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THE HIGH-VELOCITY EDGE

HOW MARKET LEADERS LEVERAGE OPERATIONAL EXCELLENCE *TO BEAT THE COMPETITION*

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In memory of
Jacob Irgang (1930–1995),
Korean War veteran, Purple Heart recipient,
Stuyvesant High School teacher extraordinaire, 1963–1995.
He knew his students were capable of far more
than even they realized.

CONTENTS

CHAPTER 7

CAPABILITY 2: PROBLEM SOLVING AND IMPROVEMENT

Chapter 6 conveyed my experience of working with experienced Toyota managers, realizing that their exceptional speed and facility in understanding, diagnosing, and designing systems depended on well-practiced, robust, reliable frameworks which they could apply broadly, rather than relying on a multitudinous library of best-practice analogies. In this chapter, we'll see a similar approach to problem solving and improvement—simple, robust frameworks which are used reliably by individuals and shared within groups that must solve problems collaboratively and cross-functionally. These frameworks both guide the direction of change—in the direction of an "ideal" system—and prescribe how change should be made—using the scientific method at high speed and low cost to solve problems while building ever deeper knowledge. Consequently, fixing something is both an end unto itself and also a means to two other ends—creating new knowledge which can be put to later, competitive use and developing greater problem-solving capacity in the people who are addressing the problem.

Let's take a closer look at what these frameworks are and how they are used to sustain a palpable sense of optimistic urgency. We'll visit several quality circles: groups of frontline operators whose responsibilities include not only doing their daily work but also improving their ability to do that work. One of the teams is at the Aisin plant that converted itself from a mass manufacturer characterized by delays and excessive inventory to a mass customizer that responds to customers' orders with exceptional rapidity (see Chapter 6). We'll also see how that plant's senior leaders practiced a similar discipline in problem solving and process improvement on a larger scale. We'll conclude by watching how Toyota leaders conveyed this discipline—work in such a way that you keep learning more about it and getting better at it—to the people for whom they were responsible. But first, let's get a preview of the discipline itself.

Problem-Solving Frameworks

Problem-Solving Goal: The "Ideal"

Once I realized that Toyota people discussed the design and operation of all processes in a patterned way (see Chapter 6), I also noticed a pattern in how they discussed improvement and innovation. For example, if I asked how a particular type of work was done, I got more than just an explanation of what was done. I also got an explanation of why it was done that way, according to the following pattern:

> *Ideally*, here is what we are trying to accomplish at this step, *but the problem is* . . . (evidence of some par-

> ticular difficulty: scrap, delays, strain, and so forth). We believe the problem is caused by (some particular factor or set of factors). Therefore, we are using this particular *countermeasure* to offset the causes that we have identified so we do not experience that problem again. As a result, we are able to do this work with fewer defects; quicker responses in reaction to customer need; smaller batches; less waste of time, effort, and material; and greater safety for those doing the work.

As I reflected on my repeated interactions with people at Toyota, who consistently answered using that same pattern, I began to recognize that this *ideal* was a "True North" beacon to which improvement efforts were oriented. This *ideal* implied that production and delivery should be:

- *Defect-free*—never compromising customer satisfaction.
- *On demand*—only in response to real need.
- *One piece at a time*—providing those who needed something exactly what they could put to use, not overburdening them with the obligation to hold things in anticipation of future need.
- *Immediate*—providing those who needed something what they needed without imposing any waiting time on them, but, if this was impossible, small batches of finished goods might be kept on hand to provide the illusion of immediacy.
- *Without waste*—never spending time, effort, creativity, and other efforts in ways that wouldn't be valued by someone else.

- *Safe*—so no one gets hurt physically or emotionally or is professionally threatened.
- *Secure*—so that material, services, or information go only to those intended and not to others.

With this ideal as an absolute standard (akin to Alcoa's standard that the best production systems result in zero injuries), if a change advanced a situation along at least one of those dimensions, that was good. If it didn't, or if it caused a regression, that was not good.

Problem-Solving Discipline

As I reflected on this pattern of explaining how work was done, and as I was later exposed to the standard way of solving problems, I recognized another implication. It was insufficient to explain what was being done in terms of a gap with the ideal. It was also necessary to explain the rationale behind the approach—what had been addressed and discovered to reach the approach that was currently being used. Rationales took this form:

- *Background:* Why we were concerned about this situation.
- *Current condition:* How work was done and what problems (symptoms) were occurring.
- *Root-cause analysis (diagnosis):* What causes were discovered when the problems were investigated.
- *Countermeasure treatments:* How we attempted to offset the causes and eliminate the problems.
- *Target condition:* How work was expected to proceed with the countermeasures in place and the problems treated.

- *Actual outcome:* What was really achieved.
- *Gap analysis:* Why the reality differed from the expectation/prediction.

This thought process was often shown in a summary document, as in Table 7-1, that captured the entire discovery process.

Table 7-1 Problem-Solving Template

Background: Description of the process being improved and what motivated concern about it.

