Improving the way organizations run through participative planning and management.
Infrastructure for a Learning Organization

Peter M. Senge, Director, Center for Organizational Learning, Massachusetts Institute of Technology, Cambridge, Massachusetts

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Peter Senge and his colleagues at the M.I.T. Organizational Learning Center have advocated systems thinking and system dynamics in organizations for the past 25 years. The difficulties encountered led him to develop a theory that management needs to do more than promote learning by individual employees and managers—organization learning is needed. His best-selling book, The Fifth Discipline (1990), detailed this thinking.

In this article, Senge shares his experiences of the past five years in helping companies to become learning organizations. He argues that an internal structure for learning is essential. He calls this an infrastructure for learning, and this was the topic of his keynote address at The Power of Systems Thinking Conference in Boston, Massachusetts on June 12, 1996. Before Peter presents his message, however, we believe it will be useful to give you a brief introductory definition of learning organizations, taken from The Fifth Discipline and The Fifth Discipline Field Book (1994):

The basic meaning of a learning organization is: “An organization that is continually expanding its capacity to create its future.” (The Fifth Discipline, page 14.)

The core of learning organization work is based on five “learning disciplines”—lifelong programs of study and practice:

• Personal Mastery—learning to expand our personal capacity to create the results we most desire, and creating an organizational environment which encourages all its members to develop themselves toward the goals and purposes they choose.

• Mental Models—reflecting upon, continually clarifying, and improving our internal pictures of the world, and seeing how they shape our actions and decisions.

• Shared Vision—building a sense of commitment in a group, by developing shared images of the future we seek to create, and the principles and guiding practices by which we hope to get there.

• Team Learning—transforming conversational and collective thinking skills, so that groups of people can reliably develop intelligence and ability greater than the sum of individual members’ talents.

• Systems Thinking—a way of thinking about, and a language for describing and understanding, the forces and interrelationships that shape the behavior of systems. This discipline helps us to see how to change systems more effectively, and to act more in tune with the larger processes of the natural and economic world. (The Fifth Discipline Field Book, page 6 & 7.)

The M.I.T. Center for Organizational Learning has grown very rapidly. I think this happened partly because people wanted practical tools—tools like System Dynamics, Chris Argyris’ work on Action Science, and David Bohm’s work on dialogue. A lot of work was also going on around building shared vision, and there were tools for that, too. These were methods that worked and they had an impact. And so things grew.

Over the five or six years since the consortium was founded, there have been many

Editor’s note

Devoting part of our fifth year to study
Devoting part of our fifth year to study, continued

notable successes—significant progress in many member companies, significant advances in theory and method, and many new papers and books. We also began to see that sometimes learning didn’t happen very well and sometimes new learning didn’t last very long. We soon become very aware of how difficult it is for an organization to create lasting learning. We began to wonder if we had a deep enough understanding of what we were trying to do. To explore this further we decided to not take on any new projects for a year and devote ourselves to understanding more deeply what we were trying to do. We can now see that what we were doing is very simple, but not easy. We were trying to understand how a very particular kind of community—a learning community—develops.

A learning community is a complex system in itself. It includes research, practice, capacity building, communications and governance. Figure 1 diagrams how we think of a learning community.

![Figure 1. Core Activities of a Learning Community](image)

Research means the disciplined approach to discovery and understanding, with a commitment to share what is being learned. Corporations do research which is proprietary, but within the domain of what they consider the corporation it is shared. The whole point of doing the research is to somehow share and build on it. So research is a disciplined approach of discovery and understanding, with a commitment to sharing as widely as is appropriate. In our case we are interested in sharing as widely as possible.

Practice is when any group of people are engaged in trying to accomplish something. They are dealing in a practical world, with practical results and practical challenges and measures of success. Practice could be a business setting, or a group of people trying to make school really work for kids. It could be people in a hospital, or people trying to make government serve its constituencies. It is a practice domain, a domain where one is really trying to make something practical occur.

A learning community is a group of people that live in those two worlds. It is a group of people who embrace the world of research and the world of practice. They are committed to generating practical, tangible results, and to building knowledge about how that is done.
A tree as a metaphor for knowledge

About six months into this process a metaphor or guiding image emerged that has been very helpful, very simple. What if we thought of the knowledge-creating process as a tree? We see a tree as a thing, but of course a tree is not only a thing, any more than you or I are only things. A tree is also a process. A tree is a continuous state of becoming, a dynamic phenomenon.

What if we thought of the roots being like theories? Theory does not get generated overnight. It is like the roots of the tree—it is below the surface, few are even aware of it; it takes years to develop; maybe a lot happens for a long time and there isn’t anything much going on above the surface.

It is interesting, by the way, that if you don’t think of knowledge like this, you fall prey to a huge trap in our culture, which is that we equate newness with importance. We are really addicted, as a culture, to what is new. And it is probably one of our most serious addictions. So let me offer an alternative view. What is important is old. Almost anything that is really important is probably quite old. Food for thought. The branches of the tree would be like the methods and the tools, the intermediary between the theory and what the tree is actually generating. If we think of a fruit tree, we can think of the fruit as the ultimate product. The fruit, in an organizational setting, would be the operational knowledge produced.

The meaning of learning and knowledge

One of the fundamental things that we have lost sight of in our society and our culture, is the meaning of knowledge, what it means to learn. What it means to learn is to create knowledge. But that is a trivial statement if you don’t define knowledge. Knowledge is a capacity for effective action, with some understanding of what is making you effective.

Michael Polanyi once said, “We know more that we can ever say.” Polanyi said that all knowledge must be understood as both tacit—in the body, in the person, irreducible at some level—and conceptual or explicit—theory, propositions, and testable ideas. By the way, that notion often strikes Westerners as novel: “Wow, that’s interesting.” It rarely strikes Easterners that way. It rarely strikes Asians that way. Our notions of knowledge are very cultural. In the evolution of our western cultural understanding of knowledge and science, we have come to almost exclusively emphasize explicit knowledge. You’ll rarely find a great mathematician or physicist, for example, who explains how they created a mathematical theorem or proof. It is central, in a real learning community, that knowledge and learning be thought about broadly— theoretical understanding and operational knowledge; insight and practical results; concept and capability.

How I first became aware of learning problems in organizations

The practical manager would say, “give me the model and tell me what to do.” My first awakening in the field of system dynamics was a study that went on for about two years in the late 60s and early 70s. It involved a lot of the best people in the field of system dynamics and it resulted in a terrific model being built. The CEO, COO, and all the right people in the company were involved. The model was focused on some
critical issues for the business. Those issues were understood at a very deep level; in this case it was a cyclical situation where the company had been losing market share through repeated business cycles, attributing it to forces outside their control. The model revealed that in fact, you could begin to understand a lot of this long-term erosion of market share (and, by the way, this was the dominant business in its industry; still is). But its market share had fallen from 80% to 50% over some 15 years, and one could attribute most of that erosion of market share to its own policies. The model developed a theory about how this had happened.

