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Six Sigma

Process Mapping

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Process Mapping

- Process mapping is an essential tool in helping us understand the activities and sequence of steps involved in any process. It also helps to identify areas where data collection should take place. It is commonly used at the early stages of project definition or project development to visualize the activities involved in a process. By completing the process map prior to performing process baselining and calculating the Sigma value, we can focus on processes that we fully understand.
- By comparing the “as is” against the “ideal” process diagram we can identify opportunities for improvement such as simplification of a complex process or elimination of non-value added operations.
- The standard set of symbols presented herein are a starting point and, as our experience grows, we can add some other symbols to draw diagrams of various levels of detail to better understand and visualize the process.
- The CT tree is linked to this tool making it useful for all levels of an organization. Six Sigma Champions can utilize this tool to visualize the process steps that may impact a Critical to Satisfaction (CTS) characteristic, while a Six Sigma Black Belt or team member would utilize this tool to visualize the impact on Critical to Quality (CTQ) characteristics. At the system level where a product is a function of processes, the process map defines a series of processes, whereas at the sub-system level, where processes are a function of operations, a process map represents operations that are linked.
- This section includes the general Process Flow Diagram, two of its variations and the “Process Flow Format,” which provides a standard form to record and analyze the activities of a process.
- The “Macro Flow Diagram” is a general view of the process. Only general descriptions of the steps are included with no decision points.
- The “Deployment Flow Diagram” identifies the individuals or departments responsible for the activities and the sequence in which these activities take place in the process.

Key Questions

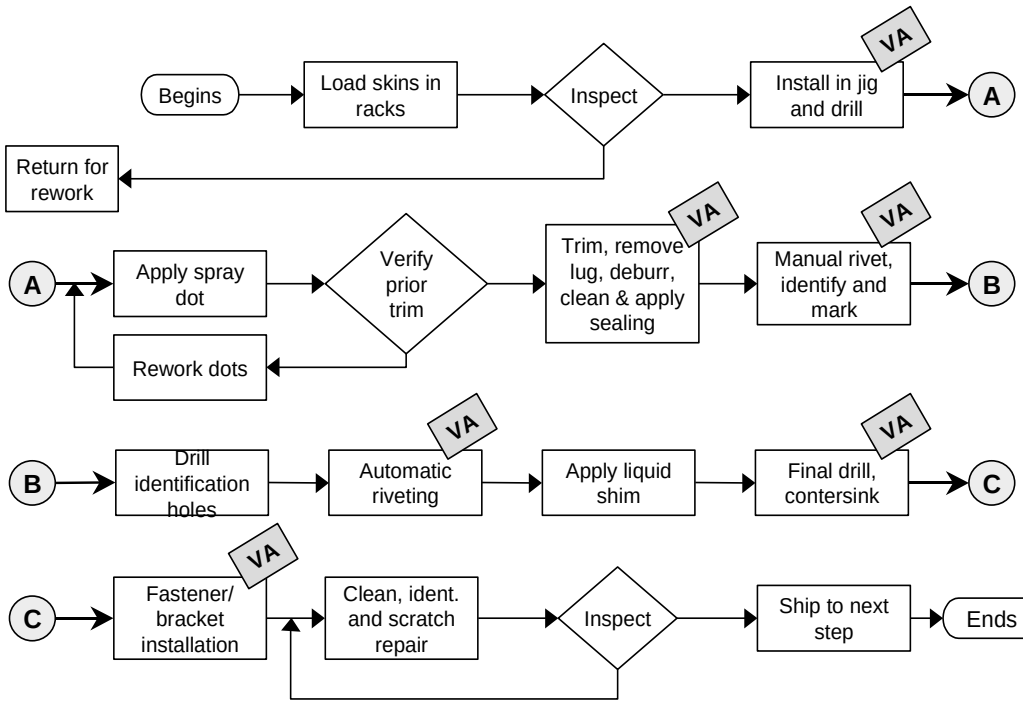
- What is a "process map" and how does it connect to CT and defect opportunities?
- What role does a process map play when making improvements?
- What are the primary benefits associated with the use of process maps?
- What are the key elements of a process map?

- How much detail should be added to a process map?
- How should a process map be put together?