Current Condition	**Target Condition**
• Description/illustration of how work was being done.	• A prediction of how work would be done with the countermeasures in place.
• Description/illustration of problems that were being experienced.	• Description/quantification of expected effects of the countermeasures.
Root-Cause Analysis/Diagnosis	**Countermeasure Treatments**
• What factors were revealed by an investigation of the causes of problems.	• Changes in how work is done to offset the causal factors and prevent the problems from reoccurring.
Actual Outcomes	**Gap Analysis**
• Description of how the work system actually behaved. • Summary of how the work system actually performed.	• Investigation of the gap between what was predicted/expected and what was actually experienced.

Let's take a closer look at how this approach is learned and applied.

Example: Quality Circle at Taiheiyo

Taiheiyo is a first-tier supplier for Toyota's Tsutumi, Takaoka, Motomachi, and Tahara assembly plants. Its main processes are stamping, welding, and plating. A team member at Taiheiyo, Mr. Ohashi, explained to me a two-year problem-solving effort of which he was part. Not only did he and his colleagues create a better process, but they also built deeper knowledge about the process and built skills to improve other processes and solve other problems later on.

Ohashi was part of a quality circle that focused on improving the overall cleanliness and environmental quality of the welding department. Interestingly, as the effort was explained, it became clear that improving the process was not an end in itself. It was the means to another end: building the *kaizen* (improvement) skills of the operators. The particular problem that Ohashi's teams were addressing was the solid and gaseous pollutants created by CO_2 welding robots. Hot spatter from the welds increased the fire risk, crudded up the equipment with hard-to-clean residue, and created smoke so severe that operators had to wear uncomfortable masks.

Consider for a moment how such a problem might be addressed in other organizations. In some, workers might be expected to grin and bear it, wearing respirators, scrubbing the residue, and knowing that every day the job was going to be unpleasant, with lots of energy devoted to unproductive activities. In somewhat more enlightened organizations, responsibility for cleaning up the mess would be delegated to a team of experts. But because the number of experts is limited and the demands on their time are great, it might be a long wait before the welding problem was addressed—if ever. In the meantime, the unpleasant conditions would have to be tolerated. In the case of Taiheiyo, the idea was that if problem-solving capacity were developed throughout the organization, those affected by a problem could often solve it themselves—and immediately—relying on the experts only for problems of sufficient scale, scope, and complexity.

Mr. Ohashi was one of 10 who had dedicated time with their group leader to clean up the welding area. Though the group leader was more experienced and capable, his job was far more than being the project leader per se, divvying up work and assigning responsibility to this person or that for ideas he had generated and directing people to do what he thought was right. A fundamental element of his job was to be a Socratic teacher, asking them questions, pulling the team along by developing their abilities to think through situations, and teaching them how to resolve problems on their own by using the scientific method.

For example, he first led them in a series of exercises to figure out how to reduce the scattering of welding spatter. Even though he might have known better, the group leader let Ohashi's team try a domelike cover for the torch. It proved ineffective because the spatter accumulated inside the cover. An umbrellalike cover was tried next. It prevented the spatter from scattering above but increased the spatter to the sides. In a third attempt, the quality circle tried a bronze shutter that shielded the torch; this proved most effective in preventing spatter from accumulating on the welding arm.

But now they had another problem to solve: More spatter was accumulating on the base of the machine. Again, the group leader might have known which materials in which configurations would have made for easier or harder cleaning. However, the idea was not to impose his notions but to teach the quality-circle members to develop and test theirs. Their trials are summarized in Table 7-2. In conducting these experiments, the team concluded that the material had to withstand 1,000 degrees Celsius, that it had to have a heat capacity above 0.3 cal/°C, and that the material had to be formable.

Having dealt with spatter, and having practiced this knowledge-building approach to solving problems, the quality circle

Table 7-2 Taiheiyo Quality Circle Test Results: Base Covers

	Material	*Melting Temperature, °C*	*Heat Capacity, cal/°C*	*Analysis*	*Conclusion*
1	0.3-mm bronze plate	1,083	0.024	Made holes, spatter stuck	Rejected
2	1.3-mm bronze/zinc	1,083	0.102	Made holes	Rejected
3	3.0-mm tile	450	0.154	Dirty, rough, not formable	Rejected
4	1.2-mm stainless steel	1,450	0.103	Made holes, difficult to form	Rejected
5	1.8-mm aluminum	685	0.103	Dirty, made holes	Rejected
6	5.5-mm ceramic plate	400	0.102	Dirty, made holes, not formable	Rejected
7	4.0-mm bronze plate	1,083	0.320	Good	Accepted

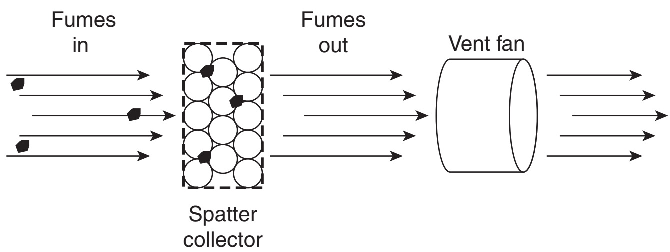
developed alternatives for capturing the fumes generated by welding. Again, the group leader might have imposed his preconceived solution to the problem or the quality circle might have solicited solutions from other divisions or other plants. However, by doing that, they would have missed the point of solving problems for the sake of building problem-solving capacity rather than merely for the sake of making the problems go away. Instead, the team practiced the skills it had been developing in solving the spatter problem.

