



# **Continuous Process Improvement/ Lean Six Sigma Guidebook Revision 1**

July 2008





## Letter to Our Readers

The original DoD Continuous Process Improvement (CPI) Transformation Guidebook was published in May 2006. The Deputy Secretary of Defense, in the Guidebook's cover memo, endorsed it as a resource for all DoD organizations to help design and manage CPI efforts and to foster a culture of continuous improvement throughout the Department.

This July 2008 CPI/Lean Six Sigma (LSS) Guidebook updates the May 2006 document. It reflects the inputs of a cross-agency DoD team as well as major developments that demonstrate further institutionalization of a CPI/LSS culture within the DoD. We have placed additional focus and emphasis on adapting continuous process improvement principles and implementing Lean Six Sigma and other effective methodologies.

I am proud and honored to be the first Director of the DoD CPI/LSS Program Office, which the Deputy Secretary established in April 2007. Our collective initiatives represent the largest continuous improvement deployment ever attempted. Engaged leadership, clear-cut objectives, high impact projects, rigorous tracking, and a strong recognition program are keys to driving CPI/LSS across DoD.

Continuous process improvement is being carried out through our focus on these leverage points for cultural change - unfettered by restrictive rules. We have not attempted to dictate how your organizations go about improving their processes, nor do we intend to. We recognize there are many ways to pursue your goals. Our interest is in providing a relevant framework to help you get there...a framework through which complicated processes can be examined in an organized and understandable fashion.

This updated Guidebook can be an effective reference document for any organization. It defines some major features we would like to see within the DoD process improvement structure, but it also provides appropriate latitude for Service/Agency implementation of those features.

I look forward to working with you all to sustain and accelerate your efforts. We are working to enable our workforce to solve problems using a culture changing methodology...one person and one project at a time.

J.D. Sicilia, Director, DoD CPI/LSS Program Office



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# Section 1.

## CPI in DoD

### Overview

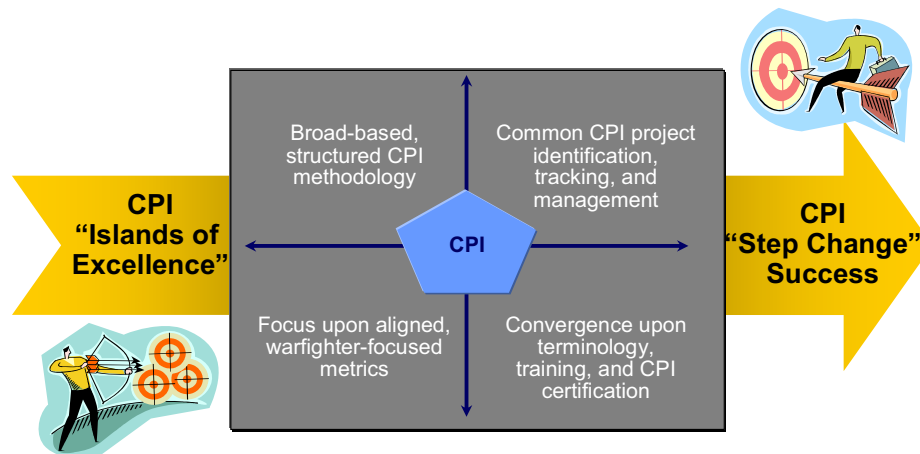
DoD is achieving significant performance improvements in its full range of activities—from operations to human resources management and logistics management—with the major focus on improving the support for the warfighter customer by applying Continuous Process Improvement (CPI) concepts and tools. Lean Six Sigma (LSS) is an important part of the Department’s CPI effort. A disciplined improvement methodology, LSS has been endorsed by DoD leadership as a primary means by which the DoD will become more efficient in its operations and more effective in its support to the warfighter. The DoD has embraced LSS and a broad range of tools and methods to strategically approach development of a culture of continuous improvement in the areas of process cycle times, resource consumption, quality, and other aspects of productivity.

For example, the Air Force applied CPI to reduce the repair cycle time for C-5 aircraft by 33 percent with an eventual goal to reduce total repair cycle time by over 50 percent. The Navy’s Surface Warfare Center carried out LSS projects in administrative, manufacturing, and research and development functions to net nearly \$9 million in savings over 3 fiscal years. The Army received tremendous payback because of LSS, saving \$30 million on its HMMWV line. The benefit was not only in cost savings, but also in the number of vehicles delivered to the soldiers who needed them. The Defense Logistics Agency (DLA) reduced interest payments and administrative lead times on a major support contract by 10 percent through lean and Six Sigma techniques. DLA is currently applying these techniques to improve Common Access Card (CAC) issuance rates. These successes, and many others like them, demonstrate the DoD’s ability to apply world-class, best-of-breed practices to meet a wide range of operational requirements.

Secretary England’s memo emphasizes the importance of CPI and LSS and the need to codify and share experiences across the Department and beyond. This guidebook is intended to facilitate CPI success from implementation through sustainment. CPI’s promise across the DoD as well as other public- and private-sector organizations relies upon the creation of an overriding culture that totally embraces continuous improvement as an everyday way of addressing all work efforts. Success rests with a mindset to attack problems and identify practical opportunities for improvement. This guidebook is a resource to be used throughout the Department for designing, managing, and sustaining CPI and LSS efforts.

This guidebook provides a framework to be used for implementing and sustaining a culture of continuous improvement (see Figure 1-1).

Figure 1-1. Guidebook Overview



It focuses on the following four key elements of CPI that require a common understanding and support to facilitate ongoing process improvement initiatives and set the stage for greater enterprise-level improvements:

- ***A broad-based, structured CPI implementation method*** that spotlights why a sound improvement plan is needed and how to determine and implement the best solution. This involves strategic planning at the enterprise level to properly focus improvement activities, and operational planning at the organizational level to achieve aligned performance improvement across the enterprise value chain. The methodology describes stakeholder key roles and responsibilities in supporting, monitoring, and repeating the improvement process. It also includes the use of peer groups to benchmark activity and cross-fertilize best management practices across the DoD. This methodology is a baseline and reference mechanism for continual refinement and application.
- ***A focus on CPI implementation within a structure of goals that are aligned to a warfighter-driven, outcome-based metric.*** Goals that are pursued and achieved in each CPI and LSS project should be measured by results-oriented performance metrics that support customer requirements most effectively in terms of time, quality, and cost. CPI projects should strategically align with an organization’s results-oriented metrics—such as measures related to the Government Performance and Results Act (GPRA)—to ensure the optimal impact on the enterprise value stream. Improved reliability, reduced process cycle times, and a focus on targeted effectiveness at lowest total cost are driving elements of improvement efforts.
- ***Emphasis on the management and integration of CPI projects.*** CPI projects require an effective project management approach to achieve results and encourage synergy within the DoD culture at large. This guidebook provides a format for initiating, tracking, and evaluating CPI and LSS improvement, including project-related activity and accomplishments.
- ***Ways to determine how well projects and organizations are progressing with CPI initiatives, training, and certification.*** This guidebook provides a framework and use-

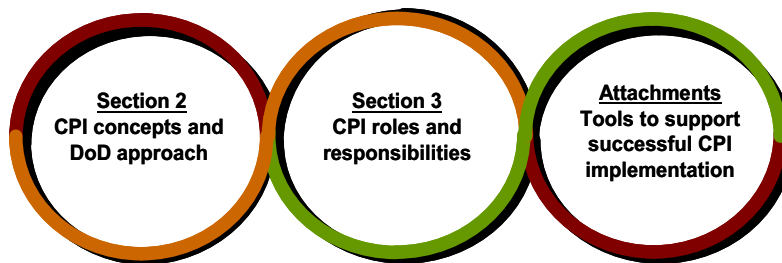
ful checklists to gauge organizational CPI and LSS maturity. Organizational maturity can be recognized at various discrete stages. A critical mass of trained process improvement resources is needed for success. To rapidly and effectively implement CPI and LSS in the DoD, individuals should be trained to fulfill various full- and part-time roles in process improvement-related functions. The commitment for some key personnel may be 2 or more years. Levels of expertise will be defined, and individuals will be identified according to the level of expertise they achieve. Outside expert assistance is likely to be needed initially from sources such as other DoD activities or the commercial sector. But the goal is to develop in-house CPI and LSS expertise and capabilities within a reasonable timeframe (1 to 3 years) and take full ownership for the continuing emphasis on process improvement.

This guidebook is designed to assist DoD organizations in using CPI and LSS concepts and tools to improve the full range of processes and activities that make up DoD operations. These concepts have been employed in the private and public sectors and have shown to be relevant and applicable to any organizational process in industrial, service, office, and field operational environments. Therefore, this guidebook is intended to be a useful resource throughout DoD and its extended supply chain. All DoD organizations will participate in defining, implementing, and sustaining continuous process improvement solutions.

## Structure and Use of This Guidebook

This guidebook applies to all levels and functions of DoD. It is organized to flow logically from the initial introduction of process improvement concepts into the strategic planning process to the required organizational structure. It describes the tools needed to solve problems, eliminate waste, reduce variability, and enhance reliability throughout the identification, execution, and sustainment of specific CPI and LSS projects.

*Figure 1-2. Guidebook Structure*



As Figure 1-2 shows, the remaining sections and attachments are organized as follows:

- The framework for DoD CPI described in Section 2 introduces and explains overall CPI concepts, and outlines the Department's approach to CPI.
- The roles and responsibility section (Section 3) addresses specific participants and organizational elements in the DoD structured approach to CPI. Each participant should understand, at least at a basic level, the roles and responsibilities of the other participants.

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- The attachments provide more in-depth material on specific topics that will be useful to various participants, depending upon their role in CPI. These include a list of useful references (Attachment A), an implementation planning framework that can be used by any organization (Attachment B), elements of CPI training and certification (Attachment C), progress assessment techniques (Attachment D), a suggested CPI project documentation format (Attachment F), key terminology (Attachment G), and a DoD-approved certification process for CPI expertise at the green belt and black belt levels (Attachment H).

Process improvements resulting from applying CPI effectively will greatly benefit the Department, in terms of both improved operations and reduced resource consumption. Cost savings and expense reductions that result from improvements in overall operating effectiveness may be retained by the organizations that generate them. Effective management oversight should lead to reinvestment in additional CPI efforts and recapitalization.

## Section 2.

# DoD CPI Framework

CPI provides organizations a structured approach for analyzing how they are currently doing work and how they can improve their processes to do the job more efficiently and effectively on an ongoing basis. CPI has evolved for the DoD as an overall approach from separate performance improvement schools of thought originating in the private and public sectors. Most notable are the contributions of

- ***Lean***, which focuses on work flow, customer value, and eliminating process waste;
- ***Six Sigma***, which focuses on satisfying customer requirements while minimizing waste by reducing and controlling variation; and
- ***Theory of constraints***, which focuses on systems thinking and improved throughput by addressing system constraints.

These schools of performance improvement have separately and collectively proven to be useful in the both the private and public sectors and increasingly, over the past decade, in improving national defense. CPI provides DoD managers and workers with proven performance improvement tools to build a strong warfighter support foundation for improving cycle time and reliability, optimizing costs, improving safety, reducing energy consumption, and improving availability of warfighting capabilities.

The DoD framework for CPI leverages the strengths of the proven CPI methods and concepts in the private and public sectors. Most important, the DoD objective is to enable our leaders and the entire workforce to be critical thinkers and problem-solvers, leveraging the insights of the men and women in the Department.

There are many measures for gauging how well an organization is meeting the needs of its customers. The premise throughout this guidebook is that the customers are the warfighters, and their readiness is the primary goal.

Cycle time refers to the amount of time required for a DoD component to accept a current or future customer demand (normally the warfighter) and provide the requested capability. CPI looks at the “touches” that occur during this period, how much time is consumed by each touch, and evaluates whether a particular touch provides value to the warfighter. Touch refers to touch labor, otherwise traditionally known as the application of direct labor, and typically includes both value-added and non-value-added components in the eyes of the customer. The objective is to align the organization and its processes to shorten the cycle time without adversely affecting the reliability and cost of the good or service. Cycle time improvement can be focused on any process to reduce the time and resources involved. An important CPI-related concept is the expansion of thinking beyond a focus on direct labor alone to look at the larger picture of all utilized labor resources, including direct, indirect, and other supporting stakeholder efforts—as part of the total labor consumption equation.

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Reliability refers to the degree of certainty that a product or service (or any expected outcome) of a process will perform as intended over a set period of time under specified conditions. Experienced CPI practitioners know that simply attempting to speed up a process with the objective of reducing cycle time is to run the risk of compromising quality, thereby degrading reliability. CPI balances the need for speed with the need for reliability.

Effectiveness and efficiency can often be improved at little cost. However, high-leverage and sustainable organizational improvements are likely to require substantial investment. CPI practitioners must consider the costs and benefits of process improvements before undertaking them. In the DoD, CPI efforts should consider the anticipated improvement in the context of improved productivity lowering total cost to deliver the targeted required value to the customer within the entire value streams at multiple levels under study.

Finally, CPI is an enabler to achieve the goals of the enterprise. For the DoD, that is the National Military Strategy and all its subordinate operational plans. The strategic and operational plans provide the foundation and building blocks for a strong and institutionalized CPI culture in the organization. In the DoD, such organizations should

- have effective methods for identifying processes whose improvement would most benefit the warfighter;
- train people to perform CPI analyses with a formal way of certifying their skills from, for example, Level 1 (novice) to Level 2 (intermediate) to Level 3 (expert);
- assess the maturity of the CPI work using an approach similar to the one addressed in Attachment D; and
- focus on knowledge management and sharing information and lessons learned, including peer groups that provide a forum for the cross-fertilization and exchange of ideas and techniques.

Section 1 of this guidebook mentions examples of impressive improvements in lowering costs and speeding up process cycle times. Initial CPI efforts often lead to a large first-time improvement in processes, but the lasting value of CPI lies in continuous improvement and ongoing fact-based measurement of results. Each time we measurably improve our work processes, we are enhancing our value-added support to the warfighter. CPI should become a daily part of how we think about and do our work. The remainder of Section 2 addresses five areas: fundamental concepts of CPI, the CPI deployment cycle, the operational plan, change management, and metrics.

## **Area 1—Fundamental Concepts of CPI**

Several concepts are fundamental to effective CPI implementation in the DoD. They include a set of “musts,” a set of principles, a value stream focus, and a recognizable CPI culture.

## ***CPI “Musts”***

Experience in both the public and private sectors indicates that the following conditions are required to ensure effective CPI implementation:

1. An established infrastructure to support CPI implementation—In the DoD, the CPI infrastructure for each organization should consist of a champion, steering committee, support team, and work groups, as appropriate. Peer groups should also be used to strengthen performance across the DoD functional areas.
2. Strategically aligned outcome-focused goals based upon the voice of the customer are identified to drive real customer value through the operations of the organization.
3. A thorough problem-solving structure—for example, Definition, Measurement, Analysis, Improvement, and Control (DMAIC)—within a logical, methodical CPI plan of action exists for all projects and other initiatives that are related to organizational objectives and priorities.
4. Strong and continuously visible leadership commitment and involvement from the very top of the organization stresses and supports a CPI culture of innovation and teamwork.

## ***CPI Principles***

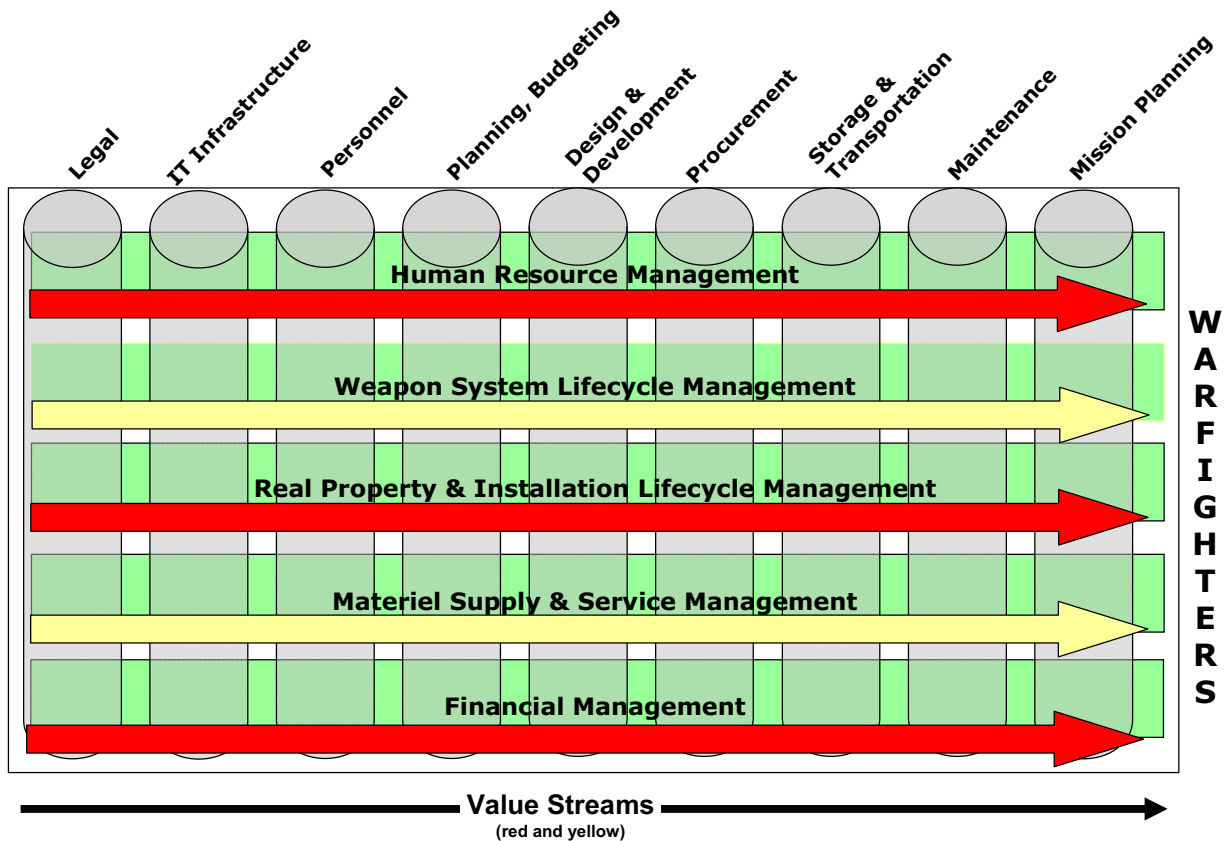
Several principles have evolved from organizations that perform CPI planning and implementation; they represent the best of current CPI thinking:

1. Determine the current situation using objective (fact-based) data analysis.
2. Evaluate the current process against 5S criteria.
3. Analyze problems utilizing the DMAIC process to determine a course of action.
4. Set a goal to holistically address the root cause and avoid sub-optimization through an isolated focus on process sub-elements.
5. Focus work and resources on the people, machines, and systems that add value.
6. Improve processes through continuous controlled experimentation.
7. Make decisions based on long-term improvement.
8. Update or create standardized processes to reduce variation and waste, and promote continuous improvement.
9. Employ partnering and knowledge sharing across the DoD and with external suppliers, customers, and other stakeholders.

## A Value Stream Focus Within the Enterprise

Successfully applying CPI requires a comprehensive value stream focus within the enterprise being transformed. As illustrated in Figure 2-1 (which is meant to be notional and not all-inclusive), numerous functional areas within the DoD enterprise as well as many management communities may engage in CPI activities. DoD’s complex enterprise creates myriad nodes, interfaces, activities, and other “touch points” that may need to be considered as parts of a specific value stream—the cross-functional enterprise-wide process—that may contribute to the improved process and support activity. For example, the notional and high-level end-to-end value stream for a DoD weapon system involves all of the functional areas and communities identified in Figure 2-1, including acquisition processes; the use of the weapon system for its intended purpose; all maintenance activities required at the organizational, intermediate, and depot levels; supply and transportation activities; and mission planning.

Figure 2-1. Value Streams and the DoD Enterprise



The focus of value stream mapping at any level of the enterprise should be centered on the customer. Individual CPI projects must address all of the potential related nodes, interfaces, and activities within the affected enterprise as they center on measuring value to the customer or warfighter. Typically 3 to 5 metrics are determined on an organization-by-organization basis to describe and measure each step in the process.



## **CPI Culture**

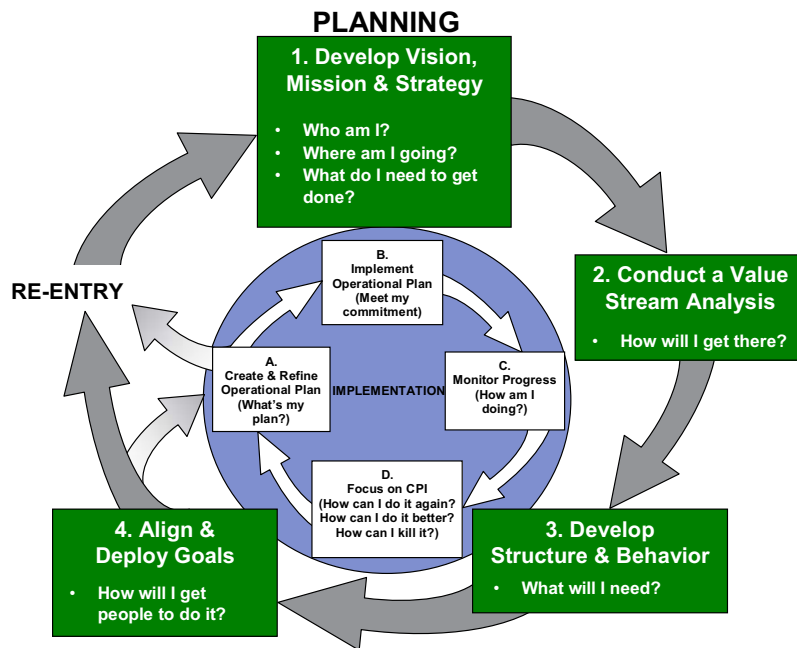
Throughout this guidebook, various CPI-related roles are defined and specific activities are identified. A supportive and innovative culture must underlie this formal framework. At the core of this transformed culture is the ever vigilant lookout for waste and the unshakeable belief that there is always a better way to get things done. If nurtured, it will increasingly flourish as the number of successful CPI projects increases. An effective CPI culture requires several core values. These should be recognized and developed throughout the organization:

- *Mutual trust and respect* within the extended enterprise beyond the organization's four walls
- Keeping the *voice of the customer first in mind at all times*
- Using *dissatisfaction with the status quo* to continually drive further performance improvement
- Always being *conscious of the total cost* of your actions as they impact customer value and your organization
- Viewing problem identification in a good light instead of bad, and recognizing the visibility of problems as an opportunity for improvement (in other words, *don't hide problems*)
- Staying *receptive to new CPI concepts* and tools as they might evolve and become applicable, while avoiding becoming locked in on a single school of thought that precludes other useful approaches and perspectives.

## **Area 2—The CPI Deployment Cycle**

The underlying CPI concepts are put into practice through a disciplined CPI deployment approach that should change how we view and think about work. It provides a customer satisfaction focus that is value-driven, not task-driven, with value being defined by the customer. Operations are viewed in the context of customer expectations and requirements, operational environments, resource requirements, and technology. Figure 2-2 illustrates the steps in the CPI deployment cycle. The following paragraphs outline each of these steps.

Figure 2-2. CPI Deployment Cycle



## ***Develop Vision, Mission, and Strategy (Fig. 2-2, Block 1)***

The first step in the deployment cycle is to establish the organization's mission and vision, and its strategy for achieving them. A clearly articulated vision, focused mission, and well-thought-out strategy provide the framework to achieve the organization's objectives through the following:

1. A common vision and marching orders that foster teamwork, inter-departmental cooperation, and alignment of goals, metrics, and actions
2. A focus on reducing constraints and other non-value-adding activity to achieve better utilization of resources and capacity
3. Continued acceleration of improvement efforts
4. A better foundation for fact-based analysis and decision-making
5. An expanding perspective on the entire (end-to-end) value stream.

## ***Vision***

The CPI vision is a view into the future that succinctly describes how the organization will conduct business. It implies a gap between the current state and a better future state. A future state can be defined as better only when it more effectively supports the organization's mission.

## Mission

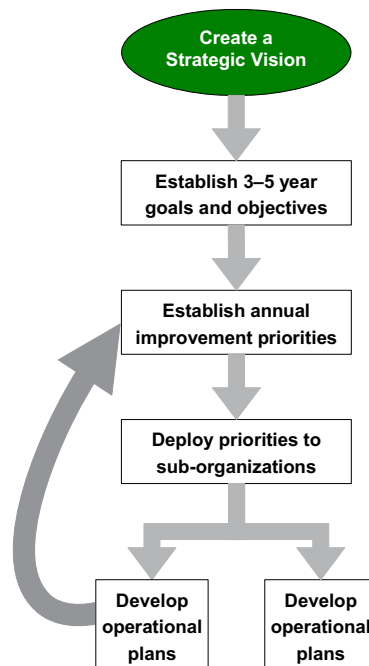
The CPI mission is a concise, unambiguous, and measurable description of the organization's role in the overall objectives of the DoD, with a clear connection to the DoD Strategic Planning Guidance and Contingency Planning Guidance.

## Strategy

The strategy for implementation can be documented in strategic plans or other living products used in an organization's strategic alignment and deployment process. These plans provide the high-level actions (as depicted in Figure 2-3) to be taken over the timeline of the plan to realize the vision and achieve the organizational goals. The strategy documents align key CPI-related initiatives with organizational goals and objectives. The major goals are cascaded down through an organization with sub-organizational goals, and CPI initiatives are appropriately aligned.

In the DoD setting, CPI-related strategy efforts must also support the overall performance management framework (such as the President's Performance Management Agenda and associated organizational planning and budget documents). This enables more informed decision-making at the leadership level, because the value and priority of particular performance improvements and CPI efforts can be evaluated in terms of strategic goals and objectives.

Figure 2-3. Strategic Deployment



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## ***Conduct a Value Stream Analysis (Fig. 2-2, Block 2)***

A value chain represents the combined end-to-end processes that create or add value as defined by the customer requesting a product or service. A value stream analysis of a process activity encompasses all the planning, execution, products, and services that go into a process to create value for a customer.

With the vision, mission, and strategy in place and communicated to the workforce, the first task is to align the processes to support that direction. Mapping the value stream helps illustrate the opportunities for improvement. Figure 2-4 depicts an example of mapping an enterprise-level notional weapon system value stream at a very high level. Value stream mapping and analysis must focus on value to the customer and typically includes both a current state map (such as the high-level example), which describes the existing process and uncovers improvement opportunities, and a future state map, which describes the vision for the desired future process and through gap analysis reveals potential leverage points for improving the process. Typically, mapping a value stream will also involve identifying and analyzing both the value-added and non-value-added time in the process.

Value stream mapping tools continue to advance, with new emphasis on consumption and provisioning, in addition to consideration of people, process, material, and information systems support. The originators and practitioners of this tool are increasingly emphasizing the need for customers to have a direct role in the mapping and analysis process. Value stream analysis helps guide the sequencing of efforts in addressing process inefficiencies with effective CPI projects.

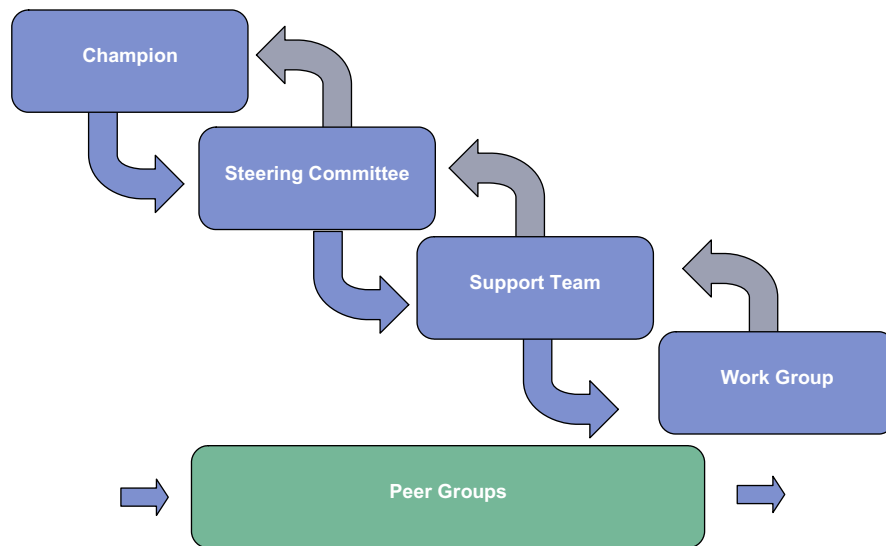
The value stream analysis is conducted at multiple levels within an enterprise and is usually better accomplished as a top-down activity. The “enterprise” itself could be a major functional area, such as depot maintenance, or it could focus on a weapon system. However the enterprise is defined for a particular CPI effort, the approach must engage knowledgeable representatives and stakeholders from every element of the enterprise to achieve a coordinated solution.



- The *steering committee* is the champion’s main vehicle for keeping the CPI efforts aligned with expectations.
- The CPI *support team* provides the technical expertise and consistency of approach. This enables CPI to become a repeatable process that is ingrained in the behavior and language of the organization and ultimately becomes a defining element of its culture.
- The *work group* accomplishes the detailed analysis of current operations, obtains the input of peer groups when appropriate, and develops options for improvements.
- *Peer groups* operate within and across functional areas to share experiences, best practices, and benchmarks.

In the DoD, the focus typically is multi-functional, which means that many functional experts will be required to participate at some level of effort with the support team and work group in developing solutions consistent with the champion’s expectations. The functional participants need not be assigned to CPI work full time, but they do need to respond in timely manner and proactively when called upon. Specific roles and responsibilities are detailed in Section 3.

Figure 2-5. CPI Implementation Structure



### **Align and Deploy Goals (Fig. 2-2, Block 4)**

One of the key elements in moving an organization forward in a coordinated manner is to align and deploy goals. The goals of an Army platoon need to align with and support the goals of its company, which need to align with and support the goals of its battalion, and so on up to the goals of the Army, which in turn need to align with and support the DoD’s goals. An Air Force squadron’s goals need to align with overall wing and headquarter goals, and a Navy ship’s goals need to align with task force and fleet goals. The goals established for each sub-unit, down to the lowest level of the organization, need to align with and support the organization’s goals. Ultimately, there should be a “line-of-sight” connection between the goals for the lowest level unit in the organization (the person) and those of the highest level organization, the DoD.

It is essential that progress toward goals be formally measured and visible. Metrics should be outcome-based as a tool for daily operations and aligned with the organization's goals. Each metric must have a direct, identifiable, causal relationship with one or more goals. CPI efforts should be selected and implemented in alignment with organizational goals and should strive to have the greatest possible positive effect on optimizing the enterprise value chain and the subordinate value streams.

### ***Create and Refine Operational Plan (Fig. 2-2, Block A)***

The first step at the implementation level is to create and refine the operational plan, which is a detailed plan of action for the process owner and the owner's supporting work group. The operational plan is a commitment to accomplish specific organizationally aligned CPI-related tasks in a specific timeframe.

### ***Implement Operational Plan (Fig. 2-2, Block B)***

Each operational plan is carried out with the support of the CPI support team, the oversight of the steering committee, and sponsorship of the champion. This plan represents a commitment to align actions with goals.

### ***Monitor Progress (Fig. 2-2, Block C)***

The steering committee—sometimes called deployment teams in the early stages of CPI or Lean Six Sigma—guides and provides business focus as the CPI support team's senior practitioners. Its members use appropriate metrics and data in coordination with each work group to determine how the work is proceeding, and they report progress back to the champion. Coaching is an outgrowth of the oversight process. This is the time to evaluate progress toward the goals as laid out in the operational plan.

### ***Focus on CPI (Fig. 2-2, Block D)***

CPI should be a basic strategy for accomplishing the operational plan. CPI enhances current practices by capturing and standardizing the positive results achieved by the work groups.

### ***Re-Entry***

Periodically, the overall process should be revisited to check whether the organization is moving toward the end state as expressed by the mission and vision and as captured in the strategic plan. This requires returning to the beginning and revisiting the mission, vision, and strategic planning steps. All the steps should be revisited in the same disciplined way to ensure that the organization is moving in the right direction.

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## Area 3—Operational Plan

The operational plan's CPI element must support the strategic plan. It is a list of actions that should be taken to achieve an effective CPI program. The goals for the plan are as follows:

1. Identify the actions to achieve the specific organizational transformation, including clear identification of sponsors and leaders.
2. Recognize and build on current good practices.
3. Provide consistent, expanding CPI deployment within the organization.

The operational plan ensures that everyone within the organization shares a common understanding of CPI and that the mission, goals, and objectives of all organizations within the end-to-end value stream are aligned. (Attachment B identifies and discusses key activities and the relationships necessary for a successful operational plan.)

## Area 4—Change Management

Managing the change process is an integral element of a successful CPI implementation. In the DoD, the following are considered keys to systematic change management:

1. *Educate leaders.* Educate key organization leaders on the concepts of CPI, the roles and responsibilities of CPI practitioners, initial and long-term decisions critical to successful change, and why the change is important.
2. *Challenge presumptions.* Challenge the status quo, empirically demonstrate the competitive benefits of change, and answer the question “What’s in it for me?” with a compelling rationale.
3. *Secure agreement.* Secure the agreement of key leaders on the need for change, the objectives necessary to implement that change, and the course of action to begin implementing that change.
4. *Prepare leaders to lead.* Educate and train leaders in defining the new standards for success, and creating the mechanisms necessary to set new expectations and generate results.
5. *Prepare staff to manage the change.* Educate and train the staff to manage the transition from the old culture to the new culture, and to assume new roles during the change.
6. *Educate the organization membership.* Educate and train everyone about the new standards and expectations. The investment in this process saves difficulties downstream and helps to ensure a successful process. Continuous improvement is everyone’s responsibility.
7. *Use DMAIC to identify and carry through with CPI initiatives.* A formal DMAIC or similar approach should be integral to implementing CPI and executing all CPI projects.



Change management begins with reviewing current performance and measuring it against the standard set by management for the organization. It is not possible to improve what is not measured. This measurement gauges the current level of performance against the desired future performance level. The resulting analysis can highlight a variance that needs to be corrected, as well as performance that is inconsistent with achieving the overall goals.

The next system element is to determine the sense of direction for the organization. This element is accomplished by seeing where the organization needs to go to reach its goals. This sense of direction comes from understanding the answers to the following questions:

1. What are the priorities of the organization, and are they aligned with higher level enterprise priorities?
2. What are the environmental elements—internal and external—that will help achieve the goals?
3. What available opportunities can be accomplished, given the current organizational capability?
4. What are promising “quick wins” that can be tackled with the initial CPI deployment while the organization is learning the methodology and realizing its positive benefits?

At this point, we should be ready to communicate the priorities for the next planning period. At the end of this segment of the management cycle, the goals are communicated to those who are required to successfully meet those goals.

Communication begins with managers discussing the priorities with their subordinates. This interaction instills a sense of ownership in the process and provides the opportunity to influence the outcome. Final goals are developed through disciplined DMAIC with explicit expectations in terms of timing, resources to be used, delegation, and capability. The process of delegating is achieved through dialogue between superiors and subordinates ensuring that the goals are clearly understood and that the necessary resources are arranged and made available to complete the goals. The result of delegation is an agreed-to plan that drives the commitment of time and resources. The plan that results from delegating goals is monitored, and coaching is given as needed.

The last review is the final opportunity to assess overall performance. Some goals may have to be carried over, depending on the priorities of the upcoming year. This information could become a basis for the next planning cycle.

Using the CPI deployment cycle creates a model for several important aspects of CPI implementation:

1. Management’s input to the process is more predictable and explicit.
2. Management has clearly communicated what is important and who is responsible for what actions.

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3. The focus is on coaching and facilitating to achieve successful results.
  4. Successes should be celebrated and communicated to reward and encourage continued improvement.

## **Area 5—Metrics**

Metrics are the means to identify worthy goals and determine whether they are achieved. The metrics used to evaluate how an organization is doing need to be aligned with the organization's goals. If, for example, the goal is to optimize cost in all operations, we need to measure costs to do the work that provides customers with recognizable value. The key is to measure total cost. Otherwise, reducing cost in one area might unknowingly and unexpectedly increase it elsewhere in the organization.

If the goal is cycle time reduction and an organization reduces its own cycle time, but simultaneously unknowingly reduces the effectiveness and reliability (an undesirable affect) of another part of the system, the burden is then passed to another activity with possibly a longer overall cycle time. DoD organizations should have a set of metrics and CPI projects that are all actively tracked and reported, and that together achieve improvements without adding unintended offsetting additional expense in other organizational processes.

### ***Leading Metrics versus Lagging Metrics***

Metrics for quality, delivery (throughput and cycle time), and cost are typically measured on a regular basis. Such measures are called lagging metrics because they are collected and reported after something has happened. They are results-oriented and fine for tracking overall performance trends, but by the time a lagging metric reflects a problem, it may already be having a major impact.

Outcome-based—leading—metrics help predict what will happen, allowing at least some problems to be anticipated and avoided. A leading metric might be a frequently recorded basic process metric coupled with a defined set of expectations or limits. An example of a leading metric is first-pass yield measured at each workstation. Operations personnel need leading metrics to minimize problems.

When a cost budget is set, the organization should manage independent metrics, such as overtime hours, to stay within that budget. Cycle time and delivery to schedule are representative dependent metrics. Dependent metrics can generally be used as lagging metrics. Independent metrics can generally be used as leading metrics.

### ***Customer-Oriented, Outcome-Based Metrics***

The outcomes to measure are those that have value in supporting the customer's mission. Several DoD organizations are currently employing customer-oriented, outcome-based metrics. The Navy, for example, uses a Ready For Tasking (RFT) metric to calibrate key processes and measures in its enterprise value chain in terms of aircraft that are available to Fleet Commanders. Management of this kind of metric requires focusing on preventive and predictive actions.

## **Criteria for Evaluating Metrics**

CPI metrics should have five key characteristics:

1. *Valid* metrics actually measure what they are intended to measure.
2. *Obtainable* metrics can actually (and practically) be gathered in a timely manner.
3. *Accurate* metrics can be trusted to give the right information.
4. *Repeatable* metrics give the same answer under the same conditions every time.
5. *Actionable* metrics allow us to do something with the information they provide, which requires both relevance and timeliness.

