PROCESS IMPROVEMENT

Match the Change Vehicle and Method To the Job

by **Jean Harvey**

Processes are at the core of continuous improvement, and improvement happens when a process is changed in one way or another. From *kaizen* events and just-in-time manufacturing to Six Sigma projects and reengineering, philosophies, methodologies and tools have been developed to make processes more effective and efficient. These innovations originated mostly in management practice; academics later interpreted and clarified the recipes such innovations embodied.[1]

In 50 Words Or Less

- **It is often difficult for an organization to decide which methodology and tools to use in process improvement.**
- **Process improvement teams must understand the definitions of the methodology, tools and change vehicles available to them.**
- **The impact of mismatches can be fatal to a fledgling improvement program.**

The abundance of great recipes has created confusion as the chefs promote their own recipes as the panacea. Since each recipe involves a considerable investment in time and resources by the organization, picking the wrong one can be costly. Also, top management's backing down and recognizing a mistake can be difficult because its strong endorsement is a critical factor in the success of the program. When management admits it made a mistake, it creates employee cynicism, which makes it even more difficult to introduce another program at a later date. Unfortunately, failure does not appear to be the exception.[2]

If the history of management thought teaches us anything, it is that there is no panacea. Most improvement approaches that have gained a foothold in management practice are valuable in some circumstances and fail miserably in others. The problem lies in the fact these circumstances are poorly understood. To limit their chances for failure, organizations should use a framework to guide them in the selection of the right methodology, tools and change vehicle for the problem at hand.

To illustrate the nature of process improvement, let's say Jack Jones has to move some belongings from his home on the West Coast to his condo on the East Coast. To do so effectively, he has to ask

Definitions

Process problems

1. **New product or service:** designing a new car or vacation package.
2. **Nonexistent process:** disjointed activities performed in a haphazard manner.
3. **Ineffective process:** does not meet customer requirements.
4. **Inefficient process:** requirements are met, but process is wasteful.
5. **Complex process:** results depend on the simultaneous action of a number of intricately related variables.
6. **Black box process:** results are produced, but management doesn't know how.
7. **Physical flow problems:** flow of people, parts or forms produces congestion, shortages or damage.

Methodologies

1. **Design for Six Sigma (DFSS):** start with the end in mind; know the capabilities of the processes up front; think in a statistical frame of mind.
2. **Define, measure, analyze, design, validate (DMADV):** same as DFSS, but it focuses on services and processes.
3. **Define, measure, analyze, improve, control (DMAIC):** Six Sigma's main improvement methodology.
4. **Just-in-time and lean manufacturing:** focuses on simplicity, frugality and economy in controlling physical flows from raw material to end product.

Improvement tools

1. **Failure mode and effects analysis (FMEA):** identifies and prioritizes process risks.
2. **Value added analysis (VAA):** identifies activities that do not contribute to the desired end result.
3. ***Poka yoke*:** failsafing; simple devices that help avoid defects.
4. ***Kanban*:** visual card system to control physical flows.
5. **Statistical process control (SPC):** using statistics and charts to interpret variations and keep a process within control parameters.
6. **Quality function deployment (QFD):** matrix driven correlation technique used to deploy desired results onto metrics and processes.
7. **Functional analysis system technique (FAST):** identifies functions a product or process must perform.

Change vehicles

1. **Project:** small, part-time team assembled around a full-time expert (two to six months).
   Basic tool project: same as a project, but does not use advanced statistical tools.
2. ***Kaizen* event:** one or more full-time teams, fully empowered to transform a process (one to two weeks).
3. **Workout:** broader and less rigorous effort to bust bureaucracy (two to three days).
4. **Process management team:** managers assembled around a process owner to design process (mid- to long-term).
5. **Semiautonomous work team:** process workers organizing to control a process on a day-to-day basis (ongoing).
6. **Just do it:** team involved in implementing a process change (two to six months).

himself four specific questions (see Figure 1): What exactly has to be moved (the problem)? What major steps will I have to take to move the material (the methodology)? What tools will I need (the toolkit)? What type of change vehicle will I need (the change vehicle)?