The team did trials for three types of intake mechanism and changed the shape and location of the vent cover to maximize the amount of fumes drawn in while minimizing the amount of spatter that dirtied it. But developing an effective ventilation system caused another problem: The vacuum used to draw in the fumes also drew in some of the spatter, risking damage to the vacuum fan and threatening to ignite a fire in the device. The team discovered that it had to develop a spatter filter in the ventilation mechanism. Here too they were given enough leeway to practice developing ideas and testing them experimentally rather than depending on established expertise for a turnkey solution.

The main issue was developing a filter that would stop the spatter without overly impeding the draw generated by the ventilating fan. The team began to test a variety of filtration materials (see Figure 7-1).

Drawing fumes through a container of pebbles proved ineffective because not enough air got through. Replacing the pebbles with golf balls was only partly successful. The golf balls accumulated residue and had to be replaced because they could not be cleaned. At ¥100 per ball, that was too costly. Metal ball bearings like Pachinko balls were too densely packed to be

Figure 7-1 Taiheiyo fume filter



effective. However, glass marbles—like those used to seal certain soft-drink bottles—worked effectively. At ¥2 per ball—and the balls could be cleaned and reused—the price was right.

The team encountered other issues before arriving at its final design: how many layers of marbles to use—one, two, or three—and how to remove other contaminants from the fumes once the spatter was gone. In every case in which there was a question, the response was to generate an answer by conducting quick experiments, not by speculating. They finally arrived at a design that included a "marble-ator" to deal with the spatter and a static-electricity dust collector to get rid of the particulates. Again, speculating that they had "solved" the problem in its entirety ran against the grain of their approach, so they developed a simple test to prove the efficacy of their contraption. To confirm that the air coming out of the device was clean, they ran the exhaust tube into a fish tank, which, according to Mr. Ohashi and his assistant manager, Mr. Koiwa, was perfectly fine for the fish.

Taiheiyo's heavy investment in the problem-solving ability of its workers had multiple benefits. The problem-solving skills of the team were increased; the cost of equipment maintenance was reduced; the environmental quality, safety, and comfort of the work site were improved, earning the supplier an ecology award from the Ministry of Science and Technology; and the more technically skilled members of the maintenance-engineering department were unburdened of routine responsibilities and freed to address more challenging situations. Whereas the maintenance-engineering department had done 100 percent of the maintenance previously, the production workers were now able to do 80 percent of the routine maintenance themselves.

Example: Quality Circle at NHK Toyota

The improvement effort of Ohashi's quality circle at Taiheiyo had several characteristics:

- Process improvement was used as a mechanism to develop the abilities of line workers.
- Those affected by the problem were involved in solving the problem.
- Improvement activities were designed and performed scientifically, not arbitrarily, with structured tests of design alternatives.
- The improvement activity was guided by a capable teacher.

Here is an example from another Toyota supplier, NHK (Nippon Hatsujo Kabushiki Kaisha, or Japan Spring Corporation), which used the same approach to improve processes and to train workers to improve processes at the same time. We'll follow a quality circle working at a Toyota City plant, where they improved the quality of molded foam parts—the inside of armrests for the Crown, Celsior, and Lexus lines—and lowered the cost of producing them.

The quality circle had eight members, guided by a leader, Mr. Nagata, and a subleader, Mr. Mori. There were several specific problems. For example, the liner material they were using allowed the foam to bleed through the seams of the mold, resulting in time consuming, material-wasting trimming (both departures from the *ideal* of "immediate" and "without waste"). To resolve this issue, the quality circle didn't ping-pong, jumping to the conclusion that one or another alternative material would work. Rather, they set up a series of trials to see what material, at what thickness, would do the trick.

There was a related problem. The pin that ejected the parts from the mold had a tendency to weaken and tear the liner; this also affected quality and cost. As with the Taiheiyo quality circle, one approach might have been to delegate the problem to a technical expert or take a solution from some other armrest plant. Or they could have swapped one pin type out for another that they speculated would yield better results. However, even if this did improve the process, it would be by luck; it wouldn't develop the employees' problem-solving skills, and it wouldn't build deeper knowledge in pursuit of superlative cold-foam molding. With these multiple considerations in mind, Nagata and Mori led the team through a set of experiments, testing different combinations of pin shapes and material thicknesses to achieve the desired outcomes.

