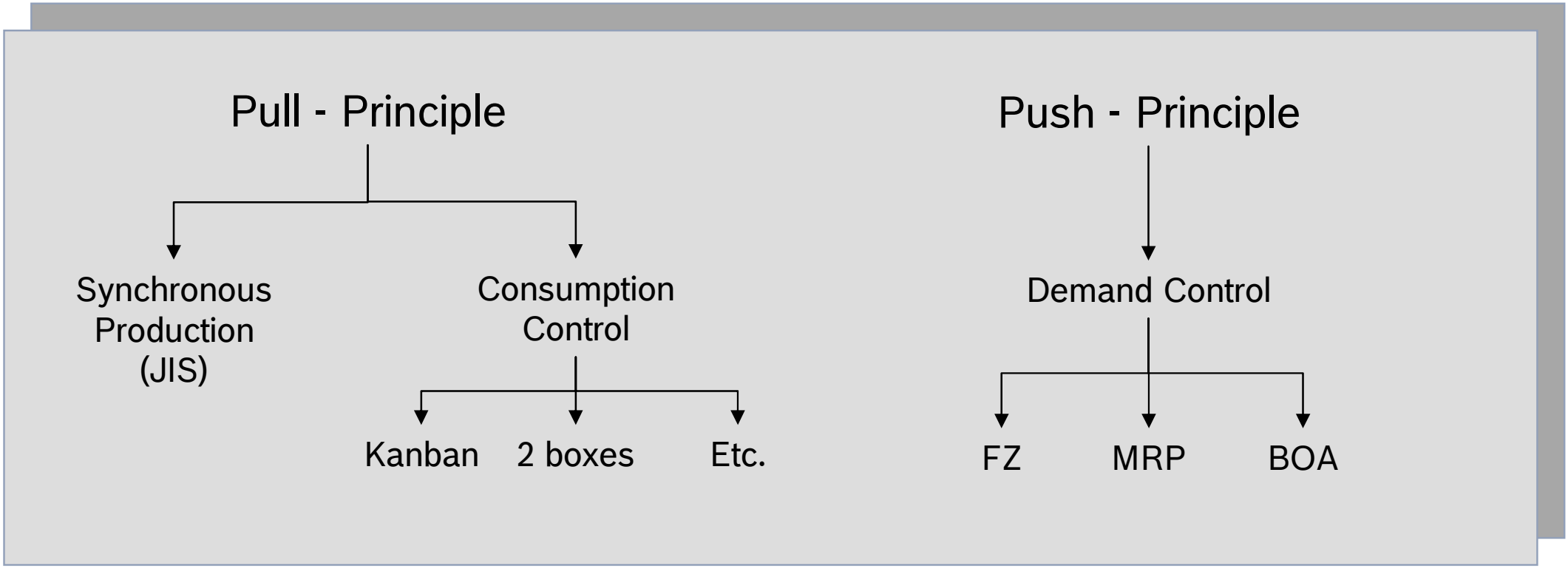
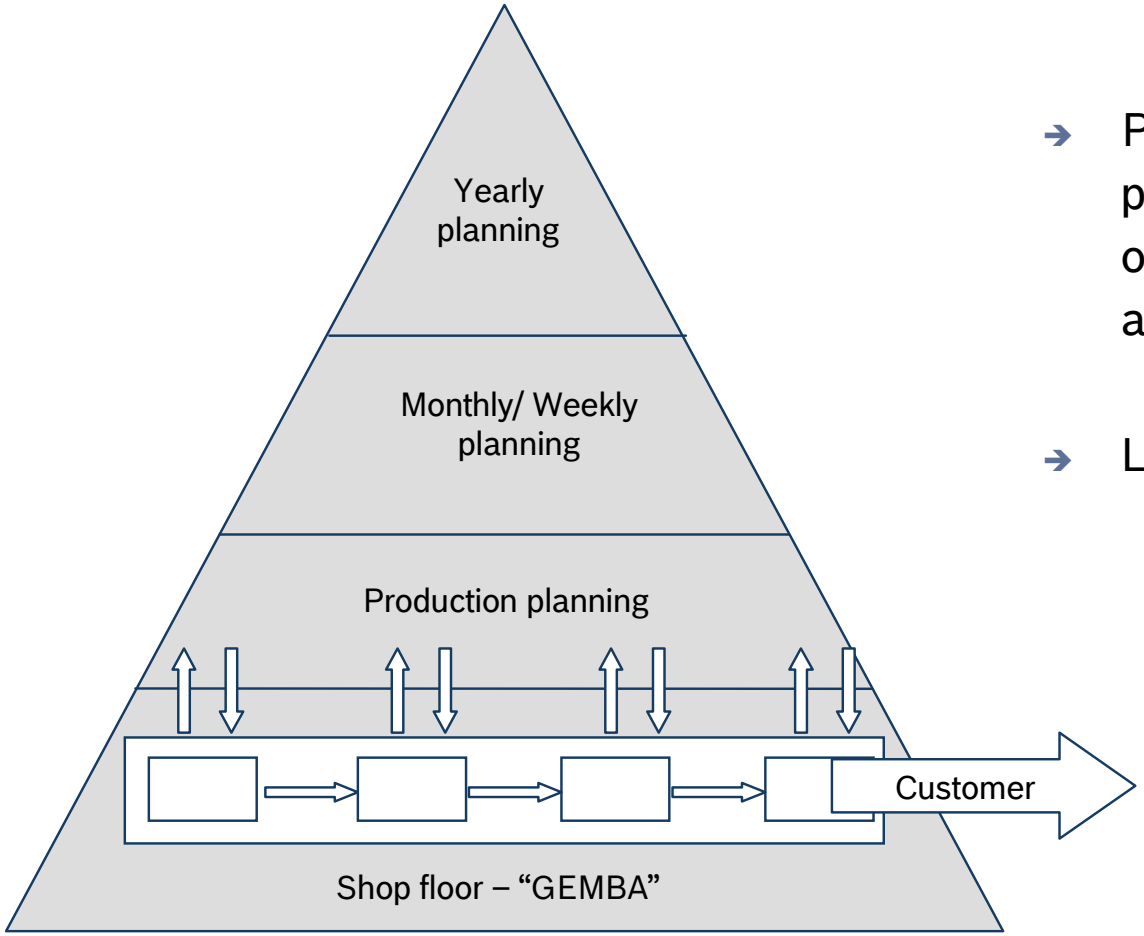
Control Principles