Other considerations related to metrics include the following:

1. *Face validity*—It may not be obvious that a given metric actually relates to a given goal, even though a causal analysis shows that it does.
2. *Level of aggregation*—Some metrics are only valid or reliable at certain levels of aggregation. For example, when costs at a depot are determined based on depot-wide overhead rates applied to labor, the cost information is only valid when the depot is taken as a whole. The actual cost for any given piece of the organization is likely different from the calculated value. In other cases, aggregated metrics can be misleading or incorrect, even though the individual metrics are correct (this is generally known in the statistics community as “Simpson’s Paradox”).
3. *Data ownership*—Even if the data exist, we might not be able to get access if the data are under the control of an individual or organization that chooses not to make them available. This might require elevation to a higher level to achieve cooperation and overcome resistance to cultural change.



## Section 3.

# CPI Roles and Responsibilities

Successful CPI implementation requires a variety of responsibilities spread across the organization. Some of the responsibilities fall upon existing roles, especially top-level leadership. These roles are applicable to various different organizational levels, and the functions performed are basically the same at each level.

Primary roles are defined below. These describe typical responsibilities; however, exact titles may vary by organization.

### Primary Roles

***CPI champions*** lead CPI within their respective organizations through active sponsorship and drive the development of the mission, vision, strategic plan, and attention to results. They ensure that the necessary resources are available to the steering committees, support teams, and work groups, while monitoring the implementation and sustainment of CPI across the organization.

***CPI steering committees*** participate in creating and sharing the vision, and acknowledge its importance to the organization's success. The steering committee members develop vision-aligned strategies, define operational plans and metrics, monitor performance, and provide guidance and business focus. This group is often referred to as a deployment team in the early stages of CPI or Lean Six Sigma implementation.

***CPI support teams*** provide organizational education and training, and facilitate DMAIC project management of CPI initiatives. The support team works closely with the steering committee and working groups to eliminate barriers to improved performance through CPI initiatives.

***CPI work groups*** accept process ownership and employ applicable CPI tools to analyze the current situation, identify ways to improve operations, seek approval for change, and execute process transformation. These groups utilize the know-how and experience of the individual members and consult, as necessary, with peer groups to accelerate process improvement.

***CPI peer groups*** share common functional responsibilities and provide an opportunity for sharing information about CPI goals, challenges, approaches, activities, and accomplishments. Peer groups share a larger common performance goal above their specific subsets of effort and collectively can influence optimization of CPI initiatives to improve overall organizational performance at affordable cost.

The following paragraphs describe CPI-related organizational roles and assignments, including specific responsibilities, and identify how these responsibilities relate to the CPI deployment cycle. Red borders in the graphics indicate the primary focus areas in the deployment cycle for the role and responsibilities described.

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## ***CPI Champions***

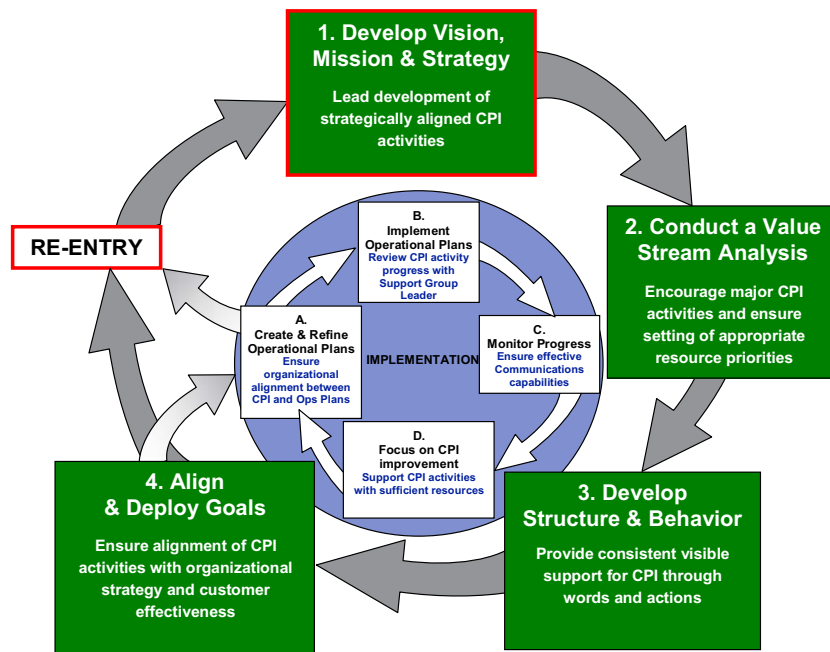
The top management champion has the primary responsibility for creating the vision and leading the development of the enterprise strategic plan. Goals and objectives will be used to align subordinate strategic and operational plan elements that cascade down through the entire organization. CPI champions may also be needed at multiple levels within the organization with similar responsibilities at their respective levels. It is imperative that CPI champions sustain visible support of CPI through consistent words and actions. In the DoD, a CPI champion should be the designated leader of the organization or a highly placed executive, whether an Under Secretary of Defense, commanding officer, or other clearly defined leader for whatever level of organization is building a CPI culture.

The following are the ongoing responsibilities of the top management champion:

- Support the prioritized efforts of all CPI-related functions (CPI steering committees, support teams, and work groups) in the organization's enterprise strategic plan.
- Conduct periodic reviews of CPI-related resource allocations with the support teams, assess CPI projects' effectiveness via progress against aligned metrics, and encourage sharing of ideas and lessons learned across the organization.
- Promote the exchange of CPI knowledge both inside and outside the organization.
- Remove barriers that cause waste or inhibit improvement opportunities.
- Remove fear of failure (punishment) to encourage risk taking.
- Publicly recognize and reward CPI successes.
- Continually convey a sense of urgency and dissatisfaction with the status quo.

The involvement of a top management champion is critical to CPI organizational success beyond isolated islands of excellence. Subordinate champions have the responsibility to align their organizations with the top management champion's vision, the organizational mission, and the enterprise-level strategic plan. It is essential that CPI champions stay well informed of progress through their respective support teams and work group leaders. Key emphasis is on monitoring timely and accurate feedback regarding project results and leading the overall alignment of CPI projects to the organizational vision, mission, and strategic plan. Figure 3-1 illustrates the CPI champions' primary roles and responsibilities.

Figure 3-1. Key CPI Champion Activities



CPI champions play key roles in each stage of implementation, as described below.

### *Develop Vision, Mission, and Strategy (Fig. 3-1, Block 1)*

- Create the organizational vision, and support the organization’s mission.
- Lead strategic planning for the organization.
- Ensure alignment throughout the organization of subordinate plans, objectives, and priorities.

### *Conduct a Value Stream Analysis (Fig. 3-1, Block 2)*

- Support the ongoing value stream analysis of enterprise-level and subordinate organizational processes.
- Charge respective steering committees to identify CPI projects, set priorities, and periodically review project performance to plan with support teams, and reallocate appropriate organizational resources as necessary to ensure cost-effective CPI success.

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### *Develop Structure and Behavior (Fig. 3-1, Block 3)*

- Provide consistent visible support through meaningful interactions with all levels of the organization.
- Take appropriate actions to support funding, review, and recognition support of CPI initiatives on an ongoing basis.

### *Align and Deploy Goals (Fig. 3-1, Block 4)*

- Review ongoing deployment to ensure continued alignment with organizational strategy and customer effectiveness goals and objectives.
- Act as the final point of appeal on decisions for support of particular projects or activities.
- Participate in the decision of how and when to provide incentives for those who actively work to move CPI forward.
  - Reward worthy problem identification.
  - Reward successful project teams.
  - Reward risk-taking project teams that put their best effort into a project that ends up not providing the expected result.

### *Create and Refine Operational Plans (Fig. 3-1, Block A)*

The CPI champion is responsible for the overall ongoing alignment between the strategic plan and the subordinate operational plans. This requires timely and accurate feedback on organizational performance.

### *Implement Operational Plans (Fig. 3-1, Block B)*

The CPI champion should receive formal regular feedback from the support teams on progress in supporting the operational plan to realize the organization's vision and strategic plan. The results need to be expressed in metrics that are directly related to the overall goals set in the strategic planning process.

### *Monitor Progress (Fig. 3-1, Block C)*

The CPI champion requires timely, accurate, regular feedback on the organization's results. The CPI champion needs to ensure that the necessary steps are taken to provide effective organizational communication capabilities.



### *Focus on CPI (Fig. 3-1, Block D)*

The CPI champion should receive regular feedback on how the results from executing the operational plan are being standardized and being used to identify follow-on projects. The CPI champion should communicate achieved results and further opportunities enterprise-wide.

### *Re-Entry*

Periodically, the CPI champion and subordinate staff need to assess the overall organization's progress in moving toward the end state expressed by the mission, vision, and strategic plan.

- Revisit and revise the strategic plan.
- Drive the organization back through the strategic steps and into a new round of implementation steps.

### **CPI Steering Committees**

CPI steering committees should include the decision makers who control the resources for all major functions within the organization. These committees, which are sometimes called deployment teams, make critical decisions regarding CPI priorities and resource allocation for the entire organization. They provide the level and prioritization of resources necessary to accomplish CPI goals. CPI steering committees are normally chaired by a senior leader of the organization and are accountable for CPI deployment actions within the respective organizations of the members; their role may lessen as the organization reaches CPI maturity.

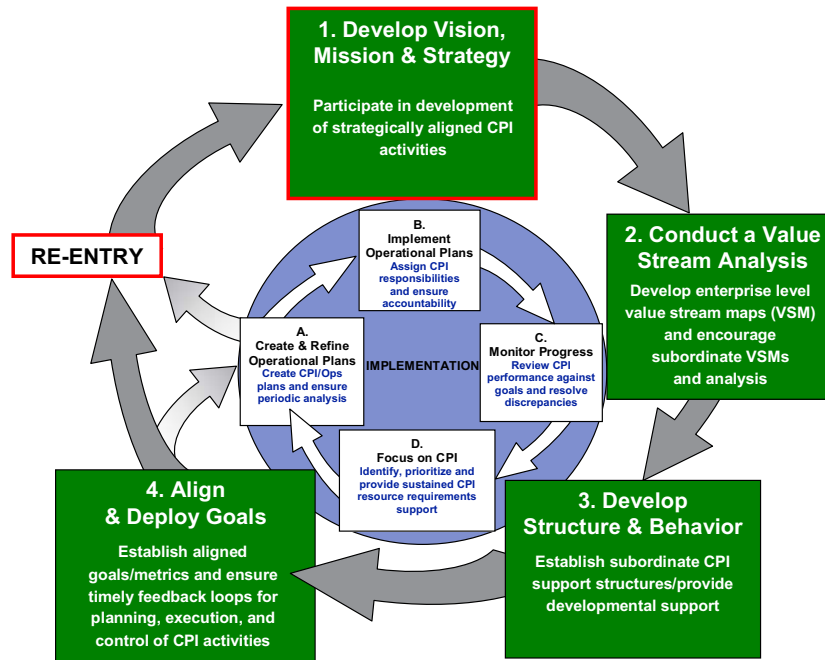
At each level in the organization, a steering committee serves to initiate and monitor deployment and culture change. Although much of the pre-deployment work and early decisions are the responsibility of the CPI steering committee, the need for "steering" will remain until CPI becomes the standard way of operating. As the deployment rolls out, the steering committee monitors progress via the deployment metrics established during pre-deployment and addresses organizational barriers that impede progress toward results.

The following are among the CPI steering committee's primary responsibilities:

- Develop and manage CPI results, goals, objectives, guidelines, and measures. Determine what is needed for successful deployment, and evaluate and report how deployment is performing relative to those needs.
- Establish and manage CPI management processes. Understand risks to deployment; develop contingency plans and execute as needed.
- Execute ongoing deployment of CPI. Ensure that the deployment within the organization is aligned with the strategic plan.
- Ensure integration between CPI activities and other processes to prevent or reconcile conflicts of interest.

Key CPI steering committee roles and responsibilities are depicted in Figure 3-2.

Figure 3-2. Key CPI Steering Committee Activities



CPI steering committees are dedicated to the organizational vision and mission while working with CPI support teams to develop and support the strategic plan and aligned major goals and objectives. CPI steering committees also ensure that the plans and actions of all the subordinate organizations are collaboratively aligned and embrace continuous process improvement.

### *Develop Vision, Mission, and Strategy (Fig. 3-2, Block 1)*

- Support creation of business cases for CPI change initiatives aligned to strategic plans, objectives, and goals. What is the gap that needs to be closed? What is the quantifiable benefit to be gained from closing the gap?
- Work with the CPI support teams to create, communicate, and sustain the sense of urgency across the organization.
- Proactively mitigate risk.
- Integrate the strategic value stream.
  - Align strategy and measures at all levels of the organization.
  - Capture the voice of the customer, and enhance continuing customer communications to anticipate and respond to changing requirements.
  - Develop and sustain the audit process for the CPI deployment.

### ***Conduct a Value Stream Analysis (Fig. 3-2, Block 2)***

CPI steering committees are responsible for encouraging support teams to develop an enterprise-level value stream analysis of the organization. This value stream analysis is used to identify key performance leverage points for CPI initiatives.

CPI steering committees are also responsible for the following actions:

- Analyze the enterprise value stream. This is not a trivial effort and is most likely to continue evolving over time if CPI-driven business transformation is actually embraced.
- Create a future state that accomplishes the mission, vision, and strategic plan.
- Establish aligned goals and metrics with “stretch” goals.
- Identify performance gaps.
- Identify and engage key stakeholders.

### ***Develop Structure and Behavior (Fig. 3-2, Block 3)***

CPI steering committees play a critical role in managing deployment. This includes providing CPI leadership as well as establishing the supporting infrastructure. CPI steering committees are specifically responsible for the following actions:

- Determine the necessary organizational structure and staff requirements for successful CPI implementation. Adapt current organizational structure and business systems to meet those needs.
- Align incentives to support established goals and metrics.
- Define and communicate desired organizational behaviors, and set expectations.
- Support education, training, certification, and coaching of organizational personnel.

### ***Align and Deploy Goals (Fig. 3-2, Block 4)***

CPI steering committees ensure that the organization’s goals are aligned and deployed throughout all of its operational elements and sponsored CPI projects.

### ***Create and Refine Operational Plans (Fig. 3-2, Block A)***

CPI steering committees identify and prioritize the activities necessary for achieving the collaborative goals and objectives of the organization.

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CPI steering committees are also responsible for the following actions:

- Create the operational plan for the organization.
- Develop supportive CPI plans to complement the strategic and operational plans.
- Ensure periodic analysis and corrective action to keep plans on schedule to deliver expected results.

### *Implement Operational Plans (Fig. 3-2, Block B)*

CPI steering committees implement the top-level operational plan and monitor the progress of subordinate organizations. CPI steering committees are also responsible for assigning responsibilities, providing the necessary leadership for prioritizing resources, and establishing accountability for elements of the operational plan.

### *Monitor Progress (Fig. 3-2, Block C)*

CPI steering committees periodically review the progress of the organization and all its elements. This information is used to evaluate the organization's progress toward achieving its major goals.

### *Focus on CPI (Fig. 3-2, Block D)*

CPI steering committees should continue an organizational scan to identify emerging CPI challenges and opportunities. They should also prioritize available resources to sustain progress and encourage a cultural environment of continuous improvement. Employees who have identified new CPI opportunities that are not able to be funded at the time deserve timely encouraging feedback on the status of their suggestions to encourage continued engagement.

### *Re-Entry*

CPI deployment is a never-ending cycle. Each year, the CPI steering committee and support teams should conduct a major review of the past year and update the strategic plan, goals, and objectives to continue the cycle of continuous process improvement. Interim monthly or quarterly updates may be warranted, depending upon the nature of the organization and its processes.

CPI steering committees are also responsible for the following actions:

- Perform formal periodic reviews of the state of CPI deployment within the organization.
- Establish interim updates for activities to ensure progress against stated objectives. Support initiatives that continue to be relevant, and proactively cancel those that are no longer justified through DMAIC analysis.

## ***CPI Support Teams***

CPI support teams are responsible for direct transfer of knowledge to all employees, encouragement to create critical mass for cultural change, and sustaining support for CPI as a journey rather than a project with an end point. The support team's ultimate goal is to create the capacity to sustain a CPI culture without support team involvement. A CPI support team is a collection of individuals who may be full or part-time, depending upon the needs of the organization. External CPI expert facilitators may likely be required at the beginning of an organization's CPI experience to overcome initial inertia and lack of expertise, but they should be expected to transfer CPI-related knowledge to facilitate internalization of all facilitator and training requirements as soon as practicable. Internal change agents and instructors are more effective in the long-term movement toward the required organization's cultural change, due to their insider acceptance and knowledge of processes, people, and obstacles.

The support team's resource requirements should be offset by the savings that are being enabled through their activities. The number of CPI support team members depends on several variables, including available funding, current staffing levels, importance of the goals to be accomplished, and availability of competent resources. It is possible to have a CPI support team whose members individually do not represent the entire range of required competencies but collectively support all the competencies. Cross-training is encouraged so that each member will eventually have multiple competencies.

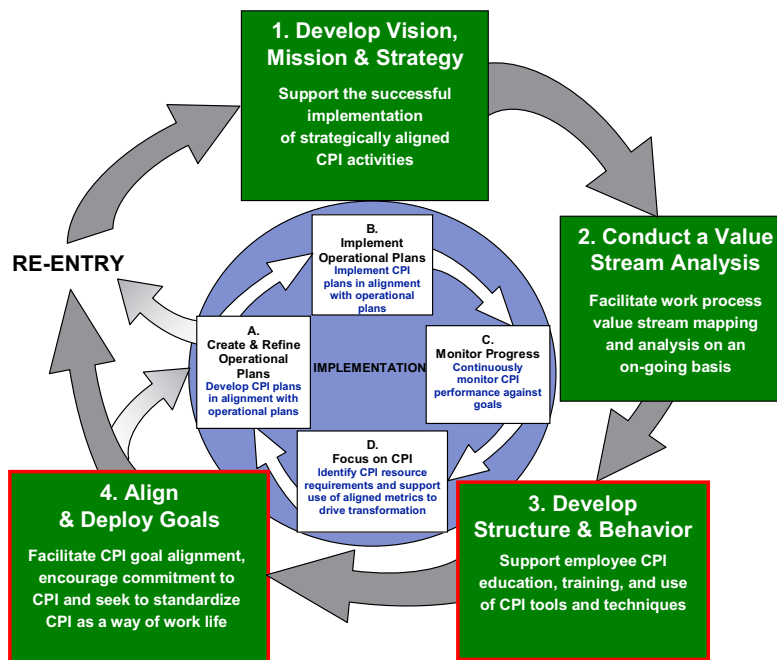
CPI support teams are integral to implementing CPI; therefore, it is essential that the team members possess extensive knowledge of CPI tools, techniques, and concepts, as well as know how to facilitate the development of a CPI culture. Support team members should ultimately take the CPI skills learned back into the operational organizations in another capacity.

CPI support team key responsibilities include the following:

- Transfer CPI knowledge to the work group.
- Plan for and oversee the development of the culture to support CPI.
- Employ DMAIC to identify and manage opportunities for CPI improvement.
- Serve as coaches to all participants in CPI initiatives.

Key support team activities are depicted in Figure 3-3.

Figure 3-3. Key CPI Support Team Activities



### *Develop Vision, Mission, and Strategy (Fig. 3-3, Block 1)*

CPI support teams are responsible for providing expertise throughout the cycle of strategic and tactical CPI improvement. The support team focus is on teaching the organization to operate in a CPI environment with continually improving competency.

The primary role of the support team is to facilitate the operational mission using CPI tools, techniques, and processes. This is accomplished by working with the CPI champions in relation to decisions on using CPI to eliminate waste and variation.

### *Conduct a Value Stream Analysis (Fig. 3-3, Block 2)*

CPI support teams facilitate value stream mapping and analysis of processes. The support teams are also responsible for ensuring that the future state reflects the use and implementation of CPI to support the mission.

CPI support teams focus on the following decisions:

- What are the appropriate initial implementation areas to map?
- What level of detail is necessary in the performance gaps for making decisions on CPI direction?

### *Develop Structure and Behavior (Fig. 3-3, Block 3)*

CPI support team efforts are integral to cultural transformation to a continuous improvement mindset. The following are key team efforts in this area:

- Organize for CPI implementation.
  - CPI support team members should be trained, ready, and available to teach the organization CPI.
  - CPI work groups should have team leaders who can solve problems involving a wide variety of issues.
- Provide education and training.
  - Training can come in three forms: on-the-job, classroom, and individual self-development.
  - Required resources must be funded, time must be provided, and all training should demonstrate relevance to accomplishing the goals.
  - Conduct assessments frequently to validate the payback for resources being spent on training.
- Identify and empower change agents.

CPI support teams should be involved in the following decisions:

- What is the selection process for CPI support team members?
- How can CPI support teams help to translate the status quo into new behavior?

### *Align and Deploy Goals (Fig. 3-3, Block 4)*

Aligning and deploying goals is the lynchpin of the CPI effort. Its purpose is to make sure the tasks for implementing CPI are consistent with operational success. Two aspects of goal deployment are important for the support team to emphasize:

- *Goal alignment*—Aligning CPI goals to ensure satisfaction of the required performance metrics.
- *Gaining commitment*—Achieving commitment, from all those who accomplish tasks, to be willing to go above and beyond what is normally expected. The plan should be complete, doable, measurable, realistic, and written at a level to achieve understanding by anyone involved. Ownership comes from the freedom to determine “how” the goal is accomplished once it has been established.

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CPI support teams share responsibility for the following decisions:

- How can deployment become a universal process for linking CPI and operations?
- How can the review process be standardized?

### *Create and Refine Operational Plans (Fig. 3-3, Block A)*

CPI support teams need to ensure that CPI activity is fully aligned with the operational plan from the top to the bottom of the organization. The support teams are also responsible for the following:

- Evaluate and recommend how fast the training should progress to meet operational performance improvement plans.
- Advise on prioritization of CPI initiatives in alignment with major operational plans.
- Facilitate visual displays that should be used to communicate operational plans and the resulting performance to plan.

### *Implement Operational Plans (Fig. 3-3, Block B)*

The CPI plan needs to be implemented to align with the organization's operations planning. The process for changing the plan should require formal effort, to prevent the operations and process improvement plans from diverging.

1. Develop detailed CPI planning. Plan activities should be written by the person who is responsible for executing the plan in sufficient detail and clarity for thorough understanding.
2. DMAIC should be utilized as a standard process for planning through execution of CPI initiatives and projects.
3. CPI tools must be "fit for purpose."

### *Monitor Progress (Fig. 3-3, Block C)*

The CPI support team needs to continuously monitor performance against goals. Performance against metrics should be made visible to the enterprise at large.

### *Focus on CPI (Fig. 3-3, Block D)*

- CPI support teams have a primary responsibility to identify changing resource requirements and support consistent metrics to drive process improvements.
- The goal should be to transform the organization to a "learning organization" as it progresses through the phases of deployment. This type of organization systematically learns from its experiences of what works and what does not work. The goal of learning is increased innovation, effectiveness, and performance.



- The organization should adopt a formal knowledge management and communication process, such as a web page or community of practice (COP) to collect lessons learned and make them available to all employees.
- Capture lessons learned and post them internally and communicate them externally to other stakeholders.
- Ensure peer groups' cross-functional teaming support of CPI initiatives and projects, and elevate for higher level support if required.

## *Re-Entry*

CPI support teams should assist the champion and steering committee as they reenter the strategic process.

## ***CPI Work Groups***

CPI work groups consist of three types of roles: process owners or sponsors, team leaders, and team members. These groups are ultimately responsible for studying and changing processes to improve their effectiveness and efficiency in accomplishing the organization's goals. The most important task for CPI work groups is to align the goals and activities of their respective processes with those of the organization. CPI work groups primarily focus on accomplishing the four implementation steps of the mission deployment cycle, although they also have an often unrecognized impact on organizational strategy through their level of support for strategic initiatives.

CPI work group process owners or sponsors are the individuals who have ultimate responsibility and authority for the performance and results of the processes being improved. It is essential that process owners be involved in any CPI activity regarding their respective processes. Process owners can exist at a variety of levels within an enterprise, from weapons system program managers to shop floor or staff employees responsible for specific work processes.

CPI work group team leaders are responsible for the overall improvement efforts for processes under their cognizance. The team leader for an improvement effort could be chosen from a variety of organizational roles, such as process owner, engineer, manager, planner, or practically any other function that would participate in the initiative. The team leader's responsibilities are as follows:

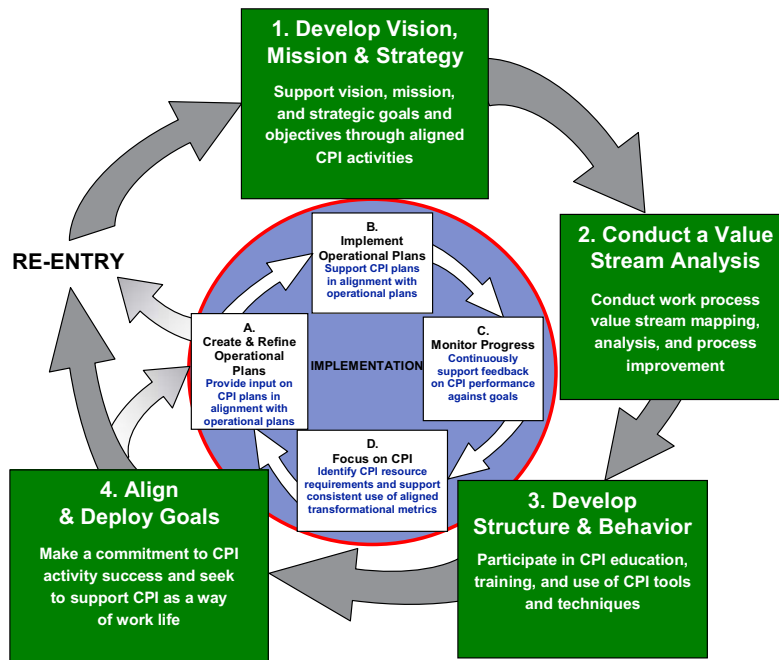
- Coordinate and facilitate team activity.
- Maintain regular communication with all other CPI participants at various levels as needed.
- Monitor, manage, and ensure documentation of team progress through metrics tracking.

CPI work group team members are knowledgeable about and have a stake in the process being improved. They are the ones who directly employ DMAIC and physically change the actual process. Their responsibilities are as follows:

- Participate in charter development and abide by it.
- Seek simplified and/or new ideas and ways to perform their jobs.
- Participate in appropriate peer groups.
- Participate in ongoing education and training to continuously improve their performance contributions.

Key CPI work group activities are depicted in Figure 3-4.

*Figure 3-4. Key CPI Work Group Activities*



### *Develop Vision, Mission, and Strategy (Fig. 3-4, Block 1)*

CPI work groups have a supportive role regarding the organization’s vision, mission, and strategic goals and objectives, through aligned CPI activity and a focus on performance to organizational metrics. Process owners play a key role in strategic planning input and performance improvement for their respective processes. They also stress alignment with organizational metrics and movement toward CPI transformation and improved business results.

### ***Conduct a Value Stream Analysis (Fig. 3-4, Block 2)***

CPI work groups and process owners play a critically active role in mapping and analyzing the value stream and in improving their organizational processes.

### ***Develop Structure and Behavior (Fig. 3-4, Block 3)***

CPI work groups and process owners participate in CPI education, training, and using CPI tools and techniques.

### ***Align and Deploy Goals (Fig. 3-4, Block 4)***

CPI transformation cannot occur without the cultural change within work groups and process owners to their commitment to continuous improvement as a way of work life.

### ***Create and Refine Operational Plans (Fig. 3-4, Block A)***

Though not a direct responsibility, except in the case of higher level process owners, CPI work groups provide inputs and participate in discussions to identify and prioritize improvement activities. This includes “close-to-the-process” expert opinion and familiarity with process issues.

### ***Implement Operational Plans (Fig. 3-4, Block B)***

Implementing operational plans is the primary CPI work group responsibility. It consists of the following tasks:

- Provide recommendations and suggestions for the CPI plan.
- Implement continuous process improvement activities. Work group members accomplish these activities by using CPI tools, techniques, and processes.

### ***Monitor Progress (Fig. 3-4, Block C)***

Performance reporting and monitoring by CPI work groups ensure timely feedback and corrective action. The CPI support team and process owner monitors CPI work group activities periodically. CPI work groups establish and manage metrics that align with the accomplishment of organizational goals. These metrics should be managed visually. This allows the team to conduct self monitoring.

### ***Focus on CPI (Fig. 3-4, Block D)***

CPI work groups have direct responsibility for all CPI tasks related to their part of the operational plan, and need to actively communicate their results to the CPI support team.

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## *Re-Entry*

CPI work groups and process owners might not have a direct role in reentry to the strategic planning stage, although they might assist the CPI champion as requested, since they are the first line of process knowledge within the organization.

## ***CPI Peer Groups***

CPI peer groups are functionally aligned committees that should be established to facilitate sharing of CPI insights and lessons learned regarding particular areas of expertise (such as gas turbine engine repairs, human resource management, or CPI training and certification). Cross-service peer groups can be very helpful in maintaining an enterprise-wide focus and ensuring consistent application of CPI concepts and tools throughout the DoD. All participants in the CPI process, particularly support teams, should foster establishment of such groups to help facilitate knowledge sharing and information on best practices. Service and agency headquarters activities should be aware of all cross-service or joint peer groups and ensure that they provide appropriate participation and support.

## **Other Important Roles and Responsibilities**

Implementing CPI depends on developing a supporting infrastructure that has a number of elements. The contributions of the following organizations may not be obvious but may be necessary for effective implementation. Consider all such functions as potential stakeholders who may need to participate in CPI activities to achieve the planned improvements. An end-to-end value stream approach will help identify all organizational elements that have an impact on value stream operations. Similarly, CPI activities within any one of these elements (or, indeed, within any DoD discipline) should consider all other stakeholders, no matter what discipline is the principal focus or genesis of the CPI activity.

## ***IT Personnel and Vendors***

One of the key elements of a CPI program is that it is driven by data. That requires appropriate systems to be in place to gather and analyze the data, and present the results. Support from both organic information technology (IT) personnel and outside system vendors may be necessary. IT staff and vendors should ensure that clarity exists in the function to be performed before determining the system form. Simplify first, then apply technology as an enabler where warranted.

## ***Contracting***

CPI frequently involves understanding or seeking modifications to contractual arrangements, particularly when the scope of work involves contractor support. Also, CPI implementation sometimes involves the need for contractor support to facilitate improvement efforts. Contracting personnel should be involved in CPI efforts as appropriate to anticipate and resolve contract-related issues and foster supply chain partnering as warranted.

## ***Facilities Management***

Implementing CPI frequently means moving equipment to get a better flow of material. Facilities support is often required to ensure that electrical, hydraulic, pneumatic, and water systems support the new layout. In some cases, the changes can be substantial. For example, a repair process may go from individual bays to a sequential process laid out as a pulsing or moving line. One result of CPI efforts is that space requirements usually go down, often dramatically. This may allow a process to be moved into a different building, freeing up the original building for other use. One of the responsibilities of facilities personnel is to create a master layout that incorporates flexibility for continued physical improvements through re-layout.

## ***Human Resources***

Successful CPI deployment often involves modifying work-related behavior and the incentives that drive it. There are also important training, certification, and role-related issues inherent in building an effective CPI organizational capacity. Human resource staffs and points of contact may be instrumental in structuring and sustaining CPI efforts and should be integrated into planning and deployment activities as appropriate.

## ***Supply***

Many CPI efforts involve a need to dramatically improve the availability of inventory or material. This can entail issues of materiel delivery, scheduling, and location. Supply personnel are essential to identifying and resolving such problems. This happens in industrial, field, and office settings. Supply should be a full team player in CPI implementations.

## ***Labor Unions***

The support and involvement of union representatives is essential and vital to successful CPI initiatives. Seek a win-win approach to partnering for continuous improvement of processes.

## ***Finance***

A hallmark of a good CPI program is the ability to act quickly to make a change that addresses a problem. The assistance of the organization's financial staff is an enabler of such changes in costing potential and achieved improvements, and eliminating unnecessary financial barriers. Additionally, it is important that the DoD's evolving enterprise financial management infrastructure support and integrate with CPI efforts. Financial management staffs are necessary to assist with the structure and validation of CPI investments and savings.

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## ***Engineering***

Engineering groups will be needed to support CPI implementation in several ways:

- Engineering help is often needed to support CPI implementation on the shop floor. Process changes are important in achieving the most efficient results. Such changes may need engineering contributions and approval, which often need to happen quickly to keep the shop floor moving forward.
- Engineering personnel make key contributions in applying CPI to reliability and obsolescence issues and processes. Engineering assists in determining the processes that need to be improved, setting the requirements for those processes, and participating in the change effort.
- Engineering plays a critical role in approving parts for purchase, by establishing specifications, participating in design reviews (if not taking outright responsibility for the design), and evaluating first-article test results. All of these activities directly affect the lead time for procuring the parts needed to repair or upgrade weapon systems.
- Engineering assists in resolving difficult technical problems.
- Engineering accumulates the standards achieved in the organization and incorporates them into new opportunities.
- Engineering seeks to expand the involvement of process owners and work groups in day-to-day work area technical processes that might not need an engineer for problem solving decision-making and correction.

# **Attachment A. Resources**

This reference list has five sections: Books, DoD Resources, Educational Resources, Professional Associations, and Other Useful Information Sources. Each section is alphabetized by title.