In one series, they ran 88 tests for different thicknesses of vinyl to find one that was both more durable and better at reducing leakage at the mold seams. In another series of experiments, the team adjusted the shape of the liner to achieve greater consistency. In a third set, they experimented with the number and location of ports in the mold to achieve a more even and consistent distribution of material. The experiments led to demonstrable cost and quality improvements. The defect rate was reduced by 89 percent and the number of parts that were too defective to use was reduced by two-thirds. The amount of material needed for each piece was reduced by 60 percent. And, of course, the team came to better understand its product, the material of which it was made, and the equipment used to make it.

We saw earlier that high-velocity organizations generate speed not only because they see and solve problems, but because the solutions quickly become incorporated into the *best known approach*—that is, the most up-to-date (and always improving) distillation of what the organization has learned *collectively* about how to do a particular piece of work with the best chance of success. This team followed the same pattern, concluding its improvement activities only after developing a set of standardized procedures so that the changes they had developed could be incorporated into the standardized work of the entire foam-molding department. Thus, they did not complete their work after discovering valuable changes; they completed it only after incorporating the changes into the regular work of the production setting.

Example: Quality Circle at Aisin

Chapter 6 included a description of the make-to-order system for manufacturing mattresses at Aisin. Over the course of several years, Aisin made enormous gains in productivity and product variety, with equally impressive reductions in inventory and lead time. Part of the improvement was rooted in switching from a functionally structured, push-based system to a process-oriented pull system. We'll see details of that system-level redesign below. However, Aisin's improvement could not be explained as a one-time change. The company's superlative levels of performance were rooted in a variety of improvement cycles, some carried out by senior managers when it came time to do large-scale reconfiguration, but many carried out more locally.

I had the privilege of interviewing members of Mr. Ito's quality circle at Aisin to learn about their experience of working in final assembly. According to Ito, there were compelling reasons to improve the line's capabilities. In 1993, the volume in the plant was growing, as was the number of workers. Each of the three production lines had the goal of reducing rejects to 250 in a six-month period (October 1993 through March 1994). Although Lines 2 and 3 met this target, with reject levels of 204 and 232, respectively, Line 1 had 258 rejects in the same period. For 1994, then, the goal was to reduce rejects on Line 1, increase productivity by reducing idle time, and "produce a workforce in which new techniques can be learned and applied." These objectives were quantified as follows: Reduce the number of defects from 258 for the six months ending in March 1994 to 170 for the six months ending in September (a 34 percent decrease) and 140 for the six months ending in March 1995 (for a total decrease of 55 percent). At the same time, the line was challenged to reduce the production time from 26.3 minutes per unit to 22.8 minutes in September (a 13 percent decrease) and 18.4 minutes in March 1995 (for a total reduction of 30 percent). Part of this improvement was to be accomplished by means of factory-level improvements, which we will explore in a bit, and part was to be accomplished by quality circles such as Ito's.

As these workers explained it, in the first phase of their employment, before joining the quality circle, they were responsible only for doing standardized work and calling for assistance when they were unable to do it. At first glance, this sounds like my experience at the Big Three plant, with the obvious exception that I hadn't even been armed with standardized work. When the quality circle was first formed, they were trained to distinguish between conditions that were and were not problematic, with the group leader challenging the team leader and team members to become more critical of the way in which their work was performed; this emphasis on seeing problems is a critical element of Capability 1, discussed in Chapter 6.

After spending a few months learning to do work according to a standard and to identify problems as they were experienced, the team was taught to suggest countermeasures to the problems they perceived. Having learned to identify problems and suggest responses, the team then learned ways to design, but not build, the countermeasures that had been suggested. The team members confessed that this became very frustrating. Why? At first, they had been "dumb and happy." Then they began to realize how much was going wrong. Now, they realized that there was a way to make things better, but they did not know how. Feeling constrained, they asked to learn skilled trades such as carpentry, electrical, plumbing, and automation so they would be able to fabricate countermeasures. Concurrently, other members of the team passed the qualifying test for assembly jobs that required higher technical skills. In other words, the team's capability increased in two dimensions. The sophistication of the production activities for which it could be responsible increased and, simultaneously, its ability to improve those activities increased.

Example: Comprehensive Process Redesign at Aisin

Mr. Ito's quality circle was a mechanism for increasing the ability of production workers to improve production activities while at the same time improving those activities. The progress it was making on skill development gave more senior people an opportunity to address more systemic issues such as line reconfiguration, rerouting of material and information flows, and modification of production equipment, knowing problems of smaller scope would be picked up and addressed by those, like Ito, who were confronting them daily.

I've paid three visits to Aisin over the years. On my first visit, the plant had three lines: small, medium, and large. On my second, it had consolidated the three lines to two, with each one capable of making any size mattress. As we'll see in this example, whether the changes at Aisin were large-scale or small-scale, conducted by experienced senior people or by less-experienced junior people, there was a disciplined problem-solving process.