They immediately put the model into practice—implemented a set of changes. In this case it had to do with how they cut back production, even more than incoming orders, when there was a downturn in orders. They implemented new production planning mechanisms.

In 1970, during a recession, they managed to maintain virtually flat production while orders were falling; everybody was terrified, they were sure they were going to get killed with excess inventory. In fact, they built market share, because all their competitors were basically using the same policy as they were. And their product was so available, during the downturn, that they actually built market share. They made, by varying estimates, lots and lots of money. They also developed a system dynamics staff internal to the company.

That was a success, right? What could be a better example of success? They had research, theory, and practice; they translated model insight into actual changes in policy. And they realized benefits. Then came the much more serious recession in 1973-1974; that was the first OPEC induced recession, with the major oil price hikes caused by the cartel cutting back supply.

What did the company do? It went back to all its traditional policies. What was going on there? My answer is that this was one of the first clear cases that showed there was a learning problem. Somehow we could not integrate the learning into the tacit knowledge of the people in the organization.

Shortly, I will get into the main topic of this paper, the infrastructure for a learning organization. But first I need to briefly mention two other issues. They are linear and nonlinear systems, and the notion of management control.

**Linear and Non-Linear Systems**

To put this in perspective, probably 99%—perhaps more—of our scientific theory is based on various assumptions of linearity. This is certainly true in the whole field of systems, engineering systems theory and systems control theory, is based on assumptions of linearity.

Jay Forrester used to tell a story about a conversation with a mathematician about what it would really mean to start to have the scientific community focus on understanding the dynamics of nonlinear systems. This was before talking about non-linearity was fashionable. He said the other gentleman responded saying, “You know it’s like we have been living our life in a tent. Then you poke a little hole through the roof of the
tent and you can begin to see this kind of firmament outside. But then we want to quickly cover up the hole and go back to our tent.” The non-linear world outside the tent is pretty awesome. That can be both a nice feeling and a kind of humbling feeling, a kind of “putting you in your place” feeling; but it can also be a very scary and disorienting feeling.

**Control**

The second issue is about control. For this, I will try to change the scientific perspective of linear and nonlinear systems, and restate the issue in managerial metaphorical language, rather than scientific. The essence of our system of management, as almost all of us have grown up with it, is the same system of management that operates in almost every school and virtually every corporation I have ever been a part of. The essence of our prevailing system of management is control. What it means to be a competent manager, is to be in control.

The notion of control is a very important one because at some level all of us as human beings have bought-in to this prevailing system of management. If we have grown up in America, or have grown up in probably any industrial culture, we have bought-in to a notion that more or less goes along the following lines. (It is like a little message has been whispered in our ear since we were very young.) The message goes something like this: “To be effective you must first understand, you must figure it out, you must know how the world works. After all, why would you be going to school? You go to school to learn how things work, right?” Somewhere along the way we all kind of bought-in to this notion that life is about figuring things out so that we can be in control. And our institutions are based on that notion.

When things go wrong, we want to find out who is to blame. What it means to look through that little opening in the roof of the tent is to peer into a world where human beings don’t control in the same old way.

**A dark side of system dynamics**

Let me make a brief personal statement, one that many in the field of system dynamics might not agree with. It is about what I consider to be the “shadow” or dark side of system dynamics: Effective managers are managers who figure out how their system works so that they can control it. And system dynamics can, potentially, be fit into this controlling paradigm. It can be seen as a way of “figuring out” the system. Now, system dynamics can also be seen in a different way—as a language for describing interdependence, as experienced by people in a system. In a funny way, system dynamics, to me, kind of sits astride two world views—an old scientific world view and an emerging, different scientific world view.

**Understanding...and then controlling...reality**

There is the old scientific world view of the engine for the extraordinary growth of scientific understanding during the last 300 or 400 years in the west. It has often been called the Western Rationalistic Tradition. In philosophy it is more often today called naive realism. Naive Realism is a view of what it means to live one’s life based on an
assumption that there is a reality “out there” and my job, should I choose to accept it, is to figure it out. That is what science does, according to this view.

However, since Kant, nobody in philosophy has been able to construct a compelling satisfactory argument that there is anything called reality that can ever be described definitively by a human being. Yet all of us went to school, and all of us operate in organizations, based on these two cornerstone notions: (1) What it means to be a smart person is to figure out what is going on, and (2) What it means to be effective is to control what is going on once you have figured it out. Those are, while not groundless, at least highly questionable propositions.

Here’s a quick question to illustrate the point: Do you have children? Do you feel like you are in control? Usually, when I ask this question in a meeting, there is a lot of laughter from the audience, and I rest my case. And yet the same people who know what it is like to grow up in a family where nobody is in control now want to walk around the workplace and say this: “What it means to be effective, if you are going to rise up the ladder, is that you have to be a very competent manager, and that means you have to figure out what is going on and be in control of things.”

Now let me pose the question in a slightly different way. What would it mean to practice a discipline of system dynamics from what I would call a non-controlling viewpoint? Or, to put it more precisely, from a viewpoint that does not presume a perspective of naive realism?

That question can lead us toward the healthy side of system dynamics. There is an extraordinary healthy side to system dynamics, beyond the obvious, i.e., understanding complexities and interdependence. We all know that is important, so I don’t mean to discount that. But there is something else, more philosophical, at what would be called an epistemological level—how we understand our world around us. When you participate as a model builder you get very clear about your active participation in constructing your understanding of the world.

As human beings what we continually do is construct our understanding of the world. It is never adequate. All models are wrong. Modeling, as a discipline, is a very humbling discipline. I think all of us who have been involved would say that. We become aware of just how incomplete our understanding is, and how much it is based on our own perspectives, our own understanding, and our own history.

How terribly parochial our own understanding is—because it is our own understanding! How could it be anything but parochial? And then we do what the scientific community aspires to do—we make our thinking public. That is really humbling. At first, when we are just building the model, we find ourselves saying, “Gee is that how it works? I think this is how it works.” Then you actually show it to somebody.

Do you know that the word theory has the same roots as the word theater. It is from the Greek root word—theo-rós. It means to lay out in the open, display. To construct a theory is to display one’s thinking. The problem is that most of us learned about science when we were kids, while we read our eighth grade science book and it...
The healthy side of system dynamics, continued

was full of all these statements which appeared to be definitive descriptions of reality, created by these strange kind of occult characters called “scientists.” The Wizard of Oz is really about that—these strange characters behind the curtain; we don’t see them; we don’t know about them as people; we don’t learn about their foibles, their flaws or their passions. We learn about them as the scientists who create these definitive statements of reality—just like that Wizard’s image projected on the screen. Rarely do we consider science as a human process, as Buckminster Fuller used to say, of “putting the data of one’s experience in order.”