## Books

Table A-1. Change Management

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>Decision Making for Leaders</i> by T. L. Saaty	Easy guide to making decisions in the complex world of business.	Master Black Belt (MBB), senior management	Yes	09620317-04
<i>Good to Great: Why Some Companies Make the Leap and Others Don't</i> by Jim Collins	Results of a study of 28 companies that made the leap from good to great. The findings serve as a guide for change management and leadership.	Management	Yes	0066620996
<i>Guiding Successful Six Sigma Projects</i> by ORIEL, Inc.	This handy guide can help anyone who takes part in or oversees an improvement or design effort. It summarizes roles, project steps, and key points you need to check throughout a project.	Black Belt (BB), MBB		1884731228
<i>Leading Six Sigma</i> by Ronald Snee and Roger Hoerl	A Step-by-Step Guide based on experience with GE and Other Six Sigma Companies. An excellent resource from leaders in the Six Sigma movement who have lead Six Sigma efforts at leading companies.	Leadership	Yes	0130084573
<i>Lean Six Sigma: A Practitioner's Guide</i> by Ian Wedgwood	Captures best-practice Lean Sigma experience from multiple projects and industries, helping any professional identify the solution that will work best—and implement it.	Everyone	Yes	0132390787
<i>Making Change Work: Practical Tools for Overcoming Human Resistance to Change</i> by Brien Palmer	Provides tools for evaluating an organization's readiness for change, and for successful change management.	BB, MBB, management	No	0873896114
<i>Six Sigma for Managers</i> by Greg Brue	Eye-catching and useful graphics for busy executives and managers.	Management		0071455485
<i>The Leader: Developing The Skills And Personal Qualities You Need To Lead Effectively</i> by Normand L. Frigon Sr. and Harry K. Jackson Jr.	Basic guide on leadership. Includes process, tools and techniques needed to develop or refine leadership ability.	Leadership	No	0974713503
<i>The Lean Manufacturing Pocket Handbook</i> by Kenneth Dailey	Concise, handy guide to lean manufacturing.	Everyone	No	1933878142
<i>The Strategy-Focused Organization: How Balanced Scorecard Companies Thrive in the New Business Environment</i> by Robert S. Kaplan and David P. Norton	Explains how companies like Mobil, CIGNA, and Chemical Retail Bank have effectively used balanced scorecard and present a step-by-step implementation outline that other organizations could use to attain similar results. Includes strategy maps.	Everyone	Yes	1578512506

**Table A-1. Change Management**

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>Why Change Doesn't Work: Why Initiatives Go Wrong and How to Try Again and Succeed</i> by Harvey Robbins and Michael Finley	Examines the challenges faced when embarking on a course of organizational change. The authors provide suggestions and guidance for dealing with the challenges.	Everyone	No	1-56079-944-7
<i>World Class Quality</i> by Keki Bhote and Adi Bhote	Stresses practical application to problem solving in an understandable fashion.	Everyone		0814404278

**Table A-2. Continuous Process Improvement**

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>A Field Guide to Focused Planning: Hoshin Kanri-American Style</i> by Joseph F. Colletti	Shows how to generate and link the high level metrics of the enterprise down to the processes in the enterprise that are generating the actual product or service.	Green Belt (GB), BB, MBB		0965071812
<i>A Self Teaching Guide To Statistics</i> by Donald Koosis	Lays out statistics logically and in straightforward fashion.	GB, BB, MBB		0471146889
<i>Activity Based Costing: Making It Work for Small and Mid-Sized Companies</i> by Douglas Hicks	An outstanding book that shows how to apply ABC in an effective manner without a massive investment in resources, although titled for "small and mid-sized," larger companies would do well to read and understand.	Anyone interested in activity-based costing	Yes	0471249599
<i>Basic Statistics: Tools for Continuous Improvement 4th Edition</i> by Mark J. Kiemle, Stephen R. Schmidt and Ronald J. Berdine	Basic statistical reference for all CPI practitioners.	CPI Practitioners		188156067
<i>Customer Service Measurement</i> by David Wilkerson and Clifton Cooksey	Takes customer service and reviews the topic from a practical perspective.	Everyone		0944533086
<i>Handbook of Quality Tools</i> by Kasuo Ozeki and Tetsuichi Asaka	Accessible to all organizational personnel, contains information for management and shop floor people. It addresses management issues, roles, challenges, implementing improvements, process control, and leadership.	Everyone		0915299453
<i>Implementing Six Sigma: Smarter Solutions Using Statistical Methods</i> by Forrest Breyfogle	A powerful overall reference for those directly involved in quality and process improvement initiatives.	BB, MBB	Yes	0471265721
<i>Introduction to Statistical Quality Control</i> by Douglas Montgomery	This book has a strong management and engineering orientation and covers the subject comprehensively.	BB, MBB		0470169923

Table A-2. Continuous Process Improvement

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>Lean Enterprise Value: Insights from MIT's Lean Aerospace Initiative</i> , Earl Murman, et al	Based on the eight-year Lean Aerospace Initiative study at MIT, this book shows a value creation framework for the aerospace industry. It gives five principles for creating lean enterprise value.	BB, MBB	Yes	0333976975
<i>Lean Extended Enterprise: Moving Beyond the Four Walls to Value Stream Excellence</i> by Steven Boe-der and Terence Burton	This book looks at lean from a big picture enterprise level across a broad spectrum of CPI concepts and tools. It contains helpful checklists, guides and progress measurement tools.	BB, MBB	No	1932159126
<i>Lean Logistics: The Nut and Bolts of Delivering Materials and Goods</i> by Michael Baudin	Lean in the logistics world.	BB, MBB		1563272962
<i>Lean Manufacturing for the Small Shop</i> by Gary Conner	Can help practitioners and change agents apply Lean quickly, with an emphasis on smaller manufacturing organizations.	GB, BB		0872635201
<i>Lean Manufacturing: A Plant Floor Guide</i> by John Allen, Charles Robinson, and David Stewart	Outlines the necessary elements in implementing lean manufacturing methods. Presents advice on identifying the causes of waste, profiling the business' needs, mapping the value stream, crafting policies, problem solving, and applying lean tools.	BB, MBB	Yes	0872635252
<i>Lean Six Sigma</i> by Michael George	Very complete treatment of the integration of Lean and Six Sigma and the strong reasons for combining them.	Everyone	Yes	0071385215
<i>Lean Six Sigma for Service: How to Use Lean Speed and Six Sigma Quality to Improve Services and Transactions</i> , by Michael L. George	A "how to" for applying the Lean Six Sigma methodology in non-manufacturing.	Everyone	Yes	0071418210
<i>Lean Six Sigma: Combining Six Sigma Quality with Lean Production Speed</i> by Michael George	Explains how to integrate Lean Production and Six Sigma. The author shows how Lean and Six Sigma complement each other and provides a detailed roadmap for integrated implementation.	Everyone	Yes	0071385215
<i>Lean Solutions: How Companies and Customers Can Create Value and Wealth Together</i> by James Womack and Daniel Jones	Offers a win-win approach to customer-supplier efforts with representative case study examples. The authors coin the term 'lean provisioning' as a new perspective that goes beyond the original lean focus and approach.	GB, BB, MBB	Yes	0743277783
<i>Lean Thinking: Banish Waste &amp; Create Wealth in Your Corporation</i> by James Womack and D. T. Jones	Overview of lean thinking and three in-depth write-ups of how a small, medium and large firm accomplished it.	Anyone interested in Lean thinking	Yes	0684810352

Table A-2. Continuous Process Improvement

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>Lean Transformation: How to Change Your Business into a Lean Enterprise</i> , by Bruce A. Henderson and Jorge L. Larco	A guide to learning an enterprise from a business perspective.	BB, MBB, management		0-9646601-2-1
<i>Learning to See: Value Stream Mapping to Add Value &amp; Eliminate Muda</i> by Mike Rother and John Shook	A "tool kit" for value stream mapping. It is divided into the following sections: getting started, current state mapping, lean value stream concepts and thinking, future state mapping, and achieving the future desired state.	GB, BB, MBB	Yes	June 1999
<i>Making Six Sigma Last</i> by George Eckes	Concise book with examples.	Everyone	Yes	0471415480
<i>Manufacturing Processes Reference Guide</i> by Todd R.H., Allen D.K and Altling L.	Good for using score cards for designing products against customer requirements.	BB, MBB	Yes	0831120490
<i>Measuring Six Sigma and Beyond: Continuous vs. Attribute Data</i> by Ron Lawson and Bob Stuart	Excellent description of data types and proper application.	BB, MBB		156946023
<i>Memory Jogger Booklet</i>	Useful and practical tool for those involved in continuous improvement.	GB, BB, MBB		Goal/QPC-Joiner Publications
<i>MINITAB Handbook</i> by Barbara Ryan and Brian Joiner	Provides practical guidance for effective MINITAB application.	Everyone		0534496008
<i>Office Kaizen: Transforming Office Operations into a Strategic Competitive Advantage</i> by William Lareau	A useful resource for those working to improve office effectiveness.	Anyone interested in learning about Kaizen		0873895568
<i>Process Improvement</i> by Clifton Cooksey, Richard Beans and Debra Eshelman	An overview of the topic with useful information.	Everyone		094453306
<i>Quality Essentials: A Reference Guide from A to Z</i> by Jack B. ReVelle	Compendium of CPI topics alphabetized and illustrated for easy reference. An essential reference for all CPI practitioners.	BB, MBB		0873896181
<i>Quality Improvement Tools &amp; Techniques</i> by Peter Mears	Outstanding book for concise explanations of all the tools and each explanation ends with a problem for the reader to solve.	Everyone		0070412197
<i>Quality in the Communications Process</i> by Charles Sengstock Jr.	Breaks down a difficult topic to show the relevance of process improvement.	Everyone		1569460221
<i>Quick Study Laminated Statistics Card</i>	Excellent quick reference.	BB, MBB		www.barcharts.com

Table A-2. Continuous Process Improvement

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>Rath and Strong's Six Sigma Pocket Guide</i> by Rath & Strong Management Consultants and AON Management Consulting	Useful and powerful reference tool.	Everyone		
<i>Reengineering the Corporation: A Manifesto for Business Revolution</i> by Michael Hammer and James Champy	The original guide to reengineering.	Anyone interested in history of reengineering		0060559535
<i>Reliability, Availability and Maintainability Analysis of Redundant and Non-Redundant Systems</i> by Michael Sparkman and David Heinzelmann	In-depth analysis of these topics in a systems environment.	MBB		1569460140
<i>Response Surface Methodology</i> by R.H Myers and D.C. Montgomery	Process and produce optimization using designed experiments.	BB, MBB	Yes	0471412554
<i>Revolution in Manufacturing: The SMED System</i> by Shingo, Shige	Initial text by father of single minute exchange of dies concept.	BB, MBB		0915299038
<i>Six Sigma for Managers</i> by Greg Brue	Managerial guide to using Six Sigma in any organization.	Management		0071387552
<i>Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations</i> by Mikel Harry (Ph.D.) and Richard	Good overview of Six Sigma methodologies.	Everyone	Yes	0385494378
<i>Six Thinking Hats</i> by Edward de Bono	Helps you look at difficult decisions from a number of perspectives.	Everyone		0316177911
<i>Statistical Methods for Quality Improvement 2nd Edition</i> by Thomas Ryan	A text on variability reduction for Black Belt and Master Black Belt level.	BB, MBB		0471197750
<i>Statistical Process Control Reference Manual</i> by Chrysler, Ford Motor and General Motors	A comprehensive review of the subject.	BB, MBB		Second Printing, 1995
<i>Statistical Quality Control: Strategies and Tools for Continual Improvement</i> by Johannes Ledolter and C. W. Burrill	A very well thought-out book covering both the team problem-solving aspects (excellent explanation of Nominal Group and Delphi Techniques) and the statistics (analysis of data, hypothesis testing, control charts, DOE (both classical and Taguchi methods) and Response Surface Methodology).	BB, MBB		0471193784

Table A-2. Continuous Process Improvement

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>Strategic Six Sigma: Best Practices from the Executive Suite</i> by Richard Smith, Jerome Blakeslee and Richard Koonce	Great reference for senior executives.	Management	Yes	0471232947
<i>Survey Assessment</i> by David Wilkerson and Jefferson Jellogg	Overview of various survey tools and their correct application.	GB, BB		0944533094
<i>Systematic Innovation: An Introduction to TRIZ</i>	Views and examines technical problem solving from various perspectives.	Everyone		1574441116
<i>The 5S Pocket Guide</i> by J Peterson, and R. Smith	A good pocket guide about the 5S's and how to apply them.	Everyone	No	0527763381
<i>The Complete Lean Enterprise: Value Stream Mapping for Administrative and Office Processes</i> , by Beau Keyte and Drew Locher	A good overview of Value Stream Mapping for quick application.	GB, BB		1563273012
<i>The Goal: A Process of On-Going Improvement</i> by E.M. Goldratt and Jeff Cox	Introduces the Theory of Constraints and applies it in manufacturing.	GB, BB, MBB	Yes	0884270610
<i>The Kaizen Blitz: Accelerating Breakthroughs in Production and Performance</i> by Anthony Laraia, Robert Hall and Patricia Moody	Presents their lessons learned since the inception of this key process improvement activity. A systematic approach to planning, executing, and achieving results with a kaizen blitz are provided and case studies are used to emphasize the potential.	GB, BB, MBB	Yes	0471246484
<i>The Lean Six Sigma Pocket Toolbook: A Quick Reference Guide to 70 Tools for Improving Quality and Speed</i> , by Michael L. George, John Maxey, David T. Rowlands and Mark Price	Outstanding Quick Reference Guide for 70+ Lean Six Sigma Tools.	Everyone	No	0071441190
<i>The Nature of Six Sigma Quality</i> by Mikel Harry	A reference about 6S quality that addresses Motorola's application.	Management		1569460094
<i>The Power of Six Sigma</i> by Subir Chowdhury	Simple and engaging quick read to give a high-level understanding of Six Sigma.	Everyone		0793144345
<i>The Six Sigma Handbook</i> by Thomas Pyzdek	Deals with problem solving, team building issues. Clear writing on performance improvement topics.	Everyone		0071410155
<i>The Six Sigma Way</i> by Peter Pande, et al	Best seller on Six Sigma with special importance for transactional processes. Pande is a consultant who works with GE Capital, American Express and Sears & Roebuck.	Management	Yes	0071358064

Table A-2. Continuous Process Improvement

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer</i> by Jeffrey Liker	Reveals the 14 foundational management principles behind the automaker's world-famous system of "Lean production." Principles are discussed in four categories: philosophy, process, people, and problem-solving.	GB, BB, MBB	Yes	0071392319
<i>The Visual Factory: Building Participation Through Shared Information</i> by Michel Greif	What's the best way to make process performance known throughout the organization? Read this book and put it into action.	BB, MBB, Management		0915299674
<i>Theory of Constraints</i> by John Teminko	Discusses the key concepts involved in Goldratt's theory of constraints: the five focusing steps; the process of change; how to prove effect-cause-effect; and how to create simple solutions to complex problems. In addition, the author discusses the adverse impact that organizational and cultural issues can have on process improvement efforts.	BB, MBB		
<i>Tolerance Design</i> by C.M Creveling	Good for using score cards for designing products and processes against specifications.	BB, MBB	Yes	0201634732
<i>Toyota Production System: Beyond Large-Scale Production</i> by Taiichi Ohno	The basic description of the Toyota Production System.	BB, MBB, Management		0915299143
<i>TPM for the Lean Factory: Innovative Methods and Worksheets for Equipment Management</i> , by Sekine, Keniche and Arai, Keisuke	A description of the Total Productive Maintenance process. Includes description of how to implement TPM.	BB, MBB	Yes	1563271915
<i>Understanding Industrial Designed Experiments (4th Edition)</i> by Stephen R. Schmidt & Robert Launsby	A very practical text that "Blends the best of the best designed experiment techniques." Deals with Taguchi, Shining and classical DOE, tells you which is best for a given situation and why. Has a great "Rule of Thumb" appendix and includes data and simulation packages.	BB, MBB		1880156032
<i>Understanding Statistical Process Control</i> by Donald Wheeler and David Chowders	Explains foundation of Shewart's control charts in depth.	BB, MBB		0945320132
<i>Understanding Variation</i> by Donald Wheeler	A great book for starting the process of understanding process variation and how to make rational decisions about it—a short and very concise read.	GB, BB, MBB		0945320353

**Table A-2. Continuous Process Improvement**

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>Value Stream Management for the Lean Office: Eight Steps in Planning, Mapping and Sustaining Lean Improvements in Administrative Areas</i> by Don Tapping and Tom Shaker	A step-by-step approach to VSM in the administrative setting.	GB, BB, MBB		1563272466
<i>Value Stream Management: Eight Steps to Planning, Mapping &amp; Sustaining Lean Improvements</i> by Don Tapping, Tom Shaker and Tom Luster	A how-to manual for implementing and sustaining lean improvements. It is very well organized, simple to follow and provides ready to use reference material in the form of hard copies and a compact disc (CD). A valuable reference for those wanting a down to earth approach to implementing lean improvements.	Everyone	Yes	1563272458

**Table A-3. Design for Lean Six Sigma**

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>Better Designs in Half the Time: Implementing QFD Quality Function Deployment</i> by Bob King	Basic reference on QFD. The book that introduced QFD to the U.S.	BB, MBB		1879364018
<i>Design and Analysis of Experiments</i> by Douglas Montgomery	Excellent foundational book on the subject.	BB, MBB	Yes	0471733040
<i>Design and Management of Service Processes</i> by Orit Ramaswamy	An excellent book on characterizing and improving service (transactional) processes (one of the AT&T series).	Everyone		0201633833
<i>Design for Six Sigma: A Roadmap for Product Development</i> by Kai Yang and Basem El-Haik	Fundamental handbook for all designers.	GB, BB, MBB		0071412085
<i>Experiments with Mixtures</i> by John Cornell	Designs, models and the analysis of mixture data.	BB, MBB	Yes	0471393673
<i>Fast Innovation</i> by Michael L. George, James Works and Kimberly Watson-Hemphill	Achieving Superior Differentiation, Speed to Market, and Increased Profitability by understanding the art of innovation.	BB, MBB	Yes	0071457895
<i>Function Deployment: How to Make QFD Work for You</i> , by Lou Cohen	The book to buy if you are trying to learn QFD.	BB, MBB		0201633302



Table A-3. Design for Lean Six Sigma

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>Patterns of Problem Solving 2nd Edition</i> by Moshe Rubenstein and Iris R. Firstenberg	An engineering approach to fact based decision making.	BB, MBB		0131227068
<i>Quality Engineering Using Robust Design</i> by Madhav S. Phadke	Background and application of Taguchi experimentation methods (one of the AT&T series). Good book on Taguchi and Robust Design methods.	Anyone interested in quality engineering		0137451679
<i>Step-By-Step QFD: Customer Driven Product Design (2nd Edition)</i> by John Terninko	Great introduction to QFD as well as TRIZ and Taguchi.	BB, MBB		1574441108
<i>The Innovation Algorithm: TRIZ, Systematic Innovation and Technical Creativity</i> by Genrich Altshuller, translated by Lev Shulyak and Steven Rodman	Description of ARIZ, TRIZ's problem solving algorithm.	MBB		0964074044
<i>The QFD Handbook</i> by Jack ReVelle, J.W. Moran and C. A Cox	Covers a wide variety of techniques and applications for assisting the translation of customer needs into the design of products and services and the related processes necessary to produce/deliver them.	BB, MBB		0471173819
<i>Today and Tomorrow</i> by Henry Ford	Ford's early text on mass production. One of the source documents for the thinking that drove the Toyota Production System.	Everyone		9780915299362
<i>Tools for Thinking and Problem Solving</i> by Moshe Rubenstein	A compendium of tools for problem solving and decision making.			0139251405

## Reliability Engineering

Table A-4. Reliability Engineering

Title and author	Why it is useful	Best for	Case studies	ISBN
<i>Practical Reliability Engineering 4th Edition</i> by Patrick D. T. O'Connor	Text on reliability engineering and management. Provides preparation for ASQ Certified Reliability Engineer examination.	MBB		0470844639
<i>Quality Engineering Statistics</i> by Robert Dovich	Statistics application in engineering quality context.	BB, MBB		0873891414
<i>Reliability Engineering Handbook</i> by Dodson and Nolan	Basic reliability engineering text.	BB, MBB		0824703642
<i>Reliability-Centered Maintenance 2nd Edition</i> by John Moubray	Basic reference on RCM.	BB, MBB		0831131462
<i>Repairable Systems Reliability</i> by Ascher and Feingold	Specifics of applying reliability to repairable systems.	Anyone interested in systems reliability		1574446207
<i>Systems Engineering and Analysis</i> by Benjamin Blanchard and Wikter Fabrycky	Basic introductory text on systems engineering.	Anyone interested in systems engineering		0131869779

## DoD Resources

Table A-5. DoD Resources

Website name	Why it is useful	Best for	URL
Air Force Material Command Lean Transformation	Contains a variety of information on the DMT Trailblazers, material initiatives, change management information and a library of briefings.	Everyone	<a href="https://afkm.wpafb.af.mil/ASPs/CoP/openCoP.asp?Filter=OO-LG-CC-DM">https://afkm.wpafb.af.mil/ASPs/CoP/openCoP.asp?Filter=OO-LG-CC-DM</a>
Army Lean Six Sigma	Contains Army program information and useful links to applicable topics.	Everyone	<a href="http://www.amc.army.mil/pa/leansixsigma.asp">http://www.amc.army.mil/pa/leansixsigma.asp</a>
DoD Maintenance Policy Programs and Resources (ADUSD(MPP&R))	The lean section of the ADUSD(MPP&R) website contains briefings on a broad range of productivity improvement initiatives in the DoD maintenance arena and hyperlinks to numerous resources regarding lean concepts and other productivity improvement tools.	Everyone	<a href="http://www.acq.osd.mil/log/mppr/index.htm">http://www.acq.osd.mil/log/mppr/index.htm</a>
iSixSigma	This website provides a great deal of information on how six sigma and lean can be integrated. It also contains an online dictionary, events calendar, resource center and many other reference materials.	Everyone	<a href="http://www.isixsigma.com/me/lean_manufacturing/">http://www.isixsigma.com/me/lean_manufacturing/</a>
Marine Corps Logistics Command (MATCOM)	The MATCOM website contains links to productivity improvement initiatives being pursued by the Marine Corps Maintenance Centers at Albany and Barstow.	Everyone	<a href="http://www.matcom.usmc.mil/">http://www.matcom.usmc.mil/</a>
Massachusetts Institute of Technology Lean Aerospace Initiative	The Lean Aerospace Initiative (LAI) was formally launched in 1993 when leaders from the U.S. Air Force, Massachusetts Institute of Technology (MIT), labor unions, and defense aerospace businesses forged a trail-blazing partnership to transform the industry, reinvigorate the workplace using lean concepts and tools.	Everyone	<a href="http://lean.mit.edu/">http://lean.mit.edu/</a>
Mid-America Manufacturing Technology Center (MAMTC)	MAMTC is a service organization that helps small and mid-sized manufacturers increase their sales and productivity, reduce costs, and improve quality. Their web site provides a variety of lean resources, explanations of concepts, and links to other sites.	Everyone	<a href="http://www.mamtc.com/lean/index.asp">http://www.mamtc.com/lean/index.asp</a>

Table A-5. DoD Resources

Website name	Why it is useful	Best for	URL
Superfactory	This is a website that began in 1997 as a simple compilation of internet links for manufacturing excellence resources. Since that time, Superfactory has continued to expand and now contains a broad range of learning aids, PowerPoint presentations and resource materials. Some of these materials are free and others require purchase.	Everyone	<a href="http://www.superfactory.com/">http://www.superfactory.com/</a>
University of Dayton Center for Competitive Change	Provides educational tools that are designed to capture and deliver the "how to's" of competitive change in a way that blends theory with successful practice and incorporates easily implementable, take-home methodologies.	Everyone	<a href="http://www.competitivechange.com/">http://www.competitivechange.com/</a>
University of Kentucky Lean Manufacturing Program	Offers a comprehensive program of assistance to companies in all phases of implementing lean manufacturing. Program elements include consultation, workshops, education and training courses, and in-plant workshops designed so that follow up activities may be conducted by internal facilitators.	Everyone	<a href="http://www.mfg.uky.edu/lean/">http://www.mfg.uky.edu/lean/</a>

## Educational Resources

Table A-6. Educational Resources

Website name	Why it is useful	Best for	URL
Massachusetts Institute of Technology Lean Aerospace Initiative	The Lean Aerospace Initiative (LAI) was formally launched in 1993 when leaders from the U.S. Air Force, Massachusetts Institute of Technology (MIT), labor unions, and defense aerospace businesses forged a trailblazing partnership to transform the industry, reinvigorate the workplace using lean concepts and tools.	Everyone	<a href="http://lean.mit.edu/">http://lean.mit.edu/</a>
University of Dayton Center for Competitive Change	The Center for Competitive Change provides educational tools that are designed to capture and deliver the “how to’s” of competitive change in a way that blends theory with successful practice and incorporates easily implementable, take-home methodologies.	Everyone	<a href="http://www.competitivechange.com/">http://www.competitivechange.com/</a>
University of Kentucky Lean Manufacturing Program	The UK Center for Manufacturing offers a comprehensive program of assistance to companies in all phases of implementing lean manufacturing. Program elements include consultation, workshops, education and training courses, and in-plant workshops designed so that follow up activities may be conducted by internal facilitators.	Everyone	<a href="http://www.mfg.uky.edu/lean/">http://www.mfg.uky.edu/lean/</a>
University of Tennessee	The Greenwood Lean Enterprise Center is dedicated to spreading knowledge about lean through academia and industry. It offers a broad range of lean-related educational resources, some of which focus on maintenance, repair and overhaul (MRO) operations.	Everyone	<a href="http://lean.utk.edu/">http://lean.utk.edu/</a>

# Professional Associations

Table A-7. Professional Associations

Website name	Why it is useful	Best for	URL
APICS—The Association for Operations Management	APICS is a global provider of information and services in production and inventory management and related areas to enable members, enterprises, and individuals to add value to their business performance. It offers educational resources for a broad range of process improvement concepts and tools (e.g., lean, six sigma, and theory of constraints).	Everyone	<a href="http://www.apics.org/">http://www.apics.org/</a>
Association for Manufacturing Excellence	Dedicated to cultivating understanding, analysis and exchange of productivity methods and their successful application in the pursuit of excellence throughout the manufacturing sector. The AME website contains resource materials, seminar information and a learning center.	Everyone	<a href="http://www.ame.org/">http://www.ame.org/</a>
IQPC—International Quality & Productivity Center	IQPC provides business executives around the world with tailored practical conferences, large scale events, topical seminars and in-house training programs, keeping them up-to-date with industry trends, technological developments and the regulatory landscape. IQPC's large scale conferences are market leading "must attend" events for their respective industries.	Everyone	<a href="http://www.iqpc.com">http://www.iqpc.com</a>
ISSSP-International Society of Six Sigma Professionals	ISSP a professional membership organization dedicated to the advancement of education, research and implementation of Six Sigma, as well as the integration of Six Sigma with other business practices. ISSSP's global community includes corporate and affiliate participants, and individual members representing large and small businesses from a wide range of industries.	Everyone	<a href="http://www.issp.com">http://www.issp.com</a>
Lean Enterprise Institute	Contains a community section for sharing knowledge, a training section workshop information and a store section with books and other training materials.	Everyone	<a href="http://www.lean.org">http://www.lean.org</a>
National Shipbuilding Research Program Lean Shipbuilding Initiative	Provides the Lean community a virtual gathering place in order to accelerate shipyard Lean transformation by facilitating a joint learning curve. LSI offers a single access point for details about Lean in the shipbuilding industry, significantly reducing time spent searching for this information on other websites and in a variety of publications.	Everyone	<a href="http://www.nsrp.org/lean/">http://www.nsrp.org/lean/</a>

Table A-7. Professional Associations

Website name	Why it is useful	Best for	URL
SAE Lean Enterprise Services	Provides seminars, symposia, professional meetings, conferences, and distance education programs facilitate the rapid deployment of lean principles at all levels of the organization including: engineering design; manufacturing; business functions; and supply chain relationships.	Everyone	<a href="http://www.sae.org/manufacturing/lean/">http://www.sae.org/manufacturing/lean/</a>
Society of Manufacturing Engineers	Offers a broad range of conferences, training courses and certification programs that are designed to help engineers, companies, educators and others achieve success in their quest to advance the manufacturing industries.	Everyone	<a href="http://www.sme.org/">http://www.sme.org/</a>
The American Society for Quality	A professional association dedicated to the advances of learning, quality improvement, and knowledge exchange to improve business results, and to create better workplaces and communities worldwide. ASQ offers technologies, concepts, tools, and training to quality professionals, quality practitioners, and everyday consumers, encouraging all to "Make Good Great."	Everyone	<a href="http://www.asq.org/">http://www.asq.org/</a>

# Other Useful Information Sources

Table A-8. Other Useful Information Resources

Website name	Why it is useful	Best for	URL
iSixSigma	This website provides a great deal of information on how six sigma and lean can be integrated. It also contains an online dictionary, events calendar, resource center and many other reference materials.		<a href="http://www.isixsigma.com/me/lean_manufacturing/">http://www.isixsigma.com/me/lean_manufacturing/</a>
Mid-America Manufacturing Technology Center (MAMTC)	MAMTC is a service organization that helps small and mid-sized manufacturers increase their sales and productivity, reduce costs, and improve quality. Their web site provides a variety of lean resources, explanations of concepts, and links to other sites.		<a href="http://www.mamtc.com/lean/index.asp">http://www.mamtc.com/lean/index.asp</a>
Superfactory	This is a website that began in 1997 as a simple compilation of internet links for manufacturing excellence resources. Since that time, Superfactory has continued to expand and now contains a broad range of learning aids, PowerPoint presentations and resource materials. Some of these materials are free and others require purchase.		<a href="http://www.superfactory.com/">http://www.superfactory.com/</a>



# Attachment B. Organizational Implementation Planning Framework

This implementation planning framework can be used by any organization—from a military service or other major organization to a small unit—when deploying a CPI culture change. The framework is separated into sections that align with the CPI deployment cycle and is designed to include tasks that are necessary to initiate a CPI culture. Appropriate inputs and approval for planning should be obtained from organizational CPI champions, as well as members of the steering committee and support team. Publishing formal plans, where appropriate, is effective for communicating with each member of the organization.

If an organization has already been working on implementing CPI, it may want to ensure that it has accomplished these tasks first, and then move on to the acceleration and sustainment phases of implementation. It should be emphasized that the elements in this planning framework apply to organizational functions that may be present in a specific organization, including, but not limited to administration, contracting, finance, personnel, operations, program management, supply chain management, and maintenance. Table B-1 identifies the planning elements, which are discussed in more detail in the paragraphs below.

*Table B-1. Planning Elements of Organizational Implementation*

CPI step	Action description
Develop Vision, Mission, and Strategy	1.1 Get Leadership Commitment
	1.2 Obtain Expert Help
	1.3 Identify/Select Steering Committee and Support Team
	1.4 Identify Strategic Goals, Vision, Metrics
	1.5 Convey Urgency/Burning Platform
	1.6 Commit to Develop People
	1.7 Focus on Customer Value
	1.8 Communicate
	1.9 Develop a Transformation Strategy
	1.10 Identify and Assign Deployment Actions
	1.11 Conduct a Risk Assessment
	1.12 Identify Funding/Resource Requirements and Sources
Conduct a Value Stream Analysis	2.1 Establish an Enterprise Approach
	2.2 Perform Customer/Stakeholder Analysis
	2.3 Identify Value Stream Map Key Processes
	2.4 Identify Leverage Points
	2.5 Select Pilot Projects
	2.6 Determine How to Measure Benefits

*Table B-1. Planning Elements of Organizational Implementation*

CPI step	Action description
Develop Structure and Behavior	3.1 Conduct Initial Training
	3.2 Identify and Select Additional Champions
	3.3 Establish CPI Support Infrastructure
	3.4 Use the Steering Committee to Share Lessons
	3.5 Organize for CPI Implementation
Align and Deploy Goals	4.1 Deploy Aligned Goals Down Through Organization
	4.2 Align Sub-Organizations Commitments to Goals
Develop an Operational Plan	5.1 Align Plan to Strategy
	5.2 Establish Deployment Funding/Resources
	5.3 Establish Timing and Priorities
	5.4 Identify the Improvement Activities
	5.4 Address Retention/Improvement of Output Quality
Implement the Operational Plan	6.1 Conduct Initial Improvement Activities
	6.2 Baseline Key Processes (Map Processes)
	6.3 Focus on Standardization: Policies, Procedures, Processes
	6.4 Focus on Quality
Monitor Progress	7.1 Monitor Performance to Established Organization Goals
	7.2 Coach for Results
Focus on CPI	8.1 Sustain Gains
	8.2 Nurture the Process
	8.3 Establish a Cross-Feed Process
	8.4 Ensure Senior Leader Participation
	8.5 Conduct a Self-Assessment Periodically
	8.6 Update Direction and Planning

## 1. Develop Vision, Mission, and Strategy

- 1.1 **Get Leadership Commitment:** The highest ranking individual (champion) in the organization should start the deployment with a strong statement of intent. This should preferably be a very visible kick-off that is witnessed by as many employees as possible and then communicated to every employee. The champion should clearly define the expectations that every employee participate and cooperate. They should also establish the capability to make other organizational leaders accountable for deployment and indicate the expectation for commitment, involvement, and cooperation. Sub-organization leaders and stakeholders need to echo this commitment immediately as part of the kick-off. Employees are looking for consistent messages and timely action and action signals inconsistency are essential to support the effort.
- 1.2 **Obtain Expert Help:** Few organizations have been successful in deploying a CPI culture without outside expert help. From the beginning, a trusted consultant or advisor should be hired to work directly with the champion, steering committee, support team, and working groups (as necessary). This type of support may last upwards of 2 years until the organization can generate organic experts.

- 1.3 Identify/Select Steering Committee and Support Team:** At the outset, the senior leader of the organization should establish a steering committee to oversee the deployment along with a support team. The steering committee is typically more effective if it is a subset of the total senior leadership—i.e., if it involves leaders from all key functions in the value stream—but they should be able to speak for and influence all senior leaders. The organizational support team will be the action agency to support the deployment and will follow the direction of the steering committee as well as the other steps in deployment planning.
- 1.4 Identify Strategic Goals, Vision, Metrics:** The organization leadership needs to start off the implementation by ensuring that they have clearly defined strategic goals, a vision, and metrics that support why the organization exists and what it is doing for its customers. The goals, vision, and metrics will be further refined during the enterprise value stream analysis in step two.
- 1.5 Convey Urgency, Burning Platform:** Leadership should be able to answer the question from their employees: “Why are we implementing CPI?” Typically organizations have a “burning platform” when they start CPI, meaning they are being forced to immediate action because of a crisis. However any organization can implement CPI and gain great benefits from it if it convinces its employees that they need to do it. Reasons sometimes cited include customers being unhappy with current support, excessive costs or budget reductions requiring drastic improvements, or an organization commitment related to owing customers more than is now being provided. Regardless of the reason identified, it must convey a sense of urgency to get the organization excited about changing.
- 1.6 Commit to Develop People:** From the beginning of a CPI implementation, leadership should understand that their most important resource that will enable change is people. Developing people includes a commitment to support, care for, encourage, and grow employees as CPI improves processes.
- 1.7 Focus on Customer Value:** From the very beginning of a CPI implementation, focus should be on the customers and satisfying their requirements. Each organization should relate why it exists in terms of the customers it supports, rather than tangentially related outputs such as producing products or achieving certain levels of readiness. Customer value should be thought of as anything the customer would be willing to pay for.
- 1.8 Communicate:** No organization can over-communicate during a CPI deployment. Leadership should use every opportunity to publicize their expectations and commitment to the deployment. A “rule of 7” always applies, meaning an organization should communicate a message in at least 7 different media for it to reach the majority of the employees. A CPI culture change requires continuous focus 100 percent of the time. Things that should be communicated are listed below:
- **Promotional Messages:** Vision/Purpose—This is the vision and purpose identified during the strategic planning. Burning platform—Service members and civilian employees should understand why DoD is deploying CPI. Successes—Successes from other organizations should be published and used to show CPI is beneficial and possible. Benchmarking organizational processes to analogous organizations that have used CPI is also helpful.

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- **Results/Feedback Messages:** Metrics—If senior leadership identified meaningful metrics that the organization can relate to, then the results attributed to CPI related to these metrics can be very powerful. Successes—Success stories should be visible and show that a set of processes in your organization or in analogous organizations were improved. The message should be that there are similar processes remaining that can be improved.
  - **Deployment Progress Messages:** Expectations—Leadership should clearly state that every service member must be committed to and participate in the deployment including accomplishing necessary training and putting to use what they learn for the organization. Metrics—Deployment metrics are different from customer-oriented metrics. Deployment metrics should give leadership indication of buy-in and participation by all sub-organizations. Examples of these metrics are number of employees trained in each category, number of facilitators trained and practicing, number of events or processes improved. These metrics will become less important as the deployment progresses, and should be replaced with meaningful metrics related to CPI output goals.
- 1.9 Develop a Transformation Strategy:** This strategy should include general concepts and rules on how to implement a CPI culture. More details will be given in the following sections.
- 1.10 Identify and Assign Deployment Actions:** Identify specific actions and action points to deploy CPI, such as who, when, where, and how.
- 1.11 Conduct a Risk Assessment:** Identify the parts of the organization that may be expected to resist this deployment, and specifically counter that resistance with actions such as increased communication and publicity.
- 1.12 Identify Funding/Resource Requirements and Sources:** Determine where long-term funding and resources will come from and when. This needs to be considered as an ongoing requirement rather than a project. Organizations often delay deployment past initial efforts waiting for savings from events, but this can ultimately slow the CPI effort to a stop. Funding needs to be established up front, then savings may be re-invested as the effort progresses.

## 2. Conduct a Value Stream Analysis

- 2.1 Establish an Enterprise Approach:** The organizational leadership should change the focus of the organization from a functionally oriented one to a single organization focused on customer satisfaction. This can be accomplished by conducting a senior strategy session that redefines the list of items below, and sometimes takes the form of an Enterprise Value Stream Mapping Assessment (EVSMA). The purpose of an EVSMA is to identify and publish the following organizational details.
- **Identify Vision and Purpose:** The organization should identify its vision of the organization in the future. The purpose is “Why the organization exists.” The purpose is sometimes called the theme of the organization, and it must relate to every employee.
  - **Identify Products and Services:** This step should be self-explanatory and should tie directly to the organization’s vision and purpose statements; however, it is also a chance to clarify core competencies.
  - **Identify Metrics and Track Process:** A single set of metrics should be established that every member of the organization can relate to. These metrics need to be communicated to every employee, and they need to be tracked and monitored. Organizational decisions should always directly support these metrics.
  - **Set/Publish Goals:** Two sets of goals should be established. In the first phase of a CPI deployment, the organization should establish training and first event goals throughout the organization to show startup and buy-in. Goals should also be set on improving the key metrics identified above, and tracked aggressively, with timetables set on milestone goal levels.
  - **Perform a Gap Analysis between Baseline and Goals:** The gap analysis should identify the areas where CPI efforts need to focus first to raise a key metric or resolve customer dissatisfaction. A prioritized list of CPI focus areas is the desired deliverable from the EVSMA, and becomes the action plan for the next time period.
  - **Identify Criteria to Select and Prioritize CPI Action Areas:** The criteria identified in this action item should allow the organization to focus on issues that will affect the largest percentage of the organization and also have the largest impact. Examples of criteria are impact on the customer, ease of accomplishing, whether or not the action can be accomplished inside the organization, or if it needs outside support, how long the action would take, or even if the impact will be short- or long-term.
  - **Select CPI Action Areas:** Once the leadership prioritizes the action areas, a final decision must be made on which to accomplish first. Although it would always be better for the organization to attack the area that would have the most impact, most organizations start with smaller pilot projects in important areas to prove the CPI process works, and accomplish a quick win to generate further interest and buy-in from organization members.

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- ***Build an Action List (with Controls):*** After the areas are selected, build a detailed list that identifies relevant dates for each effort and name of the working group lead. This list provides the details necessary to track and control the implementation effort as well as to document planned actions in the operational plan.
  - ***Establish Periodic Customer Surveys/Feedback:*** Getting feedback from customers and stakeholders should be built into the CPI program. Routine surveys/feedback should be established to ensure the “voice of the customer” is heard and heeded.
- 2.2 *Perform a Customer/Stakeholder Analysis:*** It is essential that leadership identify all customers and stakeholders—and then understand their expectations. Obviously, the organization should evaluate how well it is fulfilling these expectations.
- 2.3 *Identify Value Stream Map Key Processes:*** The organization should identify its key processes and map them out to provide visibility of problems. Eventually an organization should map all its processes, but it should start by identifying those that have the greatest impact on the organization and then work down the priority list. Leaders and managers should understand that the value stream mapping is not what we think it should be, but map it as it actually is operating. Until we understand how work is being conducted, we will not see and understand the waste and frustration our people are having to work around on a daily basis.
- 2.4 *Identify Leverage Points:*** After mapping the key processes, you should identify the specific areas (e.g., activities and inputs) that can be changed that would have a greatest impact to the successful operation of the process (leverage points).
- 2.5 *Select Pilot Projects:*** Most organizations start their CPI implementation by selecting pilot projects. These are processes that are important and will make a positive impact on the organization; they may not have the highest priority to be improved. They should be processes that are very visible, but relatively easy to improve. This approach allows the organization to learn how to use CPI tools and gain some immediate benefit from the first events. This success should fuel the remainder of the implementation by convincing everyone that CPI will work and it is worth the resource and time investments.
- 2.6 *Determine How to Measure Benefits:*** Savings in dollars, manpower, floor space, cycle time, quality, and so on should be validated against a common set of criteria agreed upon by OSD/service leadership. Financial personnel should be involved in the validation process. Savings determination is especially critical in determining rewards available to teams. Individuals outside the process-owning organization should accomplish return on investment (ROI) calculations, to ensure objectivity.

### 3. Develop Structure and Behavior

- 3.1 Conduct Initial Training:** Training should begin early and be continuous throughout deployment. The focus should be on awareness for all employees, followed by specialized training for leadership and facilitators. Train-the-trainer courses should be established from the start to ensure that an organic capability is generated over time. Implementing organizations should identify the training required by the audience groups listed below.
- **Executives/Senior Management:** This should be the first training accomplished, and should focus on recognizing the culture change that is CPI, understanding CPI procedures and tools, and leading deployment. This group includes members of the steering committee.
  - **Mid-Level Supervisors:** Training should focus on change management and acceptance.
  - **Total Population:** Mass training should be limited to awareness only. Other team training will give team members more tools as they are needed.
  - **CPI Working Group:** Group members should receive training as they need it for their team activities. If trained too soon, they will not retain what they need. This training should focus on how to change processes and sustain the gains.
  - **Newcomers:** All newcomers to the organization should be given awareness training and leadership expectations for their participation. This should be accomplished upon arrival as their introduction to the organization.
  - **Facilitators:** The content of facilitator training will be identified in detail in the DoD CPI guide. Training should be a combination of education in a classroom, as well as hands-on training with a mentor facilitating team. This group includes members of the support team.
- 3.2 Identify and Select Additional Champions:** Champions are typically the senior members of the organization who will drive and encourage the CPI implementation. The champions also act as change agents for their organization's CPI implementation.
- 3.3 Establish CPI Support Infrastructure:** To successfully deploy a CPI culture, it must be internalized within the organization. Consider dedicating full-time resources to deploying CPI. Train-the-trainer courses should help establish organic capabilities to sustain all activities.
- **Establish Initial Team Selection Process:** Initially, organizations will want to select highly qualified and motivated people to serve in the CPI implementation structure. This includes members of the steering committee, the support team, and the working groups. Leaders or members do not necessarily have to be the appropriate supervisors; rather, they may be the people most likely to lead successful change/projects.