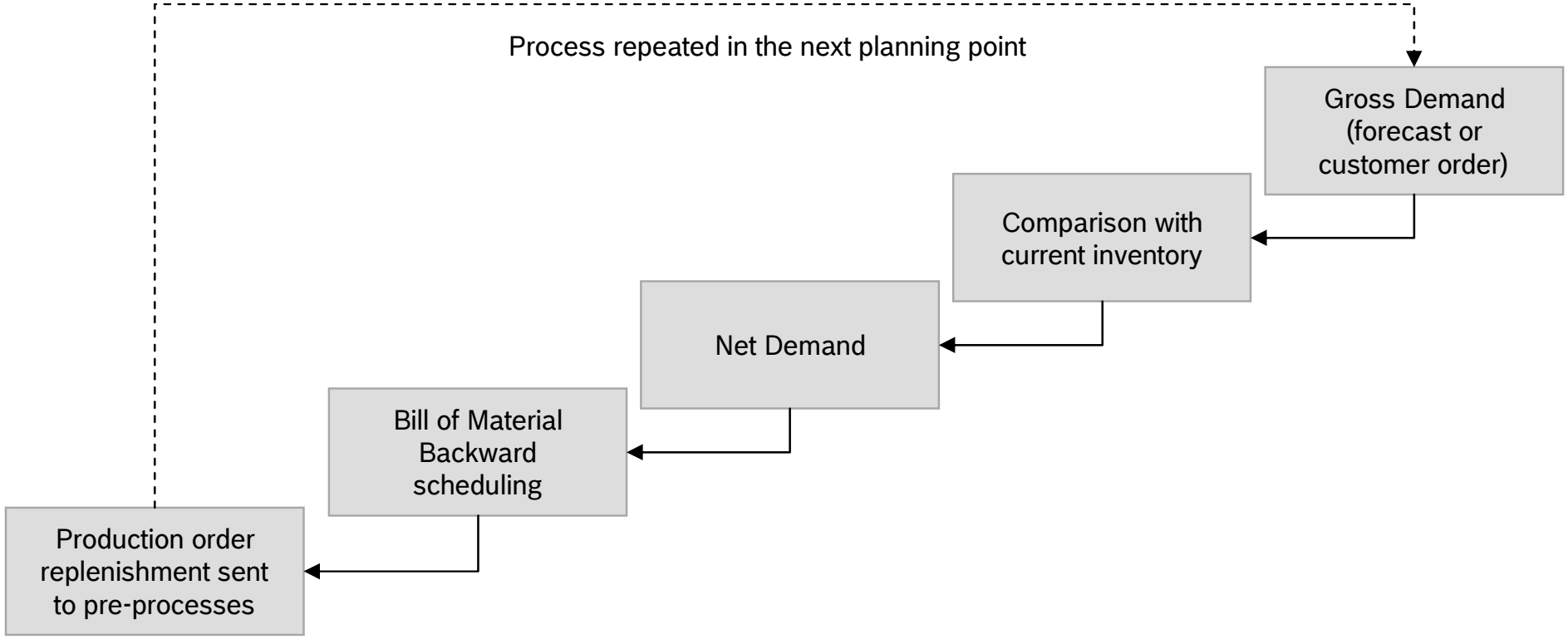
JIS – Just in Sequence
FZ – Cumulative quantities concept
MRP – Material Requirement Planning/ Management resource planning
BOA – Load-oriented release of orders

Before Pull and Leveling projects



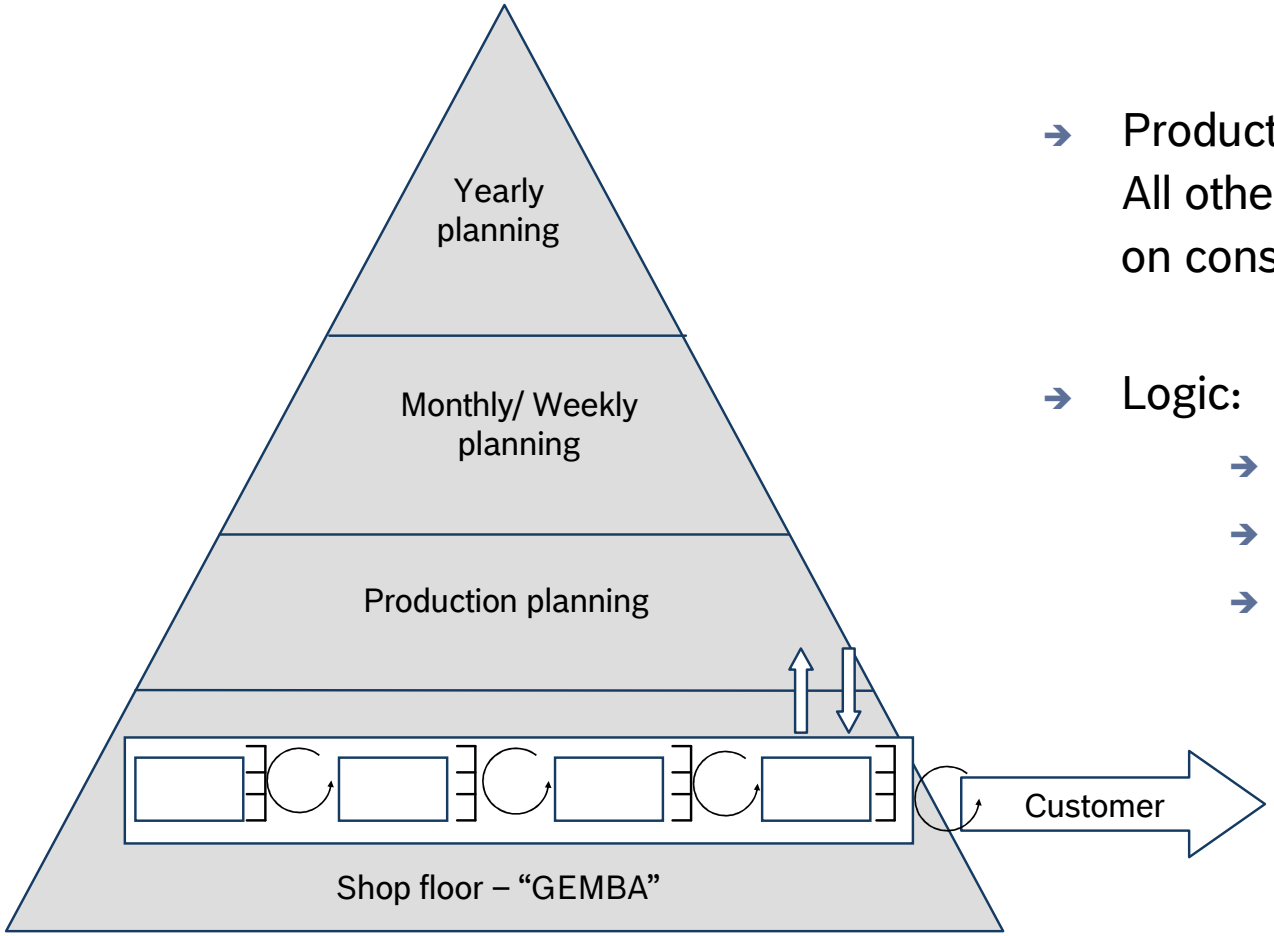
- Production planning system derived production orders from customer order bases on start\end dates for each production step at a higher planning level!
- Logic:
  - Order entry
  - Production
  - Delivery

Before Pull and Leveling projects



- Undefined inventory – Through-put time not consistent
- Deviations from the target state where the rule – production plan could not be adhered to
- Pre-processes protect themselves against these uncertainties by creating flexibility with the help of buffers

With Pull principles implemented

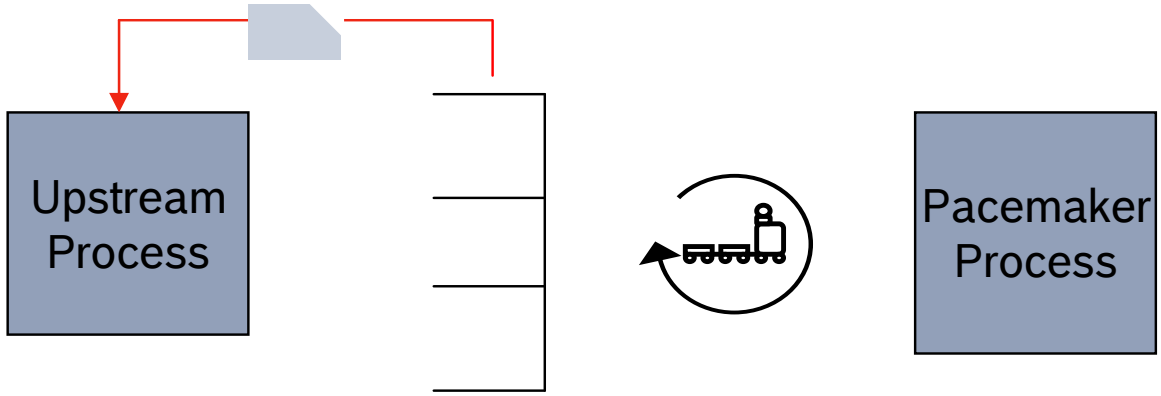


- Production planning initiated at pacemaker!! All other pre-processes are controlled based on consumption
- Logic:
  - Order entry
  - Delivery
  - Production

