RZESZOW UNIVERSITY OF TECHNOLOGY

TET

CHAPTER 3

VALUE STREAM MAPPING VSM

LEAN MANUFACTURING

Co-funded by the European Union

TET - The Evolving Textbook
Project no: 2022-1-SI01-KA220-HED-000088975

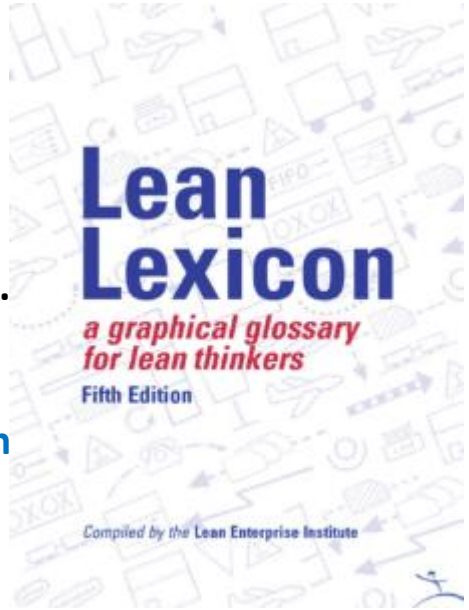
What is VSM?

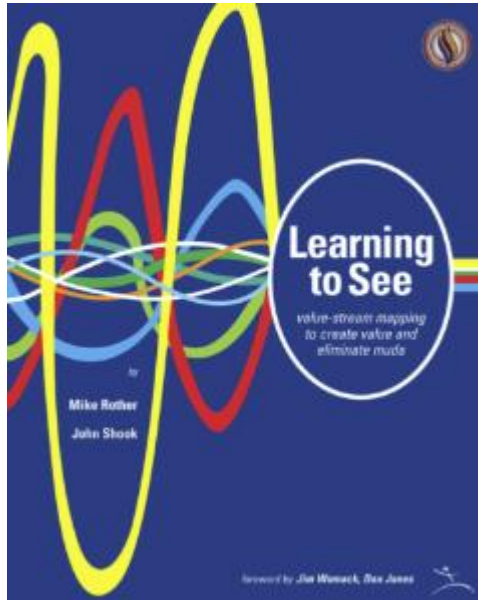
Value Stream Mapping (VSM) is a Lean Manufacturing tool used to visualize and analyze the flow of materials and information required to deliver a product or service to customers. It identifies value-added and non-value-added activities in the process. By mapping these flows, VSM highlights inefficiencies and areas for improvement, enabling organizations to streamline processes and deliver value more effectively.

Rother, M., & Shook, J. (2003). *Learning to see: value stream mapping to add value and eliminate muda*. Lean enterprise institute.

Manos, T. (2006). *Value stream mapping-an introduction*. Quality Progress, 39(6), 64.

Shook, J., & Marchwinski, C. (Eds.). (2014). **Lean lexicon: A graphical glossary for lean thinkers.** Lean Enterprise Institute.





Importance of VSM in Lean Manufacturing

VSM plays a critical role in Lean Manufacturing by providing a comprehensive view of processes. It helps identify waste, optimize workflows, and align operations with customer needs.

By focusing on value delivery, VSM enables businesses to reduce lead times, improve quality, and lower costs. Its ability to uncover hidden inefficiencies makes it an essential tool for achieving operational excellence.

Singh, B., Garg, S. K., & Sharma, S. K. (2011). *Value stream mapping: literature review and implications for Indian industry*. The International Journal of Advanced Manufacturing Technology, 53, 799-809.

Shou, W., Wang, J., Wu, P., Wang, X., & Chong, H. Y. (2017). *A cross-sector review on the use of value stream mapping*. International Journal of Production Research, 55(13), 3906-3928.

Dadashnejad, A. A., & Valmohammadi, C. (2019). *Investigating the effect of value stream mapping on overall equipment effectiveness: a case study*. Total Quality Management & Business Excellence, 30(3-4), 466-482.

Definition of "Value Stream"

A value stream consists of all the steps and activities—both **value-added** and **non-value-added**—needed to produce and deliver a product or service to a customer.

It encompasses everything from raw material procurement to final delivery.

Understanding the value stream is fundamental to identifying inefficiencies and implementing improvements that align with customer expectations.

Tahasin, T. A., Gupta, H. S., & Tuli, N. T. (2021). *Analyzing the Impact of 5S implementation in the manufacturing department: a case study*. International journal of research in industrial engineering, 10(4), 286-294.

Differentiating Between Value-Added and Non-Value-Added Activities

Value-added activities are those that directly contribute to creating a product or service that meets customer needs, such as assembly or testing.