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- ***Obtain Qualified Facilitators:*** It would ultimately be optimal to use experienced facilitators. However, at the start of the deployment, select the best managers who are open-minded and can place the CPI program in the overall context of organization success. Facilitators should also have qualities that make them effective team leaders. Facilitators may have to be contracted for until organic assets are trained; however, this training should start on the first event in the organization and be part of every one thereafter.
  - ***Consider Career Impacts:*** For both active-duty military and civilian employees working in CPI positions, consider issues such as time in a position for training payback, what management positions may require CPI experience and at what level, and how long individuals can or should be in CPI positions before being returned to their original careers.
- 3.4 *Use the Steering Committee to Share Lessons:*** The steering committee is a natural forum for sharing ideas, problems, techniques, and progress. Meetings should be more often at the beginning of deployment, with frequency being adjusted as time goes on, until they are monthly.
- 3.5 *Organize for CPI Implementation:*** As processes change, it is important to modify the organization to support the new way of doing business. Typically, the fewer layers of management that exist, the more successful the organization.



## 4. Align and Deploy Goals

- 4.1 ***Deploy Aligned Goals Down Through Organization:*** As leaders identify organizational goals, they should be able to communicate the goals clearly down to each level of the organization. Each sub-organization should be able to focus its activities to support the goals. In turn, all employees should be able to describe how their jobs support these goals. Similarly, leadership should ensure that goals are aligned with the goals of higher-level organizations.
- 4.2 ***Align Sub-Organization Commitments to Goals:*** As a goal is deployed to sub-organizations, it should be made clear how the sub-organization goal fits into the overall goal picture and what portion of the goal each sub-organization is responsible for.

## 5. Develop an Operational Plan

- 5.1 ***Align Plan to Strategy:*** Ensure that the operational plan will accomplish things that are important to the organization's strategy and its stated goals.
- 5.2 ***Establish Deployment Funding/Resources:*** Ensure that funding has been identified to support the CPI support team, and the time required to set aside a team of employees from normal operations to identify changes to the process targeted. Additionally, resources such as facilities, administrative supplies, and consultant support may need to be identified for any effort. Organizations should also identify funding to make possible process changes. If these funds are not set up ahead of the team, it can seriously degrade or delay the effect of the team activities.
- 5.3 ***Establish Timing and Priorities:*** The heart of any plan is the timing and priorities of the organization. It needs to state when each sub-organization will start its deployment and where in the organization, if deployment is widespread. The organization should not worry about a completion date, since the process should be continuous.
- 5.4 ***Identify the Improvement Activities:*** Identify the initial set of improvement activities to be carried out based on the EVSMA and the leverage points identified within processes as a result of that activity. Identify follow-on activities as appropriate using further process mapping.
- 5.5 ***Address Retention/Improvement of Output Quality:*** The elements of quality retention/improvement should be made a part of the operational plan. These elements identify how the organization will maintain or improve the level of quality in its operation while processes are being improved. Inclusion in the operational plan is meant to ensure that the organization does not forget about quality as processes are made faster and more efficient.

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## 6. Implement the Operational Plan

- 6.1 **Conduct Initial Improvement Activities:** This is the act of generating teams, having them trained on CPI basics and tools to be used, and then having the team identify changes to processes and implementing those changes. These are all the actions of the work group.
- 6.2 **Baseline Key Processes (Map Processes):** Every organization process should be mapped at some time to determine its health and prioritize it among those to be improved. Processes must be made visible through mapping before improvements can be identified. A phased approach may be used, starting with the few critical processes, then continuing through 100 percent completion.
- 6.3 **Focus on Standardization: Policies, Procedures, and Processes:** Once process changes are identified and implemented, the organization's policies, procedures, and processes that support the new process must also change. If there is more than one area of the organization that performs the process, then the change needs to be implemented in all areas. Once all associated items are changed, focus on making the changed processes the standard to ensure that there is no regression.
- 6.4 **Focus on Quality:** A focus needs to remain on producing quality products and services. Quality should not suffer when processes are improved. If it does, that means that value-added steps were adversely affected, and the changes need to be reevaluated to ensure that they are not the cause of any quality degradation.

## 7. Monitor Progress

- 7.1 **Monitor Performance to Established Organization Goals:** The organization should establish how it will track and monitor deployment progress. Initially reports should track activities like training accomplished, teams established, and events under way. As the organization matures, focus should shift to achieving the goals of individual and integrated projects. Reporting, which should be measured against established metrics, should be more frequent at first, then extend to no less often than monthly.
- 7.2 **Coach for Results:** Managers should take on the role of coaches as their employees are empowered to make changes to their processes. They need to encourage new ideas, remove barriers to progress, and support changes that positively affect operations. They also need to keep the coaching focused on process results. Changes should have a measurable result on the process, or they should continue looking for other options.

## 8. Focus on Continuous Process Improvement

- 8.1 ***Sustain Gains:*** Ensure that recommendations from the teams actually change the processes, and that the changes are sustained through regular management review. If not monitored, improved processes often revert back to what they were before, generating a huge disincentive for future actions and teams. As soon as processes are changed, it is important to document the changes and standardize the new processes across like organizations.
- 8.2 ***Nurture the Process:*** Rewards should be team-oriented rather than for individuals, and should be established to promote, distinguish, and publicize successful activities. They do not have to be elaborate or complicated, but need to be recognized by employees as worth their time and effort. Recognition awards should be of higher priority than monetary awards.
- 8.3 ***Establish a Cross-Feed Process:*** Like organizations should come together periodically to share CPI deployment lessons learned. These conferences should focus on the same levels of organizations so they will have more in common, and so they can use each other's lessons. Similarly, methods to capture new knowledge and share it within and across organizations need to be established (such as communities of practice and web pages).
- 8.4 ***Ensure Senior Leader Participation:*** A process should be established to track and monitor leadership participation. This may be events participated in monthly, time spent with teams and direct supports on CPI, or anything that shows the individual's commitment and active participation. Leaders who do not participate should be visibly removed immediately.
- 8.5 ***Conduct a Self-Assessment Periodically:*** Periodically using a tool such as a maturity assessment will keep the organization focused on proper criteria to support the CPI deployment. A high-level maturity assessment tool is included in the DoD CPI guide.
- 8.6 ***Update Direction and Planning:*** Enterprise strategic planning should be updated at least annually to reflect current achievement levels, new or revised customer imperatives, and other fact-of-life changes. Similarly, operational planning should also be updated no less than annually, although this level of planning will most likely be updated more frequently due to the completion of ongoing projects and the identification of new ones.



# Attachment C. Training and Certification

A well trained workforce will ensure the successful implementation and application of CPI methodologies and tools leading to improved organizational performance. A complementary certification program ensures that individuals possess the requisite education, skills, competencies, and experience to be successful practitioners of CPI methodologies. CPI training and certification programs take a two-pronged approach of formal classroom instruction complemented by the direct application of concepts by executing actual CPI projects.

## Training

Training is necessary to ensure the effectiveness of any CPI program. The primary objective of CPI training is to provide personnel the understanding and skills in the core competencies necessary to successfully launch and sustain the CPI initiative.

CPI training needs to address three essential elements:

- Core competencies
- Goal alignment
- Common terminology and conceptual approach.

To be effective, the CPI practitioner requires a diverse set of competencies. First, the student must develop the *conceptual skills* required by the CPI methodology the organization is applying. Secondly, the *technical skills* to analyze process problems, and to select and properly apply statistical techniques must be taught. Finally, *human interaction skills* are needed to lead teams to complete projects and affect change. These competencies are specifically listed in Table C-1 and further detailed in Table C-2.

*Table C-1. CPI Core Competencies*

Conceptual Skills	Human Interaction Skills	Technical Skills
CPI philosophy	Conflict Resolution	Value analysis
Project management	Leadership	Waste analysis
Process management	Change management	Risk analysis
Systems thinking	Team dynamics	Flow analysis
Systems engineering	Communications	Constraints analysis
Problem solving		Metrics
Decision analysis		Probability/statistics
		TPM/RCM



Table C-2. CPI Core Competencies Topics and Techniques

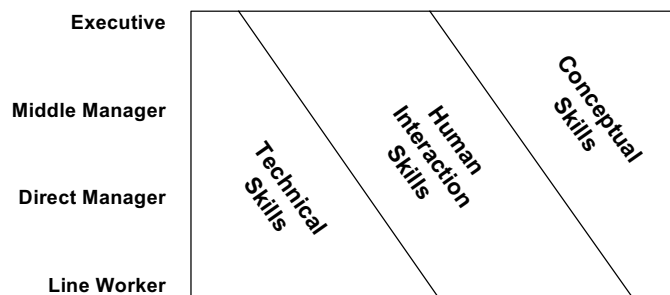
Conflict resolution (continued)	<ul style="list-style-type: none"> <li>● Strategies for managing conflicts               <ul style="list-style-type: none"> <li>○ avoidance</li> <li>○ smoothing</li> <li>○ negotiating</li> <li>○ power/dominance intervention</li> <li>○ compromise</li> <li>○ confrontation</li> </ul> </li> <li>● Dealing with difficult people</li> </ul>
Team dynamics	<ul style="list-style-type: none"> <li>● Types of teams</li> <li>● Team interactions and relationships</li> <li>● Team meetings</li> <li>● Coaching and mentoring</li> </ul>
Systems thinking	<ul style="list-style-type: none"> <li>● Types of systems</li> <li>● Systematic systems approach</li> <li>● Defining systems components</li> <li>● Determining systems boundaries</li> <li>● Determining interactions</li> <li>● Preventing the “law of unintended consequences”</li> </ul>
Systems engineering	<ul style="list-style-type: none"> <li>● Top-down design               <ul style="list-style-type: none"> <li>○ determine systems requirements</li> <li>○ design to systems requirements</li> <li>○ design tools</li> </ul> </li> <li>● Bottom-up integration               <ul style="list-style-type: none"> <li>○ allocate systems requirements to sub-systems</li> <li>○ integrate sub-systems requirements</li> </ul> </li> <li>● Life cycle design and management</li> <li>● Users’ perspective</li> <li>● Balanced value systems design</li> <li>● Systems test and validation</li> </ul>
Problem solving	<ul style="list-style-type: none"> <li>● Identifying/defining the problem</li> <li>● Discovery tools</li> <li>● Root cause analysis</li> <li>● Verifying root cause</li> </ul>
Decision analysis	<ul style="list-style-type: none"> <li>● Fact-based decision making vs. opinionated decision making</li> <li>● Generating alternatives (brainstorming, subject matter experts, etc.)</li> <li>● Organizing alternatives (management and planning tools)</li> <li>● Evaluating alternatives (dominated vs. feasible ideas)</li> <li>● Determining optimal solution(s)</li> <li>● Implementing solution</li> </ul>
Value analysis	<ul style="list-style-type: none"> <li>● Value vs. non-value-added activities</li> <li>● Cycle time vs. Takt time</li> </ul>

*Table C-2. CPI Core Competencies Topics and Techniques*

Waste analysis	<ul style="list-style-type: none"> <li>● 7 common wastes (from lean principles)</li> </ul>
Risk analysis	<ul style="list-style-type: none"> <li>● What is risk</li> <li>● Measuring risk             <ul style="list-style-type: none"> <li>○ managing risk</li> <li>○ contingency planning</li> </ul> </li> </ul>
Flow analysis:	<ul style="list-style-type: none"> <li>● Value stream mapping</li> </ul>
Metrics	<ul style="list-style-type: none"> <li>● Discrete vs. continuous</li> <li>● Data collection and storage</li> <li>● Data analysis</li> </ul>
Probability and statistics	<ul style="list-style-type: none"> <li>● Descriptive statistics</li> <li>● Inferential statistics</li> <li>● Probability theory</li> <li>● Probability of combined events</li> <li>● Conditional probability</li> <li>● Counting rules</li> <li>● Probability distributions</li> </ul>

As the role and responsibility of a candidate moves from line worker to middle management to top management, the emphasis on the three categories changes from highly technical/medium human interaction/low conceptual to low technical and medium human interaction/high conceptual. This is illustrated graphically in Figure C-1.

*Figure C-1. Fundamental Categories of Competencies*



Besides addressing the technical aspects of the core competencies, CPI training should cover conceptual and motivational factors as well. One of the most important of aspects of training is communication and reinforcement of the importance of alignment of goals throughout an enterprise. This requires that everyone know and understand the end objectives and expected results of their organization and how their tasks should contribute. This includes the selection, monitoring, and tracking of appropriate lower level metrics (process measures) to ensure compliance with and alignment to higher level organizational or enterprise goals (results measures).

Finally, the CPI training program should disseminate a common conceptual approach and terminology that can function as a universal language for CPI deployment throughout a specific organization.



This will facilitate effective communication and the ability of personnel to become active and productive participants when transferred to a new assignment or location.

Training is generally delivered in a formal classroom setting and led by “expert” level CPI practitioners. A mentoring relationship between the instructor and student is desired. Delivery of the instruction is provided through lecture, exercise and simulation formats and an assessment evaluating the student’s knowledge is completed at the end of the course. Course length varies from several hours to multiple weeks based upon students’ projected CPI roles and responsibilities in their organization.

The training should be organized to promote progressive immediate application—for example, on actual CPI projects—and minimize disruption to the value-added work flow. Individuals trained should have the opportunity to apply their newly acquired skills immediately upon completing training. Otherwise, the newly acquired knowledge will be lost.

## Certification

Training alone does not suffice for certification. Certification requires that the candidate demonstrate effective choice and application of the methodologies, tools, and techniques learned in training. More specifically, certification is accomplished by successfully completing an authorized training curriculum, the completion of an appropriate training project, the passing of a proficiency test, and the mentoring of others in CPI. For higher level certifications, more complex and/or multiple projects must be successfully completed before advanced certification is granted.

There are different approaches to CPI certification both in the commercial sector and the DoD. Typically, certification recognition is based on either belts (green, black, and master black belt) or levels (I, II, III, IV). Both approaches emphasize the same basic body of knowledge, with some variation in topical emphasis. Typically, CPI certification programs are initiated with external facilitation support during initial CPI implementation, and subsequently brought inside the organization for continued use, development, and management.

CPI certification belts or levels indicate the degree of proficiency an individual has attained. To provide consistency and interoperability across DoD components, an individual’s expertise should be depicted within a common body of knowledge framework. However, components may establish alternative corollary proficiency characterization schemes such as the “belt” system or levels approach (see example in Attachment H). As the CPI practitioner’s certification level increases, greater mastery of the CPI competencies is expected as outlined below in Table C-3, where four degrees of comprehension are used: (1) Awareness, (2) Appreciation, (3) Application, and (4) Authority.

1. **Awareness** is the lowest degree of comprehension and requires that a candidate possess only a basic understanding of the subject matter. This minimum level of comprehension is needed to successfully participate as a working contributor to a task/project.
2. **Appreciation** is the next progressive degree of comprehension and requires that the candidate have a broader view and understanding of the material. This level of comprehension is needed for self-starters and higher order contributors.

3. **Application** requires that the candidate have more in-depth knowledge and understanding of the material. This degree of comprehension is needed to succeed at a lower level of technical leadership.
4. **Authority** is an even higher degree of comprehension and requires that the candidate have a thorough knowledge/understanding of the material and can confidently teach it to others and take the lead in applying the tools/techniques to practical situations.

*Table C-3. DoD CPI Body of Core Competencies per CPI Level*

CPI core competencies	Level III	Level II	Level I
CPI philosophy	4	3	2
Leadership	4	3	2
Project management	3	3	2
Process management	4	3	2
Change management	3	2	2
Conflict resolution	4	3	2
Team dynamics	3	3	2
Systems thinking	4	3	2
Systems engineering	4	3	2
Problem solving	4	4	3
Decision analysis	4	2	2
Value analysis	4	3	3
Waste analysis	4	3	3
Risk analysis	4	3	1
Flow analysis	4	3	3
Constraints analysis	4	3	2
Metrics	4	3	2
Probability and statistics	4	3	2
TPM/RCM	3	2	1

Certification is based on meeting both training and practical application. It is required that candidates attain a minimally accepted degree of CPI proficiency. If the required proficiency is not achieved, the candidate should be required to take remedial study and be re-tested, or re-take the applicable training class.

The DoD is establishing standards for certification of competency for leadership roles in the CPI deployment cycle and course materials for use in training programs to provide certifications. CPI leaders and managers are expected to have CPI-related awareness and proficiencies even if they are not certified.

A variety of recognized professional sources of training and certification is available for Lean, Six Sigma, and Theory of Constraints (TOC). Separate certification in any of these areas contributes to CPI certification recognition, which encompasses more than one school of thought. These separate certifications indicate progress toward achieving mastery of CPI and can be referenced against the total requirements necessary for recognition of DoD CPI level.

The DoD CPI certification process is an evolution beyond separate Lean, Six Sigma, and TOC schools and their respective approaches. The DoD certification process shapes DoD CPI expertise by incorporating existing CPI-related methodologies and tools through a standard certification framework. This approach is intended to aid in standardizing and providing a consistent DoD CPI professional development path to channel service/agency-specific programs. The following progressive minimum requirements must be achieved and formally documented for CPI certification.

## **Stage I**

### *Education*

- High school or equivalent and relevant training in the candidate's field of expertise.

### *Work Experience*

- 3 years of operational, operational support, business, technical, or managerial experience.

### *Technical Capability*

- High school mathematics proficiency and basic CPI training and instruction to lead process improvement projects.

### *Computer Proficiency*

- Word processing software.

### *Team Skills*

- Ability to facilitate or lead problem solving activities in a group setting.
- Understanding and application of the DMAIC or equivalent service CPI framework in a team environment.

### *Training and CPI Project Experience*

- Completion of a service-approved Level I CPI training program.
- Leadership of at least one successful CPI project and active participation in two or more successful CPI projects/events within 1 year or less.

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## **Stage II**

### *Education*

- High school or equivalent and relevant training in the candidate's field of expertise.

### *Work Experience*

- Minimum of 3 years of operations, operational support, business, technical, or managerial/supervisory experience.
- Technical application of education and experience as a member or leader of functional and cross-functional CPI-related project teams.

### *Technical Capability*

- Project management experience and basic principles of process management.
- Proficiency in algebra.
- Ability to conduct a cost and benefit and/or business case analysis.
- Ability to teach and apply the DMAIC or equivalent service CPI framework.
- Demonstrated ability to apply statistical methods.

### *Computer Proficiency*

- Proficiency in word processing, spreadsheet, presentation, and project management skills.

### *Communication*

- Excellent oral and written communication skills.

### *Team Skills*

- Ability to conduct meetings, facilitate small groups, and successfully address conflicts.
- Ability to mentor and motivate people.

### *Training and CPI Project Experience*

- Achievement of DoD Level I CPI certification.
- Attendance in a total of 200 hours of service-approved CPI training.
- A minimum of two CPI projects and participation in a minimum of three to five CPI events.

## **Stage III**

### *Education*

- High school or equivalent and relevant training in the candidate's field of expertise.

### *Work Experience*

- 3 or more years of CPI-related experience.

### *Technical Capability*

- Demonstrated expertise in the application of the DMAIC or equivalent service CPI framework.
- Capability to perform advanced statistical analysis using a range of available tools.

### *Computer Proficiency*

- Word processing, spreadsheet, presentation and project management capabilities.
- Proficiency to use advanced statistical methods and applications.

### *Communication*

- Excellent organizational skills as evidenced in oral and written communication skills.

### *Team Skills*

- Demonstrated formal/coaching education and training.
- Proficient instructional and mentoring skills.
- Graduation from a service-approved "train the trainer" program.
- Knowledge/application of strategic planning and SWOT analysis.

### *Training and CPI Project Experience*

- Achievement of DoD Level II CPI certification.
- Completion of 5 to 10 CPI projects at Level II.

## **Management of Training and Certification**

Management has the responsibility for the CPI training program. To support the substantial amount of training that needs to be accomplished, management should develop a CPI training plan. This plan should address the training schedule, timing of training, selection of candidates,

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method of delivery (contractual, DoD/DAU, in-house classroom lecture, case studies, hands-on, on-the-job training), and organization for maximum development of personnel with the least possible disruption to the work flow, and monitoring/controlling for effectiveness.

In developing a CPI training program, it is important to remember that certification should not be an end to itself. The goal of the training and certification program should not be to build a training organization and train a large number of certified practitioners, but rather the training program should be used to generate a well-trained, appropriately sized cadre of CPI practitioners who can build a culture of sustained continuous improvement leading to improved organizational performance.

### ***Timing and Selection of Trainees***

The CPI training program is best conducted in two phases: initial training for start-up success and continued training for sustained success. Training should be first be targeted to senior leaders and flowed down through the organization, paralleling and synchronizing with the organization's deployment of CPI. The initial training should ensure that key leadership and staff personnel are prepared to inaugurate the CPI program with minimal risk of failure. This requires that initial training be performed in a concentrated, intense manner. The training curriculum needs to concentrate heavily on motivational and informational issues during this phase, as well as the required technical skills for initial deployment. The initial training phase should be followed with a more level-loaded, sustained training effort.

Candidates for training and certification should be nominated, carefully screened, and selected not only to ensure that they possess the motivation and potential for successfully completing the training/certification program but also to ensure that they have the potential to lead the initiative's deployment.

### ***Method of Delivery***

The initial training program may employ outside, contracted training providers who meet or exceed the body of knowledge for the core competencies listed in the training/certification matrix (see Table C-3). As the CPI deployment matures and the cadre of in-house CPI practitioners builds, delivery of training should transition from outside contractors to the organization's own certified employees. The organization should wean itself off external support and develop its own organic training organization and capabilities. Experience suggests that internal educator/trainers are more believable to the culture and that continuity is achieved through their sustained presence.

### ***Review and Control***

Management needs to review the CPI training program periodically and revise it as appropriate to ensure its continued effectiveness. To do this, proper metrics need to be chosen, analyzed, and tracked over time, and compared against program standards and goals. No single measurement is enough to provide the information needed to properly assess CPI training effectiveness. Metrics should be selected to measure both direct and indirect effectiveness. These metrics should address customer satisfaction from the standpoint of the student, customers, the

organization, CPI management, and the workforce. Evaluations of the training by student and their supervisors should be completed immediately after training and again some time later. After the students have applied the material covered in the training to their work activities, they and their supervisors should complete another training evaluation that supplements the topics of the original survey with additional topics on how the training helped in applying the subject matter and what they would change in the course, if anything, to improve learning and practical application.

Evaluations should include, but are not limited to, the following:

Content, length, format, instructor's knowledge, instructor's teaching ability, instructor's responsiveness to questions, presentation materials, handout materials, exercises/case studies, facilities, and an overall rating.

### ***Continuing Education***

Continuing education for each DoD CPI level is required at regular periodic intervals to maintain currency and applicability. This may be attained through demonstrated leadership and participation in CPI projects and events, as well as documented continuous improvement through attendance and participation in CPI educational processes and/or events. A combination of a specified amount (hours) of training and/or CPI-related participation must be documented.





# Attachment D.

## CPI Progress Assessment

This attachment provides techniques for assessing the organizational CPI performance and maturity level. CPI assessment techniques are helpful when determining how well an organization is doing in implementing CPI for internal purposes, external reviews, and application for recognition and awards. A good assessment tool can be used by organizational members as well as outsiders for determining progress toward the perfection of CPI as a system of improvement, the result of which is a measure of organizational achievement.

When an organization's assessment is completed, planning for higher levels of performance should begin. CPI efforts should be consistently aligned with the priorities in an integrated organizational strategic plan. Deficiencies against CPI expectations should have countermeasures in support of organizational goals and objectives.

### CPI Performance Quick Assessment

The CPI Performance Quick Assessment is intended as a simple checklist for making an overall assessment of an organization's CPI progress. This approach is intentionally kept simple without numerical evaluation. The following questions collectively make up this checklist:

1. Immediate impressions of 5S plus 1 implementation in every organizational area:
  - a. Sorting: elimination of all excess materials from all office/work environments
  - b. Straightening: everything is positioned in a specific, consistent, organized manner
  - c. Shining: everything is clean, allowing undesirable changes to be immediately visible
  - d. Standardizing: best practices and processes are formally positioned and consistently embraced
  - e. Sustaining: CPI gains have been sustained as observable in CPI progress charts and other documents
  - f. Safety: no visible safety hazards unaddressed throughout the viewed facilities.
2. Performance against aligned CPI metrics is visible to all of the organization's members and updated on a daily/weekly basis (customer response/cost effective readiness, quality/reliability, cycle time reduction, and lowering total cost). Does the randomly selected employee understand the metrics and how they can personally impact them?
3. Visible evidence of kaizen events being conducted and specific quantification of results achieved.

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4. While observing any work processes, estimate what percentage of current observable human activity is actually value-added as compared to non-value-added at the time of the snapshot (value-added as what the end customer would be willing to pay for if observing the process right now).
  5. While observing any work processes, estimate what percentage of current observable material is being worked upon by comparison to total estimated material visible (rough estimate only).
  6. Are the CPI champion's sustained efforts visible and understandable to the employees at large? Does the culture relate to the need for dissatisfaction with the status quo?
  7. Is cross-functional teaming evident and encouraged by comparison to traditional functional stove-piping and isolation?
  8. Are value stream maps in visible design and continued refinement in work environments?
  9. Is a formal CPI education and training program in place and exercised for the benefit of all employees?
  10. Are areas of CPI excellence connected or in relative isolation from other areas of excellence within the organization?

## **CPI Maturity Assessment Tool**

The CPI Maturity Assessment Tool is intended for evaluating overall organizational CPI maturity.

## **CPI Maturity Assessment Tool**

Organization: \_\_\_\_\_

Scope (Area) of Assessment: \_\_\_\_\_

Date of Assessment: \_\_\_\_\_

Name and Position of Person Filling out the Form: \_\_\_\_\_

Cumulative Average Score: \_\_\_\_\_

Cumulative average score of less than 3 = beginner stage of CPI organizational action

Cumulative average score of 3 to 4 = intermediate stage of CPI organizational action

Cumulative average score of 4 to 5 = advanced stage of CPI organizational action

### **Planning**

#### **1. Develop Vision, Mission & Strategic Planning**

These questions determine whether the organization knows what it is, where it is going, and why.

<b>Question</b>	1 Not yet started	2 In- process	3 Demon- strated	4 High Visibility	5 Trans- formation Evident
Has the organization clearly defined its initial Vision?					
Have the organization's champion and steering committee successfully conveyed a sense of urgency to the rest of the organization?					
Are there clear signs of management commitment from the perspective of the people below them?					
Have the champion and steering committee obtained organizational buy-in?					
Is there a clear commitment by the champion and steering committee to develop people's skills and abilities in support of change?					
Have the champion and steering committee created a sense of urgency for change?					
Is there strong evidence of a clear focus on providing value to the customer, including a definition of who the customer(s) is (are)?					
Is there a clear commitment to leverage the extended enterprise, the customer(s), and suppliers outside the organization itself?					

## 2. Conduct a Value Stream Analysis

These questions focus on whether the organization has determined how it will get to its desired future state.

Question	1 Not yet started	2 In- process	3 Demon- strated	4 High Visibility	5 Trans- formation Evident
Have the steering committee and CPI support team mapped the enterprise value streams?					
Have the steering committee and CPI support team internalized the vision in a well defined future state?					
Have the champion and steering committee set clear goals and metrics?					
Have the champion and steering committee identified and involved key stakeholders?					
Have the champion and steering committee, with the help of the stakeholders, identified the key leverage points that define where they should concentrate their efforts?					

## 3. Develop Structure/Behavior

These questions look at how much progress the organization has made toward overall implementation.

Question	1 Not yet started	2 In- process	3 Demon- strated	4 High Visibility	5 Trans- formation Evident
Has the organization been organized in a way that supports CPI implementation?					
Have the champion and steering committee identified and empowered change agents?					
Have the champion and steering committee aligned incentives with the goals of the CPI implementation?					
Have the champion and steering committee adapted the organization's structure and system to support CPI?					
Have the champion and steering committee defined expected organizational behaviors and set expectations accordingly?					

#### 4. Align and Deploy Goals

These questions look at how far the organization has moved toward putting the elements in place that encourage people to implement CPI.

Question	1 Not yet started	2 In- process	3 Demon- strated	4 High Visibility	5 Trans- formation Evident
Have the champion and steering committee deployed the organization's goals to everyone in the organization?					
Have the champion and steering committee brought their commitment to everyone in the organization?					

### Implementation

#### 5. Create and Refine Operational Plan

These questions look at whether the organization has created an operational plan.

Question	1 Not yet started	2 In- process	3 Demon- strated	4 High Visibility	5 Trans- formation Evident
Has the steering committee clearly identified and prioritized all CPI activities?					
Have the champion and steering committee committed the necessary resources to carry out the plan?					
Have the champion and steering committee ensured that the people have the necessary education and training to support CPI?					
Have the champion and steering committee deployed the operational plan throughout the organization?					

#### 6. Implement Operational Plan

These questions look at whether the organization is meeting its commitment.

Question	1 Not yet started	2 In- process	3 Demon- strated	4 High Visibility	5 Trans- formation Evident
Have the various pieces of the organization tasked with improvement activities developed detailed plans?					
Have the various pieces of the organization tasked with improvement activities implemented CPI activities?					

## 7. Monitor

These questions look at whether the organization has established the necessary means to monitor progress toward CPI implementation.

Question	1 Not yet started	2 In-process	3 Demonstrated	4 High Visibility	5 Transformation Evident
Have the champion and steering committee identified the right metrics to monitor performance?					
Are the data relevant to those metrics being gathered and analyzed to determine the extent of improvement?					

## 8. Focus on Continuous Process Improvement

These questions look at whether the organization has made the cultural change required to sustain CPI.

Question	1 Not yet started	2 In-process	3 Demonstrated	4 High Visibility	5 Transformation Evident
Do all levels of the organization regularly evaluate their progress toward the stated goals?					
Do the champion, steering committee, and CPI support team actively nurture the process?					
Do the champion, steering committee, and CPI support team regularly refine the plan?					
Do the steering committee and CPI support team capture and adopt new knowledge, spreading it across the organization?					
Do the steering committee and CPI support team capture and standardize successful improvements?					
Do the champion, steering committee, and CPI support team actively work to institutionalize PDCA thinking?					

## Advanced CPI Assessment Tool

This advanced CPI assessment tool is designed for use by organizations that are striving for world-class excellence. It is based in large part on a tool used extensively for similar purposes by John Allen at Total Systems Development (TSD) within both public- and private-sector organizations. Several DoD maintenance organizations have already received CPI world-class excellence recognition by pursuing similar assessment criteria provided by sources such as the Lean Aerospace Initiative and the Shingo Prize. This tool acts as both a leadership guide and progress measurement process, focusing on CPI elements in eight areas critical to CPI transformational activity. In the current state assessment, each of the CPI elements is scored based on observation and input from key organizational personnel. Then organizational leaders are asked to describe their desired state in 2–3 years. Each of the elements is then reviewed and scored in terms of the future plan and transformational change vision. These goals are then plotted for comparison with the results of the current state assessment. Examining the gap between the current and the desired states provides a picture of needs and goals that can be easily converted to a work plan and specific action steps needed to kick off the implementation.

This assessment is designed to be periodically used during the CPI implementation to measure the trend of progress. Results of a current state analysis can be plotted against the desired expectations for different phases in the implementation process. The resulting data can then be used to decide where efforts are flagging and where energy needs to be applied to bring the implementation into uniformity. By having an easily understood breakdown of world-class CPI benchmarks, organizations can better plan how to allot resources and plan for improvement.

An additional benefit of this assessment is that during the data collection and interpretation of results there are numerous opportunities to discuss important differences in viewpoint between the members of the implementation team and promote a more aligned and unified effort.

### ***Instructions***

Review the entire set of assessment questions before beginning to score the elements. Note that for each element there are five descriptions of the status of the element ranging from the complete absence of the element to world-class implementation of the element. When you fill out the form, read the descriptions and choose which description fits the current state in your organization and then score the element in the empty box at the end of the row.

Try to score the entire form in one sitting. It is anticipated to take approximately 45 minutes to complete the form. Do not leave any elements blank. The goal is to achieve meaningful comprehensive results.

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## Assessment

**Organization:**

**Scope (Area) of Assessment:**

**Date of Assessment:**

**Name and Position of Person Filling out the Form:**

### ***Leadership Vision and Commitment***

A CPI implementation must be led from the top down. Without the sponsorship and commitment of those who have the power and resources to sustain a change effort, a CPI initiative will die. A bottom-up initiative that lacks sponsorship from organizational leadership may result in short-lived or limited success and not transformation to a sustainable CPI culture. Three critical elements are leadership vision, commitment, and policy deployment.

**1.1 Vision.** Early in a CPI implementation, organizational leaders must come together to agree on what form the CPI initiative will take. There must be agreement and buy-in on a fairly specific and detailed vision such that any one of the leaders could describe what the goals and final result will look like. This shared vision must be the same vision so that conflicting messages are not created about the goal. This vision then must be communicated to the rest of the organization at every opportunity. The communications must be frequent and done with conviction so that there is no doubt of the leaders' commitment to the vision.

	<b>1.</b>	<b>2.</b>	<b>3.</b>	<b>4.</b>	<b>5.</b>	<b>Score</b>
<b>1.1 Vision</b>	Org. leaders are not informed about CPI	Some org. leaders have partial understanding of CPI, but it is not shared	Most org. leaders have an understanding of CPI but they do not communicate the vision	Most org. leaders make a disciplined effort to share a CPI vision	All org. leaders share and communicate the identical vision of CPI	

**1.2 Commitment.** Organizational leaders must provide a genuine sustained and visible commitment to the CPI vision. The level of commitment likely requires some personal inconvenience and change. CPI transformation is not achieved through compliance behaviors alone. Ideally, all organization leaders should privately commit to one another that they will stand behind the vision regardless of the challenges that might be experienced. The private commitment must be made public to those who look to them for leadership. Appropriate actions, not just words, are required. The commitment of resources and effort will demonstrate that there is real substance behind the rhetoric.

	<b>1.</b>	<b>2.</b>	<b>3.</b>	<b>4.</b>	<b>5.</b>	<b>Score</b>
<b>1.2 Commitment</b>	Org. leaders are not committed to achieving the CPI vision	Some org. leaders privately commit to achieving the CPI vision	Most org. leaders privately commit to achieving the CPI vision	All org. leaders privately commit, but only some publicly commit to achieving the CPI vision	All org. leaders privately and publicly commit to achieving the CPI vision	



**1.3 Policy Deployment.** A disciplined policy deployment process should be used to carry out the implementation and then become standard practice in the new CPI system. An effective policy deployment process is one that sets goals with input from those who must achieve the goals and then holds regular reviews to assure that progress toward the goals is being achieved. CPI implementation requires involvement from all levels of the organization. Commitment to the changes must be secured not just from the leaders, but from all stakeholders in the change effort. A policy deployment process becomes the means by which that commitment is made and the organization becomes aligned toward the same goals. As the organization matures, the policy deployment process is the means by which all become aligned around the continuous improvement goals.

	<b>1.</b>	<b>2.</b>	<b>3.</b>	<b>4.</b>	<b>5.</b>	<b>Score</b>
<b>1.3 Policy Deployment</b>	There is no effective means of tracking organization implementation policies	A plan to deploy CPI policies and processes is made but not used	CPI goals are developed with input from all levels of the organization	Managers hold regular reviews during the year which focus on progress toward CPI goals	A policy deployment process is used to set annual goals and achieve buyin and contributions from everyone	

## ***Change Management***

CPI implementers must be sensitive to change issues, since many employees might not have experience working in a CPI environment. Behavior change is typically required for success in a new CPI environment. During a change initiative some roles are critical and need to be clarified and agreed to in order to move forward. The following change management roles and responsibilities are critical to the success of the effort.

**2.1 Change Leadership.** Organizational leadership plays a critical role in the cultural conversion to CPI. In the process of sponsoring and leading change, the senior management has specific responsibilities that cannot be avoided through delegation. In the beginning, leadership defines the need for change and creates the vision of how things can be different. As others in the organization begin to embrace the vision, leaders must continue to communicate the need for change and support efforts being made to realize the vision.

	<b>1.</b>	<b>2.</b>	<b>3.</b>	<b>4.</b>	<b>5.</b>	<b>Score</b>
<b>2.1 Change Leadership</b>	Org. leaders are not involved in CPI implementation	Org. leaders are create a steering committee to oversee CPI implementation	Org. leaders periodically communicate the need for change	Org leaders effectively communicate the urgency of the need for change	Org. leaders are full sponsors of the CPI effort	

**2.2 Steering Committee.** The steering committee is intimately involved at the strategic level, creating the plan for change and dealing with specific issues that arise during design and implementation. This committee must have cross-functional representation composed of leaders who control the major resources within the organization. Members of the steering committee need to stay engaged in CPI on a daily basis to promote the CPI process and remove barriers to change.

	1.	2.	3.	4.	5.	Score
<b>2.2 Steering Committee</b>	There is no steering committee or oversight of change effort	Steering committee creates business case and initial work plan	Steering committee chooses first area to begin effort and checks readiness for change	Steering committee oversees changes made in first application area	Steering committee is actively involved in evaluating and sustaining the changes	

**2.3 Support Team.** Knowledgeable and respected organizational members are selected to support CPI as key process change agents. They must become committed to the CPI conversion, as they will likely face resistance to change on a daily basis. Training should occur before they start their CPI team involvement. A portion of these change agents will need to be engaged full time in CPI, while others might provide supplemental support.

	1.	2.	3.	4.	5.	Score
<b>2.3 Support Team</b>	Support teams are not established	Support teams begin current and future state mapping	First CPI application area is prepared	Changes begin in first application areas	Support team effectively executes the work plan	

**2.3.1 Value.** All employees need to understand the concept of what is value-added and what is not, according to the customer’s perspective. Each employee should have access to this training, and it should be emphasized in every organization. This concept should drive all organizational decisions and be updated periodically with the customer.

	1.	2.	3.	4.	5.	Score
<b>2.3.1 Value</b>	Value is not being taught to employees	Value training is available but not being used	Value is being taught to limited groups	Value is taught to all and used in some areas	Value is understood and used by all in all areas	

**2.3.2 Value Chain Analysis (VCA)/Value Stream Mapping (VSM).** VCA and VSM are important steps in improving an understanding of what has value and what is waste. They are valuable methods for making processes more visible and identifying opportunities for improvement. There is an increasing variety of VCA/VSMs for potential application, including current state, future state, consumption, and provisioning maps that focus on material, information, and/or people/process flows. VCA/VSMs should be updated for use as training aids to new employees and as a record of standard procedures. Employees gain valuable CPI experience by mapping their processes.

	1.	2.	3.	4.	5.	Score
<b>2.3.2 Value Chain Analysis/Value Stream Mapping</b>	VCA/VSM is not being taught to employees	VCA/VSM training is available but not being used	VCA/VSM is being taught to limited groups	VCA/VSM is taught to all and used in some areas	VCA/VSM is understood and used by all in all areas	

**2.3.3 Flow.** This concept defines what should be happening in an optimized process with minimized waste. Products or services should flow continuously from each value-adding step to the next, with minimal or no waiting or traveling time between them. Kanbans are often used when flow cannot be seamlessly accomplished, but should not be accepted as permanent replacements for continually refining uninterrupted real flow.