From Push to Pull

Concepts and Steps

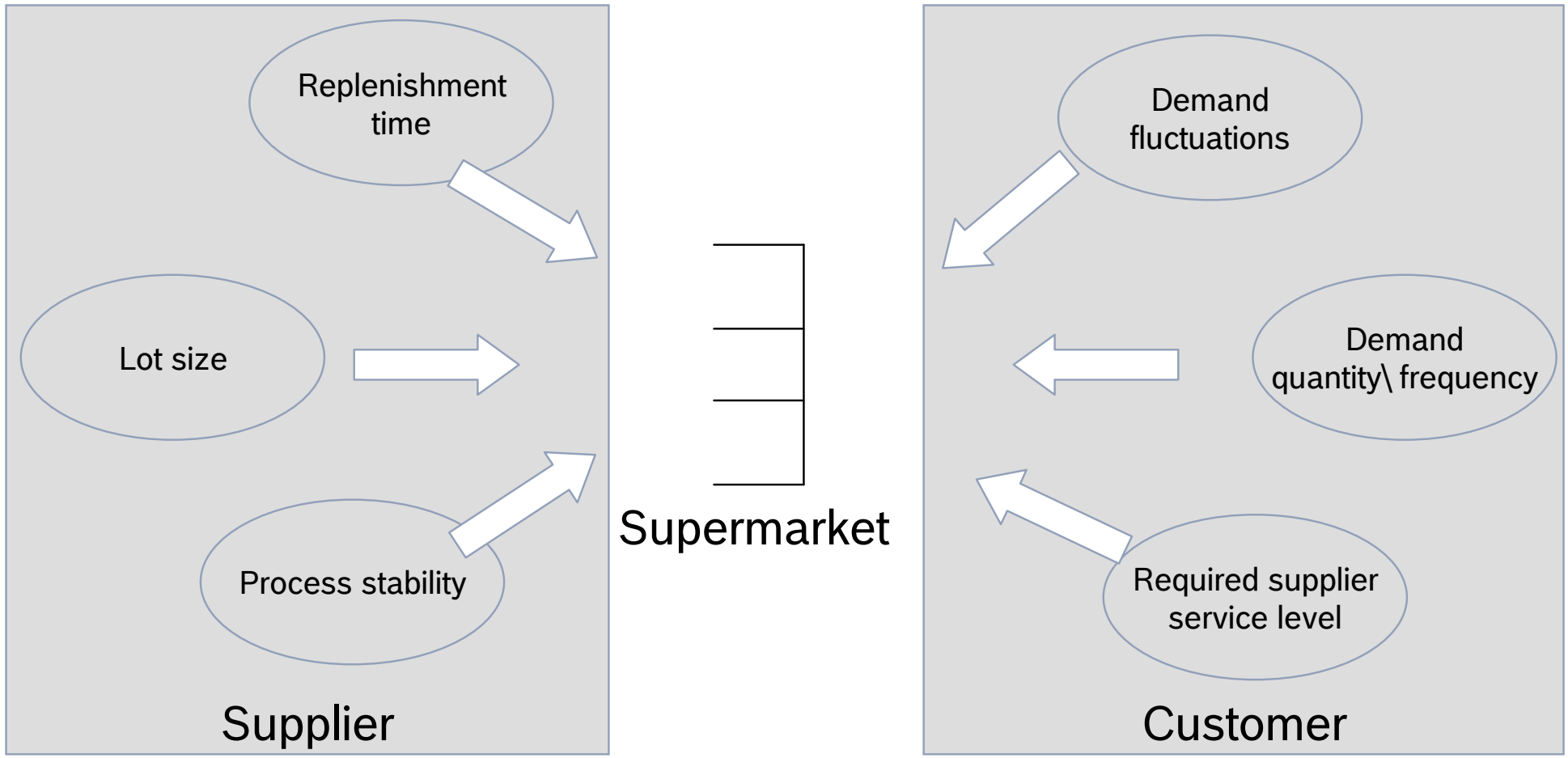
- **1st step – Implement pull controlled by consumption using kanban: Supermarkets**
  - The pacemaker is decoupled from the upstream process by a supermarket



- FIFO is not possible
- The various variants lie ready for the pacemaker
- The consumption of a variant from the supermarket acts as a trigger for the upstream process
- The pacemaker and the upstream process are able to produce completely independently of each other (sequence, lot-size, etc)
- The stock level in the supermarket depends on the quantity consumed by the pacemaker during the period that the upstream process needs to produce the parts again

From Push to Pull

Supermarket Influencing Factors



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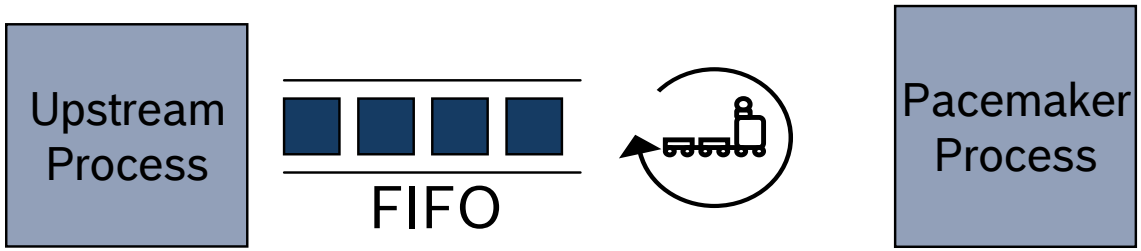
From Push to Pull

Concepts and Steps

- **2nd step – implement pull controlled by synchronous production with security buffer**
  - The right quantity is produced and delivered in the right order of sequence and at the right time

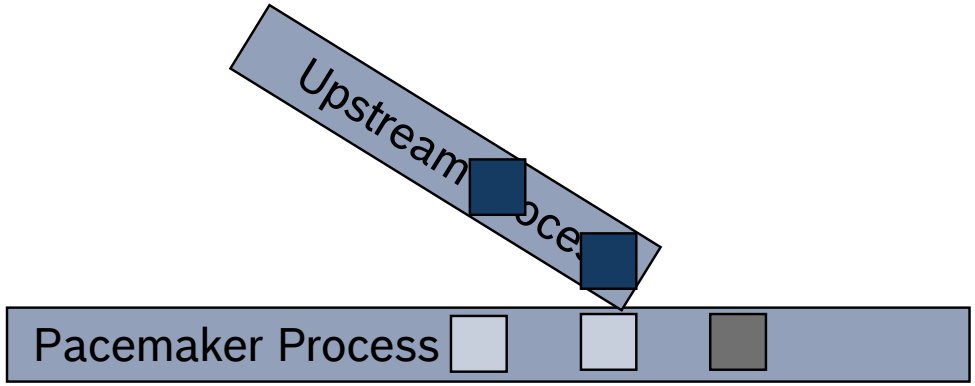


- FIFO is now possible
- The sequence is set by the pacemaker process
- Both processes work in the same type sequence and same lot size
- The cycle times of both processes are very similar
- Availability and change-over times are very similar
- There is a “frozen zone”: the time between the transmission of the sequence from the pacemaker to the upstream process and the consumption in the pacemaker process – sequence cannot be changed by either processes in this frozen zone!