Any organization that wants to improve a process must ask itself these same four questions. It needs to identify the type of process improvement problem it's facing. Then, the organization needs to look at available process change methodologies and process improvement tools. Finally, it needs to take a look at the different process change vehicles available. Only then will it be able to effectively and efficiently undergo process improvement.

Process Problems

A process is a system that transforms inputs into desired outputs. To manage an organization's portfolio of processes,[3] the following typology of process problems and opportunities is needed:

1. **New product or service.** An organization needs a new process when it creates a new product or service.
2. **Nonexistent process.** Even though certain actions are performed, there is no systematic way to perform them.
3. **Ineffective process.** The desired results for the internal or external customer are not produced.
4. **Inefficient process.** The goods are delivered, but time and money are wasted.
5. **Complex process.** Too many variables are involved.
6. **Black box process.** These processes can be effective and efficient, but management can't explain how and why they work. Knowledge is implicit and performance rests on the individual and collective actions of specific employees.
7. **Physical flow process.** The flow of people, parts or forms causes the process to fail.

See "Definitions" for further explanation.

Reality generally defies categorization, and indeed most process problems are mixed. However, careful diagnostic examination of a process will generally allow an organization to identify a dominant problem or opportunity. See Figure 2 on p. 44 for an illustration of this typology in tree format.

To help clarify this form of process identification, let's look at a bank trying to improve two processes: renewal of credit lines and auto dealer audits. The problem with the former is 30% of credit lines have not been reviewed at the pre-established date and are automatically extended, exposing the bank to unknown risks. The current process is long and bureaucratic and involves several forms and three or four departments. Because there is a process but it does not deliver the goods, Figure 2 points the bank's process identification team toward cases three and five (ineffective and complex processes). But the process does not involve complex interactions between variables, so it can be classified as an ineffective process.

Now let's look at the division of the bank that is involved in financing car dealers' inventories. The division decides to improve its auditing process because it foresees an imminent economic downturn, and there are only a few experienced auditors available to audit hundreds of dealers.

Upon first attempt to come to grips with the process, the division's process improvement team splits it into three subprocesses: audit planning (deciding who should be audited), auditing and follow-up. The team immediately recognizes audit planning offers the greatest potential for improvement, but as the team members start to map this subprocess, they realize there is no specific process (nonexistent process).

When the auditing subprocess is formalized, the team notices crucial aspects of the process, such as developing the specific audit plan, are poorly understood and important nonconformities have

