# DIGITAL TRANSFORMATION FOR MANUFACTURERS

## DIGITIZATION PROBLEM-SOLVING

## TOOLS & TECHNIQUES

The following methods and techniques can be used by Digital Transformation for Manufacturers Assessment (DMLA) teams to identify targets for improvement projects; identify root causes of performance problems and issues; and to plan and implement digitization solutions.

### A3

Named after the size of paper on which it is typically created on (A3-sized), an A3 offers a way for DMLA teams to identify a problem, explore and implement solutions, and communicate actions and results. An A3 establishes guidelines for a process to address a problem or opportunity, moving a team through seven elements:

* *Background:* Description of the problem or opportunity.
* *Current conditions*: Data (charts and tables) associated with the current state.
* *Goals/targets:* Outcomes that addressing the problem or opportunity will deliver.
* *Analysis:* Root-cause analysis of the current condition vs. the goals/targets (i.e., what currently prevents the goal from being achieved?).
* *Proposed countermeasures:* Actions to close the gap between the current condition and the goals/targets.
* *Plan:* Activities, roles, and dates for implementing countermeasures, usually with a timeline or Gantt chart.
* *Follow-up:* Progress review indicating if countermeasures are working.[[1]](#endnote-1)

### Brainstorming

Introduced by advertising executive Alex Osborn in the 1950s, brainstorming is a creative method for a group to generate ideas and find solutions for a problem. Osborn’s brainstorming method used the following four rules:

* Generate as many ideas as possible.
* No criticism of ideas.
* Encourage wild ideas.
* Improve on and combine ideas.[[2]](#endnote-2)

### DMAIC

The DMAIC (Define, Measure, Analyze, Improve, and Control) process-improvement methodology helps a DMLA team to identify the root causes of problems and apply lasting solutions. Based on the scientific method, DMAIC consists of:

1. *Define the problem*, including the end user, end-user requirements, and the primary process to meet those requirements.
2. *Measure and collect data* related to the process, such as time and quality metrics.
3. *Analyze the data* using root-cause analysis to identify gaps between end-user requirements and current performance.
4. *Improve the process* by developing a plan to fix root causes and then implementing a solution.
5. *Control the improved state* by monitoring and standardizing procedures in the process.

Gemba Walk: “Gemba” or “genba” is a Japanese term and refers to the “place where value is created.” To understand what actually occurs in the work environment, a DMLA team must go to where the work is performed (the gemba). At the gemba the team should talk with operators and ask open-ended questions in order to better comprehend the work, the nature of the value being created, and any problems. Gemba walks help a team to understand end-to-end processes, identify wastes, and solve problems. Organization leaders can use gemba walks to build relationships with frontline workers, establish mutual trust, and help people expand upon current skills and capabilities by offering support and assistance. Gemba walks require appropriate behaviors because individuals are entering someone’s workspace *while* the work is taking place and should be well-scoped (e.g., purposes, goals, and expectations) to make efficient use of time.[[3]](#endnote-3)

### Fishbone Diagram

This cause-analysis tool (also called the “Ishikawa Diagram”) helps a DMLA team to identify and group possible causes for a problem. A fishbone diagram forces users to look deeper for root causes of a problem.[[4]](#endnote-4) Each branch represents a cause and is similar to the Five Whys technique (see below), asking “Why” a branch of the diagram happens, with subsequent answers to the question forming sub-branches (sub-causes).

![Diagram

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### Five Whys

This question-and-answer interview technique helps a DMLA team drill down to the root cause of a problem in an engaging — not interrogative or confrontational — manner. Five Whys promotes deeper analysis and investigation until a root cause is identified; solving problems at the root cause can prevent the problem from recurring. For example, consider the following Five Whys conversation:

1. *Q. Why did the production line stop?* *A.* A stamping machine broke down.
2. *Q. Why did a stamping machine break down?* *A.* Bearings in the machine overheated.
3. *Q. Why did the bearings overheat? A.* The machine was not lubricated at the start of the shift.
4. *Q. Why wasn’t the machine lubricated?* *A.* A new frontline employee did not realize it was part of his job.
5. *Q. Why didn’t the employee realize it was part of his job?* *A.* It was not included in training materials for his workstation or posted at the workstation as standard work.

### Hansei/Reflection

The practice of reviewing past activities and performance to identify problems that may have occurred; determine if countermeasures are required; and communicate progress of a project or initiative. Hansei typically occurs in meetings at key milestones of a DMLA project or improvement initiative.[[5]](#endnote-5)

### Histogram

This data-analysis technique summarizes large amounts of data collected over a period of time and shows the frequency of occurrences at various data values. Because a histogram quickly illustrates the underlying distribution of data, it can help to predict future process outcomes. To develop a histogram, a DMLA team will identify the process measure they want to track, gather a large number of data values, prepare a frequency table of the data, draw the histogram from the frequency table with group data, and then interpret the histogram.[[6]](#endnote-6)

### Improvement-Planning Matrix

This matrix helps a DMLA team to prioritize improvement actions by plotting problem difficulty for the action (x axis) by performance outcome from the action (y axis). Additional information (e.g., resources required, time to implement) can be added to a matrix by incorporating size or color differences for the points plotted on the matrix.