From Push to Pull

Concepts and Steps

- **3rd step – implement pull controlled by synchronous production**
  - The right quantity is produced and delivered in the right order of sequence and at the right time

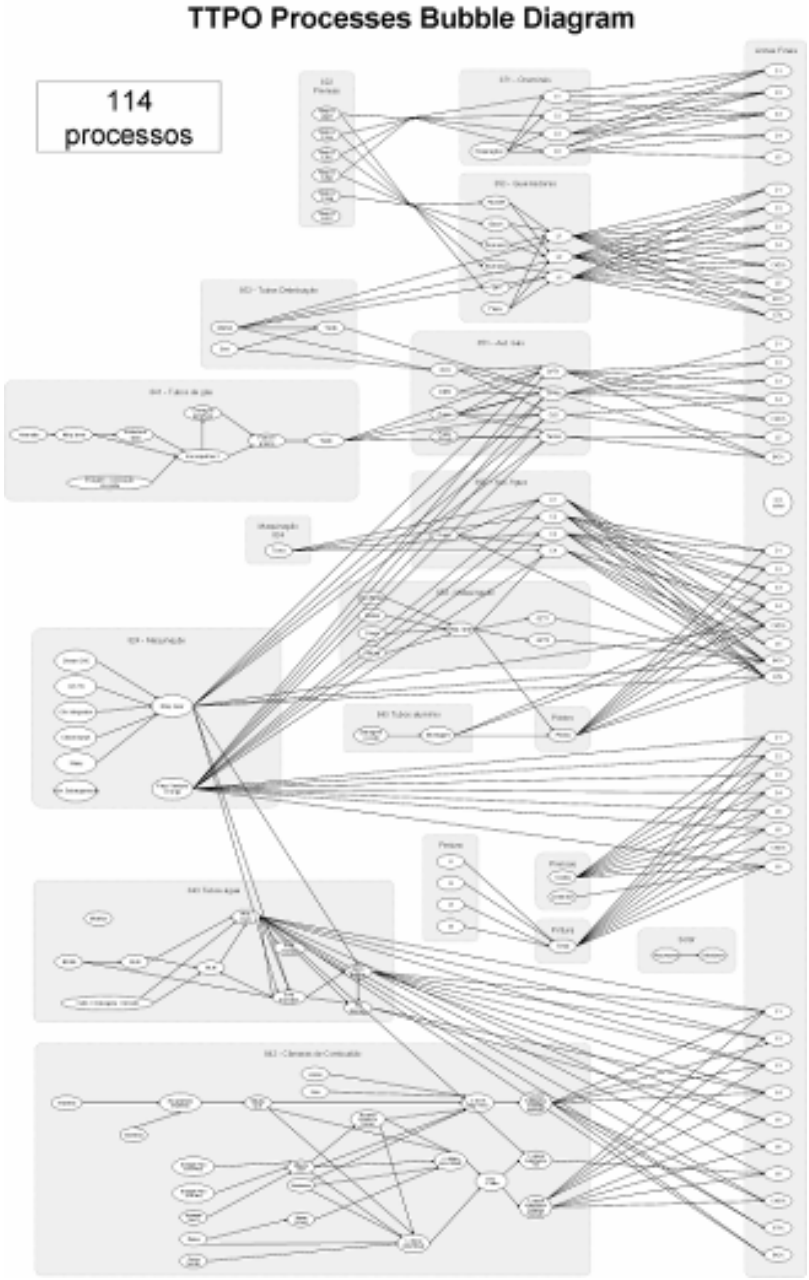


- Eliminate security buffer
- Fish bone layout

From Push to Pull

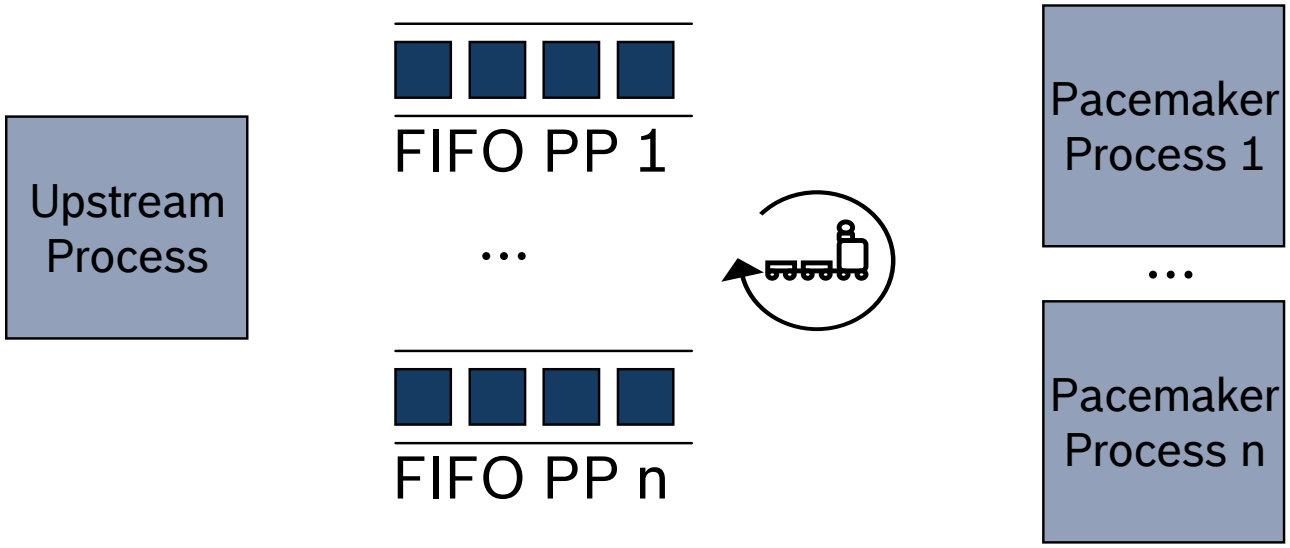
TTPO complexity

- With the actual complexity (114 different processes) It's not possible to implement fish bone layout and one-to-one processes