Now what is the message to us as managers? It is this: When you really understand what is healthy about system dynamics—making our thinking clear to ourselves, putting our assumptions out there in front of us and being willing to display them—you realize that extraordinary vulnerability comes with it. And then you can understand why it might be so difficult to do this in an institution whose fundamental modus operandi is control and looking like you’re in control.

I live in an organization that is dedicated to science. If any organization would be open to displaying one’s ignorance, one’s incomplete thinking, it would be a university, right? Do you think it is characterized any less so by control? Some even argue they are more so, which brings us to a very deep and profound disconnect, and with it some basis for appreciating why this might be difficult. I have never met anybody who is open minded who, when given an effective introduction to system dynamics—where they get to do it themselves, learn about it, see the application, and get a feeling of its practicality and that there is really a methodology, it’s not a black box—that did not really find it fascinating. This leads to the obvious question: Why isn’t it spreading like wild fire? The answer is simple. At one level this is a very powerful set of tools, grounded in some very deep theory; on the other hand, we happen to live in institutions whose fundamental way of being is antithetical to the tools. Other than that, no big problem!

As I said earlier, that is my very subjective, personal interpretation. Many people may take exception to it. That, in some sense, expresses the central dilemma of the learning organization. On one hand there is the potential of the methodology and on the other hand there is the dominant nature of our institutions, be it educational, business, or health care institutions. This has been the core dilemma underlining the work of The Center for Organizational Learning, the consortium of organizations that began to form about five years ago. The premise behind the forming of this consortium was very simple. System dynamics is as difficult as it appears to be, not just because it is technically difficult (which it is), and not just because we are novices at understanding interdependence (which we are), but because to practice it means to practice within a new institutional milieu.

He who would learn to fly one day must first learn to stand and walk and run and climb and dance; one cannot fly into flying. —Friedrich Nietzsche
The premise in forming a consortium to do this work—The Center for Organizational Learning—was very simple: (1) This is really hard. It is hard because it’s hard; it is a human attempt to model a difficult, complex and dynamic reality. (2) When human beings have something that is really difficult to do it would be foolhardy for them to try to do it by themselves. You can generalize that one more step: When organizations have something that is really hard for organizations to do, it is foolhardy for them to do it by themselves. They need to team up.

It has taken us about five years, but now I think we understand the kind of principle behind the premise. It is this: When you are seeking to bring about a change in the order of things, something that is fairly fundamental, it can only be done in the context of a community.

Now what does all this have to do with infrastructure? I am now going to present a few thoughts about infrastructure but I thought they will make more sense following the previous context material. I’ll begin with Figure 2. It is a schematic about learning. This diagram was the organizing framework for The Fifth Discipline Field Book, which is a whole bunch of tools and methods about how to get started with systems thinking and mental models.

Figure 2. A Framework of Organizational Learning

The point of this diagram is this: If you want to start to think strategically about developing your organization’s learning capabilities—it’s capabilities in system thinking, it’s capabilities to reflect on mental models, its capabilities to foster shared vision, it’s capabilities to learn—how would you do that? What would be a sensible way to think strategically? It’s one thing to say, “We have all these tools...” But tools don’t make a strategy! In fact tools,
The infrastructure for a learning organization, continued

with an absence of a strategy, can be disaster. Before you know it you are trying to convince everybody to use these tools. And they say, “Why do I want to use these tools? We have no strategic perspective about how long it is going to take, no idea of how to think in terms of phases or development. We have no idea where we should focus our attention.” All of those issues are characteristics of strategic thinking, in any situation.

Systems thinking and system dynamics contrasted

Systems thinking is something that human beings do in the way they look at the world. Systems thinking is a capability. System dynamics is a set of tools, methods and underlying theory. Tools like Causal Loop Diagrams are system dynamics tools. They come from the system dynamics body of theory and method. Systems thinking is the capability human beings might develop individually and collectively as a result of using those tools. Which do we care more about?

Capabilities and results need to be the driving forces for selecting tools and developing processes

People inherently don’t really care about tools nearly so much as they care about capabilities. It was with this distinction in mind that we went to work to build a framework around. If we are to think strategically, we must decide what are the most important priorities, and what are the secondary priorities.

Ultimately, we must judge any learning process by the results people are able to achieve. If we are talking about a school room we might say: “Hey, that is a great theory. That teacher is extraordinarily capable. Is there learning going on? What is happening with the kids? What are the results we really care about?”

The same is true in any practice setting. We are interested in practical results. We care about developing new skills and capabilities, new ways to see the world, new underlying sets of beliefs that are conducive to continually developing those skills and capabilities. We care a lot about the results we achieve.

Architecture and infrastructure for organization learning

The basic problem in any learning process, which every teacher knows, is that you can’t cause it to happen. No teacher causes the learner to learn. The old saying, “when the student is ready the teacher appears,” acknowledges an age-old understanding that ultimately the control, the real determining factors of a learning process, is always with the learner and not with the teacher. The teacher creates an environment, a setting, in which learning is a little more likely than otherwise. If I respect you as a human being, learning becomes a little more likely. If I have some real capability in what I am teaching, learning becomes a little more likely. If I really have some humility (I know I have not figured it all out, so I am kind of in awe about how exciting this is) learning becomes a little more likely. All of that is the craft of the teacher, which is about creating a learning environment; here we call it an architecture and an infrastructure.

The architecture we are interested in includes a learning infrastructure, a design for organizational learning. Having a learning infrastructure means the enterprise is designed so that learning is not left to chance (which is basically the way organizations are designed today).

The learning that really matters in an organization is when a group of people, who
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collectively have the power to take action, collectively are learning. That, by the way, is what we call a team—a group of people who collectively have the power to take action on some particular set of issues. They are interdependent with one another. They need one another to get something done. The learning is part of working, but you couldn’t work without learning. You couldn’t engage in an activity that was designed to produce real results without time to reflect on how you were going about it; and when you encountered problems, without time to step back and say, “Now wait a second, is there a shift in the burden going on here?” How could we conceptualize it, without having resources devoted to developing learning tools, and then trying to use those learning tools? Furthermore, you would not be able to do this without people committed to studying the results of the innovation, whether it worked or did not work—in effect, to studying the results of an innovative practice.

One aspect of a learning infrastructure is how to support people, in real work settings, in applying tools and methods. The focus here would be on capacity building, on how to integrate learning into very particular work settings. Many organizations have benchmarking today but how many benchmark internally? Most only benchmark externally. But that can’t be enough. If it was enough I wouldn’t hear this refrain, which I hear again and again from CEOs: “How can we learn from ourselves?”