Non-value-added activities, like waiting or excess inventory, do not add value and represent waste.

VSM distinguishes these activities to focus on eliminating or minimizing non-value-added steps.

Non-value-added activities, but necessary

Non-value-added but necessary activities are tasks that don't directly add customer value but are essential for regulatory compliance, quality assurance, or operational continuity in a process.

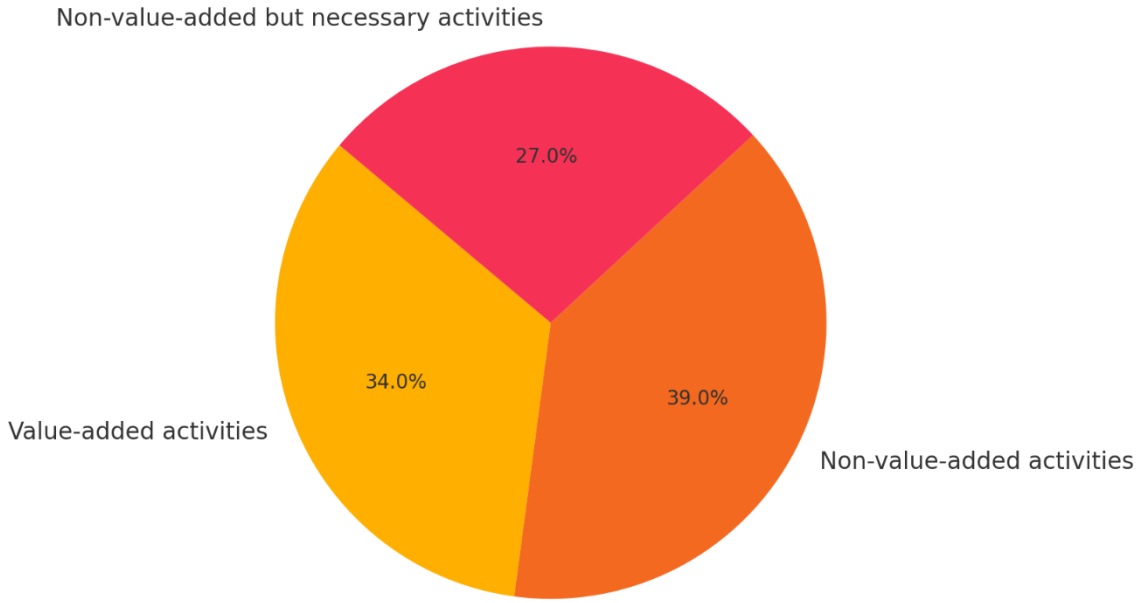


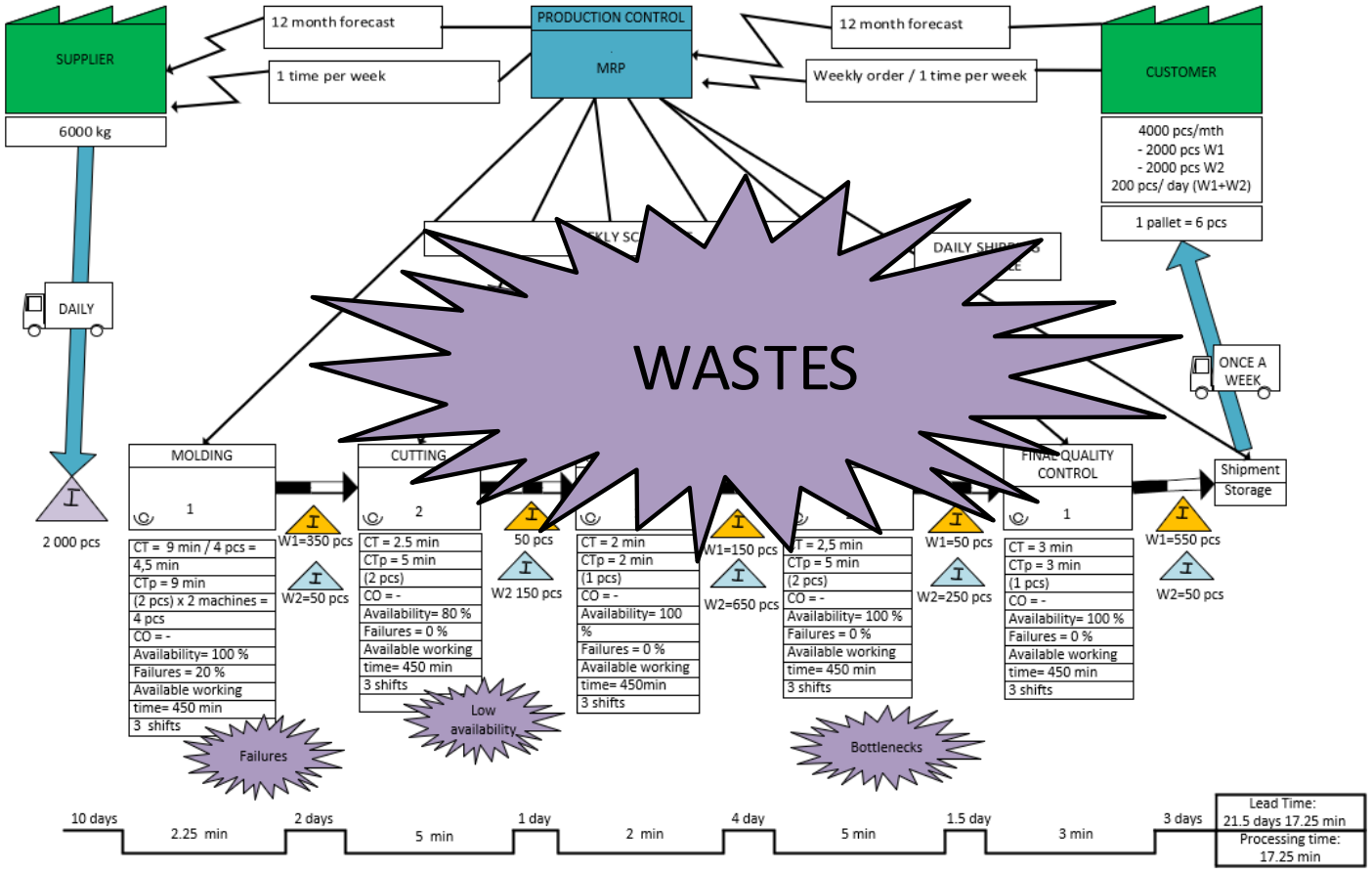
Figure 1. Proportion of activities in a manufacturing company – an example

The Role of VSM in Identifying and Eliminating Waste (Muda)