	1.	2.	3.	4.	5.	Score
<b>2.3.3 Flow</b>	No process flow	Flow occurs in isolated areas	Flow in small batches	Product flows continuously	Single piece flow with mixed	

**2.3.4 Pull.** The concept of pull is one that is not intuitive and must be reinforced through training employees. The concept is to only generate a product or service when the customer triggers a need for it. Push is the alternative to pull, where the need for a product or service is forecasted and then provided in accordance with a work plan that might be removed from the customer’s actual experience for timely support.

	1.	2.	3.	4.	5.	Score
<b>2.3.4 Pull</b>	Product is being pushed	Material accumulates at end of process	Some material is pulled into the workplace	Material is pulled into process by kanban	Material is pulled into each process based on takt	

**2.3.5 Continuous Process Improvement (CPI).** Every organization that deploys CPI must help employees to understand that process improvement is not something done just once. Process improvement must be continuous. Although this contradicts the “law of diminishing returns,” it has been proven repeatedly in CPI organizations. Each employee should have access to this training, and it should be emphasized in every organization. Formal update schedules should exist on process updates until the employees accept the true concept and every day becomes an opportunity to improve their processes.

	1.	2.	3.	4.	5.	Score
<b>2.3.5 CPI</b>	CPI is not being taught to employees	CPI training is available but not being used	CPI is being taught to limited groups	CPI is taught to all and used in some areas	CPI is understood and used by all in all areas	

**2.3.6 Champions.** Champions are individuals who through their stature and/or position are able to shape opinion about the value and sense of urgency of CPI. By showing interest and encouraging results, the champion is able to make the implementation move ahead more smoothly. Champions may exist at many levels within an organization, but the top management champion is the focus here, and is a must from the beginning of a CPI transformation initiative.

	1.	2.	3.	4.	5.	Score
<b>2.3.6 Champion</b>	Champion is not involved	Champion is partially involved	Champion is encouraging	Champion is used to conduct reviews	Champion is a normal part of operations, walking the floor, and encouraging CPI	

**2.3.7 Supply Management.** Supply management ensures that the right kind of materiel, in the right quantity, is available precisely when and where needed to support any worthy organizational process. Supply organizations and employees need to understand the impact of managing their supplies from the customer’s perspective and be actively pursuing improvements in their processes as part of the larger enterprise.

	1.	2.	3.	4.	5.	Score
<b>2.3.7 Supply Management</b>	Suppliers are treated as adversaries	Suppliers are given CPI to consider	Suppliers are doing parts of CPI	Suppliers are listened to	Suppliers are treated as partners	

## **Organizational Structure and Support System**

To implement a CPI culture change, the organizational structure must be changed to provide support to the value-adding process owners who perform the work of the enterprise. The structural and support system changes include (1) creating team-based work groups, (2) creating an aligned organization, (3) changing management mindsets and behavior, and (4) aligning human resources.

**3.1 Team-Based Work Groups.** A CPI-focused organization is one in which empowered and involved employees work together in team-based work groups focused on the needs of the customer. The work groups must function as teams with a trained team leader and sufficient organizational support to do their important work. Work groups hold regular meetings and engage in problem solving as a group. When fully functioning they are semi-autonomous, capable of evaluating and reporting on their progress toward continuous improvement.

	1.	2.	3.	4.	5.	Score
<b>3.1 Team-Based Work Groups</b>	There are no work groups	Work groups are formed but do not yet function as a team	Team leader in place and work group is beginning to function as a team	Work groups hold regular meetings and engage in problem solving as a group	Work groups are semi-autonomous, evaluating and reporting on their progress	

**3.2 Aligned Organization.** In a world-class CPI-focused organization, the entire organization is aligned to support value-add operations and the employees who do the work. In order to do this, traditional organizations must shift the structure and scope of virtually everyone’s roles and responsibilities. Reorganization around processes rather than functions is often required. The overall management approach must change to an emphasis on span of support rather than span of control. True alignment is reached when the policy deployment process aligns production activities with the business objectives.

	1.	2.	3.	4.	5.	Score
<b>3.2 Aligned Organization</b>	There is no effort at alignment	An organizational plan for CPI is established	Efforts are made to organize around process, not function	Span of support is emphasized over span of control	Policy deployment process aligns all activities with business objectives	

**3.3 Management Mindset and Behavior.** Managers seem to think and act differently in world-class CPI facilities. Changes in both mindset and behavior are required of supervisors and managers in traditional organizations implementing CPI. Three of the most important changes are as follows.

**3.3.1 Disciplined Management Process.** A consistent, fact-based approach to managing is characteristic of what you would find in a CPI-focused environment. Training in plan-do-check-act (PDCA) or another disciplined problem-solving approach is the foundation for how CPI managers address issues with their employees. This approach is the continuous improvement method used for problems with operations, as well as performance issues with employees.

	1.	2.	3.	4.	5.	Score
<b>3.3.1 PDCA Management Process</b>	There is no disciplined management process	Managers must receive training in fact-based management	Managers are expected to promote the use of PDCA or another problem-solving approach	Managers conduct developmental discussions with employees using a PDCA process	Manages consistently use a disciplined PDCA process addressing all issues with employees	

**3.3.2 Empowering, Facilitating, and Coaching Styles.** The command and control style of management is rarely most effective in CPI-focused organizations. When the team-based work groups learn to work in a semi-autonomous fashion, they do not need to be told what to do. Instead, providing support through empowering, facilitating, and coaching styles becomes an important way of sustaining continuous performance improvement.

	1.	2.	3.	4.	5.	Score
<b>3.3.2 Empowering, Facilitating, &amp; Coaching Styles</b>	Command and control is the main management style	Managers must receive training in different management styles	Managers are coached in using different management styles	Empowering and coaching is used as often as directive style	Empowering, facilitating, and coaching are the main management styles	

**3.4 Human Resources.** The human resource function is redesigned in world-class CPI facilities. An integral and visible part of the support system to the value-adder, the human resource function is a crucial component in the lean equation. Four important elements include (1) training, (2) compensation and recognition, (3) selection process for new employees, and (4) employee relations.

**3.4.1 Training.** Training is important in the conversion to CPI as the roles and responsibilities change along with the culture. Even after a CPI conversion, training remains a priority as one of the vehicles for continuous improvement. All employees must take part in ongoing training in both interpersonal and team skills as well as technical skills. For the training to be successful, employees must be encouraged and then freed up from their regular responsibilities on a continuing basis to be able to attend the training sessions.

	1.	2.	3.	4.	5.	Score
<b>3.4.1 Training</b>	Training is not a priority	Introductory CPI courses are offered	Everyone has been through introductory CPI training. CPI skills training is offered	Employees are trained in interpersonal and team skills as well as technical	Training is ongoing and employees are freed up to attend on a regular basis	

**3.4.2 Compensation and Recognition.** In most traditional organizations, employees are not rewarded for going the extra mile. In a world-class CPI organization, some portion of compensation is tied to achieving goals, and there is recognition of team and individual achievement. Recognition activities are significantly higher in CPI environments, and there is often employee involvement in formulating reward and recognition activities.

	1.	2.	3.	4.	5.	Score
<b>3.4.2 Compensation and Recognition</b>	Compensation is not tied to performance. Contributions outside compensation system go unrecognized	Performance and contribution are defined	Standard performance metrics established. monetary & non-monetary monitors are present	Individual development plans are operational	Team-level compensation and rewards are identified and implemented.	

**3.4.3 Selection Process for New Employees.** CPI organizations involve workers in the selection process for new employees. Employees are often directly involved in the interviewing and assessment process, and team members play a role in selecting new members of the team. The selection process focuses not just on technical skills and experience, but also evaluates teamwork and interpersonal skills, and willingness to learn and participate in work group activities. When an employee joins a work group, the team members play a role in orienting and evaluation during probationary periods.

	1.	2.	3.	4.	5.	Score
<b>3.4.3 Selection Process for New Employees</b>	Sole focus is technical skill. Employees are not involved in selection or orientation	HR agrees to revise selection and orientation process to reflect CPI principles	HR adopts an inclusive approach involving employees and planning new procedures	Selection focuses on teamwork, interpersonal skills, and willingness to learn, as well as technical skills	Employees are involved in selecting and orienting new team members	

## ***Corporate Culture/Workplace Climate***

The values, attitudes, and climate of world-class CPI-focused organizations set them apart from their traditional counterparts. Cultural factors are often overlooked in an implementation that focuses primarily on technical improvements. Three critical aspects of the corporate culture are worker attitudes, employee empowerment and involvement, and customer focus.

**4.1 Worker Attitudes.** The attitudes of the work force toward their work, to each other, and to the management are an important factor in the work climate of any organization. A CPI focus tends to result in a higher degree of trust, teamwork, and cooperative spirit.

**4.1.1 Employee Attitudes Toward Improvement.** Everyone in the organization is involved in the effort to continuously improve for it to be a success. The employees must value the effort to make improvements, and there must be a systematic approach for eliminating waste.

	1.	2.	3.	4.	5.	Score
<b>4.1.1 Employee Attitudes Toward Improvement</b>	Employees don't care or feel there is any need to improve	Some employees are interested in improvement	There is no systematic approach, but most employees are interested in improvement	There is a systematic approach to improvement, and employees are involved	There is enthusiasm for eliminating waste. Small improvements are viewed as important	

**4.1.2 Cooperation, Trust, and Respect.** CPI-focused employees and management enjoy a trusting relationship and cooperate to improve performance. For this to be possible, the management must nurture an open environment and reward cooperation. A trusting atmosphere is created by frequent and substantive communication from management that is consistent with its actions. Otherwise, distrust will impair any efforts to create collaborative solutions.

	1.	2.	3.	4.	5.	Score
<b>4.1.2 Cooperation, Trust, and Respect</b>	Worker-management relationship is generally adversarial, with little contact	Limited trust between work force and management. Distrust still predominant	Communication by management is frequent and consistent with actions. Individual acts of cooperation are evident	Management nurtures an open environment and rewards cooperation	Employees and management enjoy a trusting relationship and cooperate to improve performance	

**4.1.3 Employment Security.** For employees to work toward performance improvements, they must know that they will not lose their job if they succeed. Job security means that the employees engaged in CPI improvements will not lose their jobs directly as a result of their improvements, although extenuating circumstances beyond the control of organizational leadership cannot be ruled out or guaranteed.

	1.	2.	3.	4.	5.	Score
<b>4.1.3 Employment Security</b>	No job security policy	There is an unwritten assurance of job security but not formal policy	There is a policy in place of no layoffs due to productivity improvements	Everyone is assured of a job as long as the org. makes profits	There is an official policy that the org. will use layoffs only as a last resort	

**4.2 Employee Empowerment and Involvement.** The goal of employee empowerment is to have work group members gradually assume greater responsibility for organizing, planning, controlling, coordinating, and improving their daily work. Decisions, with appropriate boundaries, are delegated to work teams. As a result, decisions are made closer to where the work is done and are made faster. The dominant decision-making style is participative. Management develops and facilitates the work group's ability to make sound business decisions.

**4.2.1 Learning/Continuous Improvement.** CPI-focused organizations are committed to continuous learning. Employees have access to ongoing training, and a systematic approach to improvement through a standardized problem-solving approach is the norm. With everyone involved in a standard process for eliminating waste, performance improvements become the norm.

	1.	2.	3.	4.	5.	Score
<b>4.2.1 Learning/Continuous Improvement</b>	Training and development is not a high priority for the org.	Org. is committed to ongoing training and developments	Org. begins training in problem solving	PDCA thinking guides org./employee problem solving	Work groups participate in continuous improvement activities	

**4.2.2 Suggestion Systems.** An active suggestion system is a benchmark for a CPI-focused organization. If the employees feel valued and involved, the suggestions for improvement will far exceed the cost of implementation. Management must be prepared to follow through on its commitment, or employees will see it as yet another way in which their ideas are not really valued.

	1.	2.	3.	4.	5.	Score
<b>4.2.2 Suggestion Systems</b>	There is no suggestion system in place	Decision is made to implement a suggestion system	The system is implemented and employees are aware of it	Employees begin to experiment with system to test management commitment	Employees freely use and are comfortable with suggestion system	

**4.3 CPI support team.** A typical CPI support team will consist of change agent-oriented managers and staff. CPI Level III and II personnel (Master Black Belts and Black Belts, or the equivalent), criteria for which are defined by the organization at large, would typically be developed and participate in the support team of an organization. This team is tasked to implement the CPI deployment. They are the primary advisors to the organizations most senior leaders and are the experts on the use of tools, facilitating teams, and assisting teams in changing processes. This team is supervised by a change agent leader, who preferably has CPI Level III or II (Master Black Belt or Black Belt, or equivalent) experience. As members leave this group of experts, they should be given special consideration for future leadership positions that will continue to take advantage of their advanced CPI knowledge and experience. This will help spread and accelerate the use of CPI throughout the enterprise. As these experts transition to successively higher levels of management, there may no longer be as large a need for separate CPI support team members, and it can slowly be reduced as CPI experienced managers replace them in the organization.

**4.3.1 Selection Process.** Members of the CPI support team should be chosen from the “best and brightest future leaders” in the organization. They should be junior enough for them to progress up the ranks of facilitator, but the ultimate goal is to return them to formal management roles in the organization and continue rotating and growing the CPI culture.

	1.	2.	3.	4.	5.	Score
<b>4.3.1 Selection Process</b>	There is no selection process in place	Selection occurs using the old merit promotion system or assignment	A selection process exists but emphasis is not on the best and brightest	A selection process exists but bosses refuse to assign their best and brightest	A selection process exists and picks the best and grooms them for future leadership	



**4.3.2 Certification.** Certification of facilitators at every level should follow the criteria identified in the DoD CPI guide. Someone on the CPI support team should be tasked to monitor and track certification. These records should be integrated into the normal training and career records.

	1.	2.	3.	4.	5.	Score
<b>4.3.2 Certification</b>	There is no certification system in place	Each sub-org. is using its own system, and they don't match	A standardization system is in place but is not used by all sub-orgs.	A standardized system is in place and is used by all local sub-orgs.	A standardized system has been agreed to and is used across the extended enterprise	

## Process Stability

To sustain the continuous flow of product and services in a CPI environment, it is essential that the processes be stable and reliable. Productivity and quality are compromised if the support equipment and methods used in the organization's processes are not reliably able to maintain the required specifications. Substantially higher levels of productivity might be achieved by simply improving the availability of the support equipment used in the work process.

**5.1 Workplace Organization.** The foundation of stability is an organized workplace. Ensuring that there is a place for everything and everything is in its place is one of the first steps in a CPI implementation.

	1.	2.	3.	4.	5.	Score
<b>5.1 Workplace Organization</b>	There is no workplace order or organization	There is some organization, but most things are not in their proper place	Most of the workplace is clean and organized. The aisles, equipment, and material locations are marked	Tools are organized and labeled. Rules usually followed. Visual workplace	Workplace organization is self-maintaining with continuous improvement the norm	

**5.2 5S+1 Discipline for a Clean Workplace.** A 5S+1 program or equivalent is essential to maintaining and sustaining a clean workplace. Such programs structure the cleaning activities so that they occur on a regular basis, and the usual result is that employees take pride in a clean working environment. These processes are then standardized and applied to the entire organization. World-class CPI organizations are dramatically cleaner through employee involvement.

	1.	2.	3.	4.	5.	Score
<b>5.2 5S+1 Discipline for a Clean Workplace</b>	Workplace areas are dirty and there is no organized effort to improve them	Workplace areas are cleaned on an irregular basis	Workplace areas are cleaned on a daily basis and Employees take some pride in working environment	Working environment changes are documented and standards are consistently applied	5s+1 principles are in use throughout the entire organization	

**5.3 Operational Effectiveness.** The first step in managing lost process time is to identify the process systems constraint and related impediments and take baseline measurements of process reliability. Employees perform an ongoing role of preparation by making the process tools ready for use immediately after their previous use.

	1.	2.	3.	4.	5.	Score
<b>5.3 Operational Effectiveness</b>	Frequent lost time with no effort to manage downtime	Critical constraints are identified and baselines on reliability are obtained	Physical and operational constraints are addressed	The process is restored and maintained through planned formal effort	Continuous improvement of overall process effectiveness is the norm	

**5.4 Preventive Maintenance.** An organized and discipline preventive maintenance program is part of every world-class CPI-focused organization where process equipment is required. To prevent downtime, equipment should be cleaned and checked systematically, with the operators playing a role in ensuring that the required maintenance is done.

	1.	2.	3.	4.	5.	Score
<b>5.4 Preventive Maintenance</b>	There is no attention given to preventive maintenance	Maintenance department performs only minimal preventive checks	Machines are cleaned and checked but not systematically or on a regular basis	Machines have regular cleaning checks. Operator checklists are in use	Preventive maintenance schedule is in place, regularly followed, and work on machines is conducted during non-production hours	

**5.5 Total Productive Maintenance.** TPM is a comprehensive approach to processing equipment continuous improvement in production and maintenance environments. TPM includes preventive maintenance, employee involvement, and focused attention on continuous improvement of equipment for improving work process cycle times and costs, not just meeting existing equipment capability specifications.

	1.	2.	3.	4.	5.	Score
<b>5.5 Total Productive Maintenance</b>	No plan or practice of TPM	Decision to implement. Goal and policies are established. A plan for implementing TPM is created	Critical equipment reliability and effectiveness is improved. Operators are trained and begin autonomous maintenance	Maintenance department is engaged in a planned maintenance system	Early equipment management program in place. TPM program is in place and continuously improved upon	

## **Process Quality**

There are different CPI tools and procedures for improving quality. Four of the most important are mistake proofing, in-station process control, work standardization, and visual control.

**6.1 Error Proofing.** Error proofing a process means that a method of intervention is placed in that process to either find defects or prevent them from being passed on. Prevention is preferred because it eliminates the costs of re-work, carrying defective inventory, and material handling to

move the defective product in and out of repair operations. Error proofing is one of the key ingredients to achieving stability; it is the first stage on the road to becoming a lean organization.

	1.	2.	3.	4.	5.	Score
<b>6.1 Error Proofing</b>	There is no error proofing in place or awareness of the need	There is awareness of the need for error proofing but no attempt to implement	Some error proofing tools are applied occasionally and with little lasting gains	Error proofing is applied in a planned and effective manner but not widespread	Error proofing is applied in a planned and effective manner and is widespread	

**6.2 ISPC.** In-station process control (ISPC) integrates the inspection process within the ongoing work process. Employees performing work must understand what constitutes quality and have simple methods of measuring and controlling it. This is commonly referred to as quality and responsibility at the source.

	1.	2.	3.	4.	5.	Score
<b>6.2 ISPC</b>	No inspection or inspection standards	Both inspection and repairs are made off-line	Inspection is made in-line, but repair is made off-line	Both inspection checks and repair or rework are made in-line	In-line inspections are ongoing	

**6.3 Standardized Work.** Standardized work is a method used to organize tasks in a predictable, safe, and efficient manner. Standardized work documentation should be used anywhere there is a definable and repeatable process.

	1.	2.	3.	4.	5.	Score
<b>6.3 Standardized Work</b>	No standards are visible	Only quality standards are posted	Quality and job standards are posted but not followed	Many operations are standardized. Standards are usually followed	Standards are current, clearly posted, and followed nearly every time	

**6.4 Work Balance.** When the customer need is known, a “takt time” or drumbeat to the pattern of those needs can be set, and that determines the pace and type of work performed throughout the entire value stream for satisfying customer requirements. Work must be rebalanced as necessary to meet changing demand patterns. The goal is to develop a flexible process capable of rapid response to specific customer needs with little or no need for excess inventory or wait time.

	1.	2.	3.	4.	5.	Score
<b>6.4 Work Balance</b>	Employees set a slow pace	Employees set an uneven work pace	Employee work pace contains rhythmic movement, but hidden wait time	Employee movement is rhythmic, and pace is set by takt time	Good work balance between throughput and current customer demand replenishment	

**6.5 Visual Control/Visual Display.** Visual control of any process is achieved by eliminating barriers to current process activity visibility and using visual aids to organize the environment to ensure consistent quality and provide support for productivity standards.

	1.	2.	3.	4.	5.	Score
<b>6.5 Visual Control/ Visual Display</b>	It is difficult to recognize the differences between standard and non-standard conditions	The differences between standard and non-standard are recognized, but reaction time is slow	Mechanisms are in place to deal with differences (line stop or andon), but response is slow	Line stop or andon is in place, and response time for their use is quick	There is systematic approach for quickly responding to differences/problems and applying countermeasures	

**6.6 Customer Focus.** The ultimate customer is the focus of all process efforts. Customer requirements drive process work efforts. Customer satisfaction is regularly measured, and this information drives improvements of quality, cost, and delivery.

	1.	2.	3.	4.	5.	Score
<b>6.6 Customer Focus</b>	There is little concern with the customer satisfaction	Effort is begun to determine customer requirements	Customer satisfaction is measured. Customer information drives improvements of quality, cost, and delivery	Quick responses to customer needs are systematically communicated and anticipated	All work processing is scheduled and paced to customer requirements	

## ***Just-In-Time***

Just-in-time is a philosophy and methodology focused on ensuring the elimination of waste in any form to ensure that the right product, at the right cost and in the right quantity, is delivered to the customer at the right time. Representative JIT elements include quick setup and changeovers, streamlined cellular layouts, customer demand pull systems, and continuous balancing between customer demand and supplied goods and services.

**7.1 Setup and Changeovers.** Quick changeover is a method to shorten the changeover and setup times in any work environment using continuous improvement methods to eliminate waste.

	1.	2.	3.	4.	5.	Score
<b>7.1 Setup and Changeovers</b>	Changeovers are not standardized or regulated	Standardized work is established for changeovers	Changeover teams are set up, and improvement projects have begun	Changeover teams reduce changeover times by moving internal elements to external elements	Changeovers are accomplished within cycle times, and changeover teams use continuous improvement to reduce changeover times	

**7.2 Cellular Layout.** Although not all office, shop, and field support processes are best served by a cellular layout, many traditional process flows could be improved upon. The basic approach is to focus on layout changes based on process rather than function, with the goal of eliminating material handling and streamlining operations.

	1.	2.	3.	4.	5.	Score
<b>7.2 Cellular Layout</b>	Layout is haphazard	Current and future state analysis has taken place. Placed layout has started by instituting a logical flow	There are clear and well-defined input and output areas between cells	Operations within cells are streamlined to reduce waste. Standardized mins/maxs are created, and standardization is applied to all processes	Smoothly operating cells are organized with one-piece flow within and between cells. A system of continuous improvement is used	

**7.3 Material Planning and Processing.** World-class CPI organizations move from push to pull of materials wherever possible to eliminate waste of time, labor, and material resources.

	1.	2.	3.	4.	5.	Score
<b>7.3 Material Planning and Processing</b>	No systematic method to move material	Push methods are used to direct material flow	Push methods are used, with assigned jobs or areas	Next process picks up needed material	Triggers are used to pull material to the consuming process	

## Information Management

Timely managing of information and maintaining a flow of communication is critical to achieving the goals of CPI-focused organizations. Three important elements in information management are knowledge of customer response status, communication of performance, and aligned metrics that drive performance.

**8.1 Problem-Solving Activities.** World-class CPI-focused organizations are continuously involved in problem solving. Active problem solving is a crucial part of the culture. Continuous improvement teams seek opportunities to apply problem-solving skills.

	1.	2.	3.	4.	5.	Score
<b>8.1 Problem-Solving Activities</b>	No structured problem solving in evidence	Operators are offered training in problem solving	Work groups engage in problem solving activities on a regular basis	Continuous improvement teams	Active problem solving is crucial part of the culture	

**8.2 Communication.** For the work force to feel involved and empowered, it is important that they have they information they need about how the organization is doing and what is required of them.

	1.	2.	3.	4.	5.	Score
<b>8.2 Communication</b>	Communication between management and workforce is non-existent	Communication between management and workforce is sporadic	Communication from the site leader is frequent and direct	Management's actions are generally consistent with what it says it will do	Management communicates priorities and strategies directly and honestly to all levels and trusts the workforce	

**8.3 Metrics.** When implementing CPI, it is essential to use metrics that are aligned with organizational strategic plans, goals, and objectives. The same metrics need to be aligned down through every level of the organization. Metrics should focus on the areas of improving cost-effective customer response capability (readiness), achieving the required quality/reliability of products and services, reducing the total customer response cycle time, and achieving the lowest total cost for providing products and services.

	1.	2.	3.	4.	5.	Score
<b>8.3 Metrics</b>	No consistent visible metrics driving org. actions	Org. leadership recognizes new metrics for CPI, but use is sporadic	Different metrics are used in different process activities	Consistent metrics are aligned with org. goals and objectives	Aligned metrics are used with near real time, two-way feedback	

### Example Assessment Scoring

Table D-1 is an example worksheet for scoring an assessment based on the set of questions above. The results from a filled out worksheet can be captured in a “spider” diagram of the sort that follows it (Figure D-1).

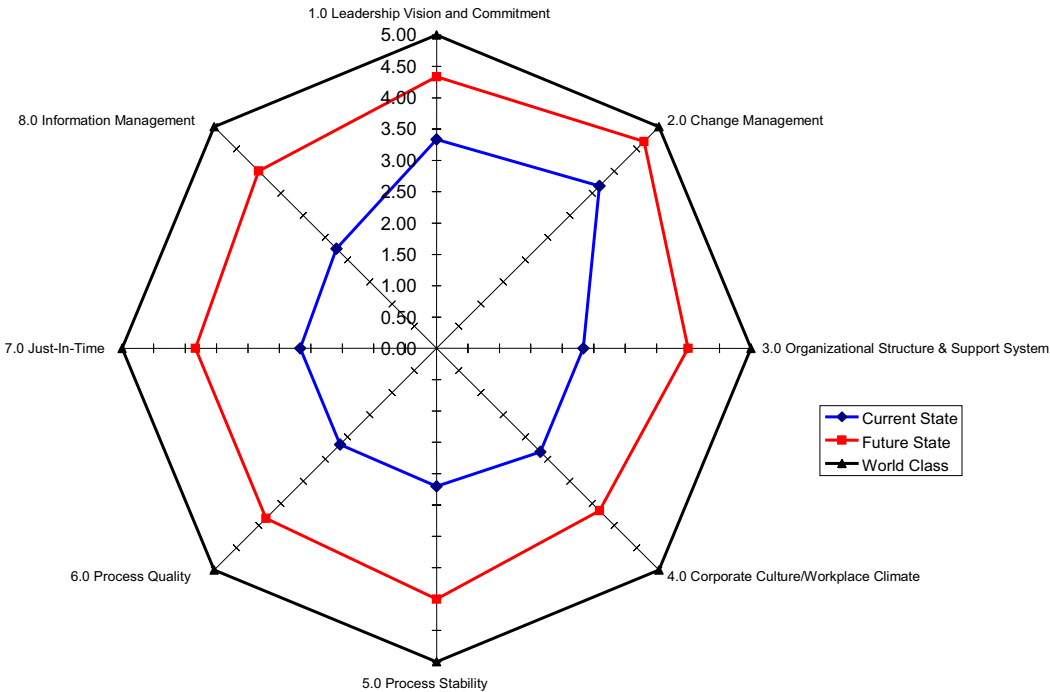
*Table D-1. Assessment Scoring Worksheet*

Item	Gap analysis	Current state	Future state	Gap	Importance	Evaluator rating
1.1	Vision					
1.2	Commitment					
1.3	Policy Deployment					
2.1	Leadership					
2.2	Steering Committee					
2.3	Support Team					
3.1	Team-Based Work Groups					
3.2	Aligned Organization					
3.3.1	PDCA Management Process					
3.3.2	Empowering, Facilitating, Coaching Styles					
3.4.1	Training					
3.4.2	Compensation and Recognition					
3.4.3	Selection Process					
4.1.1	Employee Attitudes Toward Improvement					
4.1.2	Cooperation, Trust, and Respect					
4.1.3	Employment Security					
4.2.1	Learning/Continuous Improvement					
4.2.2	Suggestion Systems					
4.3.1	Selection Process					
4.3.2	Certification					

Table D-1. Assessment Scoring Worksheet

Item	Gap analysis	Current state	Future state	Gap	Importance	Evalu- tor rating
5.1	Workplace Organization					
5.2	5S+1 Discipline for a Clean Workplace					
5.3	Operational Effectiveness					
5.4	Preventative Maintenance					
5.5	Total Productive Maintenance					
6.1	Error Proofing					
6.2	ISPC					
6.3	Standardized Work					
6.4	Work Balance					
6.5	Visual Control/Visual Display					
6.6	Customer Focus					
7.1	Setup and Changeovers					
7.2	Cellular Layout					
7.3	Planning and Processing					
8.1	Problem-Solving Activities					
8.2	Communication					
8.3	Metrics					

Figure D-1. Advanced CPI Assessment Example Spider Diagram







# Attachment E. CPI Toolbox

An organization pursuing CPI should embrace all applicable concepts, tools, techniques, and methodologies that will drive it toward better attainment of enterprise objectives. While no organization is likely to (or needs to) master every improvement technique, the objective is to seek out the best means available for continuous improvement. Key tools, concepts, and techniques have evolved to support an organization in its continuous improvement journey.

Additional tools and techniques will no doubt be created through human ingenuity to respond to difficulties which process owners have not yet faced. An unfortunately common error is to become overly focused on a single methodology or tradition to the exclusion of others. Attempting to apply the same tool or technique to every problem will inevitably result in some sub-optimization or possibly failures. A more holistic approach defines each problem carefully and applies the appropriate improvement tool or technique.

This attachment briefly describes the evolution of continuous improvement as an organizational imperative, and then identifies a sampling of the more common tools, concepts, and techniques currently available to drive CPI. Numerous detailed publications are available on specific continuous improvement techniques, so this guidebook's discussion of them is limited in number and scope. Following that are helpful documentation guides and checklists. Additional insight and knowledge can be gained from the resources identified in Attachment A.



# **CPI Toolbox**

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# Section 1. The Evolution of Continuous Improvement

## 1.1 Just-In-Time

Just-in-time (JIT) was pioneered at Toyota in the 1950s. It is a philosophy of continuous improvement with a set of concepts and techniques geared to better meet the needs of customers by eliminating waste that impairs process flows and the value-added component of any product or service. JIT is thought to originate in Japanese study of the replenishment processes at American grocery stores, where meeting customers' changing demands and spoilage challenges have to be carefully balanced. JIT originally focused on production shop floor improvement and gradually expanded to a variety of staff functions.

## 1.2 Lean

Lean is the evolution of JIT over the past decade leading into the 21<sup>st</sup> century. Several lean refinements include value stream mapping and applying refined continuous improvement to any type of organization generating a product or service. Lean is a mindset that drives individual behavior and ultimately culture change. In lean organizations,

- waste is highlighted as it is encountered,
- waste is relentlessly attacked using a variety of simple and effective tools,
- the environment challenges employees to expand their capabilities and creativity,
- leaders challenge traditional processing conventions and metrics,
- the ability to respond to the customer is quicker, with higher quality products and services at lower cost, and
- everyone listens intently to the voice of its customers in providing new and improved products and services, striving for continuous quality, cycle time, and cost improvements.

## 1.3 Continuous Process Improvement (CPI)

CPI for the purposes of the DoD enterprise is the evolution of JIT, Lean, and other best practices to support cost-effective readiness support to the warfighter. CPI contains a toolbox with an open architecture that welcomes any effective combination of continuous improvement tools and techniques. These combinations may or may not be organized to be pulled out to achieve specific objectives. All remain available for immediate access by the CPI practitioner. An example of the components of a typical toolbox might include elements of lean, theory of constraints (TOC), and Six Sigma ( $6\sigma$ ). No single set of components in a toolbox is ideal to fully drive CPI under all circumstances.



## Section 2. Tools, Concepts, and Techniques

### 2.1 Cellular Processing

Cellular flow as a technique consists of grouping nodes in a supply chain, people and machines dedicated to production or repair operations, and service activities so that a process can advance from one step to the next without waiting for a batching to be completed. Opportunities for continuous improvement have increased visibility in a cellular flow environment (see Figure 2-1).

Cells and flow are set up to make it easy to see the work flow, the operational status, and identify problems.

Cellular flow results in improved predictable customer response, product and services' quality, cycle times.

A cell utilizes minimal time, space, and materials to get the job completed. This is by design to minimize travel distances as well as allow for ease of movement of material from step to step.

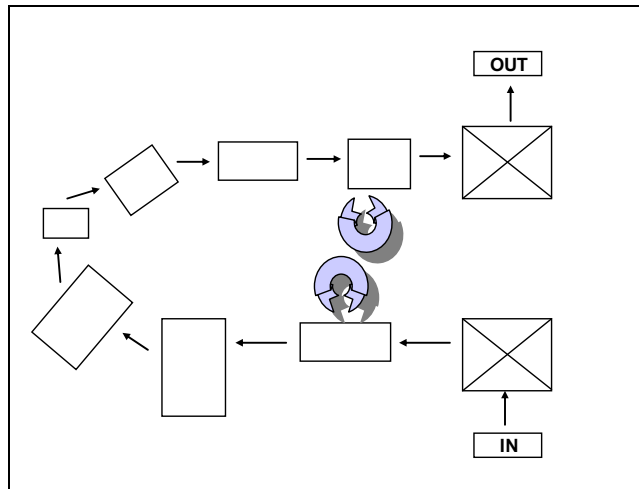


Figure 2-1. Notional Cellular Flow

### 2.2 DMAIC (Define-Measure-Analyze-Improve-Control)

DMAIC is an ordered problem-solving methodology applied widely in private- and public-sector organizations. The letters are an abbreviation for the five phases of Six Sigma improvement. These phases direct a process improvement team logically from problem definition to implementing solutions that are linked to root causes. The methodology also focuses on establishing best practices to help ensure that the improvement solutions stay in place. DMAIC is typically implemented through two primary modes in Six Sigma improvement efforts, the project team approach, which normally involves full-time deployment of key team members for 1 to 4 months, or the kaizen approach, which stresses rapid, intense progress through all DMAIC stages except full-scale implementation.

### 2.3 Error Proofing (Poka-Yoke)

Finding and correcting defects caused by errors cost more and more as a system or component flows through a process. To prevent this expense, industrial sites have long been placing a great deal of attention on the concept of error-proofing. Shigeo Shingo introduced the concept of

poka-yoke at Toyota Motor Corporation. Poka-yoke (pronounced “POH-kah YOH-kay”) translates to “avoid unintentional errors.”

The heart of error proofing is simply to pay careful attention to every activity in the process and to place checks and problem prevention at each step. It is a matter of constant, instantaneous feedback that is implemented by using simple objects like warning devices to make common mistakes virtually impossible. These devices have the following characteristics:

1. User-friendly
2. Simple to install
3. Do not require continuous attention from the employee (ideally, they should work even if the employee is not aware of them)
4. Low-cost
5. Provide instantaneous feedback, prevention, or correction.

Error proofing is designed to prevent mistakes, not merely catch them. Mechanisms such as limit switches, optical inspection systems, guide pins, or automatic shutoffs are common error-proofing strategies. These devices can be electrical, mechanical, procedural, visual, human, or any other form that prevents incorrect execution of a process step. They can be implemented in areas other than production, such as logistics, procurement, information systems, maintenance and service, or product development, where the cost of mistakes can be as much as in industrial operations.

## **2.4 Kanban**

Kanban is a signal that is sent from a customer to a supplier within an organization’s internal operations and/or throughout an entire supply chain to link a customer’s demands to the entire supplier chain for quick replenishment. The concept of kanban has been extended beyond the original concept of a signal card to include other forms of triggering signals. The key is that the kanban signal is a precise trigger that happens at precisely the same time as a demand arises for a product or service, such as a warfighter’s need for replacement of a weapons system or component, and serves to trigger the timely required response.

## **2.5 Automated Resource Planning**

As manufactured products and volumes became more complex, and computer technology advanced, tools for materials requirements planning (MRP) and manufacturing resources planning (MRP II) were designed and implemented to replace manual scheduling processes and to support expanded operational organizational information sharing. When applied with well-structured disciplines, MRP is capable of accurately tracking inventory, ordering materials, and capacity planning. It is best used as a planning device and decision-making tool for the intermediate and long-term planning of material requirements. The effectiveness of this planning tool is a function of the accuracy of the planning parameters used, the predictability of both supply and demand, the careful configuration of the system to the enterprise needs, and the rigid disciplines with which it



must be employed. A variant of this methodology in maintenance, repair, and overhaul (MRO) activity considers repair, replace, and use-as-is probability factors. MRP II is the expanded application of MRP logic and related data-gathering and -sharing capabilities across an organization to support planning, execution, and control activities.

Enterprise resource planning (ERP) is the evolutionary tool originating from MRP and MRP II. World-class users of ERP systems take advantage of their planning capabilities to ensure integrated effectiveness of the physical, material, and human resources required within their organizations and with their external supply chains to meet customer requirements. MRP II and ERP are automated technologies that promote cross-functional, multi-level intra- and extra-organizational information sharing, which are important elements in continuous improvement.

## **2.6 Mixed Model Scheduling**

In the situation where an organization is asked to produce or service more than one model of anything, the usual tendency is to set up dedicated lines for each product. This, in essence, is building in batches and not in the proportion of the customer expectation. Mixed model scheduling is a technique that aims to provide in the exact proportion what the customer orders. This approach requires very quick changeover and high process reliability.

## **2.7 Pull**

Pull is the concept related to only providing material, products, or services to the subsequent customer process when they are required. Customer-supplier relationships are viewed as existing within an organization as well as between the organization and its external customer. Pull relies on predictability in time and quality for effectiveness. Pull is exerted to generate products and services based on the rate of actual consumption, such as replacement of a working weapon system for the warfighter. Pull allows the organization to reduce inventory while simultaneously improving quality and cost-effective response to the end customer.

Pull production or maintenance means moving a subassembly or product to the next step only when that step or customer is ready to accept it and needs to actively work with it. Pull is contrasted to a push system, where the upstream step determines when the unit is sent to the downstream operation, which usually results in excess inventory and an adverse impact on capacity.