Figures 7-2 through 7-4 are excerpts from process improvement summary documents prepared by Aisin managers to capture the logic of their discovery process. Several points come through:

- *Presentation of the information*. The summary is written as an experimental report, like the generic problem-solving template in Table 7-1. For example, the *before* condition lists five specific factors and the three negative consequences they cause. The *after* condition indicates the five specific changes and the effect each one had on performance.
- *Scale and scope of the problems being addressed*. The summary addresses the factors that only someone with boundary-spanning responsibility and authority is in a position to resolve, such as the layout of one process relative to another or the coordinating mechanisms between process steps.

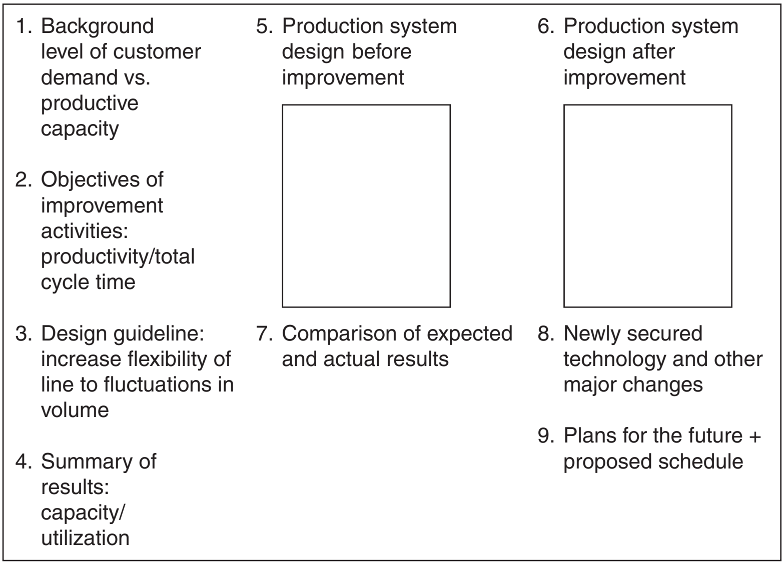
Figure 7-2 shows the main sections of the improvement activity summary. The fact that the improvement activity is understood as an experiment can be seen in its use of several before-and-after contrasts:

- *System design*—before and after the improvement effort (sections 5 and 6)
- *System performance*—before and after the improvement effort (sections 4 and 7)
- *Gap identification*—predicted results compared to actual results (section 7)
- *Countermeasures*—changes in equipment, training, and methods (sections 5, 6, and 8)

Figure 7-3, focusing on section 5 of Aisin's problem-solving summary, shows the production system before it was changed. Several points are worth noting:

- The people who worked on the process improvement (group leaders, the assistant manager, and the Toyota Production

Figure 7-2 Aisin's summary of process-improvement effort



System promotion expert who, in his role as coach, was there to ensure that this system-level problem solving also developed leaderships capabilities) identified three symptoms that diminished performance: inability to respond to fluctuations in volume, volatility in cycle times, and inability to keep the production pace tuned to the rate of demand.

- Each symptom corresponds to some aspect of the ideal discussed in the start of this chapter. Inability to respond to fluctuations corresponds to inability to respond *on demand* and *immediately*. The lack of a pacing mechanism also compromised the system's ability to produce *on demand*. Volatility caused workers and machines to block and starve each other, a source of *waste*.

- For each symptom, the process redesigners identified at least one process feature as the root cause. For example, the diagram attributes the system's inflexibility to each line's size and specialization (a rise in the demand for small mattresses could not be absorbed by one of the other two lines). This diagram states the group's sense of cause and effect.
- Figure 7-3 shows where on the shop floor the root-cause feature is observable.

Figure 7-3 Section 5 of Aisin document (before-condition diagram)