VSM helps pinpoint areas of waste (Muda), such as overproduction, waiting, excess inventory, or defects.

By mapping the current process, it becomes easier to visualize inefficiencies and design improvements that reduce waste.

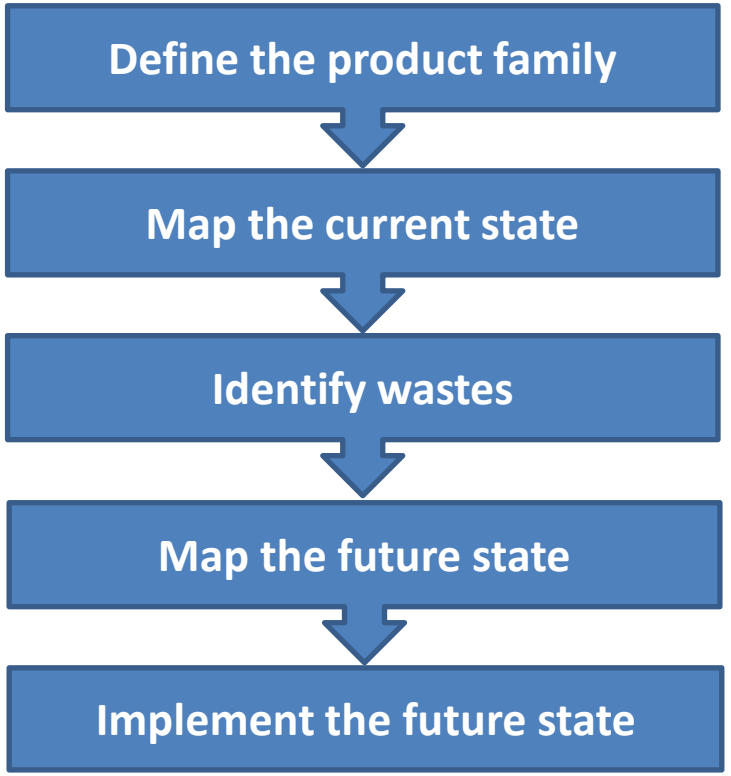
Eliminating waste enhances process efficiency, reduces costs, and increases customer satisfaction.



Steps to Create a VSM

Creating a VSM involves several key steps:

1. **Define the product family**.
2. **Map the current state** by collecting process data.
3. **Analyze the current state** to identify inefficiencies.
4. **Design a future state** that optimizes the value stream.
5. **Implement changes** and monitor progress.