Key Questions

- A process map has many uses in Six Sigma. For example, it is related to the CT and Opportunity for Defect concepts in that after identifying the CTQ, CTD, and CTC characteristics, it depicts the sequence of steps or activities that a product or service follows and the complexity level of the process that produces the deliverable. It can also be used to identify those areas where defects are likely to occur and data collection points.
- Much like the CT tree, a process map may have various levels of detail. At the system level, the process map depicts linked processes (a product is a function of processes), whereas the subsystem level represents operations that are linked (a process is a function of operations).
- There are various types of process maps. The Macro Flow Diagram is a general version that shows only major activities without any decision points. The deployment version identifies the sequence and persons responsible for completing each activity. The tabular version (process mapping format) allows us to compare "observed" against "target" values of a process map.
- Since they are based on standard symbols, process maps provide a simple picture of the steps needed in completing a deliverable. Moreover, when the “as is” version is compared against the “ideal” version, simple but significant improvements may be identified.
- All process maps have some key elements, regardless of the nature of the product. Start and end points, activities, decision points and connectors are common to all process maps.
- To ensure that a map is accurate and complete, it is recommended that the input of all team members be considered and validated.

Process Flow Diagram



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Process Flow Diagram

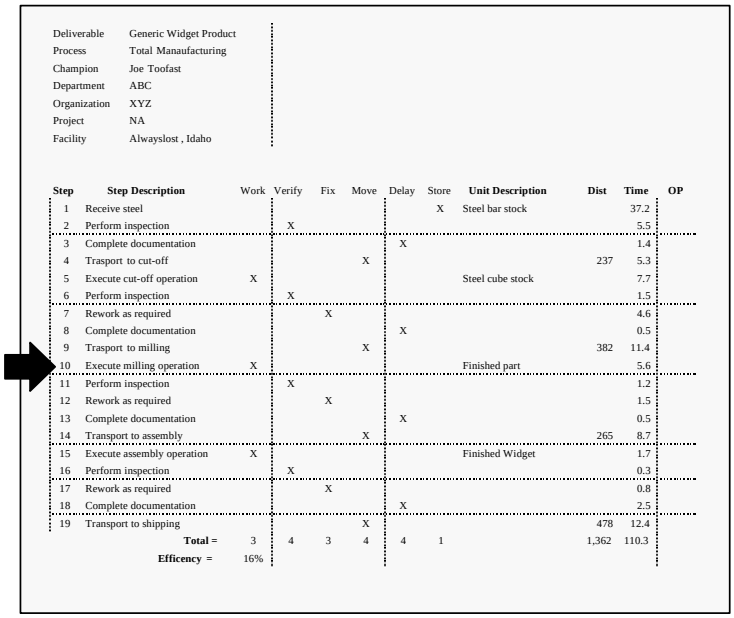
- In order to improve the customer's CTS (Critical To Satisfaction) characteristic "aircraft appearance," a Champion and a Master Black Belt were studying the possibility of launching a Six Sigma project in the assembly area of the CRJ aircraft model. Following customer feedback, they decided to further refine this CTS characteristic as "skin appearance," and they decided to concentrate on the mid-fuse section. The number of scratches per skin was defined as the CTQ (Critical To Quality) characteristic and a Six Sigma project was launched. The Six Sigma Black Belt knew that, in order to define the current defect-per-unit level, she needed to collect data. So she gathered the Six Sigma team to draw a Process Flow Diagram.

- During a brainstorming session, the team identified the standard as a skin having zero scratches. They also agreed that the activities to study would be bound by those taking place in a particular assembly department. After having identified all the steps that take place in the department, they used the standard symbols to draw the Process Flow Diagram.

- The team decided to organize data collection at the following steps: a) load skins in racks; b) apply spray dots; c) drill and apply liquid shim; and d) scratch repair. Collecting data prior to the

inspection points allowed the team to assess the “hidden factory.” In deciding which steps add value, the team considered a) Does the customer recognize it as important and would he/she pay for it if asked? b) Does the step change the product/service physically? and c) If done right first time, would this step be necessary? The following were identified as non-value operations: a) inspection; b) application of liquid shims; and c) rework dots. Thus, possible improvements were identified at early stages of the project.

