VSM Value Stream Mapping I4.0+

- **Introduction**
- **VSM information**
- **Why VSM I4.0+?**
- **The Development path.**
- **VSM adaptation to I4.0+**
- **A Sample VSM I4.0+**
- **KPIs**
- **Use Cases**
- **References**
- **Q & A**

- **Why VSM I4.0+**

  - The primary catalyst for change is the transformation brought about by I4.0.

  - The utilization of traditional VSM shorts to harness the potential benefits offered by digitization and Industry 4.0.

  - It facilitates decision-making processes that are driven by data.

  - The scope of this transformation encompasses the entire manufacturing process, from end-to-end (wall-to-wall), including cloud-based operations.

  - VSM I.40 fosters efficient collaboration among various teams - operations, production, plant engineering, maintenance, automation, quality, and software engineers, leading to a shared understanding of data interpretation.

  - The Value Stream Mapping (VSM) format for Industry 4.0 is user-friendly. Organizations with prior experience in Lean Management will find the transition to the VSM I4.0 process advantageous.
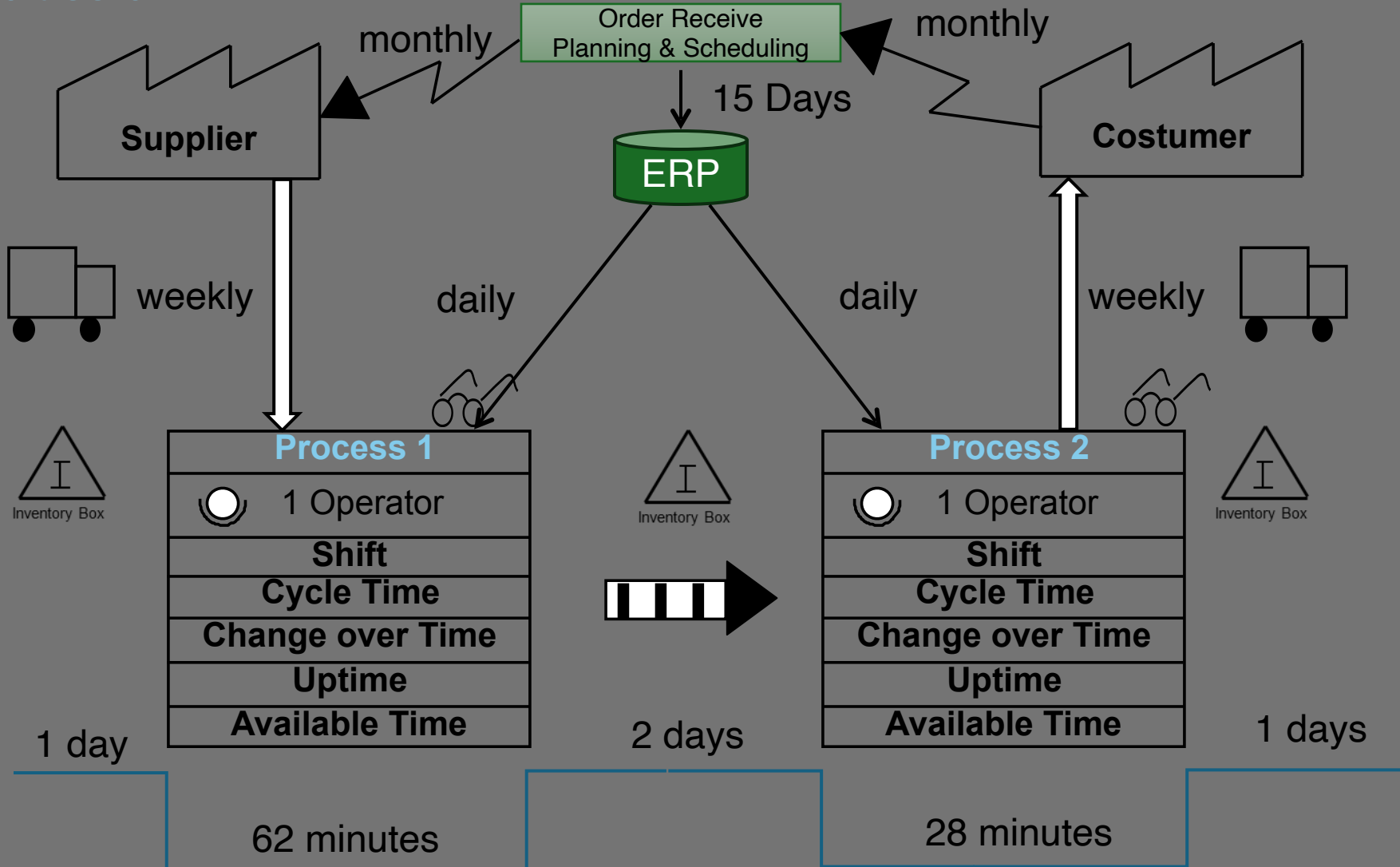
VSM Development path