Selecting the Process or Product Family

The first step in VSM is selecting a process or product family that significantly impacts customer satisfaction or business goals. This could be a high-volume product, a critical process, or an area with known inefficiencies.

Focusing on these areas ensures that VSM efforts deliver maximum value.

Product Family 1

Process

	1	2	3	4	5	6
Product 1	X	X	X	X		
Product 2		X	X	X		
Product 3	X	X	X			
Product 4				X	X	X
Product 5			X	X	X	
Product 6				X	X	X
Product 7				X	X	X

Product Family 2

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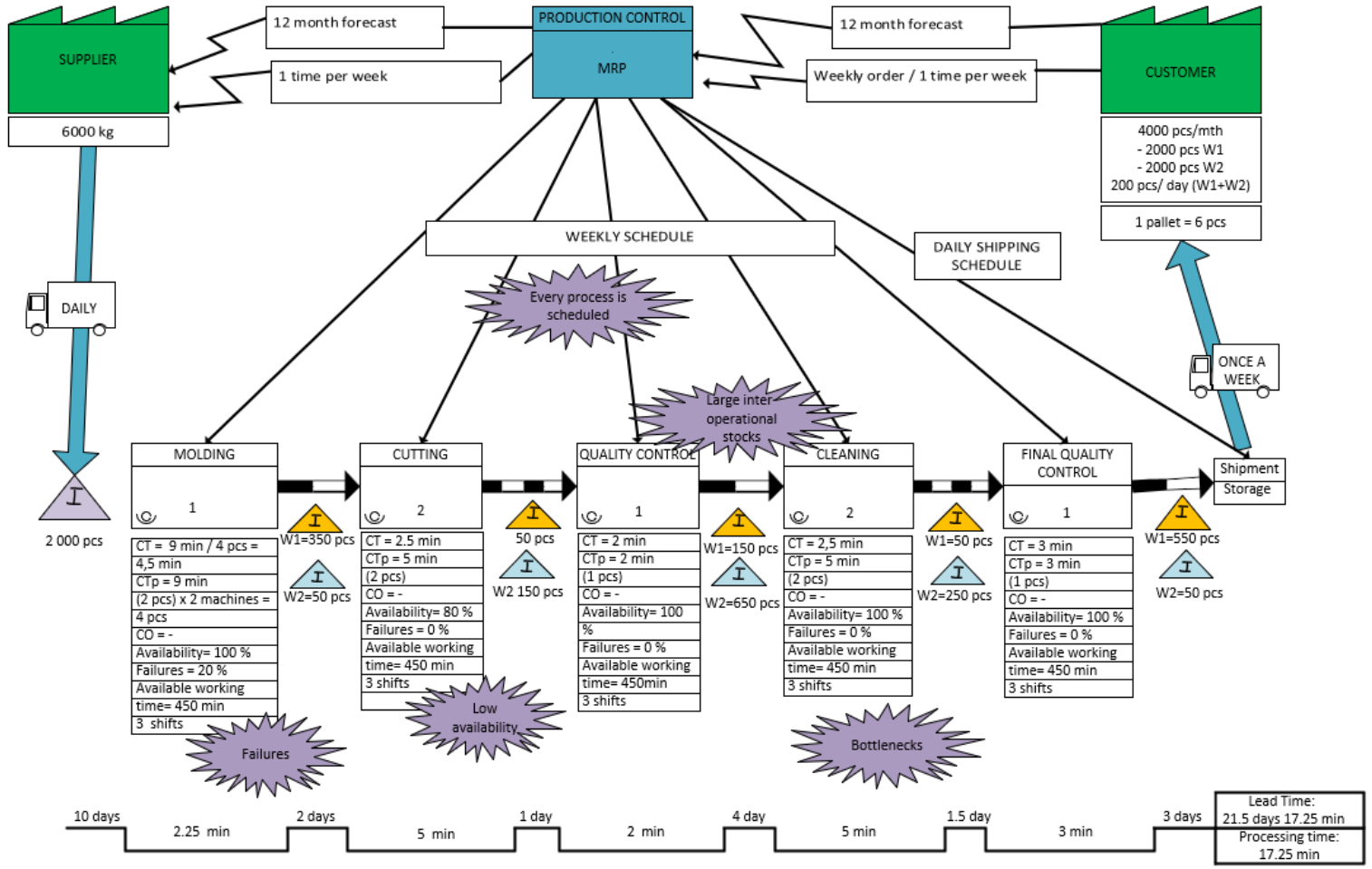
Mapping the Current State: Data Collection and Visualization

Mapping the **current state** involves gathering data about processes, such as lead times, inventory levels, and communication flows. This data is visualized using VSM symbols to create a detailed map of the existing workflow. The current state map provides a baseline for identifying bottlenecks and waste.