Process Mapping Format



Deliverable	Generic Widget Product
Process	Total Manaufacturing
Champion	Joe Toofast
Department	ABC
Organization	XYZ
Project	NA
Facility	Alwayslost , Idaho

Step	Step Description	Work	Verify	Fix	Move	Delay	Store	Unit Description	Dist	Time	OP
1	Receive steel						X	Steel bar stock		37.2	
2	Perform inspection		X							5.5	
3	Complete documentation					X				1.4	
4	Trasport to cut-off				X				237	5.3	
5	Execute cut-off operation	X						Steel cube stock		7.7	
6	Perform inspection		X							1.5	
7	Rework as required			X						4.6	
8	Complete documentation					X				0.5	
9	Trasport to milling				X				382	11.4	
10	Execute milling operation	X						Finished part		5.6	
11	Perform inspection		X							1.2	
12	Rework as required			X						1.5	
13	Complete documentation					X				0.5	
14	Transport to assembly				X				365	8.7	
15	Execute assembly operation	X						Finished Widget		1.7	
16	Perform inspection		X							0.3	
17	Rework as required			X						0.8	
18	Complete documentation					X				2.5	
19	Transport to shipping				X				478	12.4	
	Total =	3	4	3	4	4	1		1,362	110.3	
	Efficency =	16%									

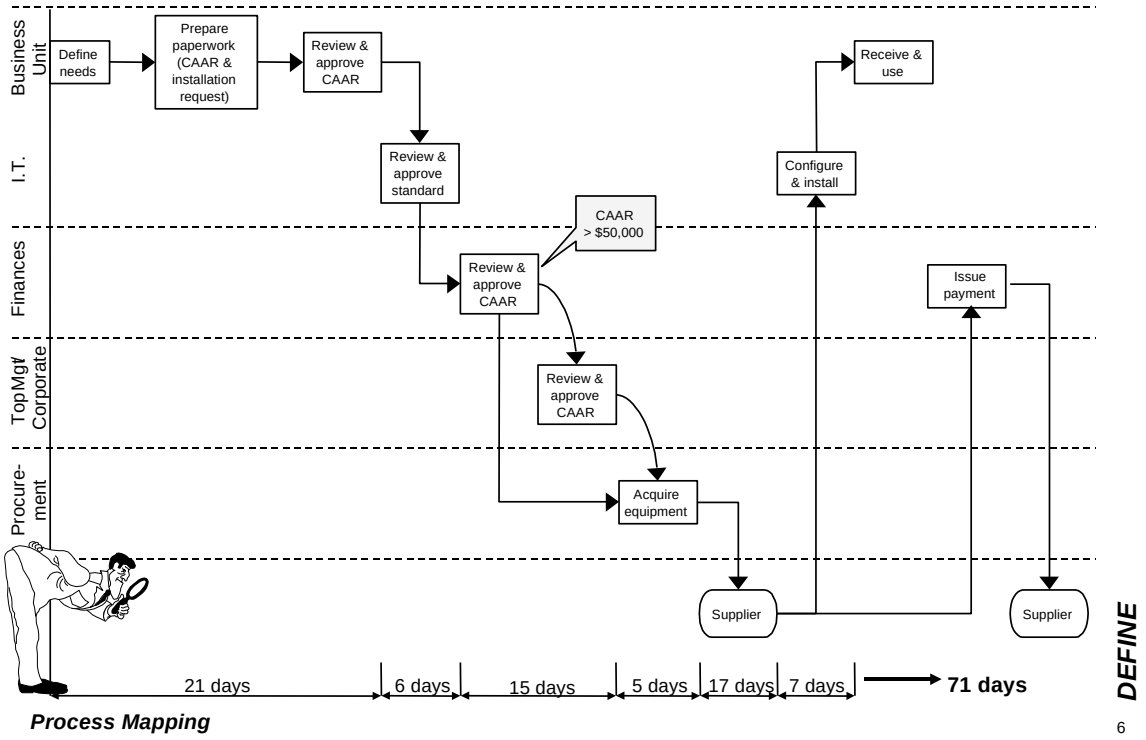
Process Mapping

Process Mapping Format

- Meanwhile, another Six Sigma Black Belt used the Process Flow Format to prepare a detailed analysis that included the distance traveled and the time required to complete the steps involved in his project.
- Using some of the concepts presented during the Six Sigma training, the Black Belt agreed with production and management personnel to observe, record, and analyze the steps involved in the milling and assembly of the subject product.
- After having completed the form as shown above, the analysis shed light on the fact that the process had an efficiency level of only 16%. That is, only three steps out of a total 19 were identified as “work,” or "value-added operations."

- The next step in the Black Belt's project was to obtain the target levels from the organization in terms of distance and time for the process. With this input, possible improvements to reduce time or distance can be identified and implemented.