Another aspect is learning deployment, so people can learn from one another. How does one create some commonality of processes, so that learning processes might transfer more readily, knowing that the actual learning has to continually be recreated by learners? Learning is a created phenomenon, the result of something the learner does. But you might discover better learning processes, so when all is said and done, you not only have a product or service to launch, you have a learning process that can be studied and potentially transferred to someplace else.

Another issue is, does the learning include senior managers? It is one thing to say, let’s send a staff task group off to investigate this system dynamics stuff. It’s another thing to say, what if our senior management team, let’s say in our business division or senior engineering team in the product development effort, would spend a day a month for the next two years. That is a different proposition.

In summary, infrastructure means an enterprise is designed so that learning is not left to chance, that people have the time and resources for learning, and that learning is a part of working. We began to ask ourselves how organizations can create this learning infrastructure. We know that the first really big hurdle that people will face, is the time it takes. People say they don’t have the time for this. And when I say people, I particularly mean the people that have the power to take action.

We are starting to think of learning infrastructure as actually having to be thought of on three levels: (1) I believe that at some level we are trying figure how to design enterprises so that when people are working together—when you get a group of people who need one another to produce action—learning and working are integrated. Ideas like learning laboratories are very important for that, and there is enough evidence that
Summary, continued

they really work. (2) Having a bunch of isolated teams learning is not enough. We need intra-organizational learning infrastructure—learning infrastructure designed for learning within an organization. (3) A third piece of the puzzle is inter-organizational learning infrastructure, a structure that enables people from different organizations to learn with each other and from each other.

An example of this third level is that the most successful accomplishment of The Learning Center has been The Learning Center. What I mean by that is the community itself. As people from Ford, Hewlett Packard, and other companies who are part of The Learning Center will attest, this is not a smooth road. We’ve seen people go through a lot of suffering doing this. We’ve seen people lose their jobs, or not have jobs offered to them, precisely because they were involved in this work or nobody could understand the work. And every time one of those things happened a lot of us thought, “Oh, oh, this is it. That will be the end of it in this company. People will say, ‘Well, when so-and-so lost his job you knew that nobody else was going to stick their neck out for this; who wants to threaten their career?’ ” But that’s not what happened. When we went back to the same organization a year later, we found twice as many people involved. Is this because of some massive insanity? I don’t think so. The answer is that obviously people care enough about what they are doing that they are willing to undertake it, knowing the risks, and secondly there is a support structure.

In case you’re wondering what happened to those people who lost their jobs, we pay very close attention to those people as individuals. Invariably, in fact I cannot think of an exception, they have turned out fine. Before you know it they are working in another company where they say, “Hey I have never had more fun.” And so it comes back to what I said at the very beginning, which is that I think we are in the business of creating learning communities.

Edgar Schein has been one of our mentors for many years. He is a senior professor at MIT and one of the very best on the subject of organization culture. Schein described what he called Stage one and Stage two change. Stage one change is the kind of change impassioned and committed line managers, with some local authority in their operation, can really bring about. Stage two change is more pervasive. He basically argued that for that change, probably people cannot learn from experts—they have to learn from one another, from peers. They have to form peer relationships where they can talk about tough problems and why somebody should really want to do something, where they have a network (he did not use the word community, he used the word network) of affiliations of other practitioners. He said, probably that could only work well when it links people from multiple companies, because every company suffers backlashes. When that happens it will be very difficult for the folks there, and they will take solace knowing that there are knowledgeable and sympathetic outside people they can connect with.

Real innovation might be, by its nature, a much more collaborative undertaking than we want to see. We tell a story that it is all about competition—that’s another cultural story in our society—if something isn’t working make it free; deregulate; the
solution to all problems is make it competitive. But, in fact, if you look more closely, the dynamics of innovation are a lot more complicated than just creating a free market. There probably is a lot of collaboration below the surface without which real innovations never spread anywhere. After all, think about it—if we are all fighting tooth and nail that is probably the most inimical condition for real innovations to spread; that is to say for any real ability to not leave learning to chance.

I thought it would be important and helpful if I let you know what we think we have learned from this journey about learning infrastructures, what has worked, what has not worked (see Figure 3).

I think the Practice Field metaphor has really worked. It creates an image, and images are very important in change. What do you think is the image that pops into people’s mind when they think of learning? Probably the school room. Unfortunately school rooms have little to do with learning. What is the typical school room? One expert and a bunch of novices; expert transmits, novices receive; then novices have to be tested to prove to expert they actually have received well. And we call that learning. That’s not learning, it’s information transmission. Machines do that better than humans—should be a clue. Human beings are not very good at information transmission. Human beings are extraordinarily good at learning.

Learning occurs over time. Learning integrates thinking and doing. Learning always is contextual.

The practice field metaphor is much more powerful for an infrastructure for learning. As we all know, performance teams practice. Do sports teams just show up every Sunday for the game? Is there a theater troupe that never rehearses, or a symphony orchestra that just shows up on opening night. Of course not. And those are all examples of teams that learn.

The Basic Approach. I think the cornerstones of this approach—learning laboratories—are becoming clear. People learn through doing and through continuously confronting their theories with the real world.

Gradually some basic design principles are emerging from the mist, although we have a lot more work to do. This is really a research agenda. We have launched about a dozen different projects; some of them have succeeded, some of them have bombed, and some of them have been in between—which is just what one would expect for a research undertaking. We are now trying to organize ourselves to study across the projects. Therefore, you can take of all what I have written here as hypothesis, which we are going to be trying to test by looking at the many different projects we started.

This world of ours is a new world, in which the unit of knowledge, the nature of human communities, the order of society, the order of ideas, the very notions of society and culture have changed, and will not return to what they have been in the past. What is new is new, not because it has never been there before, but because it has changed in quality. — J. Robert Oppenheimer
Lessons learned, continued

Figure 3. Learning Laboratory Lessons

What Has Worked

1. “Practice Field” Metaphor
   • Alternative to the schoolroom as “guiding image” for learning
   • Diffuses political agenda.

2. Basic Approach
   • People learn through doing and through continuous confrontation of their theories with the real world
   • Collective learning requires open communication and continuous testing of assumptions.

3. Tested Introductory Tools
   • Systems thinking (system archetypes)
   • Mental models (left-hand column case, ladder of inference)
   • Team learning/dialogue (check-in, “learning circles”)
   • Personal Mastery (creative tension, personal reflection).

4. When established, lead to significant results
   • Product development
   • Long-term sales
   • Service quality and total cost
   • Business unit strategy.

5. Basic Design Principles
   • Focus on most pressing business issues
   • The team that must learn together is the team that has the power to act
   • Integrate experimentation, reflection (on own behavior and values), and conceptualization over time, including both experimentation and reflection “in the laboratory” and in actual work settings
   • Over time, teams can progress from simple to more complex systems models, and from appreciating basic principles (like structure influences behavior) to gradually building and testing their own systemic theories.