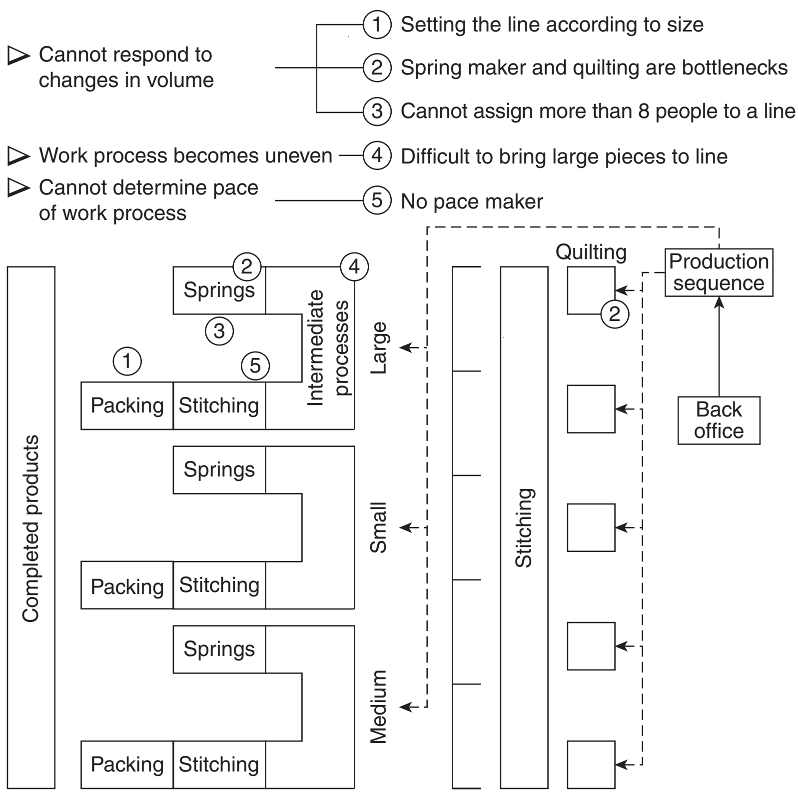


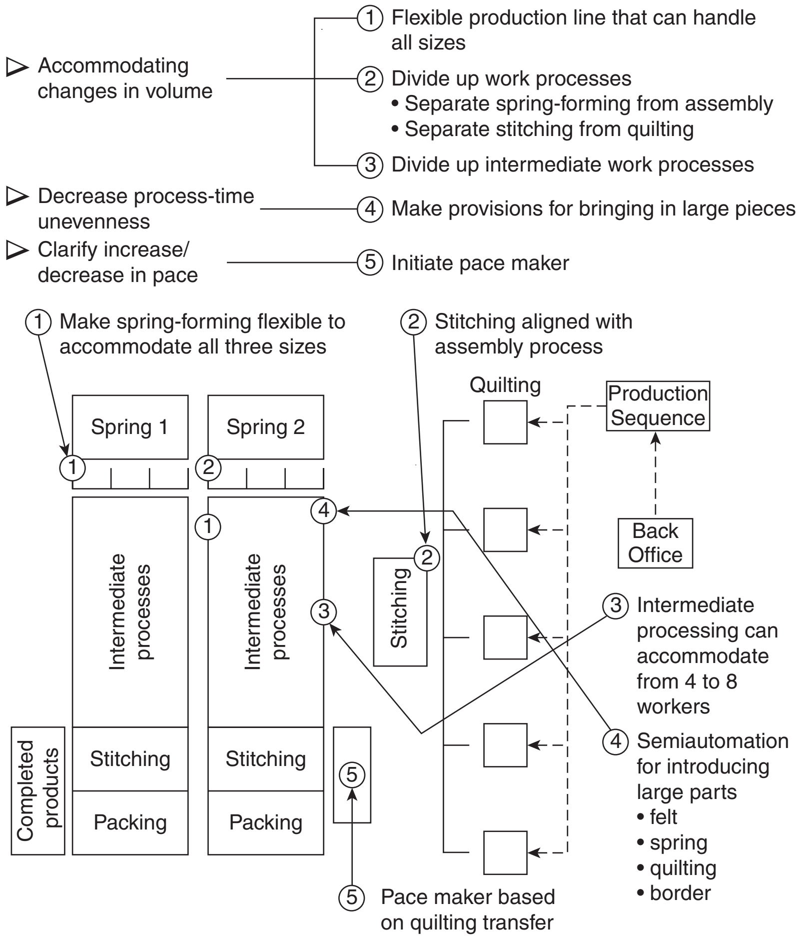
Figure 7-4 focuses on section 6 of Aisin's problem-solving summary. Again, several points are worth noting:

- For each root cause in the before-condition diagram, there is a particular change (countermeasure) in the design and operation of an activity (items 2, 3, and 4), connection (items 4 and 5), or pathway (items 1 and 2).
- Each of the countermeasures is credited with relieving a specific symptom that was identified in the before-condition diagram.
- The way each countermeasure was enacted is explained. Flexibility was achieved by altering the spring-forming process and separating spring-forming from assembly with a buffer, which prevented volatility in one activity from blocking or starving the other. Further flexibility was achieved by dividing work processes so that people could be added and subtracted easily.

In effect, this figure can be thought of in the following fashion:

> We redesigned the production system by conducting the following experiment. When we studied the system, we found three reasons to be disappointed with its performance. We traced these three disappointments to five root causes. Therefore, to improve the system's performance, we addressed each of these five root causes:
>
> - The countermeasure for cause 1 is redesigning spring-forming.

Figure 7-4 Section 6 of Aisin document (expected after-condition diagram)



• The countermeasure for cause 2 is separating stitching from quilting and spring-forming from assembly by small buffers so that volatility from one does not block or starve the other.

- The countermeasure for cause 3 is redesigning work so that people can be added and subtracted more easily from the line.
- The countermeasure for cause 4 is adding some semiautomated equipment to make it easier for the operators to lift large, bulky pieces such as frames, quilting, and felt liners and carry them from line-side stores to the work site.
- The countermeasure for cause 5 is changing the information connection between assembly and quilting so that assembly (the downstream process) determines the pace of quilting (the upstream process).

The summary document captures the line redesign as an experiment in which the "process scientists" quantified the expected outcome (objective or goal) and compared it with the actual change in performance.