![Table

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### Kaizen Event

“Kaizen” is a Japanese term for improve, and kaizen events (also called “rapid-improvement events”) are usually three- to five-day problem-solving sessions conducted by a cross-functional team to improve a process. During the event, the team:

1. Meets at the location of the process being addressed.
2. Studies and maps the process (e.g., metrics, steps, roles).
3. Identifies process problems.
4. Establishes objectives/goals for a redesigned process.
5. Develops and implements standardized changes to the process with those on the frontline who operate the process.
6. Measures outcomes.
7. Presents a follow-up plan and findings (e.g., effectiveness, applicability to other processes).

### Pareto Analysis

This problem-analysis technique charts the factor(s) that contribute to a problem. It is based on the work of Vilfredo Pareto, who in the early 1900s recognized that 80 percent of the land in Italy was owned by 20 percent of the population. When applied to problem solving, the Pareto Principle (80/20 Rule) assumes that roughly 20 percent of causes lead to 80 percent of problems.

![Chart, histogram

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### PDCA (Plan, Do, Check, Act/Adjust) Cycle

This method for continuous improvement is also known as the Deming Cycle, after the management guru who introduced it, as well as PDSA (Plan, Do, Study, Act). The four iterative steps that DMLA teams should use when following PDCA are:

1. *Plan* an improvement and set goals/targets for the outcomes.
2. *Do*/implement changes according to the plan.
3. *Check* the results of the changes. Did the changes achieve the desired goals/targets — or were the changes inadequate or the implementation flawed?
4. *Act/adjust* in response to the findings (e.g., standardize, implement again, seek alternative solutions).

### Plan for Every Part (PFEP)

A PFEP is a database or spreadsheet that contains all relevant information about a material or component (e.g., description, order frequency, supplier, supplier location, transit time, lead time, supplier reliability/performance, usage, shipment size, container size, and storage location).[[7]](#endnote-7) PFEPs can help an organization to establish supplier policies and standards; track actual supplier activity against supplier targets; and develop methods to minimize inventory levels and ensure timely access to supplies.

### Poka Yoke/Mistake-Proofing

Poka yoke is the design of a process in such a way that it is difficult or impossible for an error or problem to occur. Poka yoke mechanisms typically draw attention to a process problem (e.g., safety danger, poor-quality product) by stopping the process.

### Theory of Constraints

The Theory of Constraints methodology focuses on minimizing or removing constraints from a process. A constraint is anything that limits the process from achieving better performance; a process cannot perform better than the most-limiting constraint. Focusing improvement efforts on the constraint can rapidly impact performance of the overall process. As a process is improved, the constraint may change, which is why it’s important to repeat DMLAs to identify the most current constraint.

### Value-Stream Mapping

This method (also known as material- and information-flow mapping) is used by a DMLA team to identify all factors that contribute to the performance of a value stream. Value-stream maps consist of multiple icons indicating types of processes (e.g., truck shipment, assembly), types of material movement (e.g., first-in first-out, pull system), and types of information flow (e.g., electronic, manual) within the value stream. Value-stream mapping typically involves the following steps:

1. Observe and draw a current-state value stream map that identifies all processes and steps, from customer demand back to supplier shipment of materials and components.
2. Measure performances for the movement of material and information — e.g., value-added time, non-value-added time, total lead time — of each step and for the handoffs between processes and steps.
3. Identify current problems, such as those likely contributing to high non-value added time (i.e., process delays).
4. Apply solutions to simple and obvious problems immediately.
5. Develop a future-state value-stream map that redesigns the process in ways that may resolve more complex problems and issues.

### Zero-Loss Analysis

This method quantifies the costs associated with anything other than perfect performance — e.g., zero defects, delays, or machine breakdowns. All work processes are examined, and all major and minor problems identified, for which associated costs are calculated. Losses are aggregated by process and for a period to show the cost savings obtainable by improving the process. For many measures, perfect performance is not possible, however, zero-loss analysis directionally guides a DMLA team to address the most significant problems.

### Sources:

1. John Shook, *Managing to Learn*, Lean Enterprise Institute, Cambridge, MA, 2008. [↑](#endnote-ref-1)
2. Hanisha Besant, “The Journey of Brainstorming,” Journal of Transformational Innovation, Summer 2016. [↑](#endnote-ref-2)
3. Peter J. Sherman, “Take Great Strides with Gemba Walks,” *SCM NOW Magazine*, 2018, ASCM. [↑](#endnote-ref-3)
4. “Fishbone Diagram,” American Society for Quality. [↑](#endnote-ref-4)
5. Chet Marchwinski and John Shook, *Lean Lexicon Fifth Edition*, Lean Enterprise Institute, Boston, 2014. [↑](#endnote-ref-5)
6. Michael Brassard et al, *The Memory Jogger II*, Goal/QPC, Metheun, MA, 2016. [↑](#endnote-ref-6)
7. Rick Harris, Chris Harris, and Earl Wilson, *Making Materials Flow*, Lean Enterprise Institute, Brookline, MA, 2003. [↑](#endnote-ref-7)