1. Execute the Classic Value Stream Mapping (VSM) Data Collection.
2. Data Collection.
3. Data Assignment
4. Identify Application-Platform Combinations.
5. Implement Interface Box.
6. Classify Data Usage.
7. Draw Swim Lanes.
8. Analyze Information Logistics and Waste.
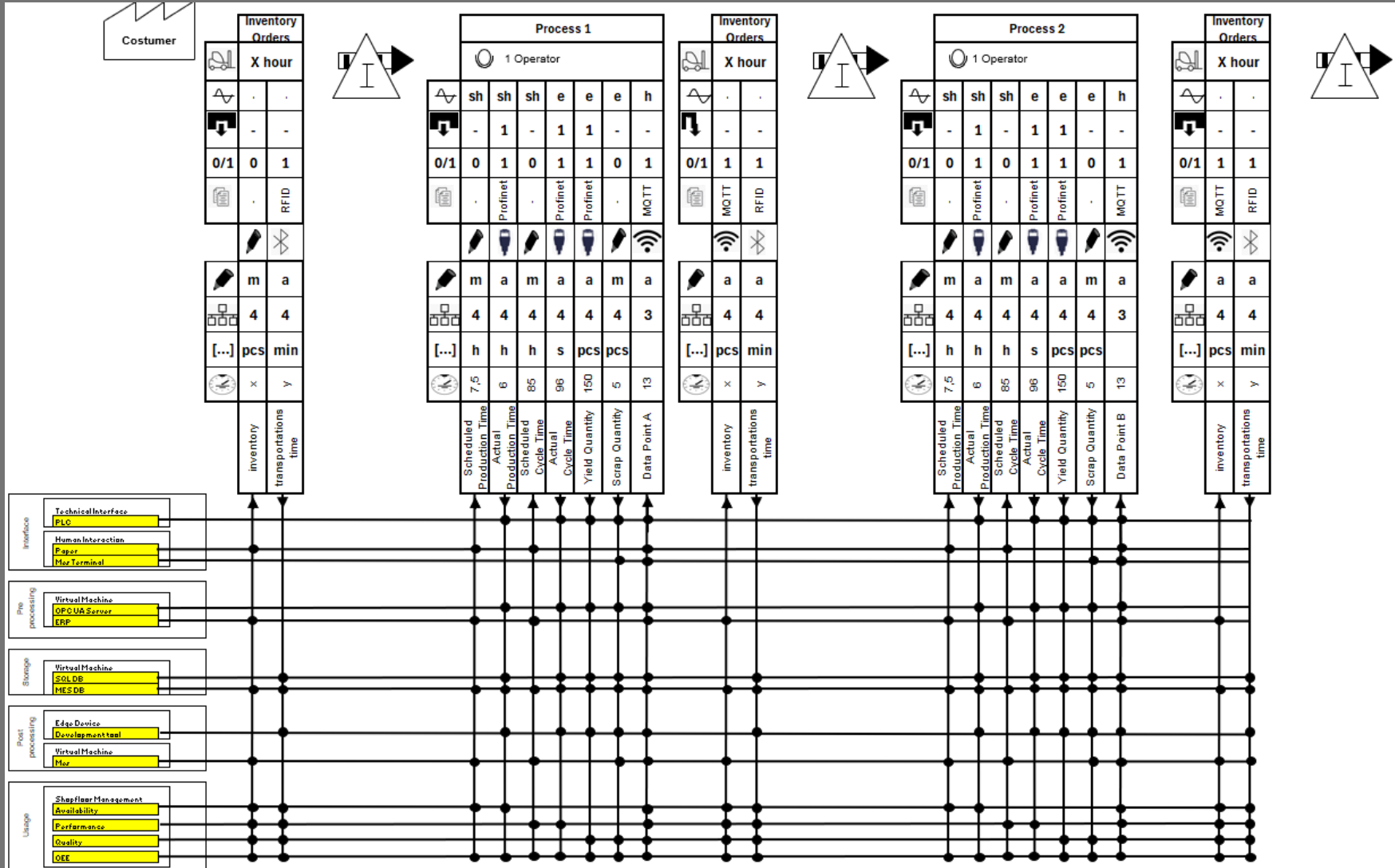
VSM classic