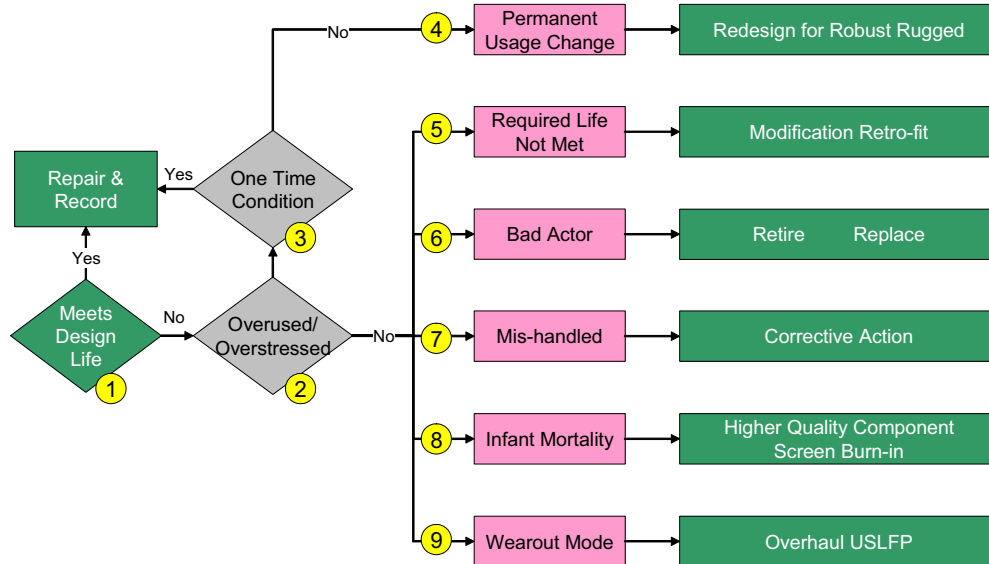
## **2.8 Rapid Improvement Event**

Rapid improvement event (RIE) is a relatively short-term, high-intensity effort tool to address a specific problem. The focus may be an effort over several days, a week, or several months; the preparation begins several weeks beforehand, and follow-up continues after. An RIE may also be called by other names, including rapid improvement workshop, kaizen event, kaizen blitz, and accelerated improvement workshop. The focus is on improving the situation regarding the existing problem, not striving for absolute perfection, which might take much longer or fail in the complexity of follow-through.

## 2.9 Reliability-Centered Maintenance

Reliability is a risk assessment method stated as the probability that a system or component will operate, as intended, in a given environment for a specified period of time, within specified maintenance guidelines. Reliability-centered maintenance (RCM) is a process for determining maintenance requirements of any asset in its operating context. Certain basic questions are asked during the RCM process, as depicted in Figure 2-2.

Figure 2-2. Reliability Fact-Based Decision-Making Process



RCM 2 is a revised approach to reliability centered maintenance being implemented by organizations today to continually improve asset reliability. Environmental consequences, revision of terms for clarity, and the addition of a secondary decision process for handling hidden functions were the primary areas of change in the RCM 2 approach.

## 2.10 Scientific Method

A number of problem-solving methodologies rely basically on the scientific method:

1. Observe and describe the situation.
2. Formulate a problem statement.
3. Use the problem statement to predict results or determine the root cause.
4. Perform controlled tests to confirm initial problem statement expectations.

The plan-do-check-act (PDCA) and design-measure-analyze-improve-control (DMAIC) methodologies are representative derivatives of these methodologies.

## 2.11 Six Sigma ( $6\sigma$ )

Six Sigma ( $6\sigma$ ) concepts and tools were originally developed by the University of Tennessee and adapted by Motorola to minimize process variation. Literally speaking, “six sigma” refers to quality at the level of plus or minus six standard deviations from the mean, or approximately 3.4 defects per million units of something processed. Six Sigma drives improvement from the top down using a well-defined structure. There are well-defined roles within this approach:

- Executives are trained as “champions” to help break down barriers.
- “Master Black Belts” serve as trainers and may oversee enterprise initiatives.
- “Black Belts” serve as trainers.
- “Black Belts” and “Green Belts” lead projects of proportionately differing complexity.

Six Sigma does not directly accelerate cycle time and responsiveness, but is essential to reducing variation that impairs cycle time and cellular flow improvements.

## 2.12 Takt Time

Takt time is a pull concept developed to tune the rate of processing to the customer’s rate of need. Synchronizing supply with demand is an important step in eliminating many forms of waste. Takt as a word is usually considered to represent a drumbeat, such as the drumbeat of a process that controls the pace of activity. It is calculated by dividing the amount of available process time by the number of units required to meet customer demand. Takt time can be used to pace the work in any environment.

Takt time is a computed rate that any individual process in a value stream should ideally require in order to exactly satisfy the customer. Takt time analysis is comparing actual process cycle times to the takt time to understand where flow is missing and non-value-added steps exist.

## 2.13 Theory of Constraints

Theory of constraints (TOC) is a concept with a set of tools developed by Eliyahu Goldratt that focuses on five steps:

1. Identifying the system’s constraint that limits overall operational performance
2. Exploiting the system’s constraint to get the most out of it without additional investment, such as running extra shifts, through breaks, etc.
3. Subordinating everything else that is not the system’s constraint to the attention on it, such as giving preferential support to the system’s constraint, since it alone determines the cycle time of the total operation

4. Elevating the system's constraint to alleviate its influence, by purchasing additional equipment, adding personnel, eliminating waste to reduce this process's requirements, or redistributing effort across other process steps to rebalance flow; as a result, some other process element or step now becomes the system's constraint
5. Go back to step one and repeat the process for the new system constraint.

Critical chain (CC) is a planning process tool that considers the constraints across a number of different projects or production/service activities, such that the practical capacities of key resources are respected, and constraints receive elevated visibility in order to be addressed and to improve overall organizational throughput and cost performance. CC is often supported by software due to the typical complexity of juggling multiple variables across potentially a number of different project/item flows.

## **2.14 Value-Added**

Value-added activities change a product or service in a way that customers view as important and necessary. From the opposite perspective, a non-value-added (NVA) activity is any step that the customer would not miss if there was a way to eliminate it. For example, if delivering a perfect product without the inspection steps would make the customer just as satisfied, then the inspection steps add no value.

This strict definition keeps the list of value-added activities very short. That intentionally causes an organization to look hard at every task. As the stack of NVA activities grows, every organization will find that it needs to prioritize those it wants to attack first. It is not uncommon to find 90 to 99 percent of the time consumed in a process to be NVA, when considering waste in any form. One useful criterion is to separate the pure waste from what is often described as "necessary" NVA. Pure waste can and should be attacked immediately. Necessary NVA activity, however, may currently be required for a variety of reasons. That is not to say that these NVA activities can be ignored. As technology improves, processes are brought into control, and business conditions change, the CPI-driven enterprise can often minimize or eliminate NVA activities that are currently regarded as necessary.

## **2.15 Value Chain Analysis**

Value chain analysis is the study of all links to an organization from original suppliers through delivery processes to the customer that add value to goods and/or services provided. This is typically a higher level, big picture mapping analysis of an enterprise that subsequently leads to lower level SIPOC (suppliers-inputs-process-outputs-customers) and value stream mapping analyses.

## **2.16 Value Stream Mapping**

Value stream mapping is a technique that begins with the objective of identifying the waste in the current state of a production, repair, or other service process. The purpose is to use this identification of waste to focus resources on the issues that will make the largest improvements on

the process as a whole. The technique draws together process owners, contributors, and users in a cross-functional team setting. Using interview and illustration techniques, a team quickly defines the process steps and the data pertinent to those steps. A subsequent deep review of the sequence and nature of those steps, the transitions between steps, time required and distance spanned, and the information systems employed reveals the level of opportunity for improvement available. There are typically four steps to driving improvement from value stream mapping:

1. Selecting the value stream to be mapped
2. Creating the current state map
3. Creating the future state map
4. Implementation.

A value stream is a set of activities to convert customer needs into delivered products or services. A value stream map (VSM) is a tool that helps visualize and understand the flow of material and information as a product or service makes its way through the value stream. The VSM is displayed at a broad level that visually presents the flow of a product or service from customer to supplier, and presents both current state and future state visions. A VSM helps an organization

- visualize multiple process levels,
- make “hidden” decision points apparent,
- look at the “big picture” as opposed to a single process step,
- quickly see sources of waste in your value stream,
- question current material and information flow,
- describe how your facility should operate,
- see the links between material and information flow,
- form the basis of a plan to implement from door-to-door,
- identify areas where lean and Six Sigma tools/techniques are applicable for problem solving,
- allocate the appropriate resources to solve the specific problems, and
- describe what is going to be done to improve baseline metrics.

A VSM can do all of the above, because it is an effective way for people to visualize the following when chosen to be documented during the data analysis:

- Lead times
- Cycle times
- Takt time
- Uptime
- Changeover time
- Shipping frequencies
- Scrap percentages
- Yields
- Value-added and non-value-added steps
- Customer forecasts
- Raw material orders
- Information flow
- Material flow
- Changeover times.

A recent addition to the VSM process is consumption value stream mapping by the customer and provisional mapping by suppliers to reduce waste in any form (Womack and Jones, 2005). These alternative maps tend to be less complex and heighten focus on direct customer involvement and voice.

## **2.17 Waste**

Waste is anything that uses resources without providing value to the customer. Resources may be materials, people, time, tools, and other things of value. The customer may be the internal series of customers or any customer along the extended value stream. Waste exists in all work at all levels within an organization. The ideal goal of CPI is to eliminate all waste within an organization. Typical examples of waste are poor quality, inventory, over production or excess repaired items beyond current demand, unnecessary processing steps, transportation/moving, waiting/delays, and excessive motion beyond the minimum required.

## **2.18 Eight-Step Problem Solving**

The OODA loop (observe, orient, decide, act)—created in the 1950s by Col. John R. Boyd, USAF—is an objective description of the decision-making process and is compatible with the principle of continuous improvement in the Department of Defense. The OODA loop can be broken down into an eight-step problem solving road map, flexible enough to be effective at any level. This approach is similar to plan, do, check, act (PDCA) and design, measure, analyze, improve, control (DMAIC).

Figure 2-3. Eight-Step Problem Solving/OODA Loop

**O**bserve

Step 1: Clarify and Validate the Problem

Step 2: Break Down the Problem and Identify Performance Gaps

**O**rient

Step 3: Set Improvement Targets

Step 4: Determine Root Causes

**D**ecide

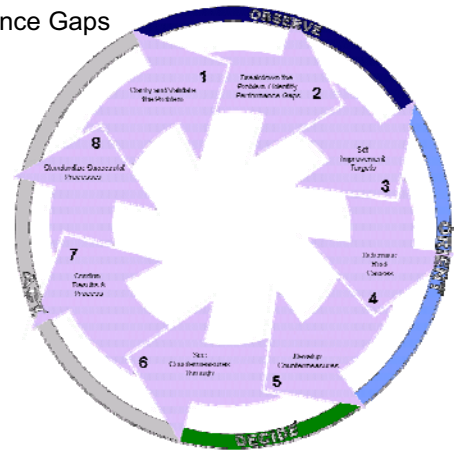
Step 5: Develop Countermeasures

**A**ct

Step 6: See Countermeasures Through

Step 7: Confirm Results and Process

Step 8: Standardize Successful Processes



Consistently applying this process provides a concise and common format for presenting data, problem-solving facts, and information. Action comes at the end of the OODA loop for a reason: to prevent senior leaders from acting too early and perpetuating a common problem found among marksmen: “ready, fire, aim.”





# Attachment F.

## Guides, Checklists, and Project Charters

The purpose of this attachment is to give facilitators a common set of helpful documentation and checklists to use when engaged in process improvement tasks or events. These documents might be especially useful to new CPI facilitators. It is assumed that these guides will be used by all levels of facilitators to ensure a common method and consistent efforts.

This documentation begins by describing a generic flow for implementing CPI. It is assumed that the organization leadership has received CPI awareness training and is pursuing a CPI approach. The first checklist in the guide helps the facilitator conduct a pre-team meeting with leadership to set the stage for change. The second checklist describes establishing a team charter for the organization's CPI steering committee. The additional checklists and other documentation describe specific activities that the implementation team should accomplish, as well as those that may be used for facilitation purposes.

The checklists are provided in a likely sequence of use during CPI implementation—for example, value stream assessment, then SIPOC, followed by value stream mapping, then rapid improvement events. The following descriptions are an overview, which is followed by the models for each document.

1. **Generic Flow and Facilitation Guide:** This is a description of how CPI activities typically begin and how they should progress.
2. **Pre-Team Meeting Guide:** This describes the information the facilitator should ask the organization's leadership when starting up an implementation team. Attendees: champion, process owner, steering committee key members, facilitator.
3. **CPI Event Analysis and Results Report:** This document is modeled after the A3 report pioneered by Toyota to identify a problem and document the analysis and results.
4. **Steering Committee Charter Accomplishments Checklist:** The next step in this process is to identify a steering team and assist it in writing a charter. The charter checklist shows the minimum information required, and care should be taken to make the charter clear but short and simple. Attendees: steering team, sponsor, process owner, implementation team leader, facilitator.
5. **Team Kick-Off Meeting Checklist:** This is the first time the implementation team meets. The steering team members first review and clarify the team charter, and they all agree upon its details. Then basic CPI team training is accomplished with the steering team in attendance. Attendees: steering team, sponsor, implementation team leader and members, facilitator.
6. **Value Stream Assessment Guide:** This is used to identify and prioritize the value streams in the organization. This effort should consider the enterprise level of the organization and

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ensure that implementation teams are focused on processes that affect the organization's aligned goals. Attendees: senior leadership, steering team, sponsor, facilitator.

7. **SIPOC Guide:** A Supplier, Input, Process, Output, Customer (SIPOC) review is a top-level checklist approach for addressing the process to be improved. It ensures that the implementation team understands where the process starts and ends, and who their customers and suppliers are. Attendees: implementation team leader and members, facilitator.
8. **Value Stream Mapping Guide:** This describes the steps to create a value stream map of any process. Attendees: implementation team leader and members, facilitator.
9. **Operational Plan Tracking Sheet:** Used to document CPI projects.
10. **Basic Lean Steps Guide:** This describes the minimum activities that should be accomplished when leaning out a process. Some of the steps are the same as the other guides and can be used to explain the lean process to the implementation team.
11. **Rapid Improvement Event (RIE) Checklist:** This describes the specific steps that should be completed to accomplish an RIE. The RIE process is broken down into three main parts: pre-event activities, the event itself, and post-event activities. Alternatively referred to as a kaizen blitz or event.
12. **Six Sigma DMAIC Basic Steps Checklist:** This checklist outlines and explains the basic steps of the Six Sigma tool for the facilitator's reference and use.
13. **Logical Problem Solving Process:** This document provides a basic approach to solving problems once they have been identified.
14. **VSM Data Collection Checklist:** This lists the minimum data inputs the facilitator should ask the implementation team to collect for the process being improved. Data items that support the organization's goals and strategic metrics should be added as required to ensure alignment of efforts.
15. **Steering Committee Agenda Checklist:** This checklist identifies the major elements in a steering committee's typical meeting.
16. **CPI Climate Survey:** This survey should be used before the organization attempts CPI events to determine if they are ready to conduct CPI efforts. If the score is too low in any area, then more education and training should be accomplished to gain the support of these groups before beginning CPI. The survey consists of 10 questions to tell a facilitator three things:
  - a. Is there senior leader support for CPI?
  - b. Is there mid-level management support for CPI?
  - c. Is there floor or basic employee support for CPI?

17. **Meeting Guide and Checklist:** This describes proper meeting dynamics and will help a facilitator make team meetings more effective. It is based on the concept of shared responsibilities in any meeting and control of the time each meeting topic takes. Although it requires the team to identify set times for each topic and stop the discussion if time has expired, the team can add time as it sees fit. The objective is to control the meeting to ensure that all topics are covered and that team members leave the meeting feeling that they have accomplished something and know what their next tasks are.
18. **Project Charter Checklist:** This documentation provides the basic requirements for sound CPI project charters and related information.
19. **Eight-Step Problem Solving Guide:** This describes proper sequence of thought when analyzing a problem and developing countermeasures and confirming results. It is based on the OODA loop concept and provides concise format for decision making.



# 1. GENERIC FLOW & FACILITATION GUIDE

## Generic Flow

1. Awareness training (transformation and/or lean)
2. First contact from organization requesting assistance
3. Pre-team meeting
4. Steering committee charter accomplishment
5. Team kickoff meeting
6. Follow steps of applicable methodology/tool
7. Implement changes to process selected
8. Sustain new processes and gains



## 2. PRE-TEAM MEETING GUIDE

DATE: \_\_\_\_\_

\_\_\_\_ 1. Confirm Team Title

\_\_\_\_ a. Project Description (Background, Problem, Business Case)

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_ b. Goal: \_\_\_\_\_

\_\_\_\_ c. Scope: Process Start: \_\_\_\_\_ Stop: \_\_\_\_\_

\_\_\_\_ d. Dates: Start: \_\_\_\_\_ ECD: \_\_\_\_\_

\_\_\_\_ 2. ID Players

\_\_\_\_ a. Champion: \_\_\_\_\_

\_\_\_\_ b. Process Owner: \_\_\_\_\_

\_\_\_\_ c. Steering Committee: \_\_\_\_\_

\_\_\_\_ d. Tentative Team Lead: \_\_\_\_\_

\_\_\_\_ e. Implementation Team (by Function): \_\_\_\_\_

\_\_\_\_ f. Facilitator/Mentor: \_\_\_\_\_

\_\_\_\_ 3. Coordinate Stakeholder Survey and Analysis

\_\_\_\_ 4. ID Event/Tools to Use: SIPOC, VSM, RIE

\_\_\_\_ 5. Plan Steering Committee Charter Accomplishment (60 Minutes)

\_\_\_\_ a. Date/Time: \_\_\_\_\_

\_\_\_\_ 6. Plan Team Kick Off Mtg.

\_\_\_\_ a. Agenda

\_\_\_\_ b. Attendees (1<sup>st</sup> Half, 2<sup>nd</sup> Half)

\_\_\_\_ c. Deliverables: Charter, Training

\_\_\_\_ 7. Finalize Team Logistics

\_\_\_\_ a. Meeting Location

\_\_\_\_ b. Dates/Times

\_\_\_\_ c. Duration

\_\_\_\_ d. Frequency

\_\_\_\_ e. Equipment Needed

\_\_\_\_ 8. Other Issues/Questions



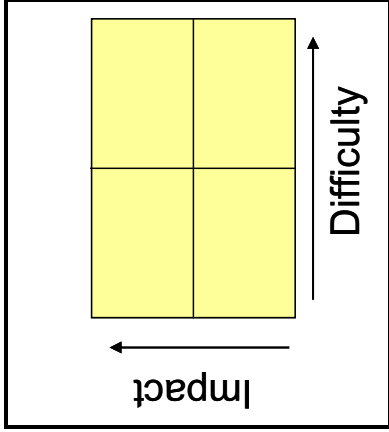


### 3. EVENT ANALYSIS AND RESULTS REPORT

Project Title: \_\_\_\_\_

Topic: \_\_\_\_\_

<input type="checkbox"/>	JDI
<input type="checkbox"/>	RIE
<input type="checkbox"/>	Project



Estimated Event Date (From/To):

Process Owner:

Team Leaders & Members:

Problem Description:

Event Description:

Implementation Costs:

Goals/Deliverables:

Savings:



## 4. ACCOMPLISHMENTS CHECKLIST

1. Complete Draft 10-Block
  - a. ID event type
  - b. PICK chart priority location
  - c. Problem description
  - d. Event description
  - e. Goals/deliverables
  - f. Estimated event dates
  - g. Process owner
  - h. Implementation team
  - i. Implementation cost
  - j. Savings
2. Team members and responsibilities
  - a. Steering committee members
    - i) \_\_\_\_\_
    - ii) \_\_\_\_\_
    - iii) \_\_\_\_\_
    - iv) \_\_\_\_\_
  - b. Steering committee responsibilities (examples):
    - i) Set vision/scope of effort
    - ii) Establish goals of effort
    - iii) Assist team in developing charter
    - iv) Select initial leader
    - v) Provide team members
    - vi) Release team members from other duties
    - vii) Fund team effort
    - viii) Ensure team is facilitated
    - ix) Ensure team has appropriate training
    - x) Monitor team progress
    - xi) Remove barriers
    - xii) Communicate team progress to senior leadership
    - xiii) Reward team successes
  - c. Team lead responsibilities (examples):
    - i) Make assignments
    - ii) Follow the lean methodology
    - iii) Learn lean tools
    - iv) Help team accomplish goals
    - v) Regular communication with steering team
  - d. Team responsibilities (examples):
    - i) Attend weekly meetings
    - ii) Be innovative, take risks, and ask why-not
    - iii) Update steering committee as required
    - iv) Generate new process recommendations
  - e. Facilitator responsibilities
    - i) Help leader get organized
    - ii) Be the process guide
    - iii) Train and mentor team members
  - f. Signatures
    - i) Process owner  
\_\_\_\_\_
    - ii) Steering committee  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
    - i) Team/project leader  
\_\_\_\_\_



## 5. TEAM KICKOFF MEETING CHECKLIST

DATE \_\_\_\_\_

\*\*\*USE of MEETING DYNAMICS REQUIRED\*\*\*

- \_\_\_\_\_ 1. Introductions/icebreaker
- \_\_\_\_\_ 2. Identify special team members
  - \_\_\_\_\_ a. Process owner
  - \_\_\_\_\_ b. Steering committee
  - \_\_\_\_\_ c. Team leader
  - \_\_\_\_\_ d. Facilitators, mentor
- \_\_\_\_\_ 3. Review/modify charter
- \_\_\_\_\_ 4. Work group/implementation team code of conduct
  - \_\_\_\_\_ a. Start and end on time (including breaks & lunch)
  - \_\_\_\_\_ b. Use meeting dynamics
  - \_\_\_\_\_ c. Maintain focus
  - \_\_\_\_\_ d. Break plan (50/10)
  - \_\_\_\_\_ e. Cell phones/pagers (VIBRATE ONLY)
  - \_\_\_\_\_ f. Everyone participates
  - \_\_\_\_\_ g. One conversation at a time
  - \_\_\_\_\_ h. No side discussions
  - \_\_\_\_\_ i. No retribution
  - \_\_\_\_\_ j. Decisions by consensus
  - \_\_\_\_\_ k. Use a “parking lot”
- \_\_\_\_\_ 5. Work group/implementation team logistics
  - \_\_\_\_\_ a. Location
  - \_\_\_\_\_ b. Dates/times
  - \_\_\_\_\_ c. Frequency
  - \_\_\_\_\_ d. Duration
  - \_\_\_\_\_ e. Equipment
  - \_\_\_\_\_ f. Reporting process
- \_\_\_\_\_ 6. ID events
- \_\_\_\_\_ 7. Event training (SIPOC, VSM, RIE)



## 6. VALUE STREAM ASSESSMENT GUIDE

### Current State

1. Identify vision, scope, goal (Directorate, Division, Branch, Process)
2. Ensure you have senior leader buy-in
3. Identify the right participants (subject matter experts, management, facilitator)
4. Identify data requirements
5. First team meeting—team introduction
  - a. Team building: code of conduct, logistics
  - b. Roles: leader, facilitator, scribe, recorder, timer
  - c. Team training: VSM, lean basics
6. Confirm data and sources
7. Identify/group major processes in organization  
(brainstorm) (major groups are the value streams)
8. Identify stakeholders in the appropriate groupings
9. List stakeholder group expectations/contributions
10. Identify top three to five expectations for each stakeholder group
11. Prioritize each stakeholder group's top three to five expectations on separate PICK (possible-implement-challenge-kill) charts
12. Identify common thread expectations
13. Prioritize value streams on a PICK chart
14. Build a prioritized focus list of value streams from PICK chart
15. Identify VSM implementation plan details





## 7. SIPOC GUIDE

1. Describe SIPOC template/blocks
  - a. Suppliers: provide inputs to process
  - b. Input: ID all process inputs relative to project scope
  - c. Process: high-level map, 5-6 steps
  - d. Outputs: process outputs delivered to customer
  - e. Customer: internal, external (end user)
2. ID customers
3. ID outputs to meet customer requirements/expectations
4. ID high-level process steps
5. ID inputs to process
6. ID suppliers
  - a. ID suppliers who are also customers
7. Request process feedback from workers (post sheets, e-mails)
  - a. Requires management approval
8. Walk/document high-level process
  - a. Product spaghetti chart
  - b. Manpower spaghetti chart
  - c. Collect step data (see template)
  - d. ID existing metric data (production number, time)
  - e. ID/collect other process data



## 8. VALUE STREAM MAPPING GUIDE

1. Validate data/sources
2. Review VSM steps (show visual)
3. Expand current state (SIPOC process steps) (product and information flows)
  - a. Touch time (active work time)
  - b. Cycle time (receipt to release)
  - c. Number of people in step
  - d. Cost of step
4. ID perfect state map
5. ID undesirable effects (UDEs) on T-chart
6. ID why UDE is a problem (T-chart, left side)
7. List possible solutions to UDEs (T-chart, right side)
8. Prioritize UDEs (PICK chart)
9. ID future state (optional before or after UDEs)
10. Generate an implementation plan—prioritize UDEs, categories of:
  - a. Just do it (JDI)
  - b. Rapid improvement event (RIE)
  - c. Project (PROJ)
11. Outbrief steering team, senior leaders
12. Task teams with JDIs, RIEs, and projects







# 10. BASIC LEAN STEP GUIDE

DATE

- \_\_\_\_\_ 1. Management selects focus for the process improvement event
- \_\_\_\_\_ 2. ID team members and baseline data
- \_\_\_\_\_ 3. Conduct a climate survey
- \_\_\_\_\_ 4. Finalize team logistics
- \_\_\_\_\_ 5. Conduct first team meeting
- \_\_\_\_\_ 6. Train implementation team on basic lean
- \_\_\_\_\_ 7. ID “as is” and “to be”
- \_\_\_\_\_ 8. Map Out existing Process
- \_\_\_\_\_ 9. ID value added and non-value added steps
- \_\_\_\_\_ 10. Map out optimum process
- \_\_\_\_\_ 11. ID and prioritize changes
- \_\_\_\_\_ 12. Implement changes with detailed plan(s)
- \_\_\_\_\_ 13. Follow up and recycle
- \_\_\_\_\_ 14. Identify additional changes





# 11. RAPID IMPROVEMENT EVENT STEPS

## 3 Main Parts

1. Pre-event activities
  - a. Management selects focus, scope
  - b. Identify team lead and alternate
  - c. Identify steering team and implementation team members
  - d. Identify baseline data to collect
  - e. Conduct organizational climate survey
  - f. Collect data
    - i) Customer demand
    - ii) Customer requirements
    - iii) Historical production data
  - g. Communicate team intent/expectations
  - h. Schedule team participation
  - i. Finalize logistics: location, dates, times
2. 2-5 Day event
  - a. Day 1: Identify current state
  - b. Day 2: Identify changes
  - c. Day 3: Prioritize changes and detail actions
  - d. Day 4: Implement changes and control plan
  - e. Day 5: Outbrief steering team
3. Post-event activities
  - a. Process owners must manage new process to control plan
  - b. Identify problems on control boards
  - c. Identify solutions to problems
  - d. Implement solutions to new process
  - e. Sustain team commitment and new process
  - f. Ensure that solutions are working
  - g. Sustain standard work
  - h. Stabilize new process
  - i. Update work documents on all changes
  - j. Compare/analyze metrics



## 12. SIX SIGMA DMAIC

### ***Steps: D M A I C***

The phases of Six Sigma are intended to improve the effectiveness of a process by identifying process variation in satisfying customer requirements and expectations, and then reducing or eliminating the variation. Once the process is stabilized, and achieving the desired level of effectiveness it is then leaned to optimize the efficiency.

#### **1. Define**

The first phase in the DMAIC process is to define the project, develop an improvement project plan, define the process, and evaluate progress. The process includes the following steps:

- Establish purpose and scope for the improvement project.
- Develop improvement project plan, including schedule and resources.
- Develop process map, including key elements and boundaries.
- Conduct a failure modes and effects analysis (FMEA).
- Identify critical parameters.

#### **2. Measure**

In the measure phase, existing process data is collected, measurement systems are evaluated, and the process capability requirements are identified. This phase includes the following steps:

- Determine process capability.
- Establish measurement method and tools.
- Determine sampling plan to meet goals.
- Collect data.
- Present status report.

#### **3. Analyze**

In this phase the process is evaluated to determine its capability. Process data are analyzed to identify opportunities for improvement and to develop plans for improving the process. This phase includes the following steps:

- Convert data into information.
- Determine process capability.
- Develop priority list of parameters.

- Perform root cause analysis.
- Update FMEA.
- Develop improvement plan.
- Present status report.
- Determine path forward.

#### **4. Improve**

In the improve phase, the improvement plan developed in the analyze phase is implemented. The results are evaluated, conclusions are drawn, and improvements are finalized and tested. After the desired improvements are implemented, the changes to the process are documented, and new instructions and procedures are developed. This phase includes the following steps:

- Implement improvement plan.
- Perform designed experiment if applicable (DOE).
- Measure improvements.
- Develop conclusions, recommendations, and next steps
- Update documentation.
- Present status report.

#### **5. Control**

In the control phase, the improvements become institutionalized. The process changes were documented in the improve phase. In this phase, control plans are developed to ensure that the process continues to be measured and evaluated. This includes implementing process audit plans, data collection plans, and plans of action for out-of-control conditions, if they occur. The control phase includes the following steps:

- Establish control system for each critical parameter.
- Establish data collection plan.
- Establish out-of-control plan.
- Establish internal audit plan.
- Develop and present final report.

## **13. LOGICAL PROBLEM SOLVING PROCESS**

1. Identify problems.
2. Prioritize problems based on impact.
3. Choose problem to attack.
4. State problem in simple, direct manner.
5. Analyze problem (reach root cause).
6. Generate solutions.
7. Generate criteria to evaluate solutions against.
8. Determine solutions that are not “dominated” (dominated solutions means there are other solutions that are better in all criteria).
9. From non-dominated solutions, determine feasible solutions (those that are legal, ethical, and meet organization requirements).
10. From feasible solutions, determine one or more optimal solutions based on overall effectiveness.
11. Perform sensitivity analysis.
12. Select and implement final solution.



## **14. VSM DATA COLLECTION TEMPLATE**

### ***OVERALL DATA REQUIRED***

1. Customer demand
2. Takt time
3. Cycle time
4. Budget breakdown
5. Number of personnel involved

### ***STEP DATA (collect for each step of a VSM):***

1. Title/name of process step
2. Touch time: active work time
3. Cycle time: time from receipt to release
4. Number of people involved
5. Cost of step activity





## **15. STEERING COMMITTEE UPDATE AGENDA**

1. Welcome steering team, visitors.
2. Identify steps accomplished since last update.
3. Identify next steps to accomplish.
4. Identify risks and barriers.
5. Questions from improvement team for steering team.
6. Questions from steering team for improvement team.



## 16. PROCESS IMPROVEMENT CLIMATE SURVEY

Questions 2–10 use the following 1–10 rating scale: 1 = Strongly Disagree. 10 = Strongly Agree. Please CIRCLE the appropriate number for each question.

1. In which of the following three categories would you place yourself?  
Senior leader (Dir, Dep, Div, Div Dep)  
Middle manager (Sup./Leader)  
Process owner/worker
2. I feel my organization's senior leaders support process improvement efforts.  
Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree
3. I feel my immediate supervisor supports process improvement efforts.  
Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree
4. I feel I would support process improvement efforts in my work area.  
Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree
5. I feel my organization senior leadership would resource process improvement efforts.  
Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree
6. I feel my immediate supervisor would resource process improvement efforts.  
Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree
7. I feel I would resource process improvement efforts in my work area.  
Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree
8. I feel that there are plenty of processes in my organization that could be improved.  
Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree
9. I feel I have an open mind to new ways of doing business in my work area.  
Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree
10. I feel I would initiate or participate in a process improvement effort in my work area if I saw the opportunity.  
Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

## Rules of Engagement for the CPI Climate Survey

**SURVEY GOAL:** To determine three things: organization’s support of CPI, organization’s willingness to resource CPI efforts, and individual’s willingness to initiate/participate in CPI efforts.

1. Give to any organization before it starts its first major process improvement effort.
2. At least 24 surveys must be completed and averaged to have valid data.
3. Representation from each category should be: 100 percent of senior leaders (Dir, Dep, Div, Div Dep); 50 percent of middle managers (Supervisors/Leads); at least 60 percent of total surveys should be from the process owner/worker category. **NOTE:** This survey should be kept anonymous and voluntary for union employees.
4. Decision points on average scores:
  - a. 8.0 or higher: Support PI. Ready to start an initiative. Management should continue what it is doing. TR will facilitate lean efforts in this organization.
  - b. 4.0–7.9: Neutral to PI. Management must strongly articulate support as the initiative begins. TR will facilitate lean efforts, but must see leadership involvement.
  - c. 1.0–3.9: Against PI. Opposed to PI. Delay any PI initiatives for 1–2 months until management can change culture and attitudes toward PI. Retake survey before starting initiative.
5. Expected averages by categories and attitude toward PI:

	Opposed to PI	Neutral to PI	Support PI
Senior leaders	6–7	7–9	9–10
Middle managers	1–3	3–5	6–8
Process owners/workers	2–4	5–7	9–10

6. Suggest survey be handed out by the Dir/Dep at a staff meeting with a pitch by senior leader. Return in two days.
7. Analysis of the survey data will be returned two days after turned in to TR for analysis.
8. Refer any questions on the survey or analysis to your organization’s CPI core team.

# 17. MEETING GUIDE

## **ROLES:**

Leader:		Purpose of meeting	
Timekeeper:			
Facilitator:			
Scribe:			
Recorder:			
Process guide:			

## **AGENDA:**

## **TIMES**

1.	Set Roles, Purpose, agenda items, and times	5	MIN
2.		_____	MIN
3.		_____	MIN
4.		_____	MIN
5.		_____	MIN
6.		_____	MIN
7.	Wrap Up	5	MIN

## **WRAP UP SPECIFICS:**

Next Meeting:

Date: \_\_\_\_\_ Time: \_\_\_\_\_

Location: \_\_\_\_\_

Tasking 1

What \_\_\_\_\_ When \_\_\_\_\_

To Whom: \_\_\_\_\_ When \_\_\_\_\_

Tasking 2

What \_\_\_\_\_ When \_\_\_\_\_

To Whom: \_\_\_\_\_ When \_\_\_\_\_

Tasking 3

What \_\_\_\_\_ When \_\_\_\_\_

To Whom: \_\_\_\_\_ When \_\_\_\_\_

Tasking 4

What \_\_\_\_\_ When \_\_\_\_\_

To Whom: \_\_\_\_\_ When \_\_\_\_\_

Tasking 5

What \_\_\_\_\_ When \_\_\_\_\_

To Whom: \_\_\_\_\_ When \_\_\_\_\_

Processing the Meeting:

Pluses

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---

---

Deltas

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***MEETING GUIDE WORKSHEET:***

# MEETING DYNAMICS GUIDE

The purpose of these instructions is to briefly describe how to use the Meeting Dynamics Worksheet to help you organize a meeting. If you use this worksheet and this format on all your meetings, you should see a reduction in meeting times, a clearer purpose and better organization of your meetings, and more participation and satisfaction from meeting attendees. These changes normally make for better, more effective meetings and communication.

## GENERAL INSTRUCTIONS

The Meeting Dynamics Worksheet must be used at the start of every meeting to be effective. As the first agenda item lists, use the first 3-5 minutes of each meeting to identify people for roles, state the purpose of the meeting, and set the agenda. If you have already sent out a pre-agenda to all the meeting attendees or this is a standard meeting, like a staff meeting, then show the pre-agenda, but still offer an opportunity to add/delete, set/change times for the agenda items. Pick people for each role who understand the job, or quickly tell them what they are to do. People pick up the roles very quickly, and you can use the brief description of the roles listed below if you need to explain one. Do your best to start on time, stay on time, and end on time, and keep the meeting focused.

## ROLES

**LEADER:** This is typically the person who requested or called the meeting. However, for team meetings, it is often effective to rotate leadership. This person directs the group and manages the meeting to accomplish the meeting objectives. The leader and facilitator work closely together to make the meeting effective and efficient. Both are responsible to ensure that the meeting covers the planned topics and accomplishes the stated purpose of the meeting.

**TIMEKEEPER:** The timekeeper is the most important role in the meeting. If you do not have a timekeeper, you are not using meeting dynamics. This person tracks the time against the agenda time for each topic. He or she calls out “two minutes” and “time’s up,” or whatever number of minutes was identified by the group, to announce the end of each topic. Then the group can decide to add time or stop discussion and go to the next topic. It is very important that you first establish reasonable times per topic, and then stick to the timetable. The objective of having a timekeeper is to allow the team to control how much time the team spends on each topic. It is not to restrict discussion or hinder communication. Don’t be afraid to call time even when the boss is talking. If they agreed to use meeting dynamics, they have agreed to accept the process.

**FACILITATOR:** The facilitator’s job is to keep the group on track. He or she stops the group from getting off the subject or telling “war stories” by simply stating, “We are getting off track. Let’s get back to the subject.” The facilitator also encourages silent members to speak up and share their thoughts with the team. The facilitator also can act as a process guide if the team decides to use a process tool during the meetings and a separate guide is not available. He or she should know the tool sufficiently to guide the team through the steps and clarify the intent of each step.

**SCRIBE:** This person runs a flip chart or dry-erase board, or anything used in the meeting to show group progress. In meetings where you brainstorm ideas or follow a set process like a problem solving process (PSP) or quality improvement process (QIP), this person documents comments so the group sees where they are at all times. The scribe is a very powerful position, since he or she often paraphrases what the group says. Be careful to ensure that the scribe does not take over the leader's role or solve conflicts by writing down just his or her own views on the flip chart.

**RECORDER:** This person functions as the secretary. The recorder captures notes on the meeting for the minutes and tasking to be reviewed during the wrap-up, and also publishes minutes if requested. He or she must ensure that an attendance sheet is passed around the room to capture names, office symbols, and E-mails of attendees. The recorder should not try to capture every statement made in the meeting, only the agreements or results of the discussions. Keep minutes short, and always start the minutes by duplicating the meeting guide and agenda that was used.

**PROCESS GUIDE:** This person leads the team through the steps and special rules when using a tool, as needed. If you do not have an expert on a specific tool, then the facilitator assumes the responsibility of the process guide and must learn enough to implement the tool in the meeting.

## **PURPOSE**

Stating the purpose of the meeting after designating roles is critical to keep the group focused. Typical categories of purposes are: information sharing, decision making, and conducting a team process. If you cannot state the purpose of the meeting, you probably are not ready to call the meeting. The purpose is especially important for attendees covering the meeting for other stakeholders.

## **AGENDA**

Although you may present a draft agenda at the beginning of the meeting, it is not final until everyone in the meeting agrees upon it. The first and last topics in the agenda are always the same. The first is to take time and set up the meeting itself by agreeing on the roles, purpose, and agenda topics and times. The last is always a wrap-up of the meeting, described below. The topics themselves can be briefings, in which case the times should be identified by the briefer, to get their buy-in into the process. Agenda discussion topics identify the desired outcome, not just to discuss a particular subject. Briefing times should include enough time for questions, not just for the briefing itself. If the group wants to add a topic after the meeting begins, it must be determined whether you will add more time, or take time away from another topic. Remember that there is flexibility to add time or topics, but do it in a controlled environment, decided by the group members themselves.

