Process Mapping:

A Practical Guide for LEAN
and Six Sigma Practitioners

E-book | MindManager

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Introduction

Introduction

Process mapping is the method of identifying the relationships between process inputs and process outputs. It is widely used in Lean Six Sigma process improvement projects.

The American Society of Mechanical Engineers (ASME) pioneered the modern form of mapping business processes over a century ago. Since then, people and organizations have used business process maps to document and understand the different steps involved in a process and, in the case of process improvement projects, identify where waste exists and how to eliminate it.

Today, there are many software tools on the market that can be used to create all types of process maps for any business or individual need. These tools facilitate collaboration between team members and make it easier than ever to share ideas and foster a culture of improvement.

In this e-book, we'll highlight some of the most popular and useful process maps and cover the basic steps for creating them.

Lean methodology is derived from lean manufacturing. It's used to reduce or eliminate waste in processes, specify and make value flow in the customer's eyes, and pursue perfection through continuous improvement.

Six Sigma methodology can be traced to fundamentals developed by Motorola in the 1980s. While similar to lean, Six Sigma focuses on reducing the variation in processes to satisfy customers and enhance bottom line results through a data-driven approach.

Lean Six Sigma combines the strategies of lean and Six Sigma into a pragmatic quality management methodology that uses a customer-focused change strategy to improve performance. It can also be looked at as a collection of tools, or a toolbox for fixing processes.enhance bottom line results through a data-driven approach.

What are processes, and why should you map them?

What are processes, and why should you map them?

Lean Six Sigma practitioners fix processes to improve quality and promote continuous improvement. Continuous improvement is all about creating a culture where many small changes are introduced incrementally and continuously to improve the delivery of an organization's products and services. Consistently delivering products or services requires well-defined processes.

You can find processes everywhere. From the moment you get up and begin preparing for the day, you're involved in a process. Consider the simple example of waking up and getting out of bed, using a simple process flowchart:
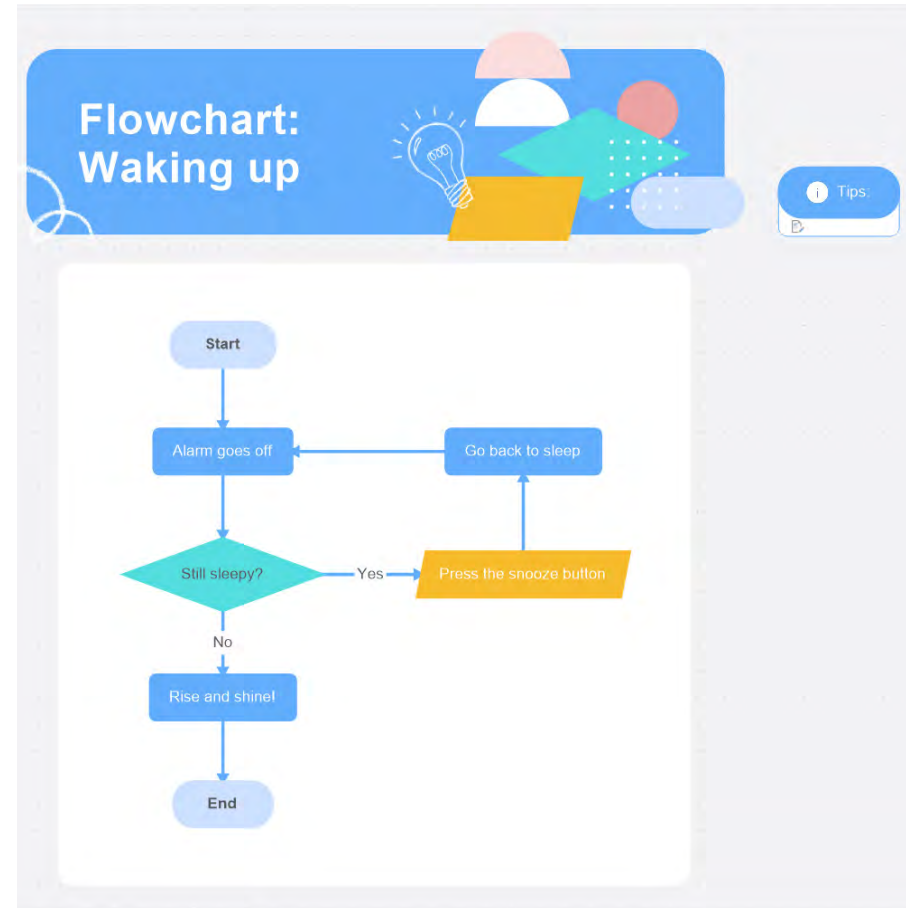
A simple process flowchart

A **process** is a series of causes and conditions that repeatedly interact to transform inputs into outcomes. Inputs can include people, methods, material, equipment, environment, and information.

Each process has a process owner, which is a person in an organization who is responsible for the end-to-end steps in the process and their outcome. The process owner should be involved in the creation of process maps.

There are many reasons for mapping processes in an organization, from documenting what happens in different departments and training new employees to assessing risk management.

Process mapping is an integral component of process improvement and directly contributes to a company's long-term success. When undertaking a process improvement project, Lean Six Sigma practitioners often follow a data-driven quality strategy known as DMAIC, which stands for define, measure, analyze, improve, and control.

Each of the five steps in the DMAIC approach has a distinct purpose:
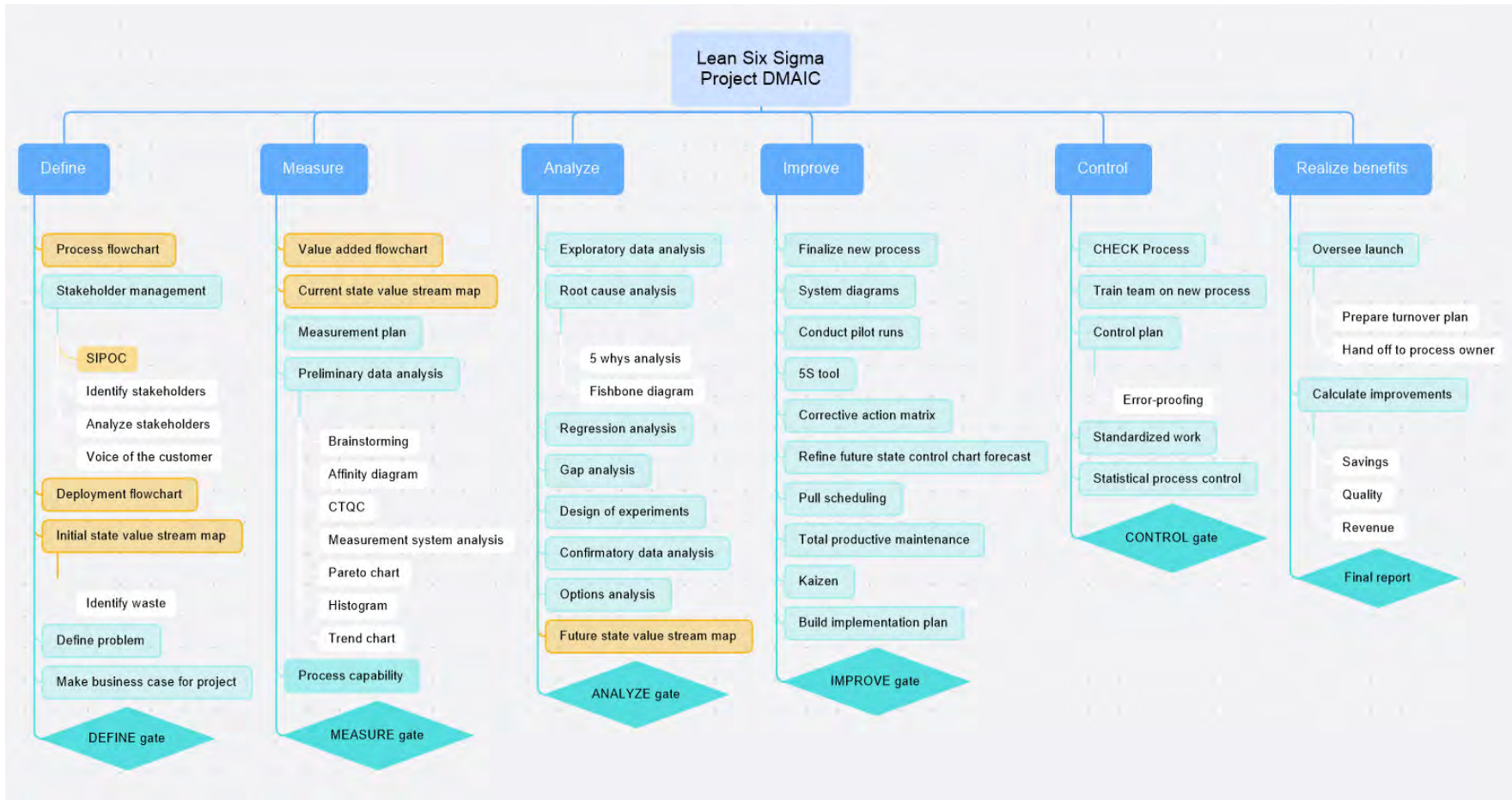
1. **Define the problem.**