Difficulties in Data Collection and Accuracy

Data collection can be challenging due to incomplete records, inconsistent measurements, or resistance from staff.

Accurate and reliable data is critical for creating an effective VSM.

Involving cross-functional teams and using standardized tools can help overcome these challenges and ensure data integrity.

MOLDING


CT = 9 min / 4 pcs =
4,5 min
CTp = 9 min
(2 pcs) x 2 machines =
4 pcs
CO = -
Availability= 100 %
Failures = 20 %
Available working
time= 450 min
3 shifts

CT – cycle time

CTp – CT per operator

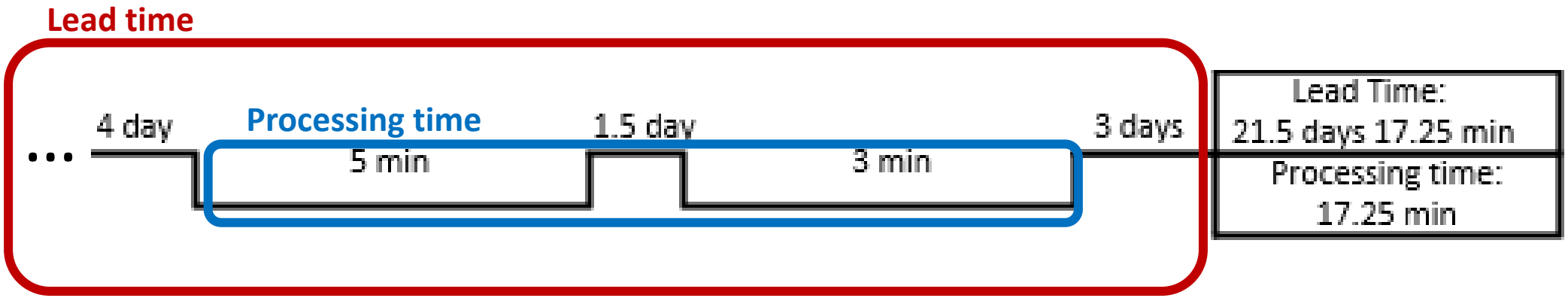
Availability of the work stand / machine

Failure of a machine

Available working time excluding planned breaks

Lead Time and Processing Time

Lead time measures the total time it takes to complete a process from start to finish, while **Processing time** represents the time required to complete a product within the manufacturing process. Understanding these metrics helps identify delays and inefficiencies, enabling organizations to improve process flow and meet customer expectations.



Takt Time and Its Importance

Takt time represents the rate at which a product must be completed to meet customer demand.

It is calculated by dividing available production time by the required output.

Takt time helps align production rates with customer needs, ensuring a balanced and efficient workflow.

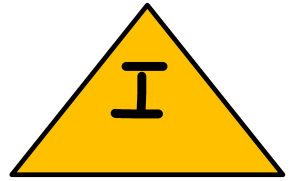
$$\text{Takt time} = \frac{\text{Available working time per day}}{\text{Daily customer demand}}$$

Inventory Levels and Flow Efficiency

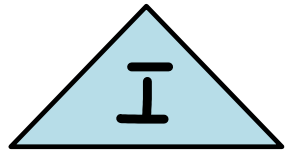
Excess inventory can lead to inefficiencies, increased costs, and longer lead times.

VSM highlights inventory levels at each stage of the process, helping organizations identify areas for improvement.

Optimizing inventory supports smoother workflows and reduces waste.