6. An Emerging Theory of Change
   • Especially powerful changes occur when a team “sees” together the systemic structures they have created that generate their problems, structures arising from their own ways of thinking and acting
   • This change dynamic only operates when the “team” in question “has the power to act,” i.e., the “team” includes those generating the structures they discover.

What Has Not Worked

1. Failure to make the practice field an ongoing learning environment (Does a sports team practice one time and then only play games?).

2. People unable to commit required time and energy.

3. Local line leadership unable to connect learning laboratory process to critical business goals and issues

4. Insufficient “expertise” to effectively facilitate learning labs.

5. “Organizational Immune System”
   • Systems thinking can be threatening
     • Politically
     • Intellectually
     • Emotionally
   • “Controlling” ethos versus “learning” ethos
   • Focus on short-term, measurable results
   • No clear job description of executives in learning organization.

6. Poorly Articulated “Theory of Practice.” Leads to:
   • Difficulty in transferring process
   • “Imitation” learning laboratories not based on core premises:
     • Ongoing learning through experience
     • Need for open communication and willingness to test own assumptions
   • Practitioners unprepared for “success.” Innovative local line leaders often poor at communicating up the hierarchy and outside their team.

7. As day-to-day work pressures increase fear and freneticness, time and trust needed to sustain a learning process suffer.

I also want to briefly comment on some things that have been most problematical. Hopefully this will give you some tips, things to be attuned to in your own efforts:

- It needs to be ongoing. People need to be able to commit the time and energy.
- Local line leadership cannot connect the learning to the work imperatives. This in terms of guiding ideas: Why are we doing this? How do we expect it to connect to our work imperatives?
- You don’t have enough help. It does need help. That’s a problem. Ideally, everybody wants to get organizations quickly to the point where they can provide enough help internally. Ford has probably a dozen different projects going on of different sorts; of course 6–12 is a lot. Most of them are internally facilitated in different ways. External facilitators help out but they are not quite as dependent on external facilitation as they were four or five years ago.
- We have not done a good job articulating the theory of practice. Our own thinking about how learning is supposed to occur has not been well articulated. That is one of the things we need to do.
- In many ways it seems to be getting more difficult. As day-to-day work pressures increase, fear and freneticness (I think I made up this word, freneticness) seem to be increasing in the time and the trust needed to engage in learning—seems to be getting more difficult in more organizational settings.

I’ve presented a brief overview of how we think about learning infrastructure: why it is important, what it means, and what we are learning about it. I have emphasized that a potential trap with tools like system dynamics is when people think it is just for figuring out the system, “out there,” rather than for better articulating your view of the system “in here,” and trying to bring that view into greater harmony with your experience of the world you are living in. Thought of in that way, it is about us, as well as the world we live in, and a more constructive interplay between the two.

I remember Bill O’Brien, former CEO of the Hanover Insurance Company, saying, “Organizational design starts with the guiding ideas. To what extent is the organization actually committed to— and people perceive it as being authentically and genuinely committed to— aspirations that go beyond just making money.” Without that you cannot expect people to really invest themselves. And if people cannot really invest themselves, it is hard for much learning to occur. So, in a sense, that is the beginning of infrastructure for learning.

Arie de Geus gave a speech in 1995 at the Royal Academy of the Arts, in London, entitled: “What is a Company?” He traced out two quite fascinating historical lines of thought around that question. He pointed out that the prevailing notion of a company, a business enterprise, is that it is a machine for making money. Now we never say that. It would be very politically incorrect. If your organization is a machine for making money, what does that mean you are? But of course that is what people experience. And that is really the “theory in use” in most of our corporations. They basically are conceived of as machines for making money. He then contrasted that with the idea that a
company is fundamentally a human community, which if it functions effectively can make money. But it is first and foremost a human community whose needs are those of any community: meaning; some degree of stability; and some degree of longevity, especially the desire to pass on things, to function intergenerationally.

Do know that the traditional word for business in Swedish is näringsliv which means “nourishment for life.” It’s a very old notion of “company,” a gathering of people who care about something, who want to do something. Sounds interesting?

If we can make this shift and actually begin to consider that, first and foremost, a business enterprise might really be thought of most fundamentally as a human community, then all kinds of things shift around. The role of people becomes very different. The notion that you could be nurturing people, and that is part of why the enterprise exists, would not be seen as a wild and crazy notion. The notion of longevity would be dealt with in a very different way. For example, there would be a different time horizon. Human communities always take a view that includes a responsibility for the future of the community.

Purpose, of course, would not be a matter of contention. There might be a lot of questions about what the purpose is, but it could never be reduced to: “Our purpose is to maximize the returns on the shareholders investment.” Now you might think that is a nutty way to think, and certainly, of course, many North American business people will think it is nutty. However, North American businesses are in a lot of trouble. And there are other parts of the world that tend to actually think more this way, and have for a long time—food for thought.

I hope that I have helped you understand the way we think about learning infrastructure. But I hope more than that, that I have put it in a little different context. This notion of learning infrastructure may or may not be the right term, so I would not get hung up on the term. The main point I have tried to stress here is how to design an enterprise for learning. On a deeper level, maybe the only way enterprise is ever designed for learning is when the enterprise starts to conceive itself as an actual learning community—a group of human beings who are first and foremost a community, which then incorporates, as one of its purposes, a requirement that it learn.

Peter M. Senge is the director of the MIT Sloan School of Management’s Center for Organizational Learning. The Center is a consortium of corporations that work together to advance methods and knowledge for building learning organizations. His work articulates a cornerstone position of human values in the workplace, namely that vision, purpose, alignment and systems thinking are essential if organizations are to truly realize their potentials. His areas of special interest and expertise focus on decentralizing the role of leadership in an organization to enhance the capacity of all people to work productively toward common goals.


Senge received a B.S. in Engineering from Stanford University, a M.S. in Social Systems Modeling, and a Ph.D. in Management from the Massachusetts Institute of Technology.
Using Systems Thinking and System Dynamics Simulations to Reengineer Manufacturing Processes at Silicon Graphics (SGI)

Authors
Matt Mayberry, Ph.D., Strategic Program Manager, High End Operations Group, SGI, Mountain View, California
Kent Hoxsey, Project Lead, Manufacturing Systems, Cisco Systems, Inc., San Jose, California
Kerry McCracken, Operations Manager, SGI
Carl Rendell, Internal Consultant, Manufacturing Division, SGI

Company background
Silicon Graphics, Inc. (SGI), founded in 1982, is a leading supplier of high-performance interactive computing systems. The company offers the broadest range of products in the industry—from low-end desktop workstations to servers and high-end Cray® supercomputers. Silicon Graphics also markets MIPS® microprocessor designs, Alias|Wavefront™ entertainment and design software and other software products. The company’s key markets include manufacturing, government, science and industries, telecommunications and entertainment sectors. With headquarters in Mountain View, California, SGI has 10,500 employees worldwide, with 7,800 in the United States. There are 75 domestic sales and support offices, 77 international offices, 32 subsidiaries and 32 distributors.