2. **Measure its impact.**

3. **Analyze the root causes and options for solving the issue at hand.**

4. **Improve the process.**

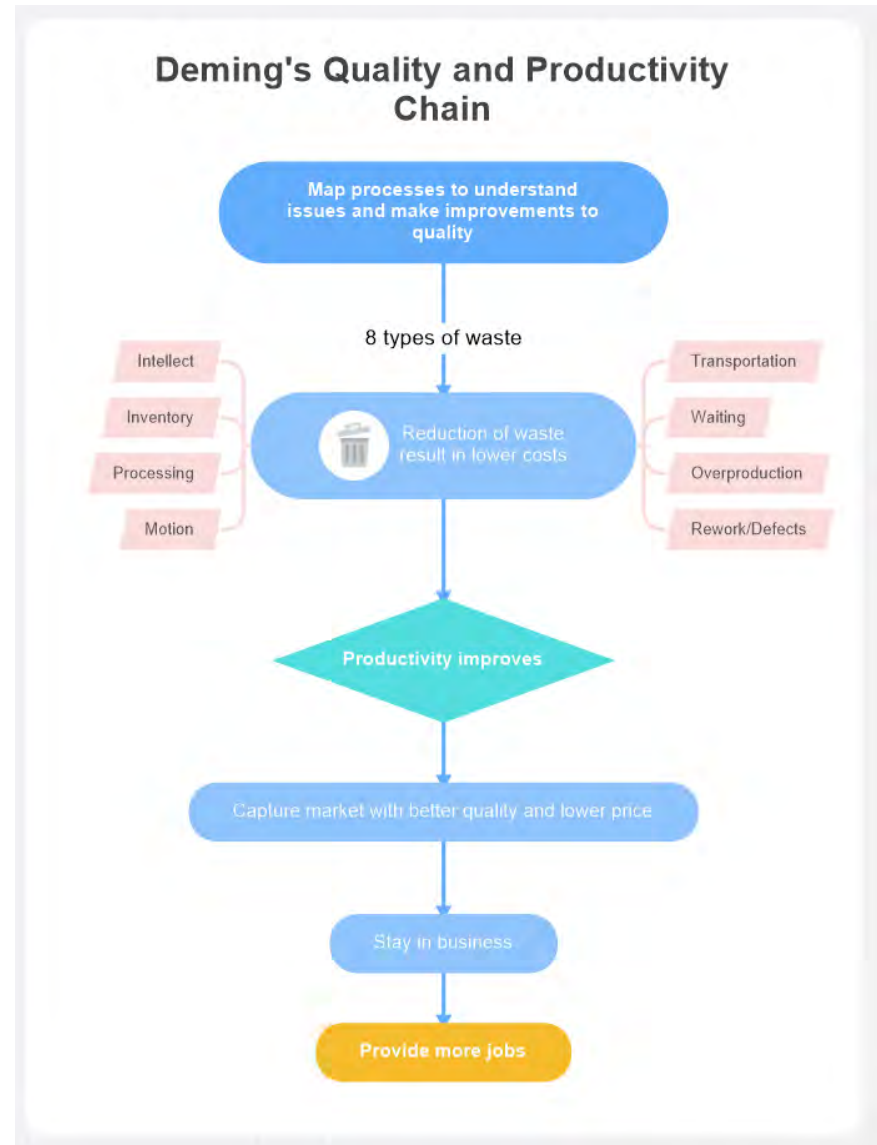5. **Implement a control plan to ensure the process remains stable.**

The most common maps are created in the define, measure, and analyze phases.

Lean Six Sigma Project DMAIC

Define
- Process flowchart
- Stakeholder management
  - SIPOC
    - Identify stakeholders
    - Analyze stakeholders
    - Voice of the customer
- Deployment flowchart
- Initial state value stream map
  - Identify waste
- Define problem
- Make business case for project
- DEFINE gate

Measure
- Value added flowchart
- Current state value stream map
- Measurement plan
- Preliminary data analysis
  - Brainstorming
  - Affinity diagram
  - CTQC
  - Measurement system analysis
  - Pareto chart
  - Histogram
  - Trend chart
- Process capability
- MEASURE gate

Analyze
- Exploratory data analysis
- Root cause analysis
  - 5 whys analysis
  - Fishbone diagram
- Regression analysis
- Gap analysis
- Design of experiments
- Confirmatory data analysis
- Options analysis
- Future state value stream map
- ANALYZE gate

Improve
- Finalize new process
- System diagrams
- Conduct pilot runs
- 5S tool
- Corrective action matrix
- Refine future state control chart forecast
- Pull scheduling
- Total productive maintenance
- Kaizen
- Build implementation plan
- IMPROVE gate

Control
- CHECK Process
- Train team on new process
- Control plan
  - Error-proofing
- Standardized work
- Statistical process control
- CONTROL gate

Realize benefits
- Oversee launch
  - Prepare turnover plan
  - Hand off to process owner
- Calculate improvements
  - Savings
  - Quality
  - Revenue
- Final report

Lean Six Sigma process maps created using the DMAIC strategy

Lean Six Sigma practitioners use process maps to achieve the following results:

- **Improve quality**. Maps help teams understand issues and make quality improvements.

- **Eliminate waste**. Maps identify problems such as waste exist, and how to address them. This helps lower costs.

- **Increase productivity**. Optimized process maps can help boost overall business efficiency.

- **Clarify roles and responsibilities**. Maps help each stakeholder understand what they need to do and/or create to contribute to a task or project.

- **Enhance communication**. Maps help communicate important information, such as how a product or service is created and delivered to customers.

- **Strengthen business stability**. When processes are understood and the causes of variation are reduced, organizations can operate in a more streamlined and predictable way.