https://www.lean.org/the-lean-post/articles/your-value-stream-map-looks-a-little-different/
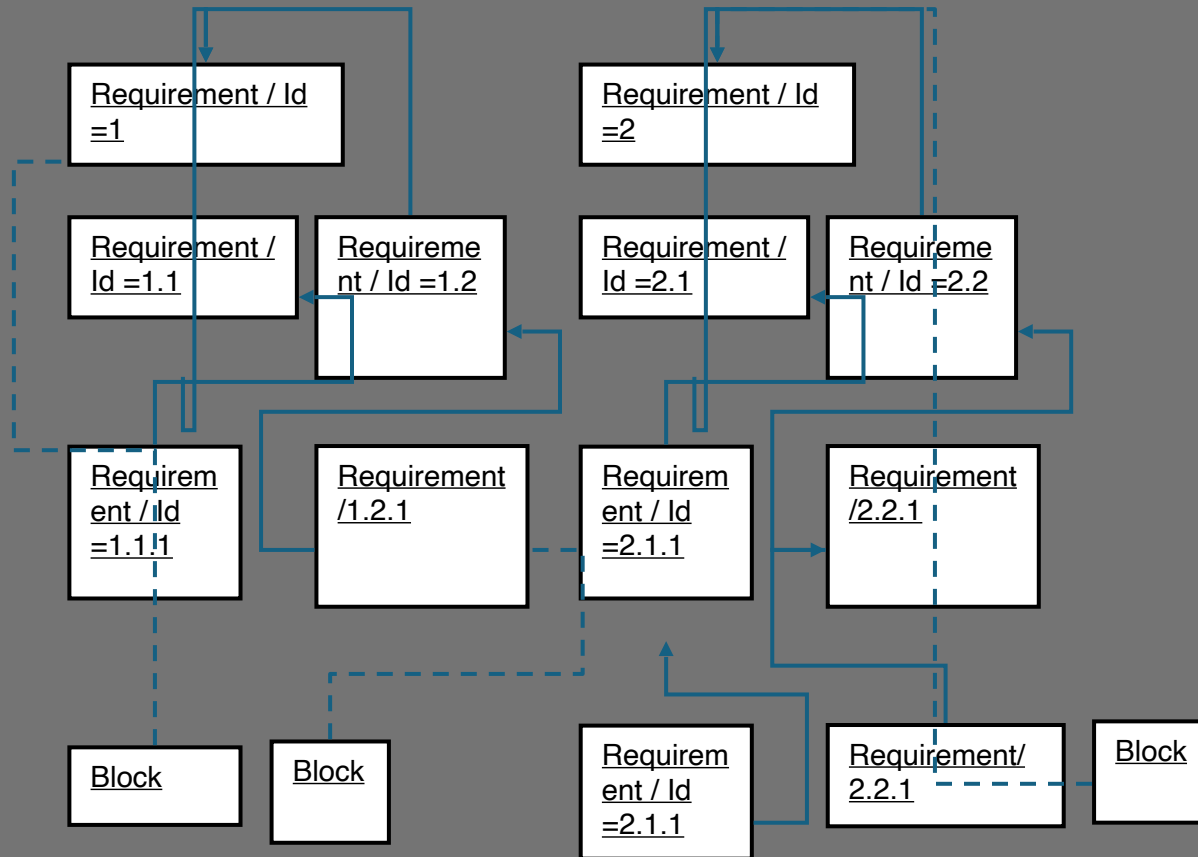
VSM classic