W1=550 pcs



W2=50 pcs

Analyzing the Current State: Identifying Bottlenecks and Waste

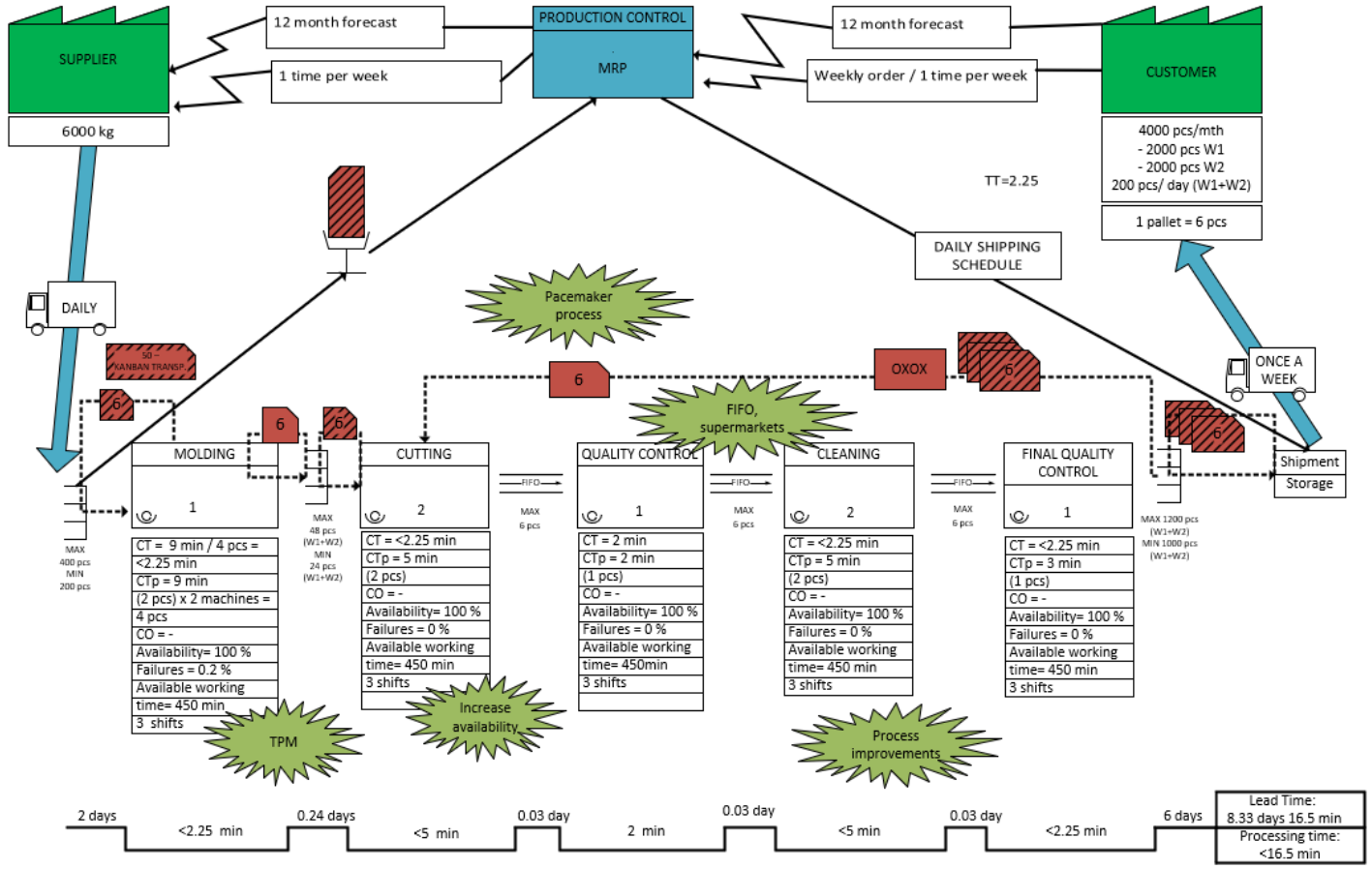
1. What is the takt time?
2. Is there a bottleneck process in the line?
3. How many workers do we need to operate the line?
4. Where can we implement continuous flow?
5. Will we produce the finished product directly for shipment or for supermarkets?
6. Where will we use a pull system such as a supermarket? What will the Kanban card cycle look like?
7. Where will we apply a FIFO queue?
8. Which single point in the value stream will control production (pacemaker process)?How will we balance mixed-model production?
9. What production increments will we release and withdraw from the scheduled process?
10. What process improvements will be necessary?

Designing the Future State: Creating a More Efficient Value Stream

The future state map is a vision of an optimized value stream.