- **Create new jobs**. Each of the above reasons can lead to a chain reaction that ultimately leads to increased market share and job creation.

Deming's Quality and Productivity Chain

Map processes to understand issues and make improvements to quality

8 types of waste

Intellect
Inventory
Processing
Motion

Reduction of waste result in lower costs

Transportation
Waiting
Overproduction
Rework/Defects

Productivity improves

Capture market with better quality and lower price

Stay in business

Provide more jobs

Example of a chain reaction caused by mapping processes

5 common process maps and how to use them

5 common process maps and how to use them

There are many types of process maps in use. In the following section, we'll explore five of the most common ones:

1. Flowchart

2. SIPOC diagram

3. Deployment flowchart

4. Value added flowchart

5. Value stream map

Regardless of the type of map used, it's important to involve everyone on your team to ensure the process is well understood and gain consensus on where problem areas may reside.

Keep the following points in mind when creating any type of process map:

- **Imagine you are the customer trying to understand your organization's process**. Walk through the process forward and backward and ask why a certain step is performed in a certain way.

- **Take thorough notes during brainstorming sessions**. These will come in handy later when investigating root causes of problems and implementing improvements.

- **Keep process maps as simple as possible**. Know the boundaries of the process you are mapping, and the focus needs to be on the content rather than the symbols.

- **Map the process where the activities occur (where possible)**. This often referred to as a "gemba walk."

- **Avoid too many cooks in the kitchen.** Carefully control who can update any process map and maintain version control with dates, etc.

- **Note that creating process maps is one part of a larger improvement effort.** It is *not* the end result.

Next, let's dive into the five most common types of process maps:

1. Flowchart

A basic flowchart is the simplest of all process maps. It is usually constructed at the beginning of an improvement project and uses symbols and shapes to visualize the steps involved in a process.
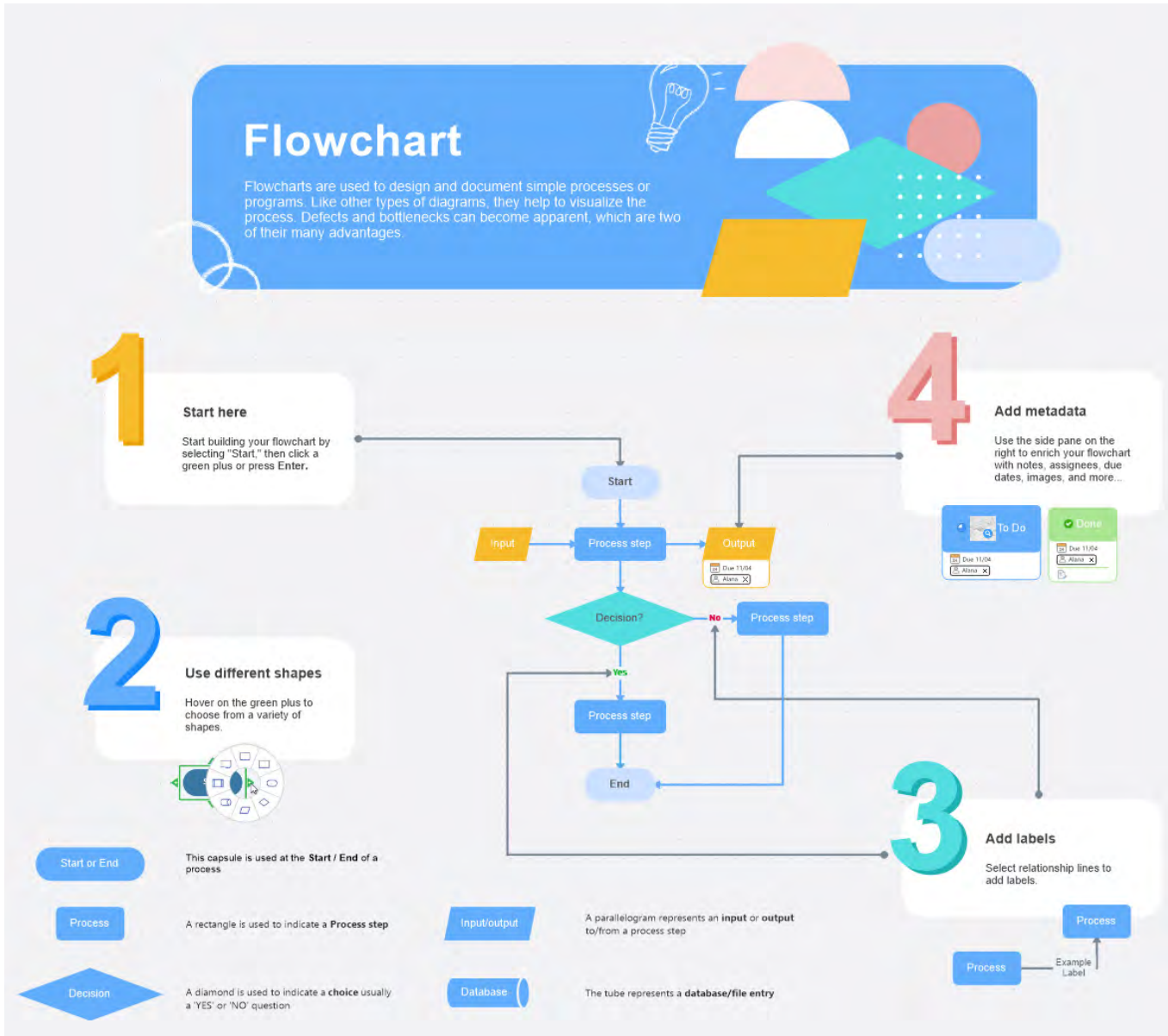
Basic flowchart shapes and their meaning

A visual mind mapping tool like MindManager® includes a gallery of shapes like the ones above to help clarify the process being mapped. Flowcharts can be enhanced by adding explanatory text alongside the shapes.

Flowcharts are versatile and can be used to document and identify the flow or sequence of activities in a process for any product or service, from the flow of materials to the steps involved in making a sale.

Flowcharts provide the following benefits:

• Provide all team members with visibility into an entire project or process.

• Identify potential roadblocks and non–value–added steps that can be removed.

• Facilitate direct communication between team members.

• Document key company processes.

• Train new employees or team members on new or existing processes

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How to create a flowchart

1. **Determine the boundaries of the process (where it starts and ends)**. Team members should also agree on the level of detail that will be used in the process map. This could range from a high-level overview to a detailed process flow that shows every action and decision point.

2. **Identify the process steps**. Conduct a series of brainstorming sessions with your team using a whiteboard or mind mapping tool like MindManager.

   For example, if your company is responding to a request for estimate (RFE), the process steps might include the following:

- Receive request for estimate (RFE).
- Conduct bid / no bid.
- Issue internal statement of work (SOW).
- Create estimates.
- Prepare costing sheets.
- Approve / reject costing.
- Rework estimates.
- Prepare pricing sheets.
- Approve / reject pricing.
- Revise pricing and profits.
- Finalize and record estimate pricing.
- Return to requestor.