FIGURE 1 Four Steps To Planning Process Improvement

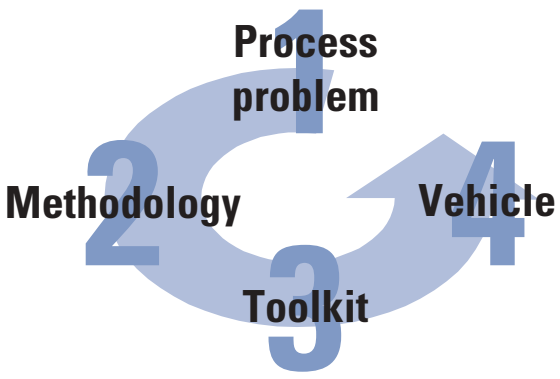
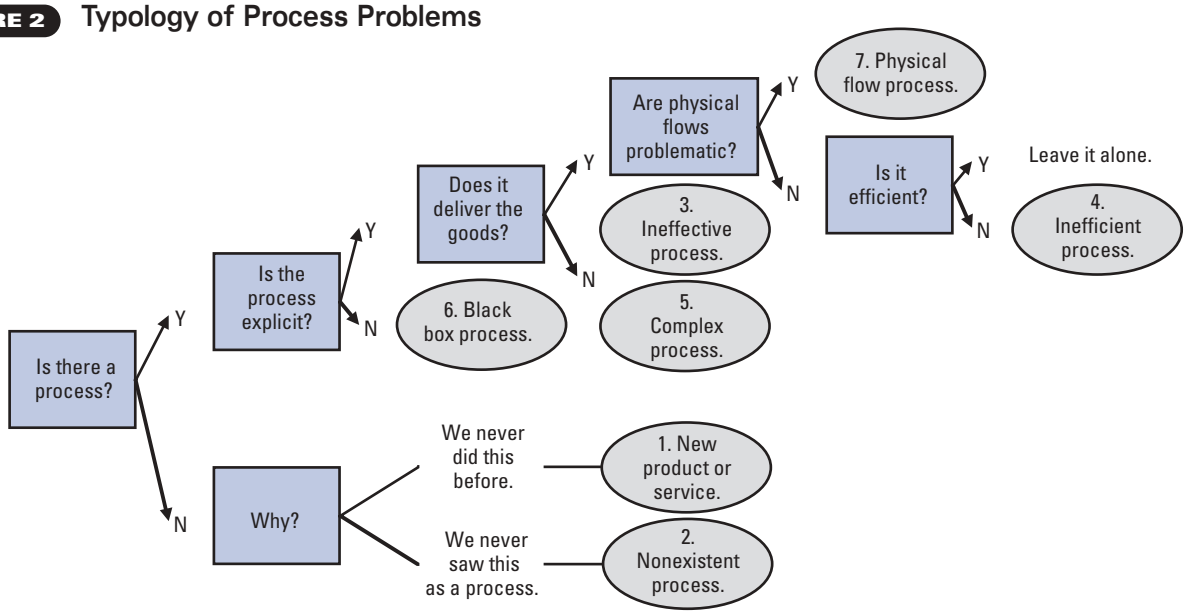


FIGURE 2 Typology of Process Problems



been overlooked (complex process).

Somehow, the audit follow-up process delivers the goods. Unfortunately, it is bureaucratic and involves back and forth, time consuming exchanges among several players, including auditors, the dealer and the head office (inefficient process).

Methodologies

The three process change methodologies linked to Six Sigma now dominate the field. The first—define, measure, analyze, improve, control (DMAIC)—is based on Walter A. Shewhart's plan-do-check-act cycle but is more rigorous. After an improvement has been scoped, process capability is established. The vital few or critical to process variables are then identified, and an optimal breakthrough solution is sought. Finally, a control system is put in place to ensure the gains are not lost once the project has been completed.

The second methodology—define, measure, analyze, design, validate (DMADV)—is probably the best for designing or redesigning a new service or process. With this approach, an organization researches the needs and wants of the customer, deploys them onto metrics and then deploys the metrics onto process functions. This is followed, in sequence, by high level and detailed design, prototyping, validation and roll out. The methodology is not as widespread as Six Sigma's signature DMAIC, but it is equally rigorous and complements DMAIC.

The third methodology is called product design but is also known as design for Six Sigma (DFSS). Though it is a more recent concept and is the subject of much debate, its premise is neither new nor controversial. According to DFSS, products should be designed with a clear understanding of required process capabilities. These capabilities and their interactions need to be understood statistically and must focus on meeting customer specifications. Most products will never reach six sigma unless they are designed with that goal in mind.

DFSS follows the same logical flow as DMADV. However, because we are dealing with product specifications and machine tolerances, the methodologies are quite different in practice.

Other well-known methodologies include the integrated capability maturity model,[4] ISO 9000 and just-in-time (JIT) or lean manufacturing. These are different from the other three because they deal with companywide improvement and are not limited to single improvement projects. Nevertheless, they are quite compatible with the other methodologies.

Tools

Process tools fall into six categories:

1. **Awareness tools:** help process workers gain

a holistic view of the process and include process mapping, procedure writing and documentation techniques.

2. **Diagnostic tools:** include Ishikawa diagrams, value added analysis (VAA) and complexity analysis.
3. **Design tools:** include quality function deployment (QFD), functional analysis and the Pugh design matrix.
4. **Operation tools:** process operations require process oriented systems, such as enterprise resource planning and customer relationship management.
5. **Improvement tools:** include failure mode and effects analysis (FMEA), fault tree analysis, *poka yoke* and design of experiments.
6. **Measurement and control tools:** include defect rate calculations, capability indexes and statistical process control (SPC).