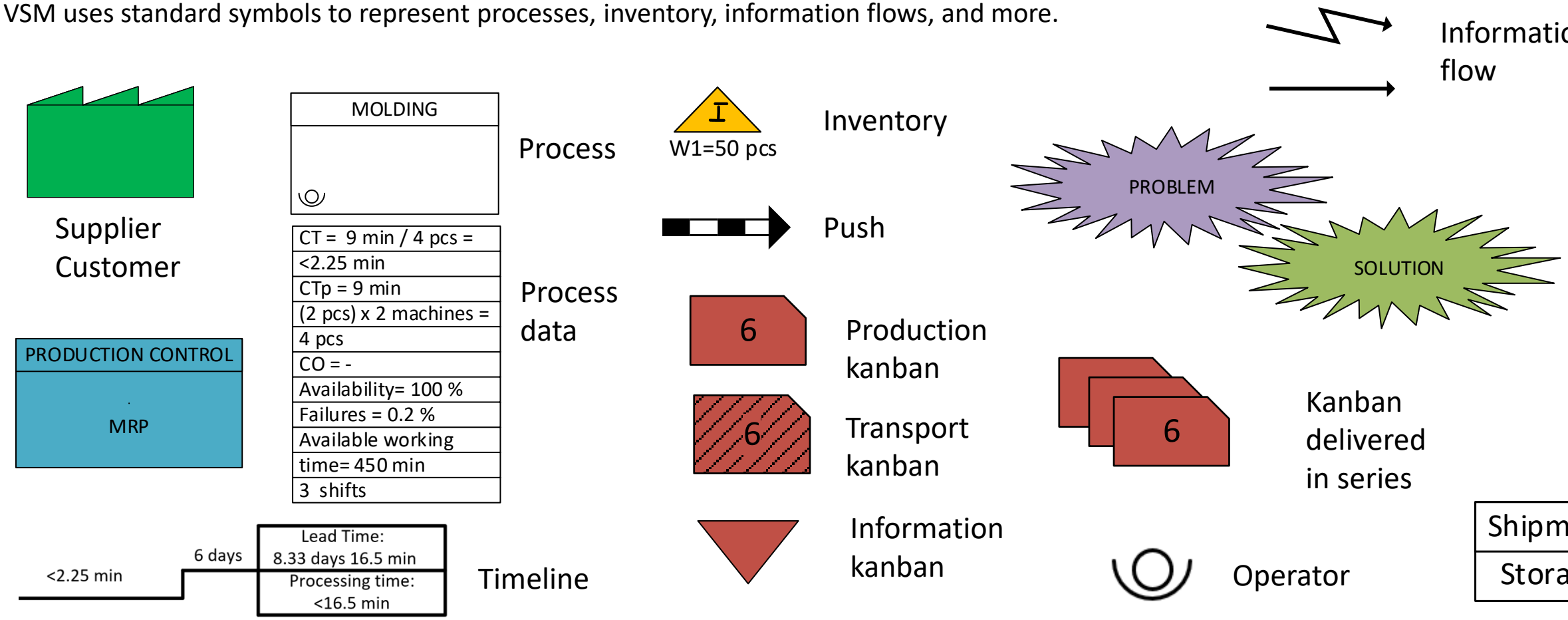
It eliminates waste, improves process flow, and aligns with customer demand.

Designing the future state involves setting goals, such as reducing lead times, improving quality, or increasing flexibility, and implementing actionable steps to achieve them.



Explanation of Standard VSM Symbols

VSM uses standard symbols to represent processes, inventory, information flows, and more.