Estimating Process

RFE Received → Bid / No Bid? —Yes→ Issue internal SoW → Create / Revise estimates → Conduct Cost Review

Bid / No Bid? —No→ Return to originator

Conduct Cost Review → Approve costs

Approve costs —No→ Create / Revise estimates

Approve costs —Yes→ Prepare / Revise Pricing sheets

Prepare / Revise Pricing sheets → Conduct Price Review → Approve Pricing

Approve Pricing → Return to originator

Approve Pricing —No→ Prepare / Revise Pricing sheets

Return to originator → End

Tips:

This is an example of a simple flowchart for responding to a Request for Estimate (RFE)

Flowchart for responding to an RFE

3. Sequence the steps in the order in which they occur. Don't worry about connecting the steps just yet. Make sure to sequence the steps as they currently occur (not how they should ideally occur). This is important to later identify problem areas and their root causes.

4. Assign a symbol or appropriate shape to each process step.

• **Ovals**: An oval or rounded rectangle is used to start the process or to show the results at the end of the process.

• **Rectangles**: A rectangle or box is used to show a task or activity. One or more arrows can enter a box, although only one arrow should be used to connect that box to the next.

• **Diamonds**: A diamond shows the points in the process where a decision is required, usually in the form of a yes or no answer.

• **Arrows**: Arrows show the direction or flow of the process.

5. Validate the process map. Consult with the process owner and ideally a subject matter expert (SME) who is not part of the team but who is closely associated with the process or work function, as this person can contribute insight that process owners or team members may not. Note any discrepancies and adjust as needed.

The amount of information included in the map will determine the usefulness of the map to your documentation and process improvement efforts.

2. SIPOC diagram

Lean Six Sigma process improvement initiatives change elements of a process or procedure, and change involves people and stakeholders. Once your team has defined the basic steps involved in the process by creating a flowchart, it's essential to understand who and what is involved in each step of the process.

A SIPOC (supplier, input, process, output, and customer) diagram is a standard map constructed during the "define" stage of continuous improvement projects. It is easy to understand and helps identify stakeholders and customer requirements.

In addition to understanding the inputs and outputs of process steps, SIPOC diagrams allow teams to identify stakeholders, learn more about the process and how that process may be linked to other processes.

A SIPOC diagram is composed of vertical swim lanes, with each swim lane or column corresponding to a step in the process, as follows:

- **Supplier**. Can be internal or external. They can also be other processes.

- **Inputs**. Consist of two types:

  1. The goods and services that are transformed by the process into outputs.

  2. Enablers of the process, such as machinery or technology (e.g., email marketing software).

- **Process**. The high-level process steps, as defined in the basic flowchart.

- **Outputs**. What results from each process step.

- **Customer**. Can be internal or external, and other processes may include the customer.

SIPOC diagrams provide the following benefits:

- Provide an understanding of how process components relate to their inputs and outputs.

- Help teams and project stakeholders agree on project boundaries and scope.

- Enable Lean Six Sigma teams to verify that process inputs match outputs of the upstream process and the inputs and/or expectations of downstream processes.

- Identify stakeholders (i.e., the suppliers who provide the required inputs and the customers who receive the outputs) involved at each step of the process.

- Clarify customer requirements.

SIPOC Diagram

The SIPOC is a map built at the beginning of continuous improvement projects. It is easy to understand and helps to identify stakeholders and customer requirements.

Tips:

1 Processing

Start by adding the steps of your process in the processing column

Author:
Revision:
Date:

Supplier	Input	Processing	Output	Customer
Identification of internal and external suppliers, providing input	List of inputs (information, materials...) feeding the process and transformed by future activities	Description of the main activities, steps, tasks and operations (without going into detail) that transform inputs into outputs	List of outputs (results, productions, documentation...) for customers (or for other downstream processes)	Identification of internal and external, intermediate and final customers

Acronym Key
1.
2.
3.

4 Add relationship

For a better readability and to indicate the direction of reading you can add relations between the topics

2 Input/output

Then fill in the input and output for each process step

3 Supplier/Customer

Lastly, fill in the information on suppliers and customers

Example SIPOC diagram

How to create a SIPOC diagram:

1. Create swim lanes. Swim lanes are used to illustrate how cross-functional resources and activities relate to the process. A SIPOC diagram includes five swim lanes: one for each letter in the acronym.

2. Set boundaries and name the process to be mapped. Know where the process begins and ends to limit the scope of the diagram, and ensure the diagram aligns with the overall project scope.

3. Complete the swim lanes. Starting with the process column, list the process steps. Make sure to sequence the steps as they actually occur and not as you think they should occur.

Future state or ideal process maps are created once solution elements have been identified. The process steps will be the same as those created in the flowchart.

SIPOC swim lanes should be completed in the following order: process (see step three above), outputs, customer, inputs, suppliers.

- **Identify the outputs from each process step**. Ask, "What does this process step lead to/ what comes out of this process?" Place these answers in the output swim lane.

- **Identify the customers that will receive the outputs**. Ask, "Who or what uses the thing(s) that come out of this process step?" Place these answers in the customer swim lane.

- **Identify the inputs required for each process step**. Ask, "What does the process require to perform this step? What goods or materials feed the process?" Place these answers in the input swim lane.

- **Identify the suppliers of the inputs to the process step**. Ask, "What or who supplies the process with these inputs? Where do the inputs come from?" Place these answers in the supplier swim lane.

4. Validate the SIPOC. Loop in the process owner and other SMEs to ensure the map accurately represents what the process entails.
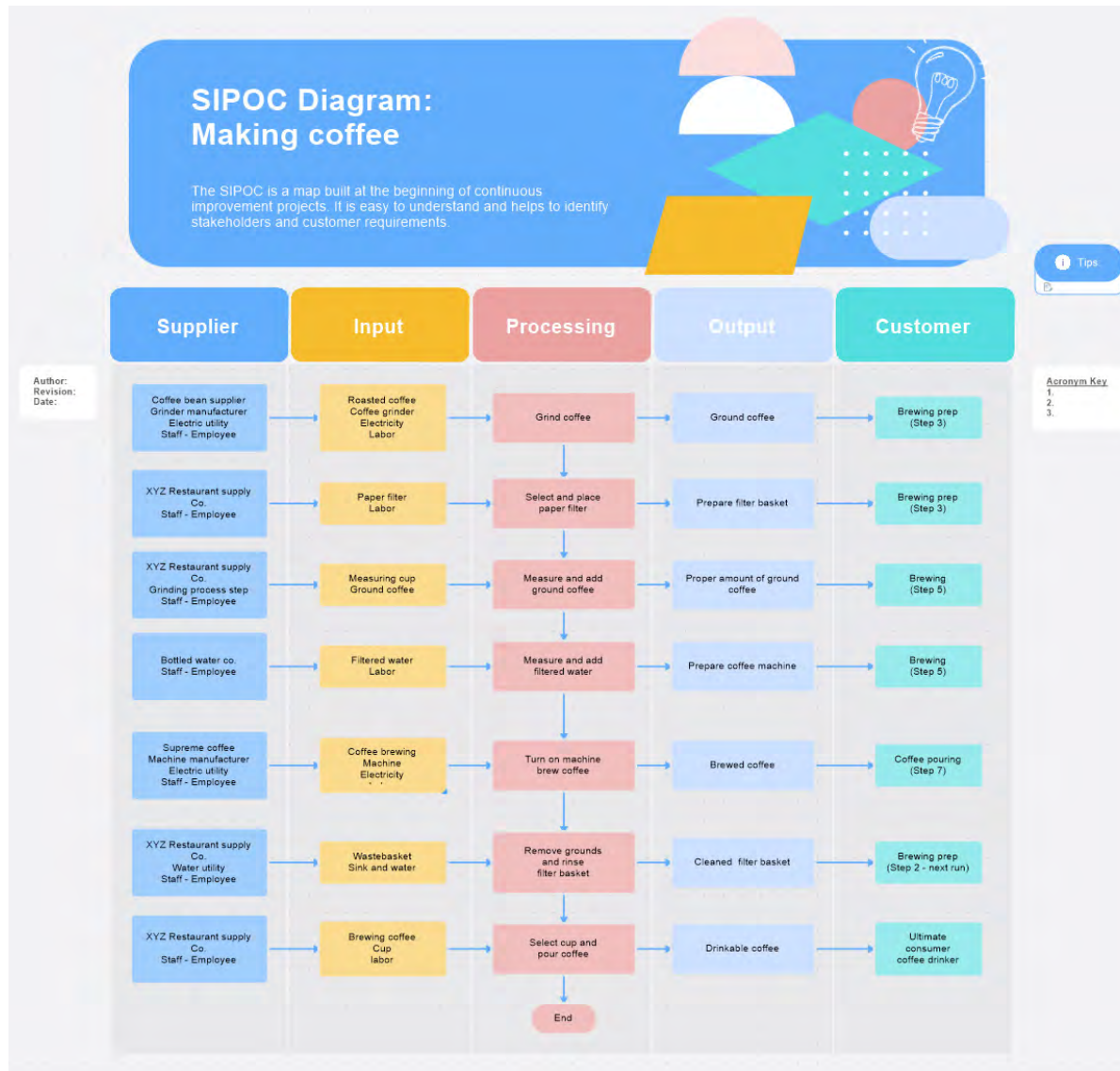
SIPOC diagram of an estimating process