These tools are only a few examples of what is available in the process toolkit. Categorization involves some gray areas, as some tools have a broad spectrum of functionality. SPC and FMEA, for example, can also contribute significantly to process diagnosis. However, choosing the right tools for the job is as important for the process change leader as it is for Jones when he is faced with the problem of moving his belongings.

To illustrate its importance, let's look at a manufacturing plant that was in the process of launching its first *kaizen* events with the transformation of two different processes: first article inspection (FAI) and nonconformance reports (NCRs). The FAI process was nonexistent (category two in Figure 2), and the NCR process was inefficient (category four). The company was unaware of these distinctions, and the only methodology available was DMAIC.

On the first Monday of the month, the two process teams received 30 minutes of instruction on both process mapping and FMEA. (They received instructions on how to use other tools throughout the week.) The teams then went their separate ways and came back three hours later to present their findings to one another.

By late afternoon, the FAI team was disgruntled, and the NCR team was all smiles. The tools were obviously not equally enlightening. Just before lunch on Tuesday, the NCR team came back excited with the results of its VAA analysis. That was enough to trigger a crisis for the FAI team, which couldn't do anything with the analysis. The team threatened to quit because it believed the tools it was given were inappropriate. An emergency plan was quickly drafted to realign the methodology and select the appropriate tools. While the improvisation saved the day, it also planted a seed of doubt in the mind of several participants and observers: Do the people leading this important initiative know what they're doing?

As you can see, tools must be selected based on the type of process problem being addressed, the methodology that will be used and the change vehicle selected. Some tools are especially effective for specific process problems. VAAs, for example, help reveal opportunities in inefficient processes, and *kanbans* work well in improving cycle time and reducing waste in physical flow processes. Complex processes, on the other hand, often require designed experiments, while other tools, such as sampling design and process capability calculation, are universal and constitute an essential part of any process design or improvement drive.

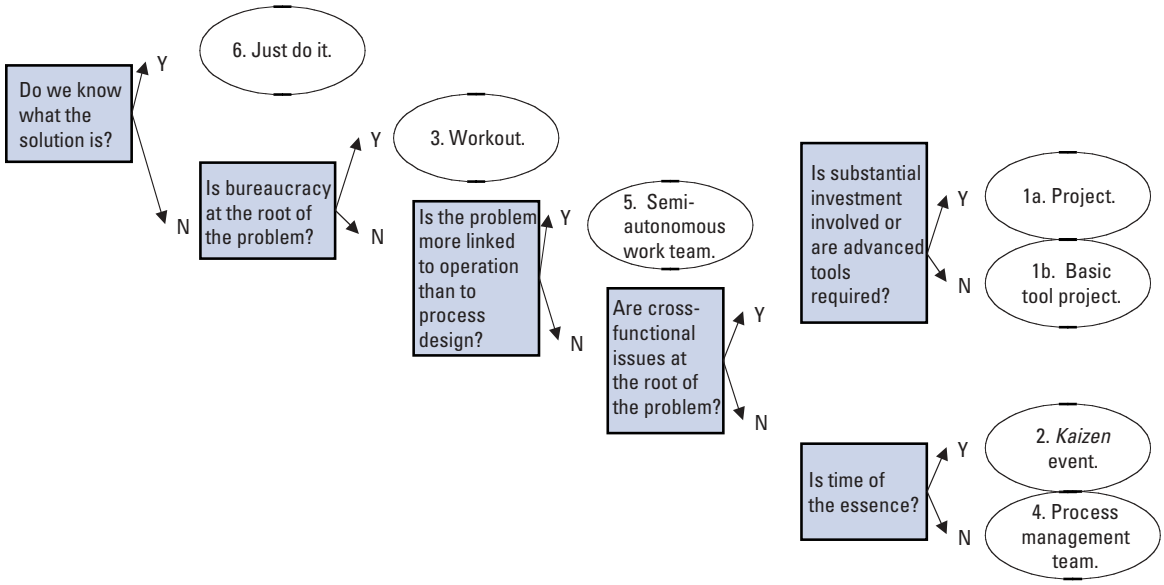
It is also important for a team to realize some tools easily adapt to particular change vehicles but will not work well with others. Advanced statistical tools, for example, require the user to have a specific educational background and substantial training and thus will not work well in a *kaizen* event where the team, not the expert, needs to be empowered. Design of experiments and Monte Carlo simulations do not respond well to the time pressure and informal environment of a *kaizen* event.