Aisin's experience reveals several key points about improvement in general:

1. Building and exercising problem-solving skills is considered an important capability for everyone from top management to frontline workers.
2. Problem-solving skills are built by solving problems, so being responsible for doing work and being responsible for improving how the work is done are intertwined tightly. This is not scientific management in the Freder-

ick Winslow Taylor sense of having big dumb lugs doing the work prescribed for them by the brainiacs.

3. Problem solving is done in a disciplined fashion. Assumptions about cause and effect are made explicit and are stated clearly, then they are tested in a rigorous fashion so improvement efforts both make processes better and deepen process knowledge.

Several other points stand out, particularly in light of my third visit to Aisin two years later. Improvement and innovation never end, and they are always done in a disciplined fashion.

On a visit to Aisin subsequent to the one during which I learned about the consolidation of small, medium, and large lines into two "any-size" lines, I saw that both lines were still configured to handle any mattress in any order. Yet, they were no longer identical. At one step in the final assembly, one line completed the step manually while the other used a new piece of automated equipment. Why the difference? Why not both manual or both automated? The reason was that the new machinery had not been fully vetted. Therefore, rather than make the large investment (and gamble) of placing it on both lines, unproven, Aisin was trying it out on one. It was a deliberate attempt to try an idea in a less expensive and more reversible fashion.

A second image comes to mind from that visit. Consider two lines, each capable of making 100 units per day. On a particular day, there is demand for 180 units. How would you allocate demand across the two? You might argue for splitting it 90 and 90. You might also argue for assigning 100 units to one line to load it fully, with the remaining 80 assigned to the other line. Both would be reasonable approaches for most organizations, but not for the high-velocity leaders that incessantly try to build useful knowledge that will make them even better performers. After all, at Aisin, they already knew how to handle 100 units a day on each line. What they weren't sure about was how to handle 110 or even 120 mattresses per day per line. But, if they were to increase their competitiveness, meeting the needs of more customers more quickly and more efficiently, they would have to. Therefore, on days when the lines were not fully loaded, they deliberately overloaded one, specifically trying to discover its failure modes. There might have been factors that didn't cause problems at a rate of 100 per day but did at a higher velocity. It was a stress test of the system, forcing it to reveal its vulnerabilities when the situation was not critical. The other line, running only 60 or 70 pieces, was there as a backup were the test to prove too stressful.

Example: Teaching Others to Generate Knowledge While Solving Problems

Let's take the perspective of a leader responsible for the development of others.

Hajime Ohba, general manager of the Toyota Supplier Support Center (TSSC), whom we met in Chapter 6, was visiting a factory in which one of TSSC's consultants was leading a training-and-improvement activity. The consultant was helping factory employees and their supervisor reduce the manufacturing lead time of a line and Ohba was there to evaluate the group's progress.

The group began its presentation by describing the steps by which the product was created. They went over a number of problems they had identified in changeover (the switch from making one part type to making another; for example, swapping out the die, scrap chutes, and metal coil on a stamping press) and explained the specific changes they had made in response to each problem. They concluded by saying, "When we started, the changeover required 15 minutes. We were hoping to reduce that by two-thirds—achieving a five-minute changeover—so we could reduce batch sizes by two-thirds. Because of the modifications we made, we achieved a changeover time of seven and a half minutes—a reduction of one-half."

Consider for a moment whether the team succeeded or failed. On the one hand, they had not achieved the goal of five minutes. On the other hand, they had cut the time in half, with all the attendant benefits of smaller batch sizes, less inventory, less cost and effort involved in material storage and tracking, and faster responsiveness to customer needs. That seems a victory.

For Ohba, it was true that they had succeeded, but not completely. Yes, they had made the changeover process much better than it had been. Their shortcoming was not that they had failed to reduce the changeover further. It was that they had failed to learn from not reducing it further. As Ohba pushed them with additional questions, increasing their understanding of the machinery and the work around it, the team realized where he saw a problem. They had not laid out clearly what they had assumed about the process—what could be changed and what was unchangeable. In other words, things could be changed, but by how much? In fact, the five-minute target was not a prediction based on a well-reasoned expectation; it was a goal based on desire. Thus, in falling short, they not only missed their target but missed the chance to push further to understand factors that they had assumed to be true but that their experience had proved to be false. The process had gotten better, but their understanding of it had not improved as much as it might have had they made clear their expectations at the start and the assumptions underpinning them, thereby having something tangible to investigate when those assumptions were proven false.

Example: Improving People While Improving Processes

In the next example, five small teams attempt to make improvements to a process. Four of the team leaders take the conventional approach: The point of process improvement is to improve the process. One team leader, the one with more experience in a high-velocity environment, takes a different approach: The point of process improvement is to improve the participants' process-improvement capabilities by coaching them as they try to improve the process.