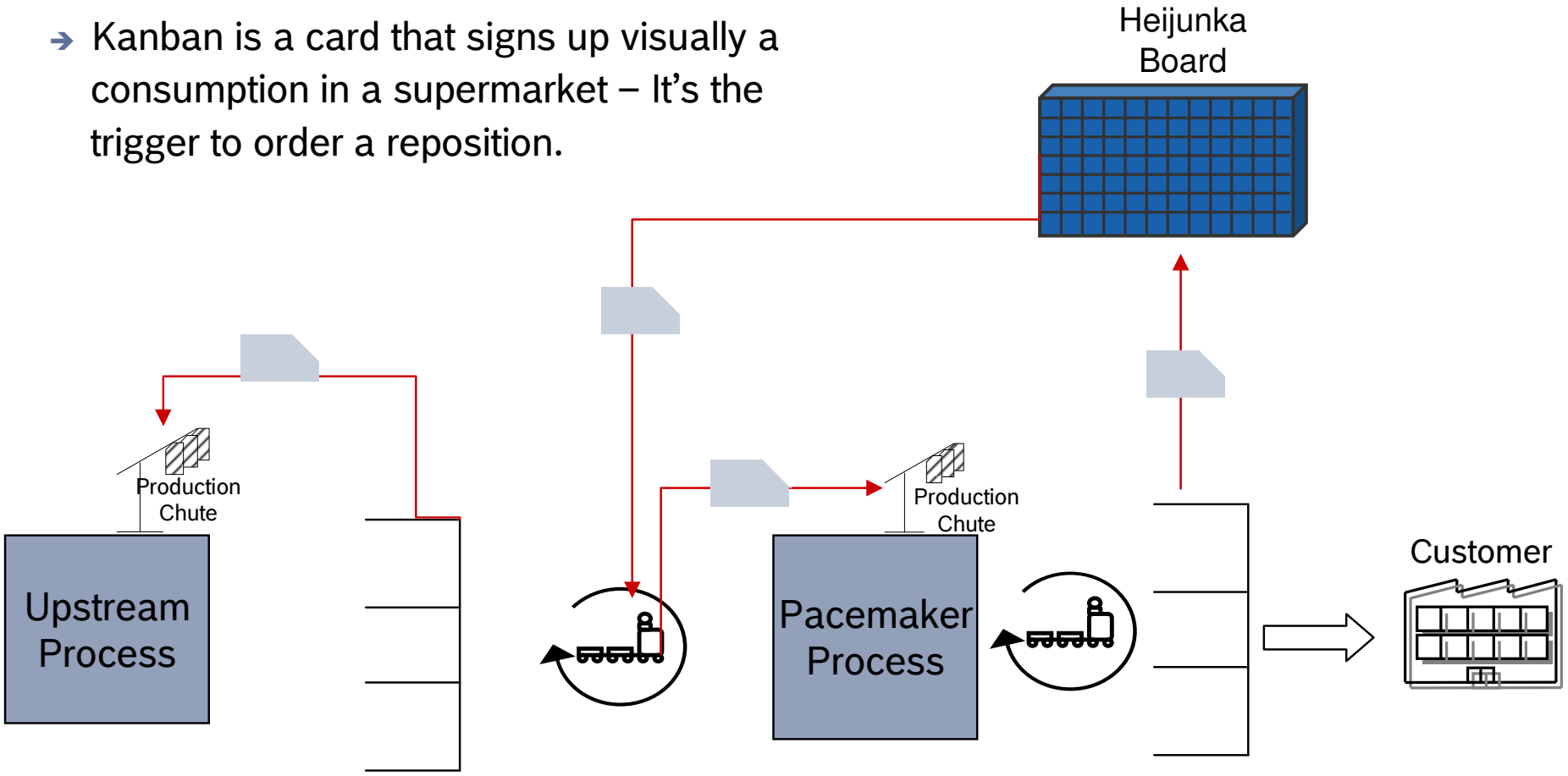
Our strategy for 2008 - 2010

- **What is a synchronous process in TTPO:**
  - The right quantity is produced and delivered in the right order of sequence and at the right time
  - FIFO rack's (security buffer) exists for each downstream process
  - Security buffer for each downstream process is <2h
  - Target: 1 upstream process to 1 pacemaker process, if not possible than 1 upstream process to n pacemaker processes being n as close to 1 as possible



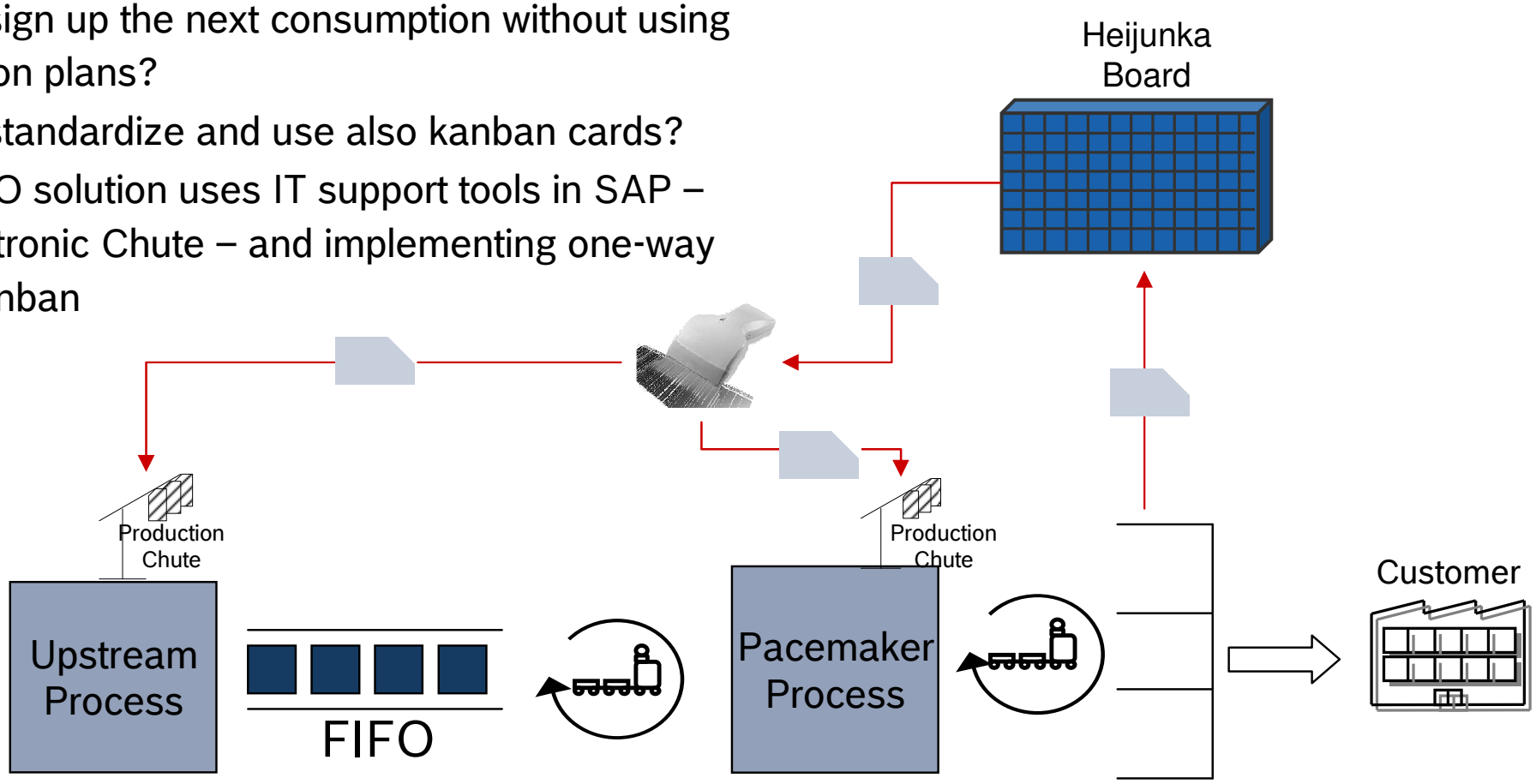
Information Flow behind Material Flow for Pull systems

- **Supermarkets: kanban control**
  - Kanban is a card that signs up visually a consumption in a supermarket – It's the trigger to order a reposition.



