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Learning Objectives

Upon completion of this course, student will be able to:

- Discuss the purpose of the Control phase in a Lean Six Sigma DMAIC project
- Walk through the steps for controlling the process
- Describe the basic elements of a Control Plan, discuss its importance, and explain how to create and implement it
- Describe the key components required for effectively closing the project, including documentation, handoff, and leverage

Introduction

Control Phase

The first four phases of the DMAIC process are Define, Measure, Analyze, and Improve. The last phase is Control.

Recall that, during the Improve phase, the team selected and tested the solution and planned for its implementation. Before it can “walk away” from the project, however, it must ensure the process improvements will be sustained in the future, and that the people (or system) will not revert to the old way of doing things.

Without a plan for controlling the process, a project may show improvement to a process metric, but will often deteriorate over time as business conditions, products, and customer requirements change. When this happens, a future project will be needed to fix the same metric.

The purpose of the Control phase is to maintain a stable and predictable process that meets customer requirements; to make adjustments to meet any changing business requirements, and close the project.

Next, let’s see how it works.

Two Parts of the Control Phase

There are two parts to the Control phase. In the first part, the team focuses on controlling the process. This includes collecting data from key points in the process, developing a Control Plan, and creating a reaction and re-evaluation strategy to ensure the Control Plan is current.
In the second part of the Control phase, the team focuses on closing the project. This includes completing the documentation, handing the project off to the process owner, and leveraging the lessons learned across the organization. We will discuss the details of closing the project later in this module.

Next, let’s take a look at controlling the process.

**Control Plan**

As you just learned, the first part of the Control phase focuses on controlling the process. Here, the team defines, writes, and implements a Control Plan for a defined process. A Control Plan is a written summary of the systematic approach the team will use to minimize product and process variation. It outlines the steps that should be followed, during each phase of the process, to ensure all process outputs are stable and operating within required specifications.

A Control Plan is a written summary of the systematic approach the process owner will use to minimize product and process variation after the improvement team hands off the implemented solution. It outlines the steps that should be followed to ensure all process outputs are stable and operating within required specifications.

The team’s first step in developing the Control Plan is to identify which data it needs to collect in order to monitor and control the process. To do this, it uses evaluation tools, process flow information, and customer requirements or specifications.

As you learn about the Control phase, it is important to remember that the phases of the DMAIC model are not additive over time. Rather, they overlap. The Control phase actually starts during the Measure phase, when the Critical to Quality variables (or CTQs) are identified. Remember, CTQs are the variables that have the greatest impact on key business measures such as customer satisfaction, costs, and productivity.

During earlier phases of the project, the team used a number of tools to gather information about which key process input variables would have a direct effect on the output. Now, the team can use many of
these tools to gain information about the data it must collect. Examples of these tools include FMEA, the Future State Value Stream Map, process maps, the CTX tree, and the results of Root Cause Analysis.

**Measurement System Analysis**

Once the team has determined the data collection points, it conducts a Measurement Systems Analysis to ensure the data truly represents the process. The team collects and plots data on a control chart to make sure the process is stable, and it identifies and corrects any special causes of variation which might be present. Once the process is stabilized, the team conducts a process capability study to serve as a baseline for the new process.

Quality gurus W. Edwards Deming and Joseph Juran have both stated that the majority of quality problems in a process are due to management-controlled factors, which are part of common cause variation. By getting this variation under control, and providing action plans for dealing with special causes of variation, the process owners will be able to maintain the new process in the future.

**Control Plan**

**Implementing a Control Plan**

Implementing a Control Plan in a process does three key things. It establishes a system for continuous monitoring of the process for stability; it corrects any problems or process deviations as they occur by deploying appropriate corrective action procedures; and it allows for a reliable assessment of process capability.

Effective use of a Control Plan provides many benefits. It helps reduce product and process variation by being proactive and focusing on control; it emphasizes the use of prevention techniques and reduces the causes of errors by mistake-proofing the process; and it promotes continuous improvement by increasing the process knowledge of employees, communicating the root causes of errors, and defining the standardized control methods being used.
Now that you understand the purpose and benefits of a Control Plan, let's take a look at its basic elements. A Control Plan can be as detailed as the one shown here, which is for a manufacturing process, or it can be as simple as a list of actions, contingency plans, and responsibilities for administrative and service related processes. Although each team may use its own customized form to develop the Control Plan, most forms include an administration section, a process section, and a control methods section.

**Administration Section**

<table>
<thead>
<tr>
<th>Control Plan Number</th>
<th>Key Contact/Phone</th>
<th>Origination Date</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Description / ID</td>
<td>Process Improvement Team</td>
<td>Customer Approvals (If required)</td>
<td></td>
</tr>
<tr>
<td>Location / Supplier</td>
<td>Approval / Date</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The administration section of the Control Plan form is used to enter basic tracking information, such as Control Plan ID Number, key contact information, origination and revision dates, as well as any approval information if required.