Change Vehicles

Once the process problem is identified and the appropriate methodology and tools have been selected, the organization needs to decide the best way to make the change. Processes can be changed in a number of ways, ranging from sending a memo to putting together an empowered, full-time team.

The six main ways to change a process are called change vehicles because they load the process to be designed or improved and take it to its destination: a fully implemented new way of doing things. Just as vehicles come in different sizes and have different payloads, traction and speed specifications, each change vehicle has its own characteristics that

FIGURE 3 Typology of Process Change Vehicles



enable it to take specific changes to fruition:

1. **Project:** a two- to six-month endeavor led by a methodology and tools expert. A **basic tool project** does not involve advanced statistical tools and can be led by someone with lesser qualifications.
2. ***Kaizen* event:** a one- to two-week intensive drive by a full-time, multifunctional team to change one or more processes simultaneously.
3. **Workout:** less rigorous but more intense than projects or *kaizen* events, it typically lasts only two days.[5]
4. **Process management team:** a multifunctional team that meets for short but intense periods—typically two days at a time—first to design or redesign a process, then to monitor and improve it.
5. **Semiautonomous work team:** a team that manages and operates a specific application or version of a process.
6. **Just do it:** sometimes, when process problems arise, the organization knows the cause and solution and can quickly pull together an implementation team.

Adapting and implementing these six vehicles to suit a particular organizational environment are complex undertakings, requiring careful attention to their human and technical aspects. Each comes with its own organizational requirements, risks and success factors. The vehicles are complementary and can be used individually or in combination. See Figure 3 for an illustration of these vehicles in tree format.

The Match

The appropriate moment to match the process problem to the methodology, toolkit and change vehicle is during the define phase of the project. Sadly, the timing is not well understood; mismatching is common. In the best mismatched cases, the resulting difficulties are puzzling for everyone as people try to understand why QFD, for example, produced fantastic results in one project and didn't work out in another. This confusion takes its toll on the improvement program and may turn out to be the deciding factor in whether to continue when a new program faces its first real challenges.

Understanding the ways in which the process problems, methodologies and change vehicles are related is key to avoiding such problems. In Table 1, a single, preferred methodology is proposed for each process problem, and the main body of the table shows how well specific problem/vehicle matches will work. The "yes" cells represent a

good match. The green cells indicate this vehicle can contribute to the solution of the problem. The yellow cells are caution beacons, and the red ones indicate a mismatch.

Though the DFSS methodology, for example, is specifically designed for new product introduction projects, a process management team can use it just as effectively because the designers are the same people who will operate and improve the new processes. The same holds true for the design of a new service. The DMADV methodology fits the job perfectly, but it is also suited for design processes where none had existed before.

In the case of the audit planning process discussed earlier, time is of the essence for the bank, so a *kaizen* event—or a variant involving three three-day sessions spread out over a longer period—can be used to quickly mobilize the organization behind the initiative. An initial workout can also be used to jumpstart the exercise, and semiautonomous work teams can help make the process come alive afterward. A project would take too long in this case.

An ineffective process can be improved using DMAIC if it has potential—as indicated by the sigma shift or gap between short- and long-term capability—or redesigned using DMADV if it does not. *Kaizen* events may sometimes suffice, as long as advanced statistical tools are not needed. If the solution is known, a just-do-it project may be in order, though any time spent making sure it is the right solution is a wise investment.