Information Flow behind Material Flow for Pull systems

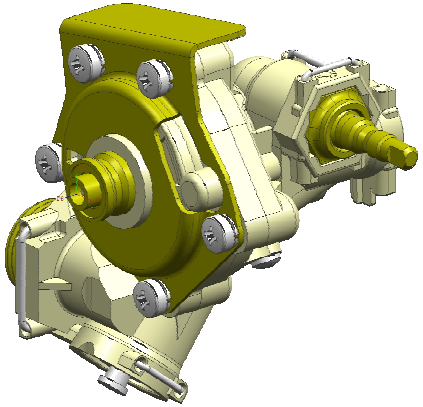
- **Synchronous production vs. kanban control**
  - How to sign up the next consumption without using production plans?
  - How to standardize and use also kanban cards?
    - TTPO solution uses IT support tools in SAP – Electronic Chute – and implementing one-way e-kanban



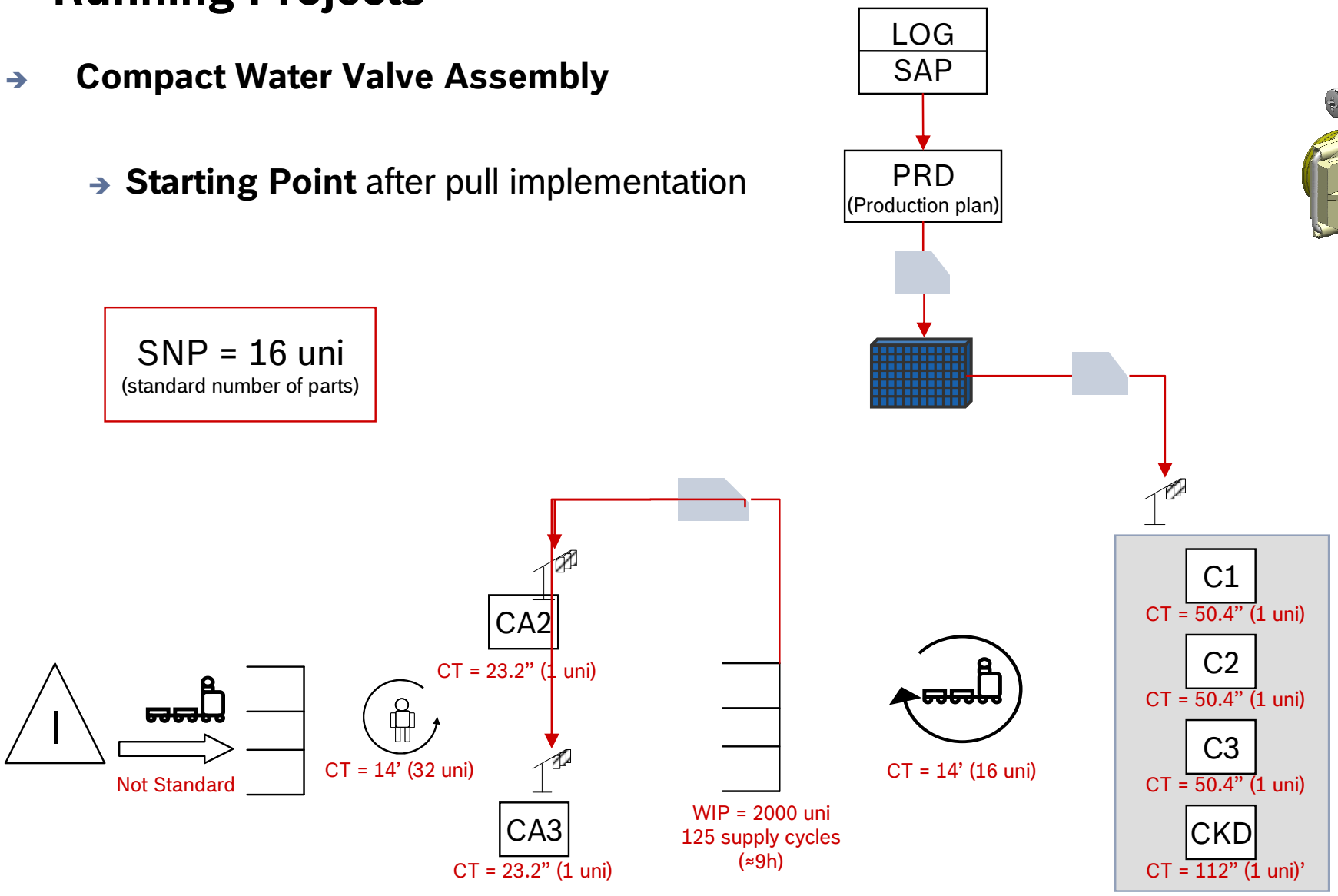
From Push to Pull

Running Projects

- **Compact Water Valve Assembly**
  - **Starting Point** after pull implementation



SNP = 16 uni
(standard number of parts)



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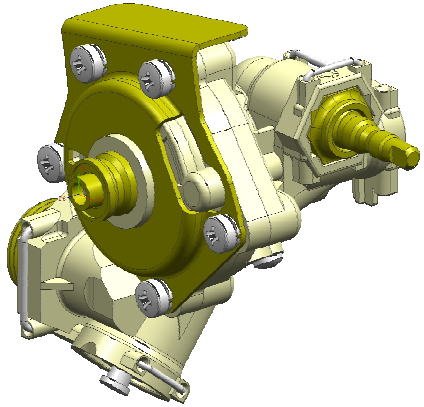
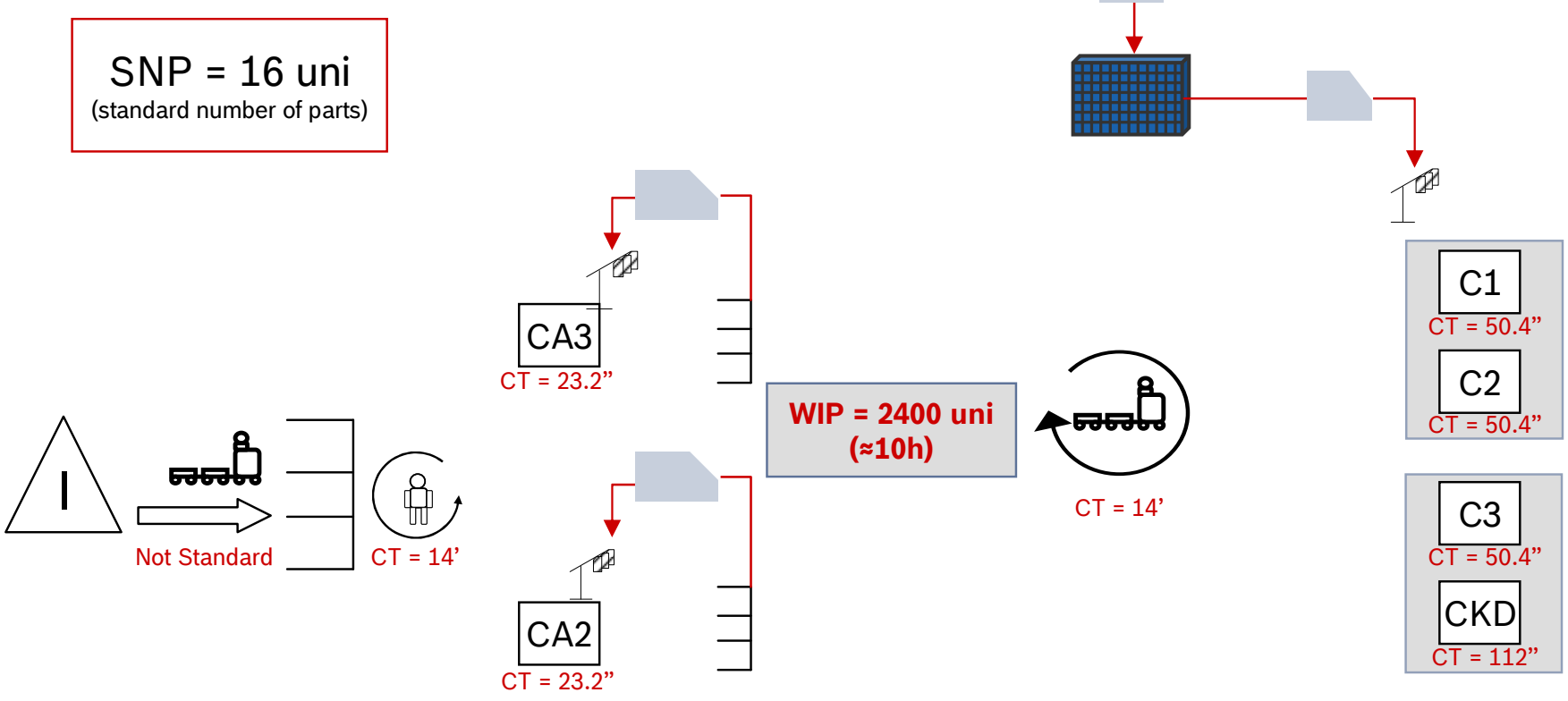
Running Projects