MacDougal, Inc., employed 200 people and had annual sales of $20 million from remanufacturing damaged starter motors and alternators, which they acquired from auto repair shops. MacDougal would disassemble, clean, diagnose, repair, reassemble, package, and ship the items, which, in turn, would be sold by distributors or auto supply stores. Work was done on 10 lines, each of which was dedicated to a product family such as Chrysler alternators or Ford starter motors. Seasonal spikes in demand led to MacDougal having a broad, deep inventory. The fact that the inputs to this process were broken made the process hard to run. Reducing the burden of excess inventory while improving responsiveness to customer needs was the company's motivation for seeking Toyota's help. Toyota's motivation was that trying to improve such an unusual process would be a great learning experience.

This example is based on a three-day process-improvement exercise that included six people from the Toyota Supplier Support Center and ten from MacDougal. (TSSC supported Toyota Production System implementations at Toyota's North American suppliers and at other companies, such as MacDougal, which were not otherwise affiliated with Toyota.) Five teams of three were formed. Each had a Toyota leader and two MacDougal people as team members. The sixth Toyota person was the coordinator.

Each team was given the same initial assignment, to calculate cycle times for each of an assembly cell's 12 process steps. What was telling was the difference in approach and the difference in results among the teams. At one extreme, Team Leader 5, like three of the four other team leaders, adopted a divide-and-conquer strategy. These leaders assigned each team member to four of the 12 steps, took four for themselves, and set off to do the measurements. Team Leader 2 took a different approach. He kept his team intact and, starting at the last process step and working back, they calculated the cycle times together. While one might think Team 5's divide-and-conquer strategy would be the most productive, it was not. That team had calculated only three cycle times accurately (the ones studied by the team leader himself). In contrast, Team 2, though their approach was slower and more methodical, was 12 for 12 in getting accurate measurements.

This dichotomy in approaches continued over the course of the three-day exercise. When it came time to improve some of the process steps, Team Leader 5 divided responsibility among himself and his two team members. Team Leader 2 worked together with his team members. Team Leaders 1, 3, and 4 occasionally worked with their team members, but mostly held to an approach like that of Team 5. At the end of the exercise, when it came time to report out, the team leaders gave most or all of the presentation, except for Team Leader 2, who stood back, listened, and observed while his team members explained what they had done, why, and with what effect. Finally, during the wrap-up, when the MacDougal people were asked to comment on the experience, Team 5's two blurted out, "It was traumatic!" whereas Team 2's members gave the satisfied nod of someone who had just had a good experience. Again, the members of Teams 1, 3, and 4 were somewhere in between, expressing some hesitation and reservation in their posture and tone.

The obvious irony is that the four team leaders who tried to be efficient by dividing the task up among the team members achieved inferior results. In contrast, the team leader who actively coached his team got superior results. Why? For the teams that "efficiently" divided up the work, their team performance was, in effect, the average of their individual performances. Since the two MacDougal people were beginners and since they didn't get any better during the exercise, they brought the average down. The fifth team leader kept his team together almost all the time—seemingly an inefficient deployment of labor. But his approach was to increase the skill of the other two. In short order, he created a multiplier effect. The team's "average" kept going up as the two MacDougal people improved.

The difference in how the exercise was perceived and approached was even more pronounced when I asked the team leaders to reflect on what had happened and what would happen next. Four emphasized the process gains that had been made: smoothing of flows, reductions in cycle times, that sort of thing. For them, the natural next step would be to install permanently the modifications for which they had run trials. Again, this emphasized that they saw the purpose of the exercise as process improvement as an end unto itself. Team Leader 2 was different. Most important for him was the practice his team members had gotten in observing, analyzing, and piloting changes. For him, the next step would be to have them observe the efficacy of the changes under normal conditions rather than in this artificial setup; the measure of success would be whether they could apply their observation and problem-solving skills elsewhere. For him, the exercise was a means to an end, improve the process to improve the people, and, because you're never sure until you see, he couldn't be sure that what they had worked on was successful until he had watched it—and them—in normal conditions.

It was not lost on me that this team leader had the most extensive experience at Toyota, having been at some of its finest plants and having worked under the guidance of some of its most accomplished managers. His behavior reflected that of his mentors, who understood that, for an organization to be high-velocity, process improvement, however valuable, must also serve to improve the people carrying it out. If it does not, then the responsibility for seeing problems, solving problems, and generating useful knowledge that will reduce or prevent future problems will be in the hands of a select few, unused by most of the organization. The other team leaders hadn't had the same experience yet and their approach reflected a less complete understanding of what it meant to lead—not only to delegate and direct, but to coach and develop as well.

Looking Ahead to Capability 3

We started this book with the observation that a number of organizations get ahead and stay ahead of their competitors despite the difficulty of differentiating themselves or gaining a monopolistic advantage in their industries. For them, the way to stay ahead is not to find a better position and defend it, but to keep moving ahead with greater speed, agility, and endurance. We've just looked at how problem solving is conducted—in a disciplined fashion that solves the problems, builds deeper knowledge about the process, and increases the capabilities of those involved.

In Chapter 8, we'll look at another capability that leads to high velocity: the ability to take lessons discovered through local problem solving and make them useful throughout the organization, so that individuals learn not just for themselves but for their present and future colleagues. This turns out to be a decisive business asset.