3. Deployment flowchart

A deployment flowchart shows the flow of the process steps and the individuals or groups responsible for each task. This type of process map is a convenient method to clarify roles and responsibilities and to highlight dependencies between sequential activities.

Deployment flowcharts use horizontal swim lanes to show which functional group is involved in each activity, and to show the transfer points between groups. These process maps are useful in cases where three or more departments are involved in an administrative or service process and to highlight the complexity of processes within an organization and where key handoffs occur.

Each department or stakeholder occupies a horizontal lane, while time flows from left to right. The process therefore crosses from one lane to another as it makes its way through the various departments from the beginning to the end of its cycle.

Deployment flowcharts provide the following benefit:

Useful for processes that span three or more functional areas. When process steps involve handoffs between departments, there are often gaps. Displaying a process using a swim lane/functional deployment flowchart is an effective way of showing the many handoffs, transport (i.e., the movement of goods and/or services), and queues (i.e., the waiting periods) involved in the process.

How to create a deployment flowchart:

1. List the steps in the process from beginning to end.

2. List the functional groups (or individuals) involved in the process. For example, in the case of the estimating process, a company may have certain departments (see table below).

3. Identify the primary departments or individual(s) involved in each step.

4. Optional: Add the time required to complete each step. This will be useful in subsequent process maps.

5. Create a flowchart with the process flow across the top and the department names from top to bottom.

6. Optional: Add the elapsed time along a swim lane at the bottom of the flowchart.

Process step	Department responsible	Time required (days)
Receive request for estimate (RFE)	Sales and marketing	0.5
Conduct bid / no bid	Senior leadership team	2
Issue internal statement of work (SOW)	Proposals and finance	1
Create estimates	Departmental estimators	5
Prepare costing sheets	Proposals and finance	1
Approve / reject costing	Senior leadership team	3
Rework estimates	Departmental estimators	3
Prepare pricing sheets	Controller	1
Approve / reject pricing	Senior leadership team	3
Revise pricing and profits	Proposals and finance	1
Finalize and record estimate pricing	Controller	0.5
Return to requestor	Sales and marketing	0.5

Sample deployment flowchart information for an RFE
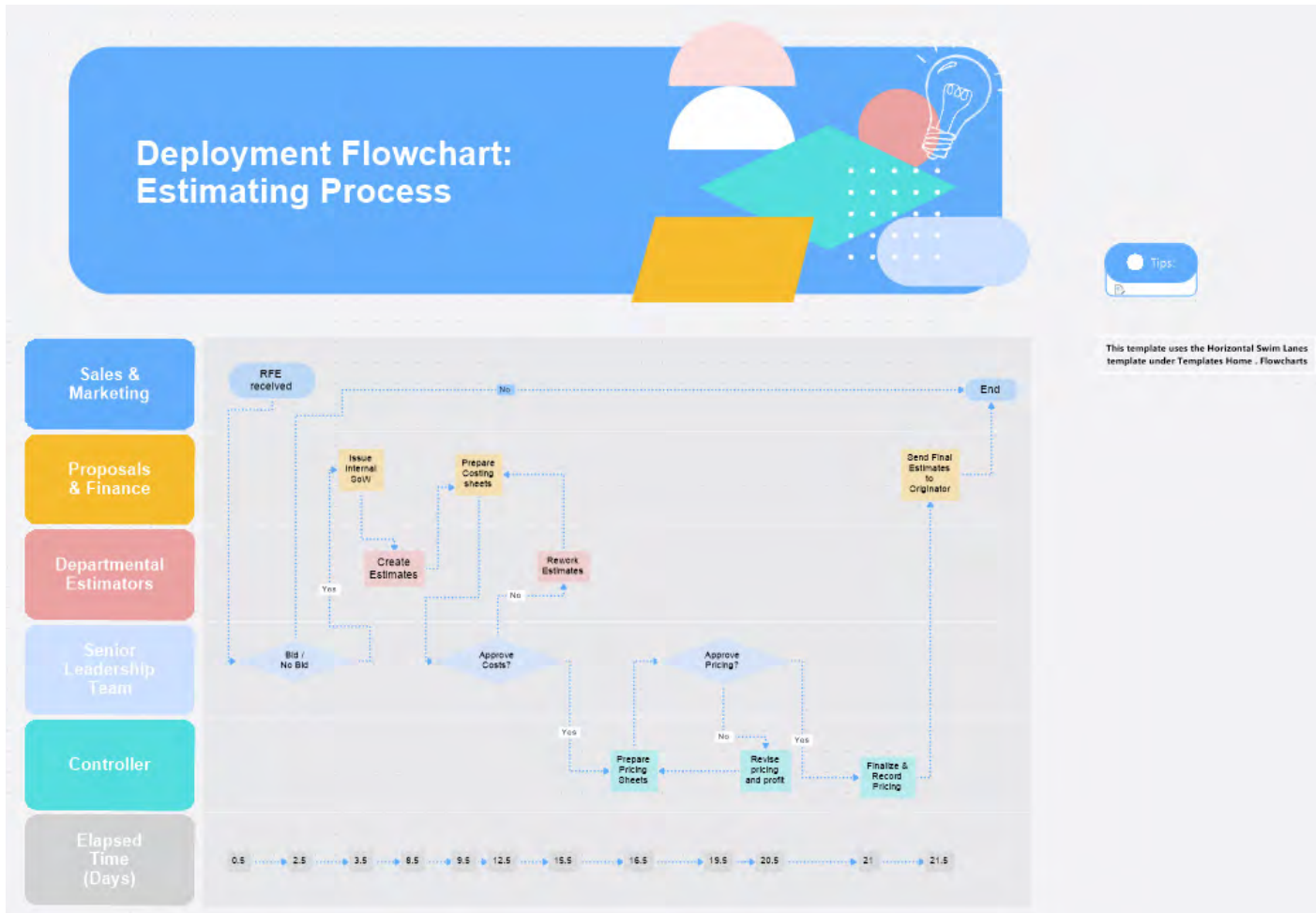
Example deployment flowchart

In the image above, you can see that some of the process steps take a long time and may benefit from optimization. We will explore this in the next section.