## **WRAP-UP**

The leader performs the wrap-up by helping the group decide when and where the next meeting will be, and summarizing taskings and suspended items. Taskings can be a request for an attendee to brief something at the next meeting, a requirement to draft a response back to a customer, or any action that the group feels needs to occur. Ensure that a suspense is identified for each tasking. This can be as simple as "by the next meeting" or by a specific date/time. The final step in the wrap-up should be to process the meeting. Processing is the act of gaining feedback on



how the meeting went and asking for ways to make the next one better. This is accomplished by listing pluses and deltas as shown on the worksheet. The pluses are what attendees liked about the meeting, and deltas are things that could be done better or constructive criticism on member inputs/conduct. Ask yourself, “How could we make the meetings better?”

## KEYS TO SUCCESSFUL MEETING DYNAMICS

1. ASK yourself: “DO we REALLY need a meeting?” Use phones, e-mails, VTCs, or tele-coms first. Face-to-face meetings should be our last resort to communicate, especially if travel is required.
2. Pre-meeting with leader: draft agenda, ID attendees, decide on tools before meeting
  - a. Rule of thumb: use guide if > 6 people AND > 1 topic
  - b. However, the guide can be used at any meeting
3. Follow guide: set roles, purpose, agenda—Critical
4. Explain meeting. flexibility and consensus voting—“thumbs” rules!
  - a. Thumbs up: I agree completely.
  - b. Thumbs level: I don’t completely agree, but I can live with it.
  - c. Thumbs down: I disagree and cannot accept.
  - d. Identify time calls at 2 minutes and time’s up for topics less than 30 minutes; half-way, 5 minutes, 2 minutes, and time’s up for topics 30 minutes or more.
5. Keep Your Sense of HUMOR. Have FUN!
6. STOP when you said you would. NO Exceptions.
7. Add agenda topics or time only on consensus.
8. Wrap up completely:
  - a. TASKS: What, who, when due?
  - b. Next MEETING: When (date/time), where?
  - c. Process MEETING itself: Participation, times, topics, focus

## 18. SAMPLE CPI PROJECT SELECTION CRITERIA

The most successful CPI projects are targeted at processes and value streams critical to the organization's customers and the warfighter. Projects should support strategic planning documents and align with relevant tactical goals and objectives.

CPI project selection should consider targeting one or more processes within a value stream that have the highest priority for improvement as well as fact-based justification for improvement. Selection should consider the following:

- “Burning platform” Issues
- Cost of poor quality (COPQ) analysis
- Strategic linkage.

“Burning platform” issues could include:

- Customer demands and/or complaints
  - Delivery times are too slow
  - Costs are too high
  - Too many failures in product(s) and/or service delivery
- “Urgent” business needs
  - Expenses are too high
  - Erosion of customer base
- Shareholder/stakeholder requirements
  - Quarterly goals, end-of-year goals, etc.
- Excessive warranty costs or customer complaint costs.

Cost of poor quality analysis could include:

- Internal failure costs (incurred prior to reaching the customer)
- External failure costs (incurred after reaching the customer)
- Appraisal costs
- Prevention costs
- Lost opportunity costs.

Strategic linkage could include strategically driven business measures such as:

- Customer retention rate
- Overall product/service yield rates
- Customer satisfaction rate
- Revenue
- Cost recovery rate
- Employee turnover
- Operational excellence
- Capacity
- Growth
- Expenses.

CPI projects—What could make a project successful—predictors:

- Strong business case
- Project goals and scope clearly defined and realistic
- Identification of key stakeholders and plan for getting buy-in
- Measurements/data available and a data collection plan
- Good project planning, management, and documentation
- Cross-functional team effort
- Results shared and applied across the business.

Making a business case for a project:

- Business case for change must be clear and concise, to help create a “shared need” and understanding
- Key elements to address:
  - Why do we need to change? (current pain, burning platform)
  - What if we fail to act? (cost of doing nothing)
  - What will the new environment look like? (desired outcome, compelling future state)

- Business case should be summarized in one to four sentences (or bullet points). Keep it simple ... make sure all team members can articulate it.

Business case (examples):

- Why do we need to change?
  - Receiving over 100 customer complaints each month
  - Five full-time people dealing with complaints
  - Losing an average of 30 customers each month, amounting to \$470,000 lost business each year
- What if we don't act?
  - Continued stream of dissatisfied customers and loss of future business
  - In jeopardy of losing a particular contract/business and won't meet sales goals for the year
- Desired Outcome?
  - Reduction in complaints and lost business by understanding and resolving the top complaints
- Why do we need to change?
  - Receiving \$500,000 in damaged shipments from suppliers each year, which has been steadily increasing
  - Over \$50,000, including overtime hours, spent each year dealing with shipping problems
- What if we don't act?
  - Will have to add additional staff to handle problems
  - Risk failing to meet delivery requirements to 20 percent of our customers or having to stockpile inventory to compensate
- Desired Outcome?
  - No significant loss of time or money due to damaged shipments
  - 100 percent on-time delivery to our customers

## Defining the CPI Project:

The champion, steering committee, and support group should discuss the project and agree on the goals and objectives up front. Project documentation, in a charter, should include things like the list below. Project leaders should be prepared to provide periodic status on both project activities and results in accordance with the categories of information suggested below:

- A description of the product or process you are working on defining or improving.
- Clear definition of goals and objectives of the project. What is the problem statement?
- A description of the business impact of the project. What is the business case? Include financial information such as cost of poor quality (COPQ) impact, expected return on investment, etc.
- Who are your core team members? What are their roles? What time commitment is expected?
- What specific metrics will be tracked? You should identify one (or two) primary metrics. Consider metrics related to reliability, cycle time, and/or cost.
  - What is the baseline data for each?
  - What is your specific improvement goal for each? For example, you may be working to improve the cycle time for processing applications; current (baseline) cycle time shows an average of 6 days (standard deviation = 1 day), and your goal is to achieve an average cycle time of no more than 2 days (with a certain standard deviation or Cpk). The DMAIC approach or other structured methodology can be helpful in this activity.
  - Note: Identify any secondary metrics that you will track as well. Secondary metrics are used to ensure that you don't meet your project goals at the expense of harming others—for example, reducing manufacturing cycle time but increasing the percentage of defective items produced. Secondary metrics are the “conscience” of your project.
- Who are the customers and suppliers for the product or process? What are their critical requirements or concerns?
- What percentage of your time will be dedicated to the project?

The sample project charter below could be considered as a guide for proper alignment of project objectives and expected results.

# Sample Project Charter

## *Project Information*

Sponsor(s) Name: \_\_\_\_\_

Project Name: \_\_\_\_\_

Project Lead: \_\_\_\_\_

Team Members \_\_\_\_\_

Issue Date: \_\_\_\_\_

## *Project Evaluation Criteria*

<b>Business Case:</b> Describe how completing this project will improve organizational goals. In addition, state how completion of this project is in alignment with organizational objectives.	
<b>Problem Statement:</b> Describe the nature of the problem in quantifiable terms.	
<b>Scope:</b> Describe parameters and key leverage points within the process.	
<b>Impact:</b> Define the impact the problem is having on the organization and business.	
<b>Goal:</b> Describe the goal of the project in quantifiable terms.	
<b>Customers:</b> Describe the person(s) or organization that will benefit (directly and indirectly) from the project.	
<b>Stakeholders:</b> Stakeholder is any person, organization, or function having an interest (positive and negative) in the project.	

## ***Project Team***

Project Team Member	Role	Organization	Contact Information
1.			
2.			
3.			
4.			
5.			

## ***Plan of Action and Milestones and Key Performance Indicators***

Milestone	Scheduled Date of Completion	Actual Date of Completion
Define Phase		
Measure Phase		
Analyze Phase		
Improve/Lean Phase		
Control Phase		

State in quantifiable terms, how the success of the project will be measured in any or all the measures below.

Measurement	Description
1. Quality	
2. Cost	
3. Schedule	
4. Risk	

## ***Project Costs***

List the costs for the project, including labor, training, contractor fees, and/or solution development costs.



## ***Project Approval***

Champion	Steering Committee Lead	Support Group Lead
Name:	Name:	Name:
Title:	Title:	Title:
Date:	Date:	Date:
Signature:	Signature:	Signature



# 19. EIGHT-STEP PROBLEM SOLVING GUIDE USING OODA

O O D A

**1. Clarify and Validate the Problem**

- Does this problem, when solved, help meet needs identified by the organization?
  - Is it linked to the SA&D of organization?
  - Does it help satisfy customer needs (VOC)?
- Does this problem, when solved, address key issues identified during SWOT analysis?
- Has this problem been identified and directed by a value stream map at the appropriate level?
  - What does the “future state” need?
  - What resources have been identified to address this issue?
- What opportunities were identified or observed by the process or problem area “walk”?
  - Will addressing or improving these issues deliver results that relate to #a or #b?
  - Will addressing or improving this problem deliver the desired future state from #c?

**TOOLS:** SA&D, Voice of Customer, VSM, Go & See

O O D A

**4. Determine Root Cause**

- What root cause analysis tools are necessary?
  - Why are these tools necessary?
  - What benefit will be gained by using them?
  - Who will need to be involved in the root cause analysis?
    - 10 heads are better than one
    - Remember “cultural” issues related to problem
- What is (are) the root cause(s) according to the tools?
- How will the root cause be addressed?
- Will addressing these address the performance gap?
- Can the problem be turned on or off by addressing the root cause?
- Does the root cause make sense if the 5 Whys are worked in reverse?
  - Working in reverse, say “therefore” between each of the “whys”

**TOOLS:** 5 Whys, Brainstorming, Pareto, Affinity, Fishbone, Control Charts

O O D A

**2. Break Down the Problem/Identify Performance Gaps**

- Does the problem require more analysis or does leadership have enough information to execute a solution?
  - Is this simply a leadership directive?
- If more data is needed, how do we measure performance now?
  - What are the KPIs? What is the performance gap?
- Does other “non-existent” data need to be gathered?
- What does the data indicate are the potential root causes?
- Does the data review indicate a bottleneck or constraint?

**TOOLS:** KPI/Metrics, Performance Gap Analysis, Bottleneck Analysis

O O D A

**5. Develop Countermeasures**

- Develop potential countermeasures
  - Tools and philosophies from lean, TOC, Six Sigma, and BPR as appropriate
- Select the most practical and effective countermeasures
- Build consensus with others by involving all stakeholders appropriately
  - Communicate, communicate, communicate
- Create clear and detailed action plan
  - B-SMART actions
  - Reference facilitation techniques as appropriate

**TOOLS:** A3, Action Plans, Timelines, Financial Reporting Template

O O D A

**3. Set Improvement Target**

- Is the improvement target measurable? Is it concrete? Is it challenging?
- Is the target “output oriented”?
  - What is the desired output?
  - Should be “things to achieve”; should avoid “things to do”
    - Will be addressed by action plans (Step 5)
- The desired target should:
  - Do what? By how much? By when?
- If it is a process problem, what is the future state?
  - How will it be realized?

**TOOLS:** Ideal State, Future State Mapping, B-SMART

O O D A

**6. See Countermeasures Through**

- Which philosophy best prescribes tools that address root cause(s)?
- Which tools best address root cause(s)?
- Which method for implementation fits the tool and improvement need?
  - Rapid improvement event?
  - Improvement project?
  - Point improvement or “just do it”?
- If RIE or project, create “charter” and communicate
- What training or education is needed? By whom?
  - Reference facilitation techniques as appropriate

**TOOLS:** 6S & Visual Mgt, Standard Work, Cell Design, Variation Reduction, Error Proofing, Quick Changeover, TPM, RIE

## 7. Confirm Results & Process

- a. How are we performing relative to the observe phase (Steps 1 and 2)?
- b. How are we performing relative to Step 3?
- c. How are we performing relative to financial reporting template projections?
- d. If we are not meeting targets, do we need to return to Step 4?
  - Most problem solving “breakdowns” occur relative to improper root cause identification

**TOOLS:** KPIs/Metrics, Performance Mgt, SA&D, Standard Work, Audit

## 8. Standardize Successful Processes

- a. What is needed to standardize improvements?
  - Tech order changes?
  - Air Force instruction changes?
  - Official instruction changes?
- b. How should improvements and lessons learned be communicated?
  - PowerSteering
  - Key meetings?
- c. Were other opportunities or problems identified by the problem solving process?
  - Restart OODA loop

**TOOLS:** Checkpoints/Standardization Table, Report Out Theme Story, Broad Implementation, PowerSteering

**Note:** OODA = Observe, Orient, Decide

Team Members:

Approval Information/Signatures:

# Attachment G. Terminology

The terminology in this attachment has been largely derived from a variety of continuous improvement-related publications and programs. Not all of these terms are found in this guidebook; rather, many are provided as background information.

In addition, key terms used in this guidebook that were not readily available in the continuous improvement lexicon but that are important to DoD CPI have been identified and defined.

5S	<p>Traditional lean manufacturing approach to cleaning up, organizing, and standardizing work: Originally five Japanese words starting with the letter S, translated as several combinations of English words; one set is as follows:</p> <ul style="list-style-type: none"><li>• Sort (organize)</li><li>• Stabilize (eliminate variations)</li><li>• Shine (clean)</li><li>• Standardize (make standard the best known way to do something)</li><li>• Sustain (consciously continue to work the previous four items).</li></ul>
6S	5S plus safety (also known as 5S plus 1).
Action Item	A formally assigned requirement to accomplish something within an assigned time frame. Very often action-item tracking numbers are used to ensure accountability.
Action Plan	A time-phased schedule for executing events, projects, and do-its that transitions a process from the current state to the desired future state, as determined by members of the lean event.
Activity-Based Costing	A management accounting system that assigns cost to products based on the amount of resources used (including floor space, raw materials, machine hours, and human effort) in order to design, order, or make a product.
Alignment	The disciplined agreement within an organization between top level strategic plans, goals and objectives with all subordinate levels' plans, goals and actions.
Advanced Planning System (APS)	Computer program that seeks to analyze and plan a logistics, manufacturing, or maintenance schedule to optimize resource use to achieve desired results.
AVCOM	Avionics Components Obsolescence Management, a software tool that helps provide forecast and other information on electronic parts obsolescence.
AWP	Awaiting parts—A special status for an item held up in a repair process while it waits for parts needed to complete the repair. In DoD, this time is generally not considered in determining the time a repair organization spends repairing something.
Backflow	A flow that returns towards its source. In a production or maintenance environment, it is any step in the process that must be corrected or redone.

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Balanced Scorecard	<p>A strategic management system used to drive performance and accountability throughout the organization. The scorecard balances traditional performance measures with more forward-looking indicators in four key dimensions:</p> <ul style="list-style-type: none"> <li>● Financial</li> <li>● Integration/Operational Excellence</li> <li>● Employees</li> <li>● Customers.</li> </ul>
Baseline Measure	A statistic or numerical value for the current performance level of a process or function. A baseline needs to be taken before improvement activities are begun to accurately reflect the rate of improvement or new level of attainment of the performance being measured.
Benchmark	A qualitative and/or quantitative performance measure of an activity or activities enacted at one or more enterprises that are considered best in class. A benchmark helps a DoD organization set goals in the strategic or tactical phase of an implementation. The comparison is usually made between companies competing for the same market shares, but can also be done based on a single similar function even if the enterprises are from different industries and participate in different markets.
Brainstorming	A method of unlocking creativity and generating ideas that is very effective for teams. In the first step, ideas are offered without the constraints of critical evaluation or judgment. The idea is to “let go.” After <u>all</u> ideas have been listened to, no matter how “far-fetched,” the ideas are then critically evaluated to select the best ones.
Breakdown Maintenance	A total productive maintenance technique: time it takes to accomplish a fix after breakdown occurs.
Buffer Stock	Maintaining some small portion of finished products/goods to temporarily satisfy variations in demand.
Business Case	A written document describing why an organization is planning to implement a process improvement initiative, including a goal and objectives that are specific and measurable based on cost, performance, or schedule.
Business Process Reengineering	A fundamental review of processes and customers with a subsequent organizational improvement initiative aimed at radical improvement in key performance measures. This is a project orientation and not normally considered an ongoing CPI activity.
Business Value	Not identified by the customer, but required to satisfy some other need (e.g., policy, law or regulation, operational security).
Capability Maturity Model® Integration Matrix	A framework for assessing organizational capability in terms of various characteristics (e.g., lean practices). Level 1 normally represents rudimentary capability and level 5 represents world-class industry leader capability. Facilitates identification of an improvement path for process improvement.
Capacity Constraint	Anything that hinders production or process flow (the weak link in the chain).
Catchball	A participative approach to decision-making. Used in policy deployment to communicate across management levels when setting annual business objectives. The analogy to tossing a ball back and forth emphasizes the interactive nature of policy deployment.
CDOV	Concept-Design-Optimize-Verify. A systems approach to requirements development and effective problem solving. The steps suggest a process from development of an improvement idea to a feedback loop that monitors performance in relation to process goals.

Cell	A logical, efficient, and usually physically self-contained arrangement of personnel and equipment to complete a sequence of work. The cell enables one-piece flow and multi-process handling. Typically, each cell has a leader who manages the workflow and is responsible for maintaining performance and productivity.
Cell Design	The technique of creating and improving cells to optimize their one-piece flow. A quality cell design results in improved space use, higher value-adding ratios, shorter lead times, lower work in process, and optimal use of employees.
Champion	An individual with primary responsibility for creating the vision and leading the development of the strategic plan. Champions are needed at multiple levels and have a strategic view of his/her organization. Champions guide CPI initiatives through critical understanding of how the organization fits into the enterprise at large.
Change Agent	Natural leader who actively supports the transformation to CPI. The person in an organization who can effect change. This is the person who leads/directs that organization on goals and expectations and holds lower levels of management accountable for accomplishing those expectations.
Change Manager	The change manager is the person designated by the change agent to lead the core team.
Communication Plan	The strategy a change agent uses to convey his or her CPI beliefs and commitment to every level of the organization. This is spelled out in each organization's "CPI Implementation Plan."
CONOPS	Concept of operations—description of how an organization will implement a certain program or effort.
Continuous Flow	The mechanism to transform a product, service, or information by which the request for the item is triggered by a customer demand, and the production process creates the needed item without delay or inventory in just the right quantity and delivered at the right time to satisfy the triggered demand.
Core Team	The full-time personnel within an organization dedicated to CPI operations on a day-to-day basis. The core team is led by the organization's change manager. It will typically consist of 1 to 3 percent of the organization's population.
Corrective Action	The action an identified group takes to reverse a downward trend in process metrics.
Corrective Maintenance	A total productive maintenance technique: Improving or modifying equipment to prevent breakdowns or to make maintenance activities easier.
CPI	Continuous process improvement—a comprehensive philosophy of operations that is built around the concept that there are always ways in which a process can be improved to better meet the needs of the customer and that an organization should constantly strive to make those improvements.
CPI Deployment Cycle	For DoD CPI, a multi-step cycle that shows how DoD views CPI progression and management. The cycle begins with strategic planning and culminates in CPI project implementation. It is an iterative cycle that builds upon achieved results.
CPI Maturity	The degree of process improvement across a defined set of process areas where management goals have been set and metrics for measuring attainment of the goals are in place. The reliability of repeatability of CPI application.
Critical Chain	A theory of constraints multiple projects network planning method that considers resource constraints and priorities across multiple projects to provide one integrated plan of action to accomplish required goals and objectives with buffering as warranted. Typically this is supported with a software-assisted tool.

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Culture Change	A major shift in attitudes, norms, sentiments, beliefs, values, operating procedures, and behavior of a group or organization.
Current State	Part of the value stream analysis, this depicts the current or “as is” process—how it actually works in terms of operations, materiel, and information flow.
Customer	Someone for whom a product is made or a service is performed. There are internal and external customers. The external customer is the end user of an organization’s product or service. Internal customers are those who take the results of some internal process step (i.e., a report, an electronic file, or a component) as an input for their work. When applied to a supply chain, entire companies become customers of one another.
Customer Relationship Management (CRM)	A philosophy that puts the customer at the design point, to be customer-centric. It should be viewed as a strategy rather than a process. It is designed to understand and anticipate the needs of current and potential customers.
Cycle Time	The time duration of a process, e.g., from request of a part to fulfillment of the order. The beginning and end of a specific cycle time are defined as part of a CPI project and used to set the baseline for related value stream analysis and improvement goals.
DMAIC	Define-Measure-Analyze-Improve-Control. DMAIC is an ordered problem-solving methodology applied widely in private and public sector organizations. The DMAIC phases direct a process improvement team logically from problem definition to implementing solutions that are linked to root causes, towards establishing best practices to help ensure the solutions stay in place.
DMALC	Define-Measure-Analyze-Lean-Control. A derivative of DMAIC. DMALC is an application of the DMAIC problem-solving methodology in the lean environment.
DMSMS	Diminished manufacturing sources and material shortages—an inclusive term for the general problem of parts becoming unavailable by becoming obsolete or through suppliers going out of business or leaving a particular market.
DoD	U.S. Department of Defense.
DoD CPI	A strategic approach for improving reliability (of outputs and products), cycle time (shorter process times), cost (less resource consumption), quality, and productivity through the use of contemporary continuous improvement tools and methodologies.
Do-It	A desired change to the current state that can be done quickly and easily—usually within days.
Driver	An action that forces an expected reaction.
Enterprise Resource Planning (ERP)	A type of software package that attempts to consolidate all the information flowing through the enterprise from finance to human resources. ERP is being employed in DoD to standardize data, streamline the analysis process, and manage long-term planning with greater ease.
Enterprise Value Stream Mapping and Analysis (EVSMA) or Enterprise Analysis and Action Planning (EA&AP)	A powerful tool for analyzing material and information flow throughout and between organizations in order to identify and plan improvements. EVSMA and EA&AP use simple diagrams to depict a current process and provide clarity to support improvements in lead time and inventory reductions. Organizations use these tools to identify and plan kaizen/related events for improved effectiveness. Use also encourages participants from all parts of the organization to gain an understanding of the current material and information flow.
Event	A short-term, high intensity effort to address a specific problem. The focus is typically a week, though the preparation normally begins several weeks in front and follow-up continues after. Also called by other names, including rapid improvement event, rapid improvement workshop, kaizen event, kaizen blitz, accelerated improvement workshop.



Event Summary	The summary provided to management of what was accomplished during an event. This includes the resulting action plan and seeks approval from management to proceed with the action plan as briefed.
Facilitator	Consultant, advisor, or subject matter expert who leads or drives the pace and direction of a group participation event.
Firefighting	Using emergency fixes for problems without eliminating the root cause; managing by crisis instead of proactive planning.
Five Whys	Taichi Ohno's and Shigeo Shingo's practice of asking "why" five times whenever a problem was encountered. Repeated questioning helps identify the root cause of a problem so that effective countermeasures can be developed and implemented.
Flow	The sequential, coordinated movement of information, a product, or a service through a process.
Flow Thinking	Production or other work areas are grouped according to various classifications (product, material used, service provided, etc.) and located close to each other to allow unimpeded coordination.
Flow Time	The amount of time it actually takes information, a product, or a service to move through a process, including wait time.
Footprint Space	The amount of physical space it takes to execute a step in a process.
Future State	A vision of the optimum operating environment with new/improved processes in place.
Gap Analysis	An analysis that compares current performance to desired performance so that solutions can be found to reduce the difference (close the gap).
HQ	Headquarters.
Ideal State	A vision of the future state that depicts what the system should look like if there were no constraints. Based on the "king or queen for a day" mentality.
Just-in-time	A strategy for inventory management in which raw materials and components are delivered from the vendor or supplier immediately before they are needed in the transformation process.
Kaikaku	A rapid and radical change process, sometimes used as a precursor to kaizen activities.
Kaizen	A Japanese term that means continuous improvement, taken from the words <i>kai</i> , meaning continuous, and <i>zen</i> , which means improvement.
Kanban	A term that means "signal." It is one of the primary tools of a just-in-time system. The kanban signals a cycle of replenishment for production and materials in order to maintain an orderly and efficient flow of materials. It is usually a printed card that contains specific information such as part name, description, quantity, etc.
Lead Time	Interval of time between the established need for something and its successful delivery.
Lean	A systematic approach to identify waste, focus activities on eliminating it, and maximize (or make available) resources to satisfy other requirements.
Lean Enterprise	A business organization that delivers value to its stakeholders, with little or no superfluous consumption of resources (materials, human, capital, time, physical plant, equipment, information, or energy).
Level Scheduling	Planning an output so that the fabrication of different items is evenly distributed over time.
Leverage Point	The point at which attention and/or application of resources would result in tangible improvements or benefits to the entire end-to-end value stream.

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Maintenance Prevention	A total productive maintenance technique: Designing and installing equipment that needs little or no maintenance.
MAJCOM	Major command—the highest level distinct commands within the military services, normally led by four-star flag officers.
Management Review	A report to management on progress made during an event. A heading check to ensure that management agrees with the approach taken by the team, normally done in the middle of an event.
Manual Cycle Time	The amount of hands-on time it takes to move a product or information through a process.
MC rate	Mission-capable rate—a calculated rate that describes the portion of aircraft or vehicles that make up a weapon system that are, at least nominally, in a mission-ready condition. It excludes from consideration any aircraft or vehicles that have been shipped to a depot for repair. When the MC rate falls below some military service-defined target, then expediting becomes necessary to get that weapon system back up to full speed.
Mission	The mission is a concise, unambiguous, and measurable description of the organization's role in the overall objectives of the Department of Defense, with a clear and explicit connection to the Strategic Planning Guidance (SPG)/Contingency Planning Guidance (CPG). The declaration should also have specific reference to the effective achievement of that mission.
Monument	Part of a process that cannot easily be altered, whether because of physical constraints or legal or regulatory requirements.
Muda	A Japanese term for waste. Lean thinking references use this term as a synonym for waste.
NCO	Non-commissioned officer.
Non-Value-Added	Any activity that takes time, materiel, or space but does not add value to the product or service from the customer's perspective. For example, inspections or reviews normally are non-value-added, because they are checking to see whether the work was done right in the first place. A non-value-added process step violates at least one of the following criteria: <ul style="list-style-type: none"> <li>• The customer is willing to pay for this activity.</li> <li>• It must be done right the first time.</li> <li>• The action must somehow change the product or service in some manner.</li> </ul>
OSD	Office of the Secretary of Defense.
One-Piece Flow	The concept of moving one work piece at a time between operations within a work cell. Sometimes referred to as a lot size of one.
OODA Loop	An eight-step decision-making process to support a consistent common format for data presentation, problem solving, and information sharing. The term stands for Observe, Orient, Decide, and Act. It is similar in purpose to PDCA and DMAIC. The eight steps consist of (1) problem clarification and validation, (2) performance gap identification, (3) setting improvement targets, (4) determining root cause, (5) developing countermeasures, (6) implementing countermeasures, (7) confirming process results, (8) and standardizing the revised process.

Operational Plan	One of two key plans that guides DoD CPI (the other is the strategic plan). Usually done at the organization level, the operational plan identifies the actions that support achieving stated organizational transformation. The operational plan recognizes and builds on current good practices and integrates them, providing consistent CPI deployment within the organization.
Outcome	The resulting effect of outputs as they relate to an organization's mission and objectives. They are the critical performance measures to capture.
Pareto Principle	In 1906, Italian economist Vilfredo Pareto observed that 20 percent of the people owned 80 percent of the wealth. In the late 1940s, Dr. Joseph M. Juran inaccurately attributed the 80/20 Rule to Pareto, calling it Pareto's Principle. In general, the concept is that for any given distribution of results, the majority of the distribution (80 percent) is determined by a small part (20 percent) of the potential contributors or causes. For example: one would expect that in a typical manufacturing operation, 80 percent or more of manufacturing costs will be driven by 20 percent or less of the cost drivers.
Peer Groups	In DoD, a group that shares common functional responsibilities and carries out similar activities. Peer groups provide an opportunity for cross feeding information about CPI goals, challenges, approaches, activities, and accomplishments. Examples of potential peer groups include turbine engines, fighter aircraft, and communications-electronics.
Performance measure	A measurable characteristic of a product, service, process, or operation the organization uses to track and improve performance. The measure or indicator should be selected to best represent the factors that lead to improved customer, operational, and financial performance.
PDCA	Plan-Do-Check-Act—A process based on the scientific method for addressing problems and opportunities.
PM	Program manager—in the DoD, the PM is in charge of logistics support for one or more specific weapon systems. Program managers, in collaboration with other key stakeholders, establish logistics support program goals for cost, customer support, and performance parameters over the program life cycle.
POA&M	Plan of Action and Milestones. A common management and reporting tool for CPI projects.
POC	Point of contact—key person representing a given organization.
Point of Use (POU)	The condition in which all supplies are within arm's reach and positioned in the sequence in which they are used to prevent hunting, reaching, lifting, straining, turning, or twisting.
Policy Deployment	The process of cascading or communicating a policy from top to middle management, and throughout the rest of the organization using a give-and-take process called "catchball."
PR	Purchase request—how an item manager initiates a purchasing process.
Preventive Maintenance	A total productive maintenance technique: Actions taken performing a specific task to prevent breakdowns from occurring.
Process Cycle Efficiency (PCE)	A lean metric derived by assessing total value-added time (to customer) against total lead time (duration of process from beginning to end).
Product Families	Items of like kind or units linked to specific material or a common end product; all equipment, workers, and support personnel arranged in a logical sequence to support a common product or product line.
Product Life Cycle Management (PLCM)	A technology for managing the entire life cycle of a product from initial development through end of life (EOL) management. PLM focuses on collaboration across the enterprise, as well with external customers and suppliers/

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Production Leveling	Configuring the workload and output of a workstation so that the workstation produces items at a rate close to takt time and in an evenly distributed mix over a time period with minimal slack or nonproductive time through balancing and rebalancing.
Pull	A system by which nothing is produced by the upstream supplier until the downstream customer signals a need.
Pull Scheduling	The flow of resources in a production process by replacing only what has been consumed.
Pure Value	Task demanded by the customer to satisfy a requirement to add form, fit, or function.
Push	A system by which suppliers produce arbitrary amounts of an item and advance it to the next stage without regard for overall demand.
Quad Chart	Graphic device for displaying the status of implementing a process, especially the enterprise processes. These charts quickly show the steps required to develop the new process; the schedule and success in deploying the new process; the internal benefits, measured in terms of personnel, dollars, or space saved; and the impact on the warfighter, based on improved availability, affordability, performance, deployability, or survivability.
Rapid Improvement Event	A short-term, high-intensity effort to address a specific problem. The focus is typically a week, though the preparation normally begins several weeks in front and follow-up continues after. Also called by other names, including rapid improvement workshop, kaizen event, kaizen blitz, or accelerated improvement workshop.
Red-Tag Campaign	Part of a 6S event, the red-tag campaign places red tags on furniture or items that are not used, need repair, or should be turned in to the Defense Reutilization and Marketing Office (DRMO). Red tags remain on the items until the appropriate action is taken.
Reliability	Refers to the degree of certainty that a product or service will perform as intended over a set period of time.
Return on Investment (ROI)	The ratio between the predicted or computed savings or cost avoidance (the return) that will result from some action and the cost of completing the action (the investment). Should take the time value of money into account.
RFT	Ready for tasking—measure of the number of an operational military unit's equipment that is ready and capable of supporting the unit's current tasks. Expressed as a percentage only of the current requirement, not as a percentage of total. For example, if unit has 10 aircraft and 8 are needed on a given day but only 6 are capable of performing the task, then the ready-for-tasking rate is 75 percent.
Senior Change Agent	Champion or head change agent who supports the transformation to CPI.
Senior Leader	The person at the top of an organization's chain of command.
Setup Time	Also called changeover time. The time it takes to change a system or subsystem from making one product to making the next. Typically divided into external setup time, which covers preparations that can be done while the previous operation is still in process, and internal setup time, which cover preparations that are done while the process is idle.
Shingo Prize	A prize established in 1988 in honor of Shigeo Shingo, as an annual award presented to organizations that achieve superior customer satisfaction and business results related to lean "excellence."
Single Minute Exchange of Die (SMED)	A detailed approach to reducing any machine setup time to less than 10 minutes.
Single Piece Flow	The movement of a product or information, upon completion, one at a time through operations without interruptions, backflow, or scrap.

SIPOC	An analysis of all inputs, processes, and outputs of an organization. The abbreviation stands for the terms <i>suppliers</i> , all <i>inputs</i> , the organization <i>process</i> , all <i>outputs</i> , and the <i>customers</i> . This analysis is often performed after a high-level supply chain analysis and before lower level value stream analyses.
Six Sigma (6σ)	<p>A strategy that espouses increasing profits by eliminating variability, defects, and waste that undermine customer loyalty. Six Sigma can be understood or perceived at three levels:</p> <ul style="list-style-type: none"> <li>● Metric—3.4 defects per million opportunities.</li> <li>● Methodology—a structured problem-solving roadmap.</li> <li>● Philosophy—reduce variation in your business and take customer-focused, data driven decisions.</li> </ul>
SMART	Specific-Measurable-Attainable-Results Focused-Timely. This approach is used in relation to setting objectives in CPI initiatives. A sound objective will have each attribute identified by the acronym.
SME	Subject matter expert—A recognized expert in a given area of knowledge (subject).
Spider Diagram or Assessment	An assessment tool used to gauge CPI commitment and maturity within an organization. Also called a radar chart. A common variant has the spokes of the diagram measure commitment and maturity (in terms of levels zero through four) by assessing the following: leader's commitment, the organization, value stream analysis, rapid improvement, process control, strategy alignment & deployment/policy deployment, 3P breakthroughs, on-demand, defect-free, achieving lot size of one, lowest cost, and visual management.
SPO	System Program Office—Home of the Air Force Program Director, the person in charge of managing a weapon system, including acquisition.
Stakeholder	Person internal or external to an organization who has a stake in the outcomes of a process.
Standard Work	An agreed upon set of work procedures that effectively combine people, materiel, and machines to maintain quality, efficiency, safety, and predictability. Work is described precisely in terms of cycle time, work in process, sequence, takt time, layout, and the inventory needed to conduct the activity.
Strategic Buffer	A predetermined quantity kept on hand to combat variability and lead time impacts.
Strategic Plan	The process an organization uses to achieve and document long-term goals and objectives. For DoD CPI, one of two key plans that guides CPI activity; the other is the operational plan.
Steering Committee	The steering committee comprises senior-level stakeholders who carry out CPI-related planning, identify key metrics, establish CPI infrastructure, monitor performance, and facilitate process improvement when necessary.
Support Team	The support team comprises dedicated and ad hoc resources that facilitate and implement CPI planning. The support team may be organizational based or may have experts brought in as needed from other activities (e.g., HQ) or the commercial sector.
Supply Chain Management (SCM)	Proactively directing the movement of goods from raw materials to the finished product delivered to customers. SCM aims to reduce operating costs, lead times, and inventory, and increase the speed of delivery, product availability, and customer satisfaction.
Surge	Rapid increase in demand.

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Takt Time	Takt is German for beat (as in the beat of music). In CPI thinking, takt time is the available production time divided by the rate of customer demand. Takt time sets the pace of production to match the rate of customer demand and becomes the heartbeat of the system.
TDY	Temporary duty—On duty (military or civilian) at other than one's home station.
Theory of Constraints (TOC)	A philosophy and a methodology for addressing logical thinking, scheduling and controlling resources, and measuring performance. The philosophy emphasizes that a systems constraint exists in any process and controls the output from the entire process.
Total Lead Time	Duration of a process from beginning to end.
Total Productive Maintenance	A set of techniques to ensure that every machine in a process is always able to perform its required tasks. It focuses on avoiding and eliminating breakdowns or maintenance delays, and increasing capacity. Its techniques include preventative maintenance, corrective maintenance, maintenance prevention, and breakdown maintenance.
Total Quality Management (TQM)	A concept which requires management and resource commitment to adopt a perpetual improvement philosophy, through succinct management of all processes, practices, and systems throughout the organization to fulfill or exceed the customer expectations.
Total Value-Added Time	The total time in a process during which the value of the product going through the process to the customer is increased.
UDE	A theory of constraints term that means undesirable effect. Pronounced "OO dee."
Value	A need the customer is willing to pay for, expressed in terms of a specific required product or service.
Value-Added	The parts of the process that add worth to the customer's product or service. To be considered value-added, the action must meet <i>all three</i> of the following criteria: <ul style="list-style-type: none"> <li>• The customer is willing to pay for this activity.</li> <li>• It must be done right the first time.</li> <li>• The action must somehow change the product or service in some manner.</li> </ul>
Value Categories	Pure value, business value, non-value-added, value-added.
Value Chain	All of the processes that add value to the goods and services provided by an organization that are often mapped as an enterprise view of activities, events, and possibly related information links. A value chain analysis further includes value-added metrics for each activity.
Value Stream	The specific activities required to design, order, and provide a specific product or piece of information, from concept to launch, order to delivery into the hands of the customer. In DoD, a term used to encompass all the planning, execution, products, and services that go into an organization-wide process to create value for the customer.
Value Stream Map	Identification of all the specific activities occurring along a value stream for a product or product family.
Variability	An aspect of an item or process that is likely to be unstable or has an inherent or inborn chance of unpredictability.
Vision	The vision is a clear depiction of the future that describes clearly and succinctly how the organization will conduct business on a day-to-day basis.
Visual Management	Tools that allows managers to quickly, visually determine whether a process is proceeding as expected or is in trouble.

Warfighter	For DoD CPI, the ultimate customer. The warfighter is the ultimate focus of CPI activity and should drive the key metrics that serve as the focal for alignment of subordinate metrics and for the synchronization of CPI activity.
Waste	<p>Anything that adds cost or time without adding value. Generally, waste includes injuries, defects, inventory, overproduction, waiting time, motion, transportation, and processing waste. Waste is often placed into the following categories:</p> <ul style="list-style-type: none"><li>● Overproduction—To produce an item before it is actually required.</li><li>● Waiting—Whenever goods are not moving or being processed, the waste of waiting occurs.</li><li>● Transporting—Moving product between processes is a cost that adds no value to the product.</li><li>● Inappropriate Processing—Often termed as “using a bazooka to swat flies,” many organizations use expensive, high-precision equipment where simpler tools would be sufficient.</li><li>● Unnecessary Inventory—Stockpiles of both in-process and finished goods inventories are a direct result of overproduction and waiting.</li><li>● Unnecessary/Excess Motion—This waste is related to ergonomics and is seen in all instances of bending, stretching, walking, lifting, and reaching.</li><li>● Defects—Having a direct impact to the bottom line, quality defects resulting in rework or scrap are a tremendous cost to organizations.</li><li>● Underutilization of Employees—Failure of organizations to capitalize on employees’ creativity.</li></ul>
Work in Process (WIP)	At any given time, items currently somewhere between the start of a process and the end of the process. In a CPI system, standardized work in process is the minimum number of parts (including units in machines) needed to keep a cell or process flowing smoothly.
Work Group	The work group is the key implementation activity for CPI projects that improve operations. Work groups consist of members who have functional expertise in operations in the value stream being assessed and improved. Work group members also have expertise in CPI tools, or the team is augmented with such capabilities.