**Process Section**

The process section of the Control Plan form is used for describing each of the CTQ variables identified as part of the Define phase.
Control Section

The team uses the control methods section to describe the type of process controls to use on each CTQ variable identified during the Define phase. Here, the team defines the type of control chart, sample frequency, sample size, and corrective action procedures.

Another critical part of the control methods section is the Reaction Plan and procedures. These are the actions that must be taken if the process goes out of control or fails to meet the requirements of the plan. Action should be the responsibility of the people closest to the process. The Reaction Plan can simply refer to standard operating procedures, and identify the person responsible for the reaction procedure.

There are three types of reactions. The lowest level is a compensation action. This type of control involves making a process adjustment to bring the variable back in control without identifying or correcting the factor that caused the situation. The next level is a corrective action, in which the cause of the variation is identified and corrected temporarily. With a corrective action, the problem may reappear soon. The highest level of reaction is prevention. In this type of action, the cause of the variation is identified and permanently corrected. The cause will not happen again, or at least will not occur as often. For some types of problems, a combination of these reaction types may be necessary. For example, while searching for a preventive action, it may be necessary to compensate for a problem in order to stop producing defective product.

Closing the project

The Control phase is the conclusion of the team’s journey. At this point, the team has selected and implemented the solution. It has also implemented process controls to monitor the results and take action if needed. But there are still a few critical tasks remaining. Sometimes these tasks are overlooked because the team becomes anxious to bring the project to a close. It is important, however, for the team to bring the same level of energy and commitment to the Control phase as it did to all the other phases. Otherwise, the process may well revert to its former performance level, resulting in the loss of some or all of the project gains.
As you learned earlier, the second part of the Control phase focuses on closing the project. Closing the project requires the team to complete the proper documentation, hand-off the new process to the process owner (if this has not already been done), and leverage the process across the organization.

There are two types of documentation required to close the project: process documentation and project documentation. We’ll take a closer look at each.

**Documentation**

The first type of documentation required to close the project is process documentation. While Control Plans are an important and critical component for process improvement, they are not a substitute for detailed process procedures or work specifications. They may only give detail on a specific operation, where a critical parameter in the process is being controlled.

In the past, standard operating procedures were generally documented in a large book of printed materials, consisting mostly of words. Thankfully, things have changed. Many of the tools the team used in its project can also serve as documentation for the new process. As it documents the process, the team should keep these basic guidelines in mind: keep it simple; write clearly; use pictures, flowcharts, videos, and diagrams whenever possible; and anticipate problems and warning signs that cropped up when the solution was piloted.

**Problems with Standardization**

As you just learned, standard operating procedures have evolved significantly over the years. However, many organizations still face problems with standardization. Here are some of the main reasons:

Process documentation is not properly used. This is particularly true in the administrative areas, where documentation may have been developed for the sole purpose of passing an external audit from the customer or a third party.
Few employees have experienced the benefits of effective standardization, and many have been subjected to rigid and forced implementation of arbitrary rules.

Most employees receive little training on how to do their jobs. Instead, they are left to learn by watching a more experienced operator. As a result, these employees develop their own unique versions of any general procedure they witnessed.

Changes to procedures are haphazard or non-existent. Many procedures, especially in office areas, are written and never updated.

**Arguments**

In many organizations there are arguments against standardization. People fear it will stifle creativity by requiring everyone to follow a rigid procedure. Process documentation can also add bureaucracy and red tape, creating an inflexible process that cannot change as business conditions change.

On the other hand, good documentation can make progress visible so defects become more obvious. Standardization ensures the system itself will not be a source of variation. Rather, it will be predictable from person to person, location to location, or product to product.

The arguments for and against standardization are both valid. It is up to an organization to define the proper balance to ensure consistency and reliability, while providing a process that allows for creativity and flexibility. A good rule of thumb is to keep the documentation as simple as possible to meet the requirements of the process. Organizations should seek to standardize where needed, but must also recognize where detailed documentation is not necessary.

**Project Documentation**

You just learned about process documentation. Now let’s take a look at project documentation, which is the second type of documentation required for closing the project.
The team must keep good records throughout the project. Because it will be “walking away” from the project after completion of the Control phase, the process improvement team must document the new process in a manner that ensures the process owner who is responsible for holding the gains made during the project can do so as part of his or her day-to-day duties. In other words, the new process must become part of the system. The best way to keep formal records is to summarize main points, metrics, and essential data. The better the records, the better the transition to the process owner will be.

Hand-off

As you just learned, documentation is a key component of the Control phase. Another key component required for closing the project is hand-off, or transfer of ownership to the process owner.

To successfully hand-off the process, the team must know who the process owner is. This is especially important in situations where there may be multiple owners of a large, cross-functional process. Because the team should have determined the process owner very early in the project, there should be no surprises when the Control phase arrives. Ideally, the process owner will have a key role in running the project. If this is not the case, a clearer transfer of ownership is needed.

The team and process owner must determine how the day-to-day responsibilities for monitoring and continual improvement will be transferred to the process owner and how the Control Plan will be managed. This includes assigning responsibilities for actions, and a periodic review of the Control Plan to ensure it remains up to date. The team and process owner must make sure all documentation is complete and that the appropriate people have been trained in the new process.