Compact Water Valve Assembly

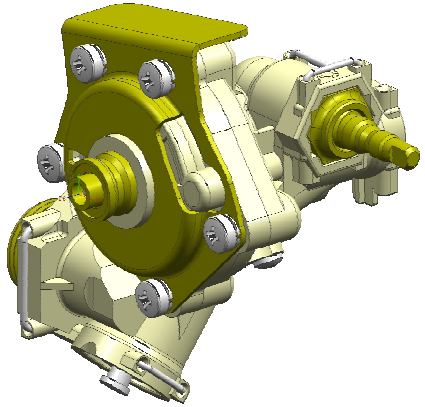
- **Step 1** – Layout Changes to allow process oriented material flow and process dedication

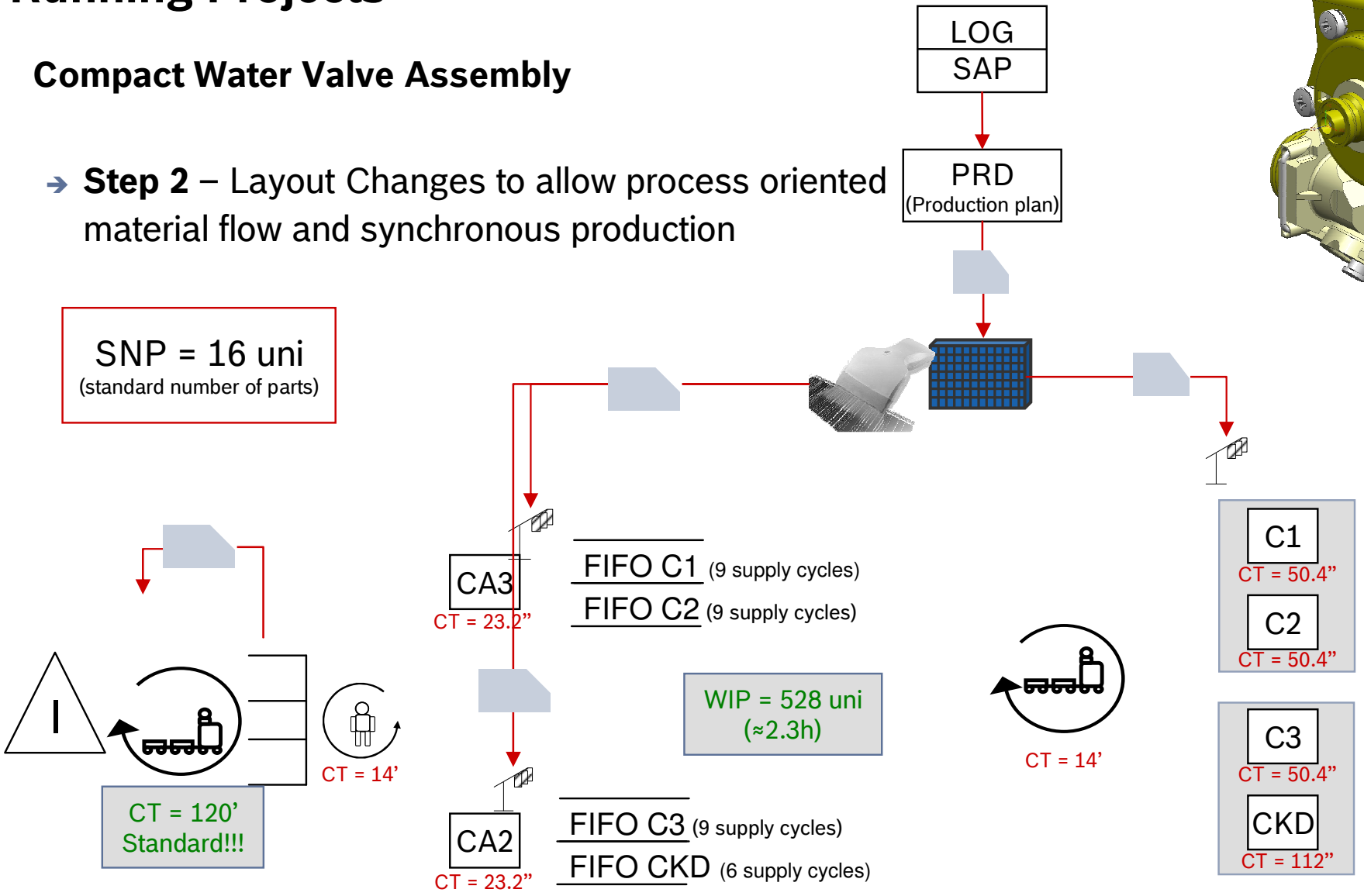




Running Projects

- **Compact Water Valve Assembly**
  - **Step 2** – Layout Changes to allow process oriented material flow and synchronous production