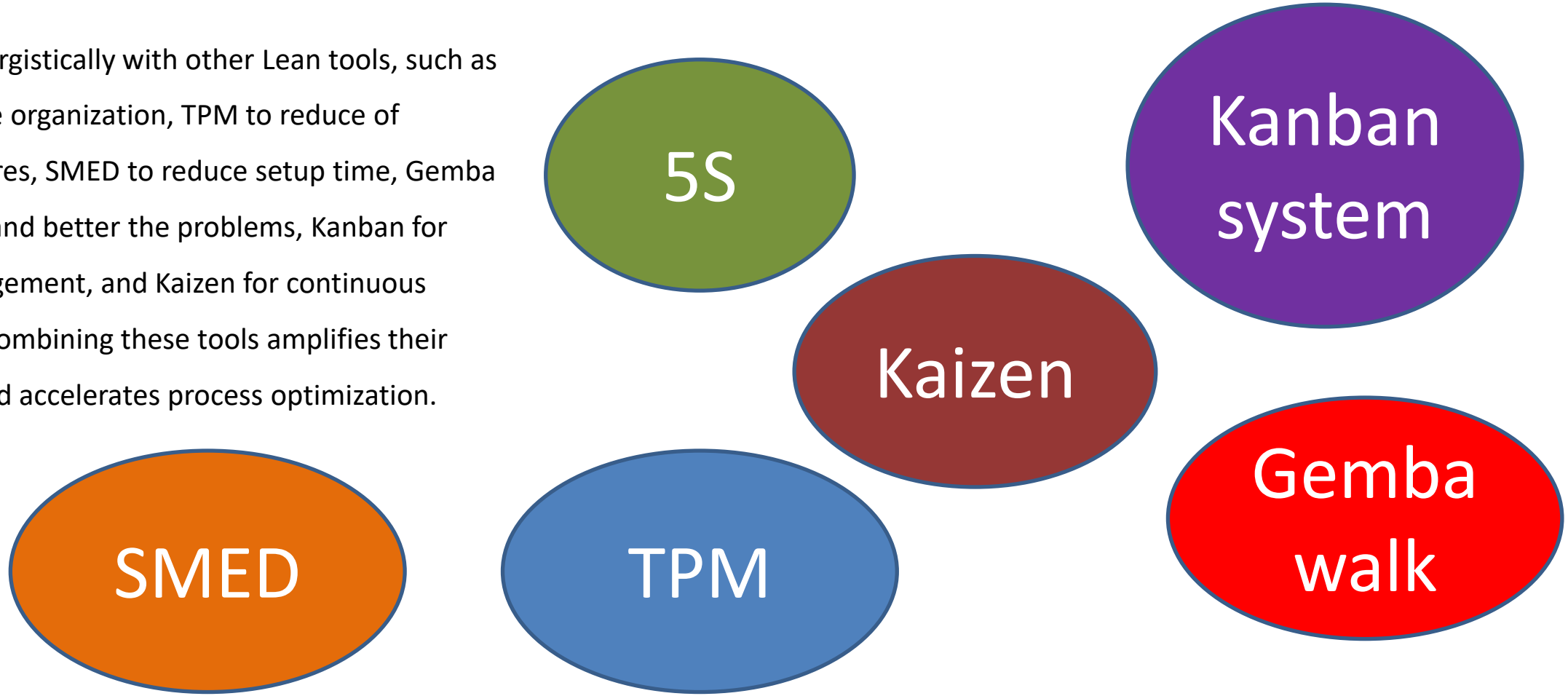


Tools and Software Used for Creating VSM Diagrams

Various tools and software, such as Microsoft Visio, Lucidchart, and specialized Lean tools, facilitate the creation of VSM diagrams. These tools offer templates and visualization features that simplify the process and improve collaboration among teams.

Integrating VSM with Other Lean Tools

VSM works synergistically with other Lean tools, such as 5S for workplace organization, TPM to reduce of equipment failures, SMED to reduce setup time, Gemba walk to understand better the problems, Kanban for workflow management, and Kaizen for continuous improvement. Combining these tools amplifies their effectiveness and accelerates process optimization.



Case Studies from Manufacturing and Service Industries

Real-life examples demonstrate the versatility of VSM across industries.

Case studies highlight improvements in lead times, cost reductions, and quality enhancements achieved through VSM.

These success stories showcase the tangible benefits of adopting VSM.

Stadnicka D., Litwin P. (2017). *Value stream and system dynamics analysis - an automotive case study*. 10th CIRP Conference on Intelligent Computation in Manufacturing Engineering - CIRP ICME '16. 20- 22 July 2016, Ischia, Italy. Procedia CIRP, Volume 62, Pages 363–368.

Stadnicka D., Ratnayake R.M.C. (2017): *Enhancing performance in service organisations: a case study based on value stream analysis in the telecommunications industry*. International Journal of Production Research. Vol. 55 , Iss. 23, 2017. Str. 6984-6999.

Bukowska, B., & Stadnicka, D. (2020). *Value stream mapping of a unique complex product manufacturing process*. Technologia i Automatyzacja Montażu, 1/2020, pp. 36-43.

Benefits of VSM Implementation

Implementing VSM delivers numerous benefits, including streamlined workflows, reduced waste, shorter lead times, and improved customer satisfaction.

It also fosters a culture of continuous improvement and aligns organizational efforts with strategic goals.

Forno, A. J. D., Pereira, F. A., Forcellini, F. A., & Kipper, L. M. (2014). *Value Stream Mapping: a study about the problems and challenges found in the literature from the past 15 years about application of Lean tools*. The International Journal of Advanced Manufacturing Technology, 72, 779-790.

Q&A

What is the primary goal of Value Stream Mapping (VSM)?

a) Developing a new product for the customer

b) Identifying waste and improving value flow

c) Increasing the number of workers in the process

What are the two main stages in the VSM process?

a) Bottleneck analysis and automation implementation

b) Mapping the current state and designing the future state

c) Budget planning and team training

What does the term "takt time" mean in VSM?

a) The time required to produce an entire batch of products

b) The expected production pace

c) Time for machine maintenance

What is the purpose of using the "arrow" symbol on a value stream map?

a) To indicate the flow of information or materials

b) To mark storage locations

c) To indicate employee zones

Which of the following elements is NOT included when creating a VS map?

a) Process cycle times

b) Location of end customers

c) Material flow

What tool is often used as support when implementing VSM?

a) Pareto diagram

b) Kanban

c) Ishikawa diagram

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Thank you for your attention.

Dorota Stadnicka

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