Leverage

You have just learned about two key components of closing the project, documentation and hand-off. Another very important component is leverage, which involves turning the knowledge gained in the project into knowledge that can be used across the enterprise. There are many instances where a good idea in one part of the organization will be of equal or greater savings in another part.

There are two aspects to leverage. The first focuses on extending the return on investment of the project to other parts of the organization. The second aspect involves sharing new insights and lessons learned about Lean Six Sigma and project work.

When the team looks for ways to get the most leverage from its project, or from lessons learned, it should consider the following questions: What other areas of the organization might benefit from the process improvements, knowledge, and learning?
How might the organization capture best practices and lessons learned to leverage improvements across the business?

What other systems in the organization are affected by, or could benefit from, the project results?

What can be done to facilitate knowledge transfer and improvements?

**Example of Leverage**

Now let’s look at an example of leverage.

In this example, a Process Improvement team was investigating ways to reduce inventory. Part of the solution was to design and develop an automated system for tracking and controlling obsolete inventory. This online system resulted in significant reduction in inventory lost due to scrap and rework of outdated product.

The team shared its results with the rest of the organization. Another team, which was looking at improving throughput in a production area, saw that the inventory program could be modified slightly to provide a tool for tracking equipment that was sent to a lab for calibration. The IT organization was able to clone the database and make the necessary changes to provide a means for tracking equipment. But the leverage did not stop there. The inventory team then shared the new insights it gained in working with the company database to extract needed information. Subsequently, another team with a similar project was able to use this information to help it collect data.

These two examples illustrate the value of leverage. Without the additional information and shared knowledge from the inventory project, the other two teams would have had to work through these issues on their own. This extra work would take up unnecessary time and resources. In addition, if the teams hadn’t shared information to leverage the results, the two inventory teams would run the risk of having duplicate systems, doing essentially the same thing.
Wrap Up Questions

As the team wraps up the project, it should reflect back on the project and discuss lessons learned. Some good questions for sparking discussion include the following:
- Did we meet our main objectives?
- Did we allocate enough time to each task?
- Were there any warning signs that we ignored?
- Did we have the right people on the team at the right time?
- If we were to start over again, what would we do differently?

Discussing lessons learned is a good way to gain organizational knowledge for managing projects. Next, we will describe some vehicles the team can use to share the lessons learned.

Keeping Leverage in Mind

Because different project teams throughout the organization will likely benefit from different lessons learned, it is important for the team to keep leverage in mind during each step of its project.

Leverage can be divided into three general categories, including documentation (the Who, What, When, Where, Why questions), communication, and training. The team must find ways to get this information and support to other projects. And it must do so in such a way that other teams can celebrate the arrival of its expertise and understand its potential value.

A central repository or database is a useful vehicle for sharing information. The team can post project results, which can be searched by others interested in gaining further knowledge about the team’s results and approach to solving the problem.

Documentation During Leverage

As you learned earlier, good project documentation is critical for communicating with, and transitioning to, a project’s control team. From a leverage perspective, it can also be immensely helpful to other project teams, which may try to learn from the original project team’s experiences, key learnings, solutions, and accomplishments. As the team works through the project, it should try to identify three types of projects that might benefit from its work. These include replication projects, related projects, and spin-off projects.

Replication projects are identical business processes in other operating units. The savings realized from a team focused on a common business problem (like ‘travel cost containment’, for example) might very well be leveraged into significant savings from another business segment. Related projects can also benefit from the original project’s work. An example might be other teams pushing the limits of customer satisfaction data gathering.

‘Spin-Off’ projects are opportunities that fall within the same major business process, but outside the scope of the current project. In other words, they are projects that focus on a different sub-process. For
example, if a team’s improvement project addressed one of the primary CTQs of a process, a spin-off project might efficiently produce additional savings by attacking another CTQ variable.

**Your Role in Leverage**

Each team member should take an active role in leveraging the project. For example, one member can take the lead role, making sure the team thoroughly documents the project discoveries and reports findings in the computer tracking system.

Other team members can take the initiative to make another team’s job a whole lot easier. Some ideas for taking initiative might include ‘going the extra mile’ to partner with people on similar projects; assuring a smooth hand-off of the project’s documentation to another team; or maybe even assuming the role of Subject Matter Expert for similar projects. Ultimately, the success of business improvement comes down to personal commitment.

**Closing**

When closing the project, it is important to recognize and reward the team for its hard work. Companies committed to continuous business improvement are constantly looking for ways to engrain process improvement into the corporate culture. In this module, you have learned the importance of leveraging a project across the organization. This provides a good opportunity to recognize and reward the efforts of the team.

There are many ways for the project leader to reward success and make a real impact. Simple things like recognizing the team at a company event; an article in the newsletter; or a storyboard of the project and results in a prominent location go a long way in giving people a sense of accomplishment. The goal of recognizing the team and celebrating success is to reinforce the power of the process improvement tools and techniques throughout the organization.