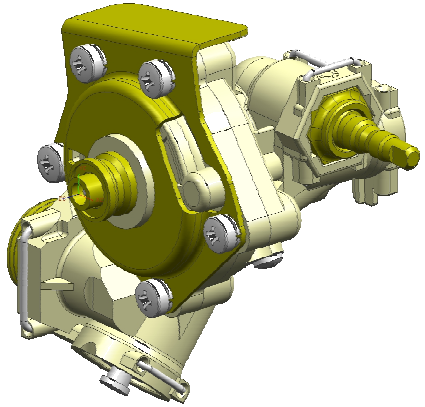


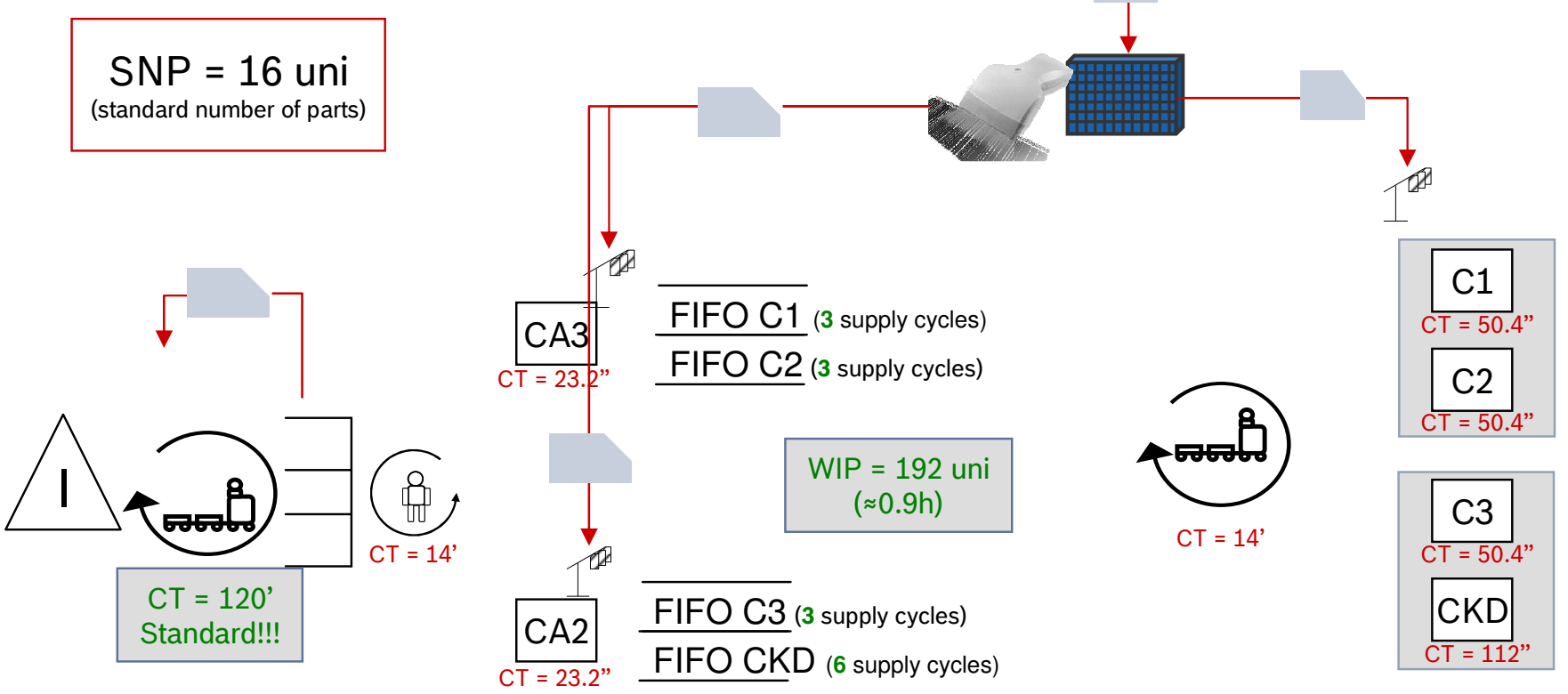


Running Projects

Compact Water Valve Assembly

Step 3 – Synchronous production improvements





Lessons Learned

- Quick communication of the consumption to trigger new stock to be replaced is the key to synchronous production and inventory reduction. This save space and costs;
- There is little room for errors. In addition, quality inspection and poke-yoke must be implemented in the sequencing step to guarantee that the sequenced components match the assembly sequence perfectly;
- IT system must be a mirror of the steps in the material flow: it must reflect exactly what's happening in GEMBA;
- The transportation must be "perfect" and flow of materials must be assured;
- A SNP (standard number of parts) must be implemented towards all value stream;
- Some of the initial results are very negative, problems are highly exposed due to the inexistence of security buffers: when a process problem or bad parts surfaced on the production, the entire process has to be slowed or even stopped. It's highly important to have a continuous improvement process supporting all activities;
- A step by step methodology is the key success factor;
- People must be involved and must understand perfectly the system: Employees and systems must properly manage exceptional scenarios;
- **Just-in-time is a mean to improve performance of the system, not an end.**

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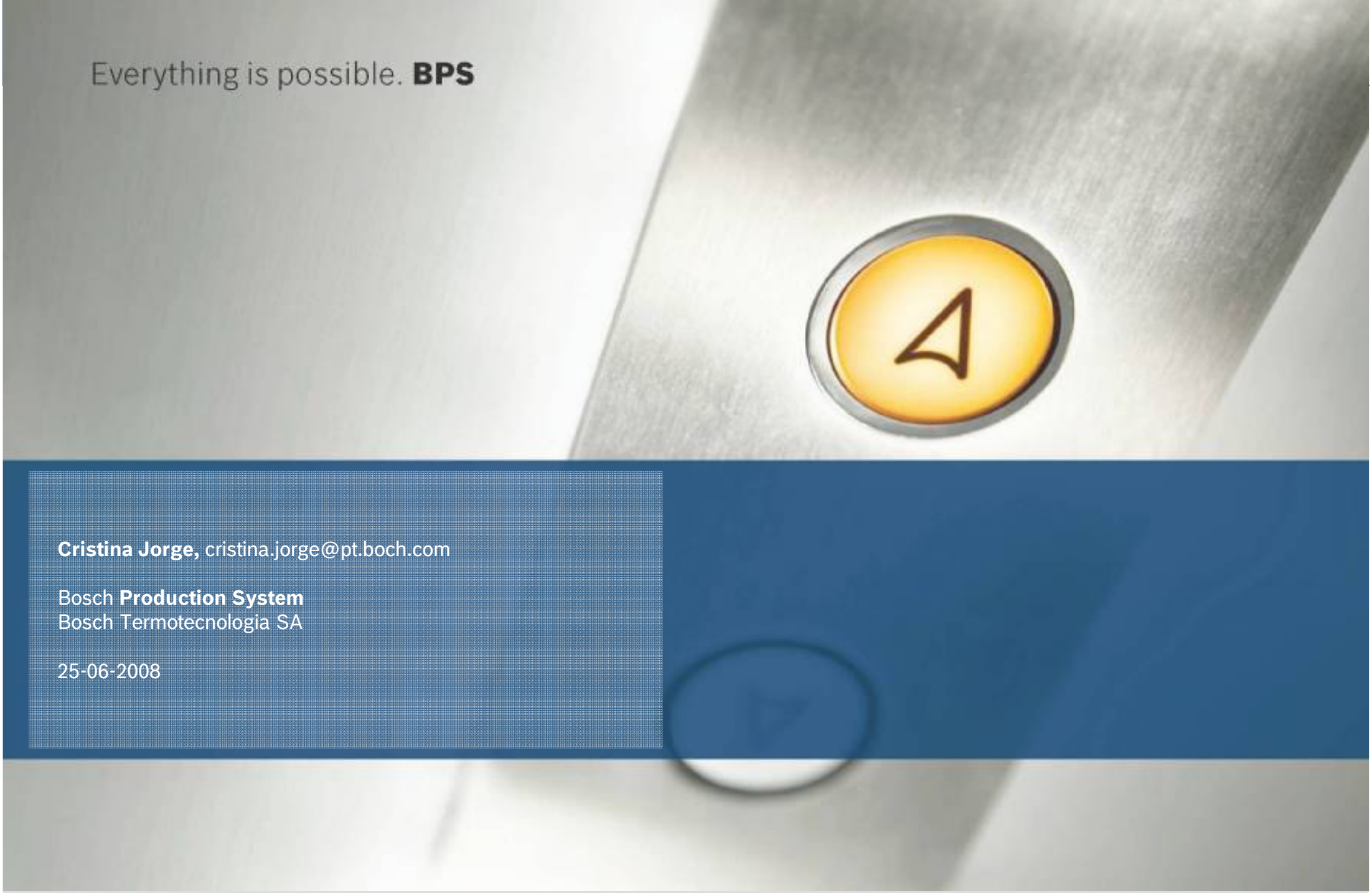

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