# Attachment H.

## DoD Certification Process

A well-trained workforce will ensure the successful implementation and application of CPI methodologies and tools, leading to improved organizational performance. A complementary certification program ensures that individuals possess the requisite education, skills, competencies, and experience to be successful practitioners of CPI methodologies. CPI training and certification programs take a two-pronged approach of formal classroom instruction complemented by the direct application of concepts to accomplishing actual CPI projects.

There are different approaches to CPI certification, both in the commercial sector and DoD. Typically, certification recognition is based on either belts (green, black, and master black belt) or levels (I, II, III, IV). Both approaches emphasize the same basic body of knowledge, with some variation in topical emphasis. The following is a CPI certification process example developed and recommended by OSD.

### **OSD Developed Certification Approach**

#### ***OSD Lean Six Sigma Green Belt Certification***

The topics in this Body of Knowledge (BoK) include additional detail in the form of sub-text explanations and the associated cognitive level of understanding. A more complete description of cognitive levels is provided at the end of this document.

#### ***Enterprise-Wide Deployment***

1. Enterprise view
  - a. History of organizational improvement. Identify the origin of various continuous improvement tools, including lean, Six Sigma, theory of constraints, etc. (Remember)
  - b. Foundations of Lean Six Sigma. Describe the organizational value of Lean Six Sigma in terms of its philosophy and principles, and identify how lean tools, the DMAIC model, and the theory of constraints relate to each other. (Understand)
  - c. Business systems and processes. Identify the interrelationships among organizational structure and processes. Describe how the selection and management of value streams relates to the organizational structure and processes, and confirm the link of value streams to organizational strategic plans. (Understand)
  - d. Suppliers, inputs, processes, outputs, customers (SIPOC). Describe how SIPOC can be used to identify appropriate value streams, based on how the value streams influence enterprise systems (cost, quality, schedule, financial paths, business flow, etc.). (Apply)

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## 2. Leadership

- a. Enterprise leadership. Identify the roles and responsibilities of executive leadership and how their involvement can affect the deployment of Lean Six Sigma initiatives (providing resources, accountability, etc.). (Remember)
- b. Lean Six Sigma roles and responsibilities. Define the roles and responsibilities of Lean Six Sigma champion, black belt, master black belt, green belt, value stream champion, process owners, customers, and stakeholders. (Apply)
- c. Linking projects to organizational goals. Describe how kaizen events or rapid improvement events (RIEs) are selected during the value stream analysis process. (Apply)

## *Business Processes*

### 1. Process management and results

- a. Basic process management. Identify and describe the concept of process management, from defining the organizational mission and vision through the attributes of process ownership. (Understand)
- b. Process performance metrics. Recognize the need for process performance metrics to determine how the process is performing. (Understand)
- c. Benchmarking. Define and distinguish between various types of benchmarking. (Apply)
- d. Supply chain management. Describe customer-supplier relationships and how these relationships and the supply chain are affected by project initiatives. (Remember)
- e. Financial measures. Define and use financial measures including return on investment (ROI) to underscore potential financial results. (Remember)
- f. Balanced Scorecard. Describe how balanced scorecard is used to evaluate organizational goals against customer expectations and organizational processes. (Remember)

### 2. Voice of the customer

- a. Identify the customer. Identify and segment various customers (internal, external, long-term, loyal, etc.) that will be impacted by changes to existing value streams. (Analyze)
- b. Collect and validate customer data. Determine which measurement method to use to collect customer feedback (surveys, focus groups, interviews, observation, etc.) in order to understand customer needs, expectations, and requirements, and use appropriate methods to ensure measurement validity and reliability (review questions for bias, ambiguity, etc.). (Analyze)

3. Customer data analysis. Determine which graphical, qualitative, or statistical tools are most appropriate for analyzing customer data. (Understand).
4. Identify critical to x (CTx) requirements. Identify and use various metrics to evaluate product and process performance that are critical to quality (CTQ), cost (CTC), process (CTP), safety (CTS), and delivery (CTD). (Apply)
5. Change management
  - a. Organizational roadblocks. Identify the inherent structures of an organization (such as its culture and construct) and describe how they can become barriers to improvement. (Apply)
  - b. Change agent. Describe the role of change agent. (Apply)
  - c. Motivation techniques. Define and apply various techniques used to support and sustain participation in process improvement efforts. (Apply)
  - d. Conflict resolution techniques. Use various techniques to help conflicting parties recognize common goals and ways they can work together to achieve them. (Apply)
  - e. Communication planning and deployment. Develop and deploy communication plans that support process improvement efforts and will help prevent rumors, false expectations, and other obstacles from interfering with successful implementation of change. (Analyze)

## *Project Team Management*

1. Initial steps
  - a. Initiating teams. Describe and identify the elements required when launching a team (clear purpose and goals, commitment, ground rules, etc.) and how they affect the team's success (ability to gain support from management, team empowerment, team cohesion, etc.). (Apply)
  - b. Charter negotiations (chartering a team). Determine the appropriate number and type of team members (in terms of skills sets, technical/subject-matter expertise, etc.) based on the team's charter and goals, and ensure appropriate representation of the stakeholders. (Apply)
  - c. Team roles. Define and describe team roles and responsibilities, including team leader, facilitator, etc. (Understand)
2. Team stages. Identify and facilitate the stages of team evolution (forming, storming, norming, performing, adjourning/mourning). (Apply)
3. Team-building and facilitation techniques. Apply various techniques (such as coaching, mentoring, intervention, etc.) to build and guide a team, and use appropriate tools to overcome

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common problems such as overbearing, dominant, or reluctant participants, the unquestioned acceptance of opinions as facts, groupthink, feuding, floundering, the rush to accomplish/finish, digressions, and tangents. (Apply)

4. Team performance evaluation. Measure team progress in relation to goals, objectives, and metrics that support team success, and recognize and reward accomplishments. (Analyze)
5. Team tools. Define, select, and apply the following creative and management and planning tools used by teams in various situations: brainstorming, nominal group technique, multi-voting, affinity diagrams, tree diagrams, etc. (Analyze)

### *Define the Problem or Opportunity*

1. Documentation and presentation
  - a. Documentation elements. Create data- and fact-driven process documents and determine appropriate tools for recording and using them (e.g., spreadsheets, storyboards, phased reviews, management reviews). (Apply)
  - b. Presentation. Determine the appropriate style to use when communicating, taking into account the target audience and the purpose of the presentation. (Apply)
2. Charter and plan
  - a. Charter and plan elements. Create a project charter and plan (including objectives, scope, boundaries, resources, transition, and closure) for an RIE. (Apply)
  - b. Charter negotiation. Use various negotiation techniques when changes to the charter are proposed by various stakeholders and team members, and determine when it is appropriate to make changes to the charter. (Apply)
  - c. Execution. Use various tools to track an RIE (e.g., newspaper, quad sheet). (Apply)
3. Mission, vision, and problem statement. Develop a mission and vision statement for an RIE, and develop a problem statement containing a clear case for action and describing current and desired performance level of process. (Apply)
4. Project scope. Identify the boundaries of an RIE using value stream maps, SIPOC, and other tools to align with the goals of the organization and to ensure that it has value to the customer. (Apply)
5. Project metrics. Identify or establish process performance measurements that point to the critical elements of the process and can be connected to financial benefits. (Apply)

## *Measure the Current State*

1. Process analysis
  - a. Process inputs and outputs. Identify process input variables and output variables, and document their relationships through cause and effect diagrams and data collection and analysis. (Apply)
  - b. Process flow and effective utilization. Evaluate process flow and utilization by identifying the waste and constraints along the critical chain and analyzing work in progress (WIP), work in queue (WIQ), touch time, takt time, cycle time, and throughput. (Evaluate)
  - c. Tool. Develop and review both higher and lower value stream maps, process maps, written procedures, work instructions, flowcharts, spaghetti diagrams, circle diagrams, etc. (Analyze)
2. Collecting and summarizing data
  - a. Types of data. Identify, define, classify and compare qualitative and quantitative data. (Apply)
  - b. Methods for collecting data. Prepare data collection plans, and apply methods for collecting data using check sheets, data coding, automatic gauging, etc. (Apply)
  - c. Measurement scales. Define and apply nominal, ordinal, interval, and ratio measurement scales. (Understand)
  - d. Techniques for assuring data accuracy and integrity. Define and apply techniques for assuring data accuracy and integrity, such as random sampling and stratified sampling. (Apply)
3. Basic statistics
  - a. Descriptive statistics. Define, compute, and interpret measures of dispersion and central tendency (mean, median, mode, variance, standard deviation, and z-values). (Apply)
  - b. Draw valid statistical conclusions. Distinguish between descriptive and analytical studies, and distinguish between a population and a sample statistic. (Apply)
  - c. Graphical methods. Construct, apply, and interpret diagrams and charts such as run charts, Pareto diagrams, histograms, normal probability plots, etc. (Analyze)

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4. Measurement systems
    - a. Measurement methods. Describe measurement systems and identify measurement methods for continuous and discrete data. (Apply)
    - b. Measurement system analysis (MSA). Determine measurement system capability by using tools such as repeatability and reproducibility studies. (Apply)
  5. Statistical process control (SPC)
    - a. Objectives and benefits. Identify and explain the objectives and benefits of SPC (e.g., controlling process performance, distinguishing special from common causes). (Apply)
    - b. Analysis of control charts. Interpret control charts and distinguish between common and special causes. (Analyze)

### *Analyze the Data*

1. Wastes. Define and apply the classic eight wastes: overproduction, inventory, defects, over-processing, waiting, motion, wasted capital, and transportation. Analyze value-added and non-value-added activities, and develop metrics and evaluate data to identify constraints in value flow. (Create)
2. Tools for identifying significant or root cause. Describe, use, and interpret various root cause analysis tools, including (1) the five whys, (2) fishbone (Ishikawa) diagrams, and (3) the cause and effect matrix. (Evaluate)

### *Improve the Process*

1. Eliminating waste. Define, describe and select the following tools and techniques for eliminating waste and improving processes: (1) Pull/Kanban, (2) 5S, (3) Flow, (4) Standard work, (5) Poka-yoke, (6) Cycle-time reduction, (7) Set-up time reduction, (8) reducing variation, (9) reducing complexity/steps. (Evaluate)
2. Theory of constraints. Describe and use Goldratt's process for identifying, exploiting, and elevating constraints, and explain how to subordinate non-constraints in a process. (Application)
3. Critical chain project management. Define and use project buffer management, the drum-buffer-rope method, etc., and distinguish between critical chain and critical path. (Remember)
4. Implement the improved process
  - a. Plan the implementation. Develop a plan for implementing the improved process. Identify the issues and roadblocks that may be encountered when the plan is implemented and determine the best methods for responding to those issues. (Analyze)

- b. Conduct a pilot or a simulation. Describe and apply the concepts required to conduct a pilot and identify the steps needed for a successful pilot or simulation. (Analyze)
- c. Select the optimum solution. Analyze data collected from the pilot or simulation to determine the best solution. (Analyze)
- d. Roll out the optimum solution. Implement a full-scale version of the improved process and monitor results. (Analyze)

## *Control and Sustain the Improved Process*

1. Implement and maintain controls
  - a. Process control plan. Develop a follow-up plan to identify appropriate controls for ensuring/validating the ongoing success of the improved process. (Analyze)
  - b. Visual factory. Define the elements of visual factory and describe how they can help control the improved process. (Understand)
  - c. Measurement system re-analysis. Recognize the need to improve or revise measurement system capability as process capability improves. Evaluate the use of control measurement systems, and ensure that measurement capability is sufficient for its intended use. (Apply)
2. Sustain the improvement
  - a. Knowledge management and lessons learned. Identify and document the lessons learned and ensure that those lessons and process successes are disseminated to participants in future process improvement opportunities. Recognize how the improved process can be replicated and applied to other processes in the organization. (Apply)
  - b. Training plan. Determine an appropriate training plan for ensuring the continued support of the improved processes. (Analyze)
  - c. Monitor for new constraints. Identify the steps required to monitor the improved process for new constraints and additional opportunities for improvement. (Apply)

### Levels of Cognition based on Bloom's Taxonomy–Revised (2001)

In addition to content specifics, the subtext for each topic in this BOK also indicates the intended complexity level of the test questions for that topic. These levels are based on “Levels of Cognition” (from Bloom's Taxonomy–Revised, 2001) and are presented below in rank order, from least to most complex.

**Remember.** Recall or recognize terms, definitions, facts, ideas, materials, patterns, sequences, methods, principles, etc.

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**Understand.** Read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc.

**Apply.** Know when and how to use ideas, procedures, methods, formulas, principles, theories, etc.

**Analyze.** Break down information into its constituent parts and recognize their relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario.

**Evaluate.** Make judgments about the value of proposed ideas, solutions, etc., by comparing the proposal to specific criteria or standards.

**Create.** Put parts or elements together in such a way as to reveal a pattern or structure not clearly there before; identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn.



## OSD-Trained Green Belt Certification Checklist

Candidate Name \_\_\_\_\_ Date of Review \_\_\_\_\_

The following items will be reviewed by the OSD Certification Review Board (CRB) when considering final qualification as an OSD-certified green belt:

- Green belt test results. Ensure student met minimum passing score (80%) for final exam.
- Tollgate review signature page. Ensure that all signature blocks are signed.
- Tollgate summary brief. Ensure that a completed tollgate summary brief has been created as part of the final project documentation.
  - Is candidate's project at the correct level of difficulty for a green belt project?  
YES/NO (circle one). Comments:
  - Provide other work products created during the project. Examples of work products are data spreadsheets, charts, process maps.

OSD Training Coordinator comments:

Master Black Belt comments:

We hereby certify that \_\_\_\_\_ has completed all requirements for OSD Green Belt certification.

\_\_\_\_\_  
OSD Training Coordinator (Print name)

\_\_\_\_\_  
Master Black Belt (Print name)

\_\_\_\_\_  
Signature/Date

\_\_\_\_\_  
Signature/Date

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## ***OSD Lean Six Sigma Black Belt Certification***

The topics in this Body of Knowledge (BoK) include subtext explanations and the cognitive level used for development of the OSD examination. The descriptor in parentheses at the end of each entry refers to the maximum cognitive level at which the topic will be tested.

### ***Enterprise-Wide Deployment***

1. Enterprise view
  - a. History of organizational improvement. Identify the origin of various continuous improvement tools including quality control, statistical process control (SPC), total quality management/leadership (including the 14 points), lean, Six Sigma, theory of constraints, etc. (Remember)
  - b. Foundations of Lean Six Sigma. Describe the organizational value of Lean Six Sigma in terms of its philosophy and principles, and identify how lean tools, the DMAIC model, and the theory of constraints relate to each other. (Apply)
  - c. Business systems and processes. Identify the interrelationships between organizational structure and processes. Describe how the selection and management of value streams relates to the organizational structure and processes, and confirm the link of value streams to organizational strategic plans. (Apply)
  - d. Suppliers, inputs, processes, outputs, customers (SIPOC). Describe how SIPOC can be used to identify appropriate value streams, based on how the value streams influence enterprise systems (cost, quality, schedule, financial paths, business flow, etc.). (Apply)
2. Leadership
  - a. Enterprise leadership roles and responsibilities. Identify the roles and responsibilities of executive leadership and how their involvement can affect the deployment of Lean Six Sigma initiatives (providing resources, accountability, etc.). (Analyze)
  - b. Lean Six Sigma roles and responsibilities. Define the roles and responsibilities of black belt, master black belt, green belt, value stream champion, process owners, customers, and stakeholders. (Apply)
  - c. Linking projects to organizational goals. Describe how projects or kaizen events are identified and selected, such as identifying constraints in the value stream and knowing when to use Lean Six Sigma instead of other problem-solving approaches. (Apply)

## *Business Processes*

1. Process management and results
  - a. Basic process management. Identify and describe the nine steps of the process management, from defining the mission and vision through acknowledging the team and reporting results. (Analyze)
  - b. Process performance metrics. Recognize the effect process performance metrics can have on enterprise decisions, such as how metrics propagate upward and allocate downward. (Analyze)
  - c. Benchmarking. Define and distinguish between various types of benchmarking. (Apply)
  - d. Supply chain management. Describe customer-supplier relationships and how these relationships and the supply chain are affected by project initiatives. (Understand)
  - e. Financial measures. Define and use financial measures including net present value (NPV), return on investment (ROI), cost of quality (COQ), etc., to underscore potential financial results. (Understand)
  - f. Balanced Scorecard. Describe how balanced scorecard is used to evaluate organizational goals against customer expectations and organizational processes. (Apply)
2. Voice of the customer
  - a. Identify the customer. Identify and segment various customers (internal, external, long-term, loyal, etc.) that will be impacted by changes to existing value streams. (Analyze)
  - b. Collect and validate customer data. Determine which measurement method to use to collect customer feedback (surveys, focus groups, interviews, observation, etc.) in order to understand customers needs, expectations, and requirements, and use appropriate methods to ensure measurement validity and reliability (review questions for bias, ambiguity, etc.). (Apply)
  - c. Customer data analysis. Determine which graphical, qualitative, or statistical tools are most appropriate for analyzing customer data. (Analyze).
  - d. Identify critical to x (CTx) requirements. Identify and use various metrics to evaluate product and process performance that are critical to quality (CTQ), cost (CTC), process (CTP), safety (CTS), and delivery (CTD). (Analyze)
  - e. X-Y Matrix. Define, interpret, and use an X-Y matrix in customer requirements analysis. (Analyze)

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### 3. Change management

- a. Organizational roadblocks. Identify the inherent structures of an organization (such as its culture and construct) and describe how they can become barriers to improvement. (Analyze)
- b. Change agent. Describe the role of change agent. (Analyze)
- c. Motivation techniques. Define and apply various techniques used to support and sustain participation in process improvement efforts. (Analyze)
- d. Conflict resolution technique. Use various techniques to help conflicting parties recognize common goals and ways they can work together to achieve them. (Apply)
- e. Communication planning and deployment. Develop and deploy communication plans that support process improvement efforts and will help prevent rumors, false expectations, and other obstacles from interfering with successful implementation of the change. (Analyze)

## *Project Team Management*

### 1. Initial steps

- a. Initiating teams. Describe and identify the elements required when launching a team (clear purpose and goals, commitment, ground rules, etc.) and how they affect the team's success (ability to gain support from management, team empowerment, team cohesion, etc.). (Analyze)
  - b. Selecting team members. Determine the appropriate number and type of team members (in terms of skills sets, technical/subject-matter expertise, etc.) based on the team's charter and goals, and ensure appropriate representation of the stakeholders. (Analyze)
  - c. Team roles. Define and describe team roles and responsibilities, including team leader, facilitator, etc. (Apply)
2. Team stages. Identify and facilitate the stages of team evolution (forming, storming, norming, performing, adjourning/mourning). (Understand)
  3. Team-building and facilitation techniques. Apply various techniques (such as coaching, mentoring, intervention, etc.) to build and guide a team, and use appropriate tools to overcome common problems such as overbearing, dominant, or reluctant participants, the unquestioned acceptance of opinions as facts, groupthink, feuding, floundering, the rush to accomplish/finish, digressions, and tangents. (Evaluate)
  4. Team performance evaluation. Measure team progress in relation to goals, objectives, and metrics that support team success, and recognize and reward accomplishments. (Analyze)

5. Team tools. Define, select, and apply the following creative and management and planning tools used by teams in various situations: brainstorming, nominal group technique, multi-voting, affinity diagrams, tree diagrams, various matrix diagrams and interrelationship digraphs, activity network diagrams, etc. (Evaluate)

## *Define the Problem or Opportunity*

1. Documentation and presentation
  - a. Documentation elements. Create data- and fact-driven project documents and determine appropriate tools for recording and using them (e.g., spreadsheets, storyboards, phased reviews, management reviews). (Analyze)
  - b. Presentation. Determine the appropriate style to use when communicating complex or technical issues (e.g., visual displays of data and information) taking into account the target audience and the purpose of the presentation. (Evaluate)
2. Charter and plan
  - a. Charter and plan elements. Create a project charter and plan (including objectives, scope, boundaries, resources, transition, and closure) for a kaizen event or Lean Six Sigma project. (Analyze)
  - b. Charter negotiation. Use various negotiation techniques when changes to the charter are proposed by various stakeholders and team members, and determine when it is appropriate to make changes to the charter. (Analyze)
  - c. Execution. Use various tools to track a Lean Six Sigma project or event (toll-gates, milestones, red flags, etc.). (Analyze)
3. Mission, vision, and problem statement. Develop a mission and vision statement for a project, and develop a problem statement containing a clear case for action and describing current and desired performance level of process. (Analyze)
4. Project scope. Identify the boundaries of project using value stream maps, SIPOC, and other tools to align with the goals of the organization and to ensure that it has value to the customer. (Evaluate)
5. Project metrics. Identify or establish process performance measurements that point to the critical elements of the process and can be connected to financial benefits. (Apply)

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## *Measure the Current State*

1. Process analysis
  - a. Process inputs and outputs. Identify process input variables and output variables, and document their relationships through cause and effect diagrams, relational matrices, and data collection and analysis. (Evaluate)
  - b. Process flow and effective utilization. Evaluate process flow and utilization by identifying the waste and constraints along the critical chain and analyzing work in progress (WIP), work in queue (WIQ), touch time, takt time, cycle time, and throughput. (Evaluate)
  - c. Tools. Develop and review value stream maps, process maps, written procedures, work instructions, flowcharts, spaghetti diagrams, circle diagrams, etc. (Evaluate)
2. Collecting and summarizing data
  - a. Types of data. Identify, define, classify and compare qualitative and quantitative data, continuous (variables) and discrete (attributes) data, and their types of distributions (binomial and Poisson). Identify opportunities to convert attributes data to variables measures. (Analyze)
  - b. Methods for collecting data. Prepare data collection plans, and apply methods for collecting data using check sheets, data coding, automatic gauging, etc. (Evaluate)
  - c. Measurement scales. Define and apply nominal, ordinal, interval, and ratio measurement scales. (Apply)
  - d. Techniques for ensuring data accuracy and integrity. Define and apply techniques for ensuring data accuracy and integrity such as random sampling, stratified sampling, sample homogeneity, etc. (Evaluate)
3. Basic statistics
  - a. Central limit theorem. Define the central limit theorem and describe its significance in the application of inferential statistics for confidence intervals, control charts, etc. (Understand)
  - b. Descriptive statistics. Define, compute, and interpret measures of dispersion and central tendency (mean, median, mode, variance, standard deviation, and z-values), and construct and interpret frequency distributions and cumulative frequency distributions. (Analyze)
  - c. Drawing valid statistical conclusions. Distinguish between enumerative (descriptive) and analytical (inferential) studies, and distinguish between a population parameter and a sample statistic. (Analyze)

- d. Graphical methods. Construct, apply, and interpret diagrams and charts such as box-and-whisker plots, run charts, scatter diagrams, histograms, normal probability plots, etc. (Evaluate)
4. Measurement systems
  - a. Measurement methods. Describe measurement systems and identify measurement methods for continuous and discrete data. (Apply)
  - b. Measurement system analysis (MSA). Determine measurement system capability by using tools such as repeatability and reproducibility studies, correlation, bias, linearity, etc. (Analyze)
5. Statistical process control (SPC)
  - a. Objectives and benefits. Identify and explain the objectives and benefits of SPC (e.g., controlling process performance, distinguishing special from common causes). (Evaluate)
  - b. Selection of variable. Identify and select critical characteristics for monitoring by control chart. (Evaluate)
  - c. Rational subgrouping. Define and apply the principle of rational subgrouping. (Apply)
  - d. Selection and application of control charts. Identify, select, construct, and use control charts, including individual and moving range (ImR/XmR), p, np, c, and u. (Apply)
  - e. Analysis of control charts. Interpret control charts and distinguish between common and special causes using rules for determining statistical control. (Evaluate)
6. Analyzing process capability
  - a. Designing and conducting process capability studies. Identify, describe, and apply the elements of designing and conducting process capability studies, including identifying characteristics, identifying specifications and tolerances, developing sampling plans, and verifying stability and normality. (Apply)
  - b. Calculating process performance vs. specification. Distinguish between natural process limits and specification limits, and calculate process performance metrics, such as percent defective, parts per million (PPM), defects per million opportunities (DPMO), defects per unit (DPU), process sigma, rolled throughput yield (RTY), activity-based costing, etc. (Analyze)
  - c. Process capability indices. Define, select, and calculate Cp and Cpk, and assess process capability. (Apply)

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- d. Short-term and long-term capability studies. Describe the appropriate assumptions and conventions to use when only short-term data or attributes data are available. Describe the changes in relationships that occur when long-term data are used. Describe and interpret the relationships between long-term and short-term capability. (Apply)
  - e. Process capability for non-normal data. Describe the cause of non-normal data and determine when it is appropriate to use a Box-Cox or other power transformation techniques. (Understand)
  - f. Process capability for attributes data. Calculate the process capability and process sigma level for attributes data. (Apply)

## *Analyze the Data*

1. Wastes. Define and apply the classic eight wastes: overproduction, inventory, defects, over-processing, waiting, motion, wasted capital and transportation. Analyze value-added and non-value-added activities, and develop metrics and evaluate data to identify constraints in value flow. (Analyze)
2. Measuring and modeling relationships between variables
  - a. Simple and multiple least-squares linear regression. Describe and interpret the regression equation; apply and interpret hypothesis tests for regression statistics; use the regression model for estimation and prediction, and analyze the uncertainty in the estimate. (Understand)  
  
[NOTE: Models that have non-linear parameters will not be tested.]
  - b. Simple linear correlation. Describe and interpret the correlation coefficient and its confidence interval; apply and interpret a hypothesis test for the correlation coefficient. Describe the difference between correlation and causation. (Understand)  
  
[NOTE: Serial correlation will not be tested.]
  - c. Diagnostics. Analyze residuals of the model. (Understand)
3. Basic hypothesis testing
  - a. Statistical vs. practical significance. Define, compare, and contrast statistical and practical significance. (Apply)
  - b. Significance level, power, type I and type II (Alpha and Beta) errors. Apply and interpret the significance level, power, type I, and type II errors of statistical tests. (Understand)
  - c. Sample size. Describe the impact of sample size for any given hypothesis test. (Apply)



- d. Null and alternate hypotheses. Develop the null or alternate hypothesis as required in various situations. (Apply)
  - e. Probability (p) value. Interpret p-value in rejecting or failing to reject null hypothesis. (Apply)
4. Advanced hypothesis testing
- a. Point and interval estimation. Define and interpret the efficiency and bias of estimators; interpret and draw conclusions from statistics such as standard error, tolerance intervals, and confidence intervals; distinguish between confidence intervals and prediction intervals. (Understand)
  - b. Tests for means, variances, and proportions. Define and determine applicability of hypothesis tests for means (t-test, ANOVA, etc.), variances (F-Test, Levene's test, etc.), and proportions, and interpret results for significance of process inputs. (Understand)
  - c. Paired-comparison tests. Define, determine applicability, and interpret paired-comparison parametric hypothesis tests. (Understand)
  - d. Goodness-of-fit tests. Define, determine applicability, and interpret chi-square tests. (Understand)
5. Failure mode and effects analysis (FMEA). Describe the purpose and elements of FMEA and how this tool is used for processes, products, and services. (Evaluate)
6. Tools for identifying significant or root cause. Describe, use, and interpret various root cause analysis tools, including (1) the five whys, (2) fishbone (Ishikawa) diagrams, and (3) the cause and effect matrix. (Evaluate)

## *Improve the Process*

1. Design of experiments (DOE)
- a. Basic terms. Define independent and dependent variables, factors and levels, response, treatment, error, repetition, and replication. (Understand)
  - b. Planning and organizing experiments. Describe and apply the basic elements of experiment planning and organizing, including determining the experiment objective, selecting factors, responses, and measurement methods, choosing the appropriate design, etc. (Understand)
  - c. Design principles. Define and apply the principles of power and sample size, balance, replication, order, efficiency, randomization and blocking, interaction, and confounding. (Understand)

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- d. Design and analysis. Construct full-factorial and fractional designs of experiments and interpret computational and graphical results. Describe the limitations of fractional factorials caused by confounding. (Understand)
  2. Eliminating waste. Define, describe and select the following tools and techniques for eliminating waste and improving processes: 1) Pull/Kanban, 2) 5S, 3) Flow, 4) Standard work, 5) Poka-yoke, 6) Cycle-time reduction, 7) Set-up time reduction. (Evaluate)
  3. Theory of constraints. Describe and use Goldratt's process for exploiting and elevating constraints, and explain how to subordinate non-constraints in a process. (Application)
  4. Critical chain project management. Define and use project buffer management, the drum-buffer-rope method, etc., and distinguish between critical chain and critical path. (Understand)
  5. Implement the improved process
    - a. Plan the implementation. Develop a plan for implementing the improved process. Identify the issues and roadblocks that may be encountered when the plan is implemented and determine the best methods for responding to those issues. (Evaluate)
    - b. Conduct a pilot or a simulation. Describe and apply the concepts required to conduct a pilot and identify the steps needed for a successful pilot or simulation. (Analyze)
    - c. Select the optimum solution. Analyze data collected from the pilot or simulation to determine the best solution. (Evaluate)
    - d. Roll out the optimum solution. Implement a full-scale version of the improved process and monitor results. (Analyze)

## *Control and Sustain the Improved Process*

1. Implement and maintain controls
  - a. Control plan. Develop a follow-up plan that will identify appropriate controls for ensuring the ongoing success of the improved process. (Evaluate)
  - b. Total productive maintenance (TPM). Define TPM and its elements, and describe how it can be used as a control in the improved process. (Remember)
  - c. Visual factory. Define the elements of visual factory and describe how they can help control the improved process. (Understand)
  - d. Measurement system reanalysis. Recognize the need to improve or revise measurement system capability as process capability improves. Evaluate the use of control measurement systems, and ensure that measurement capability is sufficient for its intended use. (Apply)

2. Sustain the improvement

- a. Knowledge management and lessons learned. Identify and document the lessons learned, and ensure that those lessons and process successes are disseminated to participants in future process improvement opportunities. Recognize how the improved process can be replicated and applied to other processes in the organization. (Analyze)
- b. Training plan. Determine an appropriate training plan for ensuring the continued support of the improved processes. (Analyze)
- c. Monitor for new constraints. Identify the steps required to monitor the improved process for new constraints and additional opportunities for improvement. (Analyze)

Levels of Cognition based on Bloom’s Taxonomy–Revised (2001)

In addition to content specifics, the subtext for each topic in this BOK also indicates the intended complexity level of understanding for that topic. These levels are based on “Levels of Cognition” (from Bloom’s Taxonomy–Revised, 2001) and are presented below in rank order, from least to most complex.

**Remember.** Recall or recognize terms, definitions, facts, ideas, materials, patterns, sequences, methods, principles, etc.

**Understand.** Read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc.

**Apply.** Know when and how to use ideas, procedures, methods, formulas, principles, theories, etc.

**Analyze.** Break down information into its constituent parts and recognize their relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario.

**Evaluate.** Make judgments about the value of proposed ideas, solutions, etc., by comparing the proposal to specific criteria or standards.

**Create.** Put parts or elements together in such a way as to reveal a pattern or structure not clearly there before; identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn.

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## **OSD-Trained Black Belt Certification Checklist**

Candidate Name \_\_\_\_\_ Date of Review \_\_\_\_\_

The following items will be reviewed by the OSD Certification Review Board (CRB) when considering final qualification as an OSD-certified black belt:

- Black belt test results. Ensure that student met minimum passing score (80%) for final exam.
- Tollgate review signature page. Ensure that all signature blocks are signed.
- Tollgate summary brief. Ensure that a completed tollgate summary brief has been provided as part of the final project documentation.
- Is candidate's project at the correct level of difficulty for a black belt project? YES/NO (circle one). Comments:
- Provide other work products created during the project. Examples of work products are data spreadsheets, charts, process maps.
- List names of two green belts who were mentored through project completion. Also list project name:

Name	Project
_____	_____
_____	_____

- Classroom instruction: Check all that apply: (a minimum of one item is required for certification)
  - Instructed \_\_\_\_\_ OSD-training module for an  
Module name  
OSD-sponsored GB/BB class (circle one).
  - Briefed completed project at an OSD-sponsored GB/BB class. (circle one)

Candidate Name \_\_\_\_\_ Date of Review \_\_\_\_\_  
OSD Training Coordinator comments:

Master Black Belt comments:

We hereby certify that \_\_\_\_\_ has completed all requirements for OSD Black Belt certification.

\_\_\_\_\_  
OSD Training Coordinator (Print name)

\_\_\_\_\_  
Master Black Belt (Print name)

\_\_\_\_\_  
Signature/Date

\_\_\_\_\_  
Signature/Date

# Project Tollgate Approval Summary Example

## (Project Name) Tollgate Approval Summary

Define	Measure	Analyze	Improve	Control
<input type="checkbox"/> <b>Project Charter</b> <ul style="list-style-type: none"> <li>Clear Problem Statement</li> <li>Business Case justified</li> <li>Goals/Benefits identified</li> <li>Realistic scope</li> </ul>	<input type="checkbox"/> <b>"As Is" Process Map</b> <ul style="list-style-type: none"> <li>Swim lanes identified</li> <li>All steps documented</li> </ul>	<input type="checkbox"/> <b>Likely Influencing Factors (Potential Xs)</b> <ul style="list-style-type: none"> <li>Clearly identified</li> <li>Related to problem</li> </ul>	<input type="checkbox"/> <b>"To Be" Process Map</b> <ul style="list-style-type: none"> <li>Swim lanes identified</li> <li>Optimal flow</li> <li>Value-added steps</li> </ul>	<input type="checkbox"/> <b>Transition Plan</b> <ul style="list-style-type: none"> <li>Documented handoff from Project Lead to Process Owner</li> <li>Finalize SOPs/business rules</li> </ul>
<input type="checkbox"/> <b>Measurable Output (Y)</b> <ul style="list-style-type: none"> <li>Known Target/Goal</li> <li>Voice of the Customer (VOC) expectations identified</li> <li>ID Existing/Necessary metrics</li> </ul>	<input type="checkbox"/> <b>Data Collection Plan</b> <ul style="list-style-type: none"> <li>Data Collected</li> <li>Sample size identified</li> <li>ID Data categorizing methods</li> </ul>	<input type="checkbox"/> <b>Most Influential Factors (Critical Xs)</b> <ul style="list-style-type: none"> <li>Clearly identified</li> <li>Related to problem</li> </ul>	<input type="checkbox"/> <b>Improvement Strategy</b> <ul style="list-style-type: none"> <li>List improvement steps</li> <li>Draft SOPs and business rules</li> </ul>	<input type="checkbox"/> <b>Quality Control Chart</b> <ul style="list-style-type: none"> <li>Charts that monitor process performance with defined boundaries</li> </ul>
<input type="checkbox"/> <b>Key Players identified</b> <ul style="list-style-type: none"> <li>Champion</li> <li>Sponsor</li> <li>Process Owner</li> <li>Team Members/Belts</li> </ul>	<input type="checkbox"/> <b>Data Display</b> <ul style="list-style-type: none"> <li>Shows range, frequency, standard deviation</li> <li>Shows basic nature of the problem</li> </ul>	<input type="checkbox"/> <b>Required Data Display</b> <ul style="list-style-type: none"> <li>Pareto Chart</li> <li>Fish Bone Diagram</li> <li>Histogram</li> </ul>	<input type="checkbox"/> <b>Mistake Proofing</b> <ul style="list-style-type: none"> <li>Identify processes or procedures that don't allow error</li> </ul>	<input type="checkbox"/> <b>Communication</b> <ul style="list-style-type: none"> <li>Announcing new processes and business rules to the organization</li> </ul>
<input type="checkbox"/> <b>Project Timeline</b> <ul style="list-style-type: none"> <li>Completion dates each phase</li> <li>Realistic</li> </ul>	<input type="checkbox"/> <b>Identified CTQs/CTPs</b> <ul style="list-style-type: none"> <li>Key factors Critical to Quality</li> <li>Key factors Critical to Process</li> </ul>	<input type="checkbox"/> <b>Optional Data Display</b> <ul style="list-style-type: none"> <li>Descriptive Statistics</li> <li>Time Series Plots</li> <li>Control Charts</li> </ul>	<input type="checkbox"/> <b>FMEA</b> <ul style="list-style-type: none"> <li>Failure Mode Effect Analysis</li> <li>Prioritize most significant steps that can fail</li> </ul>	<input type="checkbox"/> <b>Project Documentation</b> <ul style="list-style-type: none"> <li>Ensures documentation of all project phases</li> <li>Required for Belt cert.</li> </ul>
<input type="checkbox"/> <b>SIPOC Diagram</b> <ul style="list-style-type: none"> <li>Identifies correct Suppliers, Input, Process, Output and Customers</li> </ul>	<input type="checkbox"/> <b>Output Target (Y)</b> <ul style="list-style-type: none"> <li>Show actual performance as compared to desired target</li> </ul>	<input type="checkbox"/> <b>XY Matrix</b> <ul style="list-style-type: none"> <li>Correlation among factors</li> <li>Weighted values</li> </ul>	<input type="checkbox"/> <b>Risk Analysis and Risk Mitigation Plan</b> <ul style="list-style-type: none"> <li>Understand and manage factors influencing risk</li> </ul>	
I accept the <b>Define</b> Tollgate. Signed:	I accept the <b>Measure</b> Tollgate. Signed:	I accept the <b>Analyze</b> Tollgate. Signed:	I accept the <b>Improve</b> Tollgate. Signed:	I accept the <b>Control</b> Tollgate. Signed:
<i>(Sponsor)</i>	<i>(Sponsor)</i>	<i>(Sponsor)</i>	<i>(Sponsor)</i>	<i>(Sponsor)</i>
<i>(Champion/Process Owner)</i>	<i>(Champion/Process Owner)</i>	<i>(Champion/Process Owner)</i>	<i>(Champion/Process Owner)</i>	<i>(Champion/Process Owner)</i>
<i>(Master Black Belt)</i>	<i>(Master Black Belt)</i>	<i>(Master Black Belt)</i>	<i>(Master Black Belt)</i>	<i>(Master Black Belt)</i>
<i>(Finance Owner)</i>		<i>(Finance Owner)</i>		<i>(Finance Owner)</i>

## (Project Name) Tollgate Approval Summary

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