In the case of the expired credit line, the bank is exposed to unknown risks. Thus, it would be smart to start with a workout to identify and address any immediate exposure and to follow up with a project or process management team using DMAIC. The team should, however, be ready to switch to DMADV if the actual process turns out not to have the required potential.

Kaizen events are good at fixing inefficient processes because basic tools will generally do the trick, and the multifunctional team dynamics go a long way toward bringing solutions to the surface. Projects may be risky in this context, however, because they often lack such dynamics. The bank's audit follow-up process is a good candidate for a *kaizen* event using the DMAIC methodology.

One of the major contributions of Six Sigma is the application of DMAIC with advanced statistical tools to the improvement of complex processes. Although the tools were already available, the methodology put them together in an effective way.

The auditing process, for example, is a complex

TABLE 1 **Relationship Among Process Problems, Methodologies and Change Vehicles**

Process problems	Methodology	Vehicle					
		(1) Project	(2) *Kaizen* event	(3) Workout	(4) Process management team	(5) Semiautonomous work team [1]	(6) Just do it
New product (1a)	DFSS	YES			YES		
New service (1b)	DMADV	YES	YES		YES		
Nonexistent process (2)	DMADV	YES	YES		YES		
Ineffective process (3)	DMAIC or DMADV	YES			YES		
Inefficient process (4)	DMAIC		YES				
Complex process (5)	DMAIC	YES					
Black box process (6)	DMAIC		YES		YES		
Physical flow process (7)	JIT	YES	YES				

[1] None of the methodologies discussed here apply. This vehicle has to be used in combination with one or more of the others.

Legend
- Will not solve that problem.
- Will contribute, but will not be the primary solution to the problem.
- Might be used in some cases, but be careful.

process. It involves analyzing many financial and operational variables related in complex ways. The financial results of the business are impacted by the way the auto dealership is operated. Understanding these results will provide critical clues as to how best to conduct the audit, focusing on the vital few aspects of the operation and not wasting time and money on trivia. A project will afford the team enough time to perform the rigorous data gathering and analysis required to optimize the process.

The job required for a black box process, on the other hand, is more fundamental: Understand and give some basic structure to a process that is unknown. Not only would the rigor of a DMAIC project be wasted here, but such rigor would risk zooming in on some complex aspects of the process at the expense of its overall coherence. In such a case, *kaizen* and process management teams are better suited to the job.

The best methodology for improving physical flows is JIT. The optimum implementation of JIT is through a combination of projects and *kaizen* events, though the other change vehicles can potentially contribute to the improvement drive, too.

Further examination of Table 1 (p. 47) shows three change vehicles—workouts, semiautonomous work teams and just do it—complement the three major process change vehicles, and just do it is always subject to caution.

Improvement Is a Process

While considering how he is going to move his belongings, Jones needs to learn a bit about the moving business. Though he knows the items he wants to move, he has never looked at them as objects to be moved. He has also never considered moving as a process. He needs to start thinking like a mover and see his items as objects being prepared to be uninstalled, handled, transported, handled and reinstalled.

Similarly, organizations that want to improve their processes must learn to view improvement itself as a process to be designed and improved. Processes are the object of improvements, each with its own specific requirements (see Figure 2, p. 44). Organizations must become acquainted with the complex characteristics of the methodologies and learn how they best combine with the change vehicles and tools to solve various problems (see Table 1, p. 47). Organizations must also learn about the unique features of the several change vehicles (see Figure 3, p. 46) and be able to relate them to their own culture and circumstances.

The miseries and risks created by the use of an inappropriate methodology or vehicle can be avoided. The process problem just needs to be accurately characterized during the define phase, and a proper match must be achieved. However, not all methodologies and vehicles are available at the outset of an improvement program, as each requires a substantial investment in learning, training and communication. Thus, some process problems have to be sidetracked initially because an appropriate methodology or change vehicle isn't available.

The reasons for sidetracking a problem must be explained to all involved and a timeframe for addressing each problem must be given. Failure to do so will result in increasing frustration as some problems are systematically tossed aside, eventually taking the wind out of the sails of the fledgling program.

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