Silicon Graphics’ stand-alone revenue for fiscal 1996 was $2.8 billion, a 24% increase over the prior year. Net income was $245 million or $1.39 per common share, compared with $225 million or $1.28 per common share for fiscal 1995.

Abstract
Business Process Reengineering is our methodology for fundamentally changing key business processes to improve performance. The type of systemic change implied by the notion of a radical rethinking of business processes lends itself well to a System Dynamics (SD) approach. In this paper, we describe how various System Dynamics tools have helped our reengineering team implement fundamental changes to our material planning and control processes at Silicon Graphics. These methods have helped our organization gain a deeper understanding of our supply chain dynamics, develop alternative structures and ultimately change the way “material flow” is managed.

Introduction
Reengineering is about radical change. Hammer & Champy (1993) refers to the need for “discontinuous thinking—identifying and abandoning the outdated rules and fundamental assumptions that underlie current business operations.” But how do we
identify the old thinking that needs to be abandoned, and how do we challenge it? How do we create low-risk opportunities for members of an organization to develop fundamentally new thinking and experiment with new behaviors? These were questions our Reengineering Team realized we needed to address if we were to be effective catalysts of change within our organization.

Our pilot Business Process Reengineering project took place within the manufacturing division of Silicon Graphics. Late in 1994, our team was formed (in manufacturing) to address the problem of inconsistent material flow through our factory. Chronic shortages of printed circuit assemblies (PCAs) on the production floor prevented us from creating credible “build plans” and meeting customer delivery commitments. Reducing the PCA cycle time—the elapsed time from the start of the process to the delivery of boards—was seen as a way to increase flexibility by postponing the commitment of material. Our Reengineering Team (dubbed the CORE PCA team) was thus presented with the following challenge: to reduce PCA cycle times from “three weeks to three days.” We were largely on our own as a team to figure out how to tackle this problem and influence the rest of the organization to change.

As our project evolved, we eventually incorporated a variety of System Dynamics tools into our effort. Ultimately, these tools helped us to cut inventory levels on the factory floor by a third, and virtually eliminate material shortages.

Our first challenge as a team was to figure out why PCA cycle times were so long. Through a scientific approach to data collection, we quickly determined that material shortages throughout the supply chain (which caused process delays) were independent of PCA size, type or technology. Systems thinking enabled us within a few weeks to piece together a dynamic “story” about why these chronic shortages were an inevitable consequence of our material planning and control system. This story is depicted in Figure 1 and described below.

Our story begins with our customer demand, which fluctuates wildly at the product level. In part, this is due to the wide range of workstation configurations (i.e. different memory, processor, graphics, etc.) that SGI offers to customers. Because of these variations in demand, it is virtually impossible to accurately predict the mix and timing of customer orders throughout the quarter. Yet, we tended to use our Manufacturing Resource Planning (MRP) scheduling system as though the forecasts were in fact accurate. Purchase orders, work orders and production schedules were all established with precise quantities and timings. Whenever pre-programmed schedules did not coincide with actual demand, the material plans and schedules were changed, and components and subassemblies were expedited to meet the urgent demands of the production lines. Expedites became especially prevalent each quarter-end.

While this expediting activity temporarily eliminated the shortages—especially at quarter-end—it created a host of other problems. For example, expediting from suppliers to satisfy near-term demand created future shortages because on-order material in
The basic structure is that of a “quick fix that backfires,” continued

the pipeline was depleted. Thus, intense expediting to “make the quarter” resulted in scarce material availability at the beginning of the following quarter. In addition, the time spent rescheduling and expediting material diverted attention away from longer-term problem solving.

Even local attempts to reduce the effects of uncertain demand and supply by hedging backfired. Planners and schedulers built up inventories of subassemblies or systems before they were needed—so-called “just in case” inventory. This committed common material to particular workstation configurations earlier than necessary, thus creating additional shortages.

Figure 1. The Systems “Story” About Long PCA Cycle Times

“Systems” story created knowledge and understanding

Using Simulation to Experiment with Conceptual Process Designs

The beauty of this story, compared to traditional Business Process Reengineering analyses using flowcharts and cycle-time accounting, was that it could be summarized on one page, it was easily understood, and it presented a dynamic picture of why shortages were so tough to eliminate. Furthermore, we weren’t blaming any one functional area for the systemic problems. The fact that the “system” was flawed helped our team overcome organizational resistance to our analysis.

To confirm our systems story, we created a simulation game to recreate the typical patterns of material shortages and quarter-end expediting observed. (This was inspired by the “Beer Game” as well as a simulation used by the consulting firm of Pittiglio, Rabin, Todd, and McGrath to teach just-in-time material control principles.) In our simulation, we recreated a simplified supply chain and represented material processing.
Using Simulation to Experiment with Conceptual Process Designs, continued

through the movement and assembly of Legos on several game boards. Participants played roles patterned after traditional functional roles in SGI’s manufacturing organization and made real-life decisions about material scheduling, ordering and processing. The only constraints were the process leadtimes, the stream of customer orders, and the marketing forecasts. With this game, we were able to validate our “systems story” remarkably well, reproducing observed patterns of material shortages and process delays.

We quickly realized that the same game could be used to experiment with our conceptual design ideas. A key breakthrough for our team occurred one day when we lined up a single row of cups (representing “kanban” inventory controls) and played with basic demand-pull (just-in-time) material replenishment techniques. The self-regulating property of demand-pull was most striking: material moved along the supply chain only when there was demand for it. If demand decreased, the material movement automatically slowed. If demand increased, material movement sped up. No rescheduling was needed and material shortages were virtually eliminated. It was just this insight which convinced us to propose a demand-pull implementation for our division and it was this same learning experience that we hoped to share with the rest of the organization to build enthusiasm for the effort.

Since then, we have conducted over 25 full-day sessions with our MRP/pull simulation for various manufacturing teams and vendor partners. Typically, we spend the morning on the MRP simulation, break for lunch, and then change the game over to demonstrate a demand-pull system. The simulation provides a direct juxtaposition of the present system (MRP) with a fundamentally different system (pull), providing players with a clear idea of the differences and advantages of pull-based execution. Rather than lecturing to the organization about the advantages of demand-pull, participants experience for themselves the differences between the two systems. This approach helped generate a great deal of support for our subsequent implementation of a pilot process on our highest volume production line.

It is one thing to demonstrate a conceptual design in a simulation game and quite another to formalize the design to the point where implementation is feasible. To successfully implement a new process, roles must be defined, I/S tools developed, employees trained and diagnostics put in place to measure performance. For our reengineering team, these requirements meant that the science of dynamic kanban sizing in an environment with nonlinear demand had to be developed. Using dynamic simulations helped us to develop our pull theory by allowing us to experiment. What began as an informal guessing about how to size kanbans ended up as hard business rules and a systematic approach which could be coded into our information system.