4. Value-added flowchart

A value-added flowchart visually separates value-added (VA) steps from non-value added (NVA) steps.

Value is defined as what the customer is willing to pay for. Any excess time waiting, rework or any of the eight types of waste shown in the image are non-value-added activities.

Non-value-added steps fall into two categories: business non-value-add and non-value-add. Sometimes a step is needed but takes too long for a variety of reasons. This step would be a business non-value-add and is sometimes called required waste.

Business non-value-adds should be minimized or eliminated. Non-value-add activities should be eliminated.

Value-added process maps are useful for team members who are new to thinking in terms of customer value as it relates to work done, and where potential improvement efforts should be focused. It's also a good preliminary exercise in preparation for value stream mapping, which we'll cover in the next section.

In the image left, the value-added portion of the process to renew a driver's license is only 8% of the total cycle time. This is typical of many processes and is useful in highlighting wasteful activities such as waiting in line and a lengthy commute.
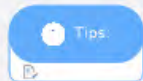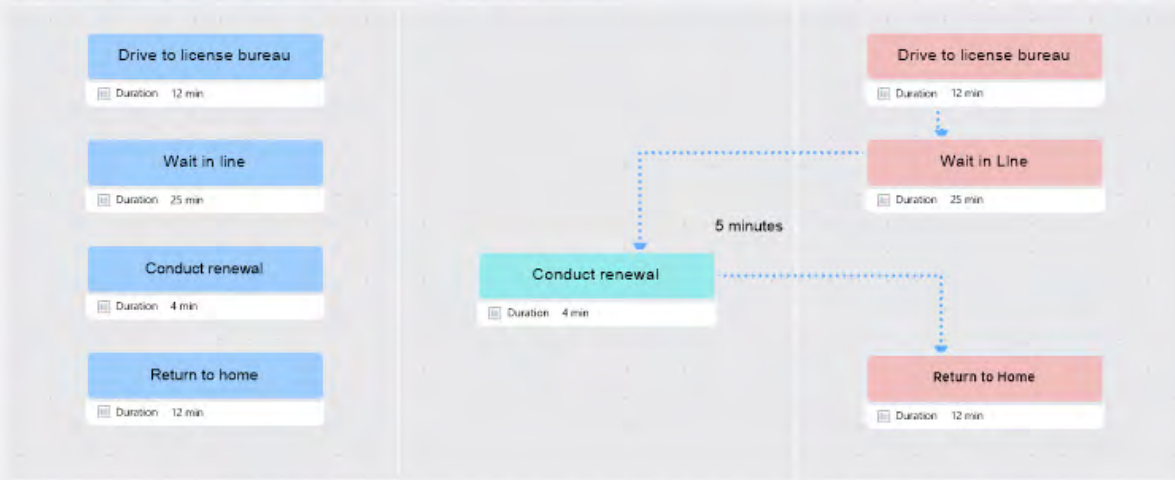
Value-added flowchart example

Value-added flowcharts provide the following benefits:

- Identify and eliminate (or reduce) hidden costs that do not add value to the customer.

- Increase capacity by better utilization of resources.

- Reduce unnecessary process complexity, and by extension, errors.

How to create a value-added flowchart:

1. List the process steps in the left-most column from beginning to end, in sequence.

2. Create a diagram with a box for every step,in sequence.

3. Calculate the time currently required to complete each step of the process and add that time to the box.

4. Enter the time for each step in the topic box immediately to the right.

5. Add the time in each box to yield the total cycle time. (Note: MindManager performs this calculation automatically.)

6. Copy the entire series of process steps into the center column, value-added steps.

7. Select all the boxes representing non-value-added processes and move them to the right-most column, non-value-added steps. Remember that non-value-add includes business non-value-add or required waste.

8. Add the time in each of the value-added process steps to yield the value-added cycle time.

9. Add the time in each of the non-value-added process steps to yield the non-value-added cycle time. This is where waste may exist that could be reduced or eliminated.

10. Divide the total time of non-value-added steps by the total cycle time to calculate the percentage of total cycle time that is a function of non-value-added operations.

11. Analyze the non-value-added steps to identify improvement opportunities.

12. Diagram the improved process and the target process to identify gaps.
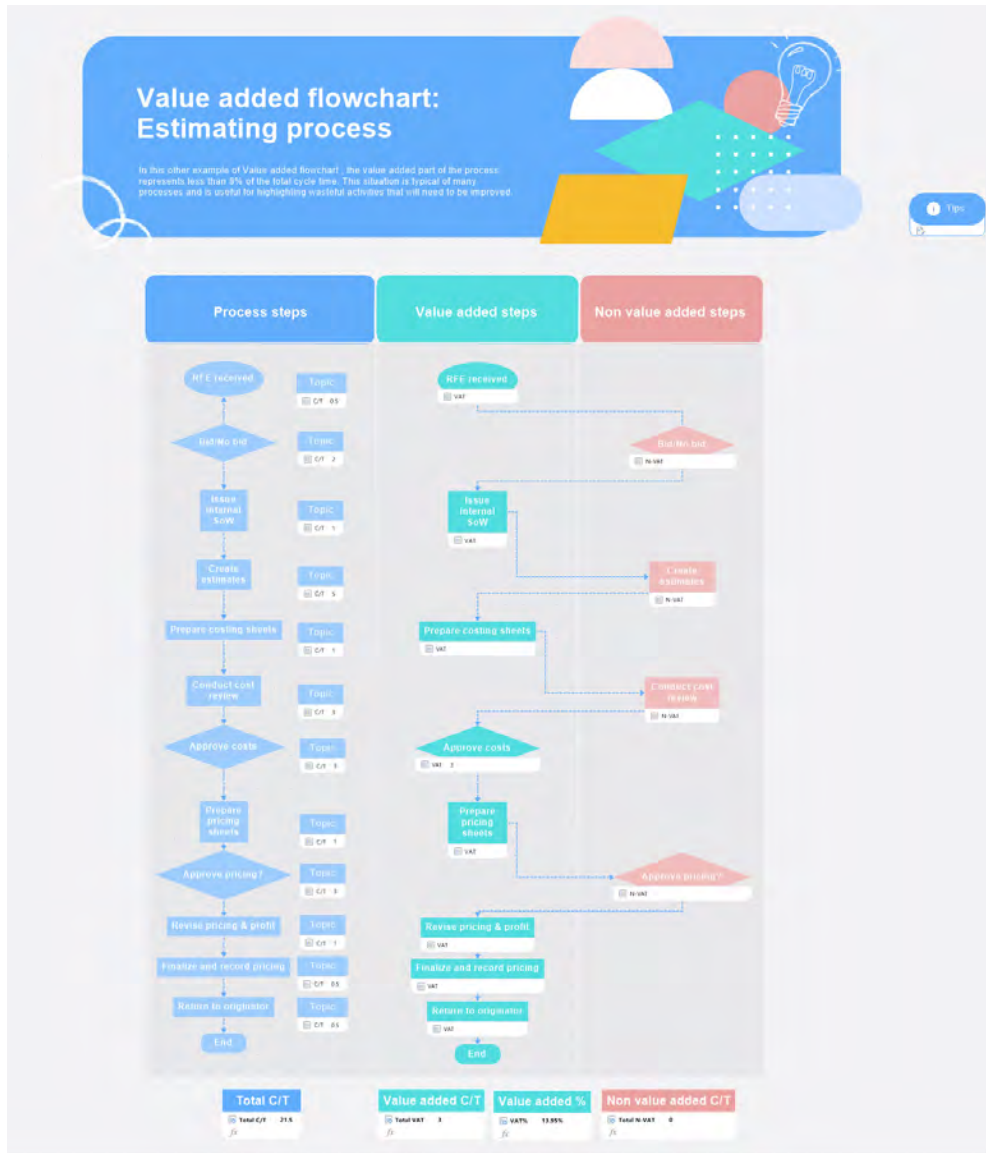
Example of a value-added flowchart for an RFE

5. Value stream map

As the name implies, a value stream map (VSM) deals with value streams. A value stream is the complete sequence of activities required for an organization to produce and deliver its products or services. The value stream includes suppliers, internal processes, and end users.