Deployment Flow Diagram



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Deployment Flow Diagram

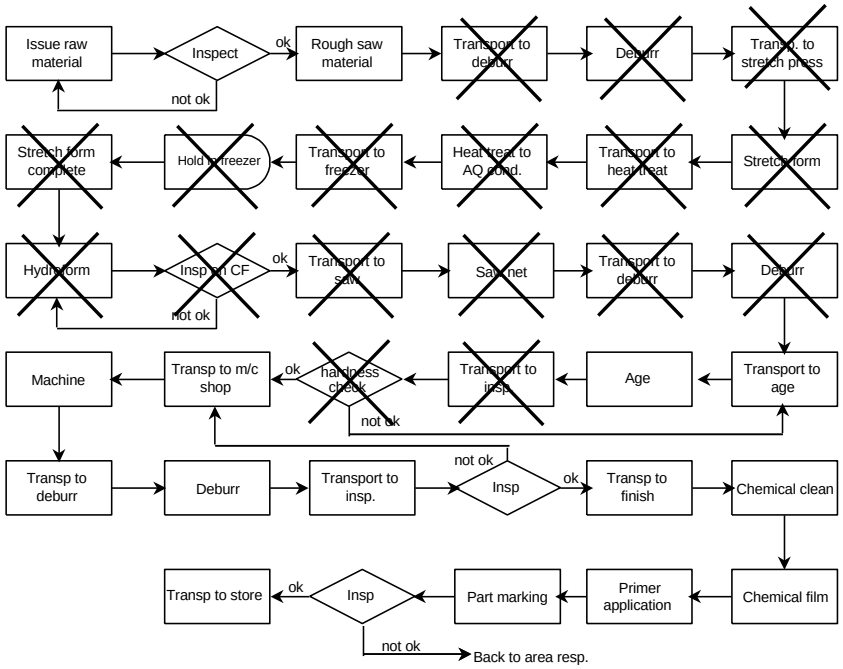
- A Six Sigma Champion responsible for the procurement of computer equipment was wondering if a Six Sigma project could be launched in his area. Working with a Master Black Belt, they singled out cycle time of the acquisition process as the CTS characteristic.

- Their first task was to identify the length of time that it currently takes to procure computer equipment for their various clients. Once they agreed on the general steps of the process, the Master Black Belt assisted the Champion with the analysis of preliminary data, and they determined that the acquisition process currently takes 71 days from definition of needs to receipt of the equipment by the customer.

- Further analysis revealed that definition of needs, paperwork preparation, and approval by the business unit represented 30% of the cycle time, while approval by the Finance department represented 20%. The Procurement/Supplier process represented an additional 30% and IT spent the remaining 20% approving the standard and installing the equipment.

- Having identified these elements, the Champion and the Master Black Belt knew that one or various Six Sigma projects could be launched in relation to this business process.

Step Reduction Through Process Mapping



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Step Reduction Through Process Mapping

- A Six Sigma Black Belt is assigned to a project with the objective of improving the quality of parts used in the assembly area. To narrow the scope of the project, the team decided to focus on reducing the amount of shimming used to close gaps and mismatches between ribs and spars.
- To better understand the existing process, one of the steps the Black Belt did was to draw the “as is” process map. Upon further analysis and discussion, the team proposed a series of changes to reduce the number of operations required to fabricate the components. Some of the modifications include:
  - Changing the raw material to T6 condition, thus eliminating operations for heat treating and delays in freezer storage;

- Producing the parts in the machine shop instead of stretch forming, thus combining almost all fabrication steps, eliminating the need for multiple deburr operations and combining inspection steps.

- By utilizing this relatively easy but powerful tool, the team was able to obtain some quick improvements, reduce the complexity of the process and increase the capability of the CTQ.
- This tool can be used by all levels in the organizations (i.e., Champions, Master Black Belts, Black Belts, etc.) and is applicable to all areas of the business (i.e., manufacturing, transactions, engineering, etc.).

Lessons Learned

- Process mapping is a tool that applies to all types of projects (manufacturing, transactions, engineering, etc.).
- The expertise of all members can add value to the process map. Working with a team we ensure the "as is" process is represented, and the opportunities for improvement are identified.
- Various levels of the organization can benefit from the use of process maps. Champions can better identify and define opportunities for Six Sigma projects, and Black Belts can understand and improve actual processes.
- By linking process maps to the CT tree and to performance specifications, we can identify the areas where defects are likely to occur and we can establish data collection points to better record and assess current defect levels and improvements.
- At the system level of the CT tree, a process map represents a service of linked processes.
- At the subsystem level, a process map represents a series of linked operations.

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