Even highly complex supply chains can be built up from simple modules or cells which are easily modelled using dynamic simulation tools such as High Performance Systems i think® software. Using simple models it is relatively straightforward to reproduce realistic conditions, including demand fluctuations, the “hockey stick” (non-
Using Dynamic Simulation to Facilitate Implementation, continued

linear orders), supplier leadtime variability, forecast accuracy, product transitions and so on. Playing with these factors allowed us to develop an intuitive understanding of pull dynamics and thus develop a comprehensive approach which addressed real-life issues.

By varying the parameters to reproduce specific situations, the model also allowed us to deal with a number of practical issues which surfaced during the pilot implementation. For example, there was concern that postponing the production build until later in the quarter would create a risk of getting caught short of capacity at quarter end. Using ithink®, we were able to develop a capacity planning tool which allowed the line to identify the critical point in the quarter where they needed to utilize all of their capacity by building to stock. This tool was rapidly adopted by the line and replaced their existing MRP scheduling tool.

One of our challenges during implementation was to compress our team’s learning into a relatively simple set of principles which we could transfer to the organization. To accomplish this, we developed a training course in pull. For the theoretical portion of the class, we used ithink dynamic models to demonstrate concepts and allow students to experiment with their new roles as managers of the pull process. We used a step-by-step approach, adding complexity to the models gradually so that successive exercises built upon knowledge gained from previous exercises. By the end of the course, students were able to successfully size kanbans in a variety of realistic situations. They also gained experience working as a team to manage the supply chain, react to problems, diagnose them and fix them.

We also developed a fundamentally new set of metrics based on our experience with simulation. These metrics allowed us to track pull part performance, diagnose problems and evaluate the success of our pilot implementation effort.

Conclusion

We have outlined briefly here how the use of systems thinking and system dynamics simulation models throughout the reengineering process can help streamline analysis, improve conceptual designs, refine concepts, gain organizational acceptance, overcome obstacles during implementation, train the organization, and create new metrics. What started out for our team as an interest in gaining a deeper understanding of the root causes of material shortages in manufacturing, ultimately became an indispensable part of our effort to lead organizational change.

While our team has solved a variety of complex materials problems, we also realize that we have not addressed many of the cultural factors and organizational dynamics which have allowed these problems to persist for so long. These issues cannot be addressed by a reengineering team in isolation. They require “discontinuous thinking” beyond the dynamics of material flow. Our next challenge, then, is to find ways to get the organization itself engaged in this broader learning process. Only then will self-sustaining improvements be achieved.
References/Notes


1. We acknowledge the invaluable contributions of our CORE PCA teammates: Angel Figueroa, Jason Landis, Kristine Brezovec, Bob Spiegel (Cisco Systems, Inc.), and Steve Hussey (Pittiglio, Rabin, Todd & McGrath).

Author information

Matt Mayberry is Strategic Program Manager for the High End Operations Group at Silicon Graphics. Dr. Mayberry obtained a Ph.D. in Physics from MIT in 1986 and worked on fusion energy research at General Atomics in San Diego until 1991. After attending the Stanford University Business School, and obtaining an MBA in 1993, he joined SGI where he has focused on process improvement and change management work, primarily within the manufacturing division.

Kent Hoxsey is a Project Lead in manufacturing information systems at Cisco Systems, Inc., San Diego, California, where he develops and supports Cisco’s production order fulfillment systems. He has been involved in several system dynamics projects in the last ten years, including working as a software developer in STELLA, a systems thinking simulation tool.

Kerry McCracken is an operations manager at SGI, working with her management team on implementing demand-pull for the mid-range production line. She has been a leader in process innovation at Silicon Graphics over the past six years. Ms. McCracken continues to expand her efforts in business process reengineering through studying organizational learning literature and pursuing the latest in information technologies.

Carl Rendell is an internal consultant in Silicon Graphic's manufacturing division. He is responsible for orchestrating process changes and discovering new technologies. Accomplishments include the creation of the Dynamic Kanban Planning (DKP) theory, and the design and implementation of customized pull-process tools for the current Oracle 10.5 inventory planning environment. Mr. Rendell is currently working on HTML based processes and information tools for SGI manufacturing via the intranet.
In this unparalleled age of organizational renaissance and innovation, more and more companies are seeing their primary assets as knowledge-based capital. It seems to me that we are not in the “Information Age,” but rather, the “Applied Knowledge Age.” The way we put this knowledge to use, whether it's for generating a new concept or problem-solving is different and must be different from the way we did it five years, or even six months ago. As Albert Einstein observed, “The significant problems we face cannot be solved at the same level of thinking we were at when we created them.”

Many people today look for the magic “breakthrough,” hoping that one good idea, the idea, will improve their bottom line and put them ahead of the competition. That's wrong. Competitive breakthroughs, as singular isolated events, are unlikely to have lasting benefit; they will be demanded continuously. So, a company must not look for one breakthrough, but continuous breakthrough. Successful organizations will not be looking for one good idea, but several ideas, hundreds of ideas, and yes, thousands of ideas. This is because individuals or teams don't usually produce breakthrough ideas at first pass. These ideas are born from the generation of many ideas. This is why Thomas Edison said that in order to have a good idea, we must have lots of ideas.

A different way of thinking is needed for such idea generation, a kind of thinking that raises new questions so one does not keep getting old answers. To foster this, management needs to develop a compelling momentum for innovation throughout the organization, not just in Research and Development, Marketing, or Planning. In short, a company-wide creativity needs to be in place and sustained.

Recognizing the value of tools in helping teams focus their energies and achieving synergies, GOAL/QPC developed a set of tools for creativity, called The Seven Creativity Tool Boxes. The tool boxes help teams create an environment and provide some proven tools for breakthrough. This article provides an initial journey into the tool boxes.

Tools and methods have always been useful for understanding and implementing far reaching concepts. In the early 1960s, Koaru Ishikawa assembled “seven basic problem solving tools” and named them the Seven Quality Tools (7 QC Tools).
Background on planning and management tools, continued

The ability to be creative and innovative on an organizational level is greatly improved when it is within a continuous improvement environment, and where the proper use of creativity enhancing tools provides a special framework. This framework serves as “guide rails” for creative thinking. The various tools can then facilitate the cognitive processes used by creative thinkers, intuitively and systematically leading them into creative thinking.