A VSM is a diagram of the value stream and shows the flow and transformation of information and material using standard symbols. These maps are useful to process improvement teams for quantifying waste since they capture all workflows and information in a process along with key process metrics.

Mapping the value stream provides visibility of waste within the processes that make up the value stream. To be used effectively, teams need to create two separate VSMs:

1. Current state map. This helps the organization to visualize the actual flow of material and information and to identify sources of waste as they exist in the current state.

2. Future state map. This forms the basis of your lean improvement implementation plan and identifies the specific areas and magnitude of improvement required to achieve a desired future state.

A VSM has three main components:
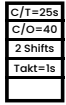
1. The flow of material and information from production by suppliers to delivery to customers.

2. The transportation of the material and information into finished products or services.

3. The flow of information that supports the first two parts.

Value stream maps provide the following benefits:
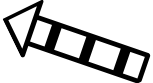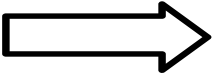
• Uncover sources of waste. Mapping the value stream uncovers the most impactful sources of waste rather than those that are the easiest to resolve.

• Combine the qualitative benefit of a visual tool with the quantitative benefit of an analytical tool.

• Provide a framework for tying together an organization's lean improvement activities.

• Visualize issues and improvements regarding flow so they are more apparent

5. Value stream map icons

VSM terminology and the names of the symbols typically used are geared towards manufacturing settings, where the value of goods and services is created in the process and then transferred to the customer. Many non-manufacturing processes lend themselves to the same logic of providing value to the customer.

| VSM symbols for material and production flow		
Name	**Description**	**Icon**
Process step	Represents a process step. The department name is usually placed in the top section and the name of the process step in the bottom section.	Press
Shared process shared	Same as process step, except the process is shared between functional areas.	Heat Treat
Outside source	Suppliers of material and information and customers of the end product or service.	XYZ Corp.
Customer demand	Customer requirements.	Customer Demand
Data box	Includes key data or metrics related to changeover times, as well as availability and efficiency.	C/T=25s C/O=40 2 Shifts Takt=1s

VSM symbols for material and production flow

Name	Description	Icon
Inventory box, WIP, queue time	Shows the inventory count or queue time.	
Truck shipment	Shipment over land.	
PUSH movement	Shows the flow of material provided by the previous process step.	
PUSH movement	Shows the flow of material provided by the previous process step.	
PULL movement	Finished goods to customer. Shows the flow of material required by the next process step.	
First-in-first-out sequence flow	Item longest in a batch is first to be removed for the next step.	
Supermarket	Controlled inventory of parts used to schedule upstream processes.	
Physical pull	Shows that material is physically pulled from inventory.	

VSM symbols for material and production flow

Name	Description	Icon
Move by forklift	Shows movement of material by forklift.	
Boat shipment	Shipment over sea.	
Operator	This symbol would have a number inside showing the quantity of individuals required to perform a process step or operation.	
Manual information flow	Shows information that is moved manually.	
Electronic information flow	Shows information that is moved electronically.	
Schedule	Weekly scheduled activities.	Weekly Schedule
Load leveling	Indicates load leveling has been employed. (Load leveling is a key element of "just-in-time" production, which Kanban systems help facilitate.)	OXOX

VSM symbols for material and production flow

Name	Description	Icon
Withdrawal Kanban	A physical or virtual card that is used to withdraw material from inventory.	
Production Kanban	A physical or virtual card that indicates completion of a process step.	
Signal Kanban	A physical or virtual card used to start a batch operation.	
Kanban card post	Indicates that a physical or virtual Kanban card mailbox is used.	
Sequenced pull ball	Indicates immediate production of a quantity (i.e., a pull system without the supermarket).	
Go see production scheduling	Adjusting schedules based on physically verifying inventory levels.	

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How to create a value stream map:

1. Create a basic process flowchart or high-level SIPOC prior to constructing a VSM. This will help save time and prevent you from going into too much detail in the VSM. Note that the process to be mapped should involve a product or service that meets the following criteria:

- There is a high volume of this product or service and an associated high cost.

- All products or services follow a common and repeatable series of steps.

2. Arrange the main activities or process steps in sequence.

- Begin at the end of the process.

- Work upstream.

- Use standard VSM symbols.

3. Show the flow of material.

- Add suppliers at the beginning of the process.

- Use material flow symbols.

4. Show the flow of information.

- Map the information flow between process steps and show how the process communicates with the supplier and customer

5. Map the current state VSM. This will show the total flow of material and information and identify sources of waste.

6. Analyze the current state for waste. In the example above, there is a significant amount of waiting time contributing to almost 20 days (147 hours) of lead time for an average estimate. Root cause analysis allowed the process improvement team to significantly reduce the delays and lead to a future state target with less waste.