Order Receive Planning & Scheduling

monthly

monthly

Supplier

Costumer

ERP

15 Days

weekly

daily

daily

weekly

Inventory Box

Inventory Box

Inventory Box

Process 1

1 Operator

Shift

Cycle Time

Change over Time

Uptime

Available Time

Process 2

1 Operator

Shift

Cycle Time

Change over Time

Uptime

Available Time

1 day

2 days

1 days

62 minutes

28 minutes

- Production Lead Time 4.2 days
- Processing Time 90 minutes.

VSM Digital& I4.0+

Requirement Diagram

Requirement / Id =1

Requirement / Id =1.1

Requirement / Id =1.2

Requirement / Id =1.1.1

Requirement /1.2.1

Block

Block

Requirement / Id =2

Requirement / Id =2.1

Requirement / Id =2.2

Requirement / Id =2.1.1

Requirement /2.2.1

Requirement / Id =2.1.1

Requirement/ 2.2.1

Block

VSM 4.0 KPIs

- **DA - Data Availability**

$$DA(Process\_x) = \frac{\sum_1^n Process\_x_{data\,point\_i}}{\sum_1^n Process\_x_{planned\,data\,point\_i}} \times 100\,[\%]$$

- **DU - Data Usage**

$$DU(Process\_x) = \frac{\sum_1^n Process\_x_{data\,point\_usage\_i}}{\sum_1^n Process\_x_{planned\,data\,point\_i}} \times 100\,[\%]$$

- **DR – Digitalization Rate**

$$DR(value\_stream) = \frac{\sum_1^n digital\,data\,point_{Process\_i}}{\sum_1^n all\,data\,point_{Process\_i}} \times 100\,[\%]$$

Use Cases

- Automotive: New Audi Plant in Mexico : Smart Factory. Audi used VSM I4.0 for Smart Factory deployment.

- Education : Technische Universität Darmstadt: works with the industry, the university give Smart Factory training. Including VSM I4.0. The university has own Smart Factory for I4.0 training.

- Automotive: BMW Smart Factory Munich: about 8000 worker in the factory, and approximately 1000 cars and over 2000 engines are produce every day. Bur the variety of products is such that only 2 cars per month are identical.

  The plant is located in a semi central area of the city. Therefore, there is no longer possible to expand the factory. The automation level is very high nearly %98. The body shop has 1500 robots.

  BMW Munich invested its plant based on two concept sustainability and flexibility and the plant uses the in-line inspection, VSM I4.0, in which ML machine learning, the cloud Augment reality integrated to verify the correct assembly of every component.

- Aviation : Boing England with the University Sheffield and the Advance manufacturing research center. They have a development program, Factory 2050.

References :

1. Learning to see and Lean Lexicon / Lean Enterprise Institut
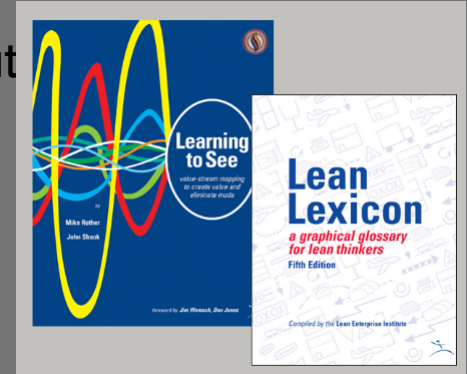
2. Reference Architectural Model Industrie 4.0 (RAMI 4.0).
3. Wertstrom 4.0 / Value stream mapping 4.0: Holistic examination of value stream and information logistics in production T . Meudt, J. Metternich, E. Abel

4. Extension of value stream mapping 4.0 for comprehensive identification of data and information flows within the manufacturing domain
Production Engineering (2023) 17:915–927 https://doi.org/10.1007/s11740-023-01207-5 by Maximilian Bega1 · Patrick Sapel · Furkan Ercan · Thomas Schramm · Martin Spitz · Bernd Kuhlenkötter · Christian Hopmann2