7. Map the future state VSM. This forms the basis of your lean improvement implementation plan and identifies the specific areas and magnitude of improvement required. In the example above, the process improvement team was able to implement several changes to the process and ultimately reduce the lead time by more than half (8.9 days), as shown in the future state VSM below.
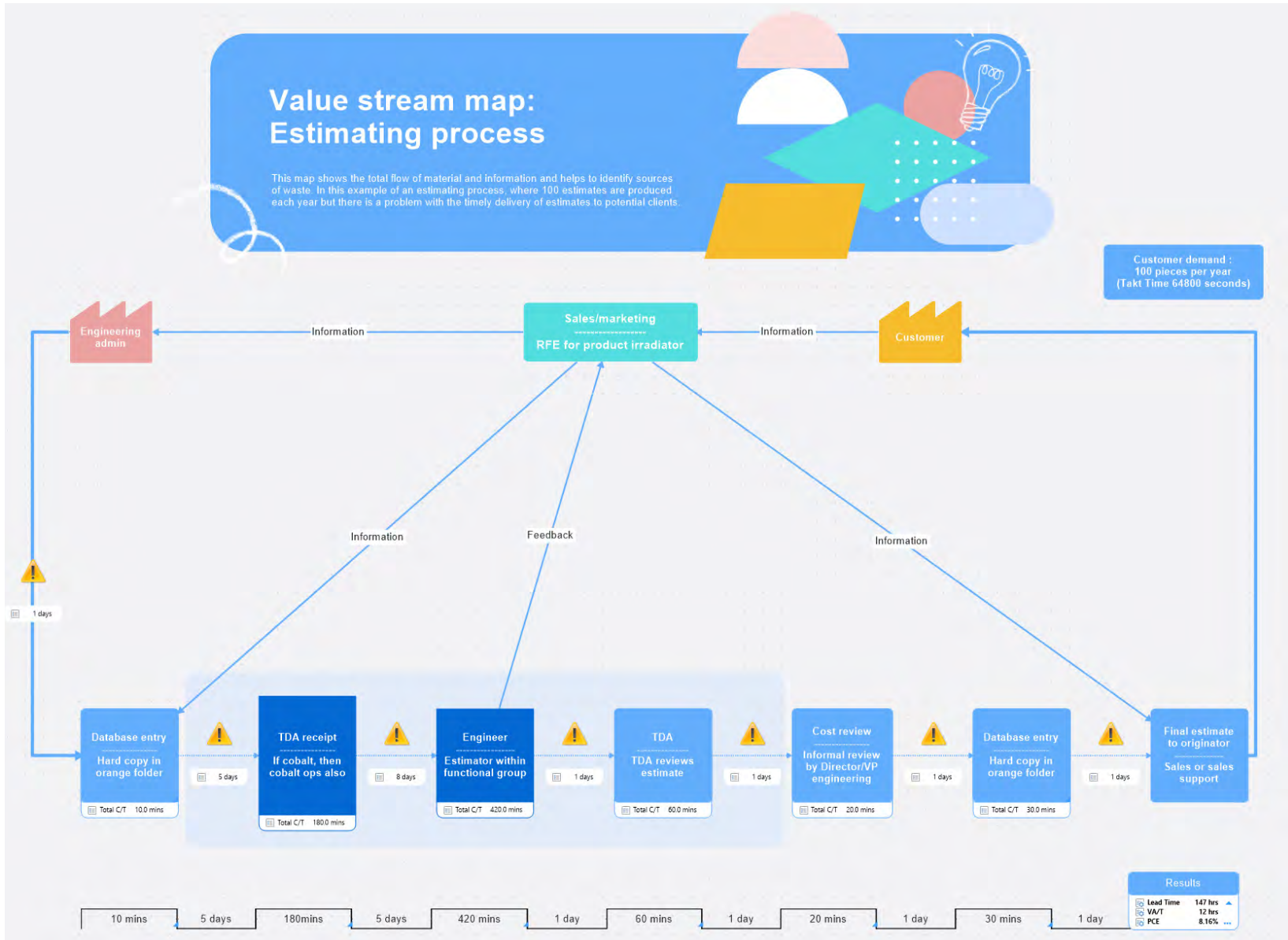
Example of current state value stream map
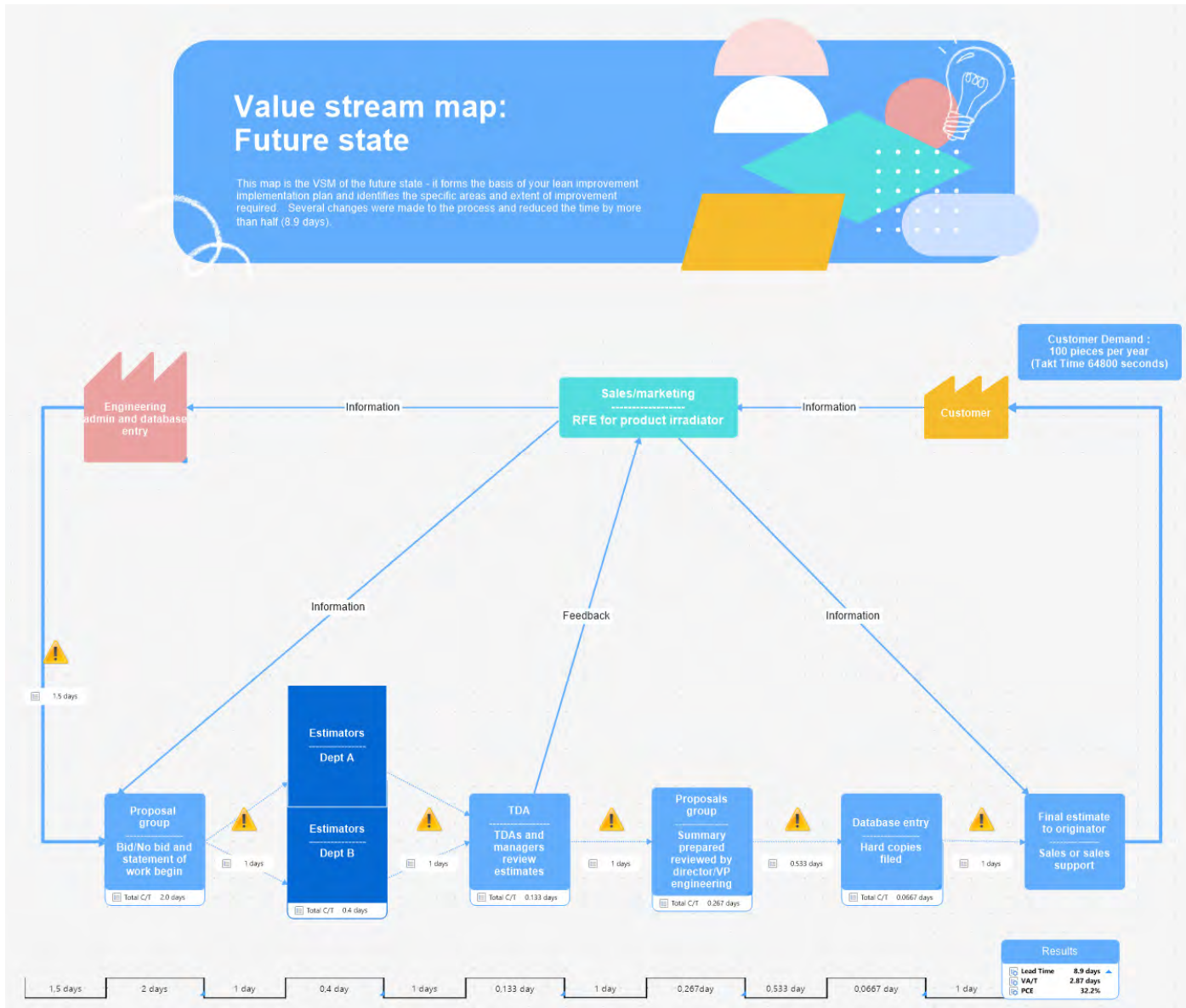
Example of a future state value stream map

How MindManager enables efficient process map creation

How MindManager enables easy process map creation

Process maps are simple but powerful tools with many advantages in that they are flexible, hierarchical, and can be modified to fit specific needs. None of the map types highlighted in this e-book are "best." Instead, they are complementary and should be combined for optimal results.

As a visual communication tool, process maps are an excellent way to get everybody on the same page. They clarify the interfaces between process steps as well as accountability. Lean and Six Sigma practitioners rely on process maps to guide data collection and analysis, and to share ideas with stakeholders.

Making process maps easily available to team members and stakeholders is key, which is where using a solution like **MindManager** can be extremely beneficial.

MindManager enables lean management methodology by providing an innovative visual productivity solution that comes pre-loaded with a variety of templates to help you easily create and customize value maps and other diagrams.

Team members can edit process maps in real time to ensure everyone has access to the latest version, while **MindManager for Microsoft Teams** enables Teams group members to participate in dynamic planning, brainstorming, whiteboarding, and more, without ever leaving the app.

Ready to simplify process improvement with MindManager? Get started today with five free templates that you can start using immediately to support lean management techniques.

Download them here!

Learn more about the benefits of MindManager for process mapping.

![MindManager Ideated by Alludo logo]