The development of “The Seven Creativity Tool Boxes”

It is with this intent that GOAL/QPC developed “The Seven Creativity Tool Boxes.” A team consisting of Dr. Helmut Schlicksupp, formerly of the Battelle Institute of Frankfurt, Bob King, CEO of GOAL/QPC and myself, an affiliated instructor of GOAL/QPC, pooled ideas and resources. These tools were based on research by Dr. Schlicksupp during the late 1960s and early 1970s. Although literally hundreds of creativity methods were researched, some were found to be ineffective, unnecessarily complicated, or “too exotic.” By working closely with many German companies, Schlicksupp learned which tools actually worked. Additionally, these tools were sometimes modified or adapted, depending on the participants and the problems. The participating companies were excited about their innovative results, and asked for onsite seminars. Such enthusiasm for tools reflects the spirit of continuing discovery of creativity tools that work!

What managers want to know

The Seven Creativity Tool Boxes are application-based classifications of tools for innovation. Any manager who has a hands-on need for innovative idea generation, wants to know:

• What works and produces breakthrough?
• Why use one tool and not another?
• When does it work?

Some early results

Companies that are starting to use the Seven Creativity Tool Boxes include Kodak, Inter American University of Puerto Rico, Air University, Kennametal, Bosch, Ford, Chevron, and Black & Decker. Individual teams at Black & Decker, for example, were each able to produce an average of 40 new ideas for new products in less than 20 minutes, going beyond brainstorming and using two of the Seven Creativity Tool Boxes. A group at...
Some early results, continued

Air University was able to create multiple complete scenarios in each of its thirteen teams for devising air support for ground forces in the year 2025 using the morphological box from the seventh tool box. All within less than an hour!

Unique aspects of the tool boxes

The Seven Creativity Tool Boxes are presented in a flexible, yet disciplined way to provide widespread education and to promote company-wide creativity. It is the only known innovative tool set that:

- Is simply and graphically interrelated
- Integrates with all major systems of TQM (Continuous Improvement, Hoshin Management, Cross-Functional Management)
- Integrates with existing tools (7MP Tools, 7 QC Tools, Quality Function Deployment)
- Is both intuitively based and systematically structured.
- Is readily adaptive into team processes.

A list of the seven tool boxes

What are the Tool Boxes and what’s inside? The following is a brief list:

- Tool Box #1: Creative Problem (Re) Formulation
- Tool Box #2: Brainstorming and its Variations
- Tool Box #3: Brainwriting and its Variations
- Tool Box #4: Pattern Breakers
- Tool Box #5: Simple Analogies and Associations
- Tool Box #6: Complex Analogies and Associations
- Tool Box #7: Morphology.

Each tool box has a key tool called a “Target Tool”

Each tool box contains multiple tools. Within each tool box, a target tool is emphasized. The target tool is a representative tool in the tool box that is:

- Necessary and fundamental to understanding the tool box
- Is readily understandable for problem-solving applications
- Used at all levels, from novice to expert team members.

I will now outline each tool box and its respective target tool.

Tool Box #1: Creative Problem (Re)Formulation

Target tool: Heuristic Redefinition

Understanding the problem as a system is an important starting point for creativity. The tools in this tool box help reveal the structure and the relationships of the elements within the problem. The tools offer new and inventive ways of asking questions and redefining the problems. The target tool is Heuristic Redefinition. It is a two-step macro process that brings together the visual presentation of the problem, along with a systematic evaluation that helps in the search for a solution. A visual representation is
Encouraged, and accomplished by having the team draw:

- Pictures of the system, and
- Symbols/icons of important pieces of the problem.

The visualization process makes the problem clearer as a system because the picture reveals:

- Components
- Subsystems
- Relationships to each other in terms of the overall goal.

Potential problems, in terms of questions, are formed based on these relationships. Then they are systematically evaluated in a matrix (Figure 1), where the likelihood of success, effort needed, and quality of the result of each are noted. Finally, the team discusses which problem is best suited in terms of success, opportunities, and/or innovations.

**Figure 1. A Matrix for Evaluation of Problems**

<table>
<thead>
<tr>
<th>Likelihood that it can be done</th>
<th>Minimal effort is needed</th>
<th>High quality results</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem 1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Problem 2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Problem 3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Problem 4</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Problem 5</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Problem 6</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

1 = lowest rating  
2 = moderate rating  
3 = high rating

For each problem, the ratings in the three categories are added, giving a total score reflecting an overall chance for success with that problem.

This tool box is a collection of five most frequently used Brainstorming tools. These tools function as a gathering mechanism for idea generation in groups, the team becoming a synergistic multiplier from mutual associations formed during brainstorming sessions. Brainstorming is a mandatory preceding step for all creativity processes and tools, yet it is either never done or it is the only tool used. Both can be disastrous! As one Fortune 50 company executive discovered at an overseas meeting, to eliminate this important step and go on to more elegant tools can result in the production of no new ideas. The target tool, Classic Brainstorming, is pictured in Figure 2 showing the necessary, but seldom recognized, phases for a successful session.
An Introduction to the Seven Creativity Tool Boxes

TOOLS

Figure 2. The Phases of Classic Brainstorming

Figure 3. A Sample Team and Method 365 Form

Tool Box #3: Brainwriting and its Variations
Target tool: Method 365

Four Brainwriting methods are contained in this tool box. Similar to Brainstorming, Brainwriting is a silent, introspective written process—yet it is still highly interactive, because all team members see and share each other’s generative output. The target tool in this tool box is Method 365. It is the most structured of the Brainwriting methods (see Figure 3). The framework for Method 365 is based on:

- Six team members
- Generating three ideas each round
- Allowing five minutes for each round.

The output is 108 ideas in 30 minutes (six Method 365 forms with 18 completed ideas each and five minutes multiplied by six rounds). This output can then be used for the creation of an Affinity Diagram. Generating 100+ ideas has been shown to lead to a more robust Affinity than relying on one constructed from only 20-40 ideas.
Here begins the more advanced tool boxes. Pattern Breakers dissolve patterns of thinking that can prevent, instead of lead to, creative thinking. They eliminate the self-projected restrictions teams place on themselves during idea generation. The “pattern breaker” target tool is Imaginary Brainstorming, which is fundamentally different from other types of brainstorming. Imaginary Brainstorming directs thinking in new ways by shifting the original or real problem by formulating an imaginary problem (see Figure 4). The formulation of an imaginary problem is structured and specific, enabling people to discover solution patterns they never would have come upon if they had limited themselves to a single brainstorming session with just the real problem.

Figure 4. A Visual Representation of Imaginary Brainstorming

![Figure 4](image)

The mechanisms in this tool box push one outside the immediate knowledge field of the problem and make it possible to search for new ideas by “activating” as many different fields as possible. The target tools are, categorically: Stimulating Word, Picture and Objects (see Figure 5). Unpacked, they specifically are:

- Stimulating Word Analysis (customized for technical or non-technical problems)
- Catalogue Technique using actual catalogues
- Picture Projection using slides, transparencies or CD-ROM
- Biotechniques—understanding how “nature solves its problems.”

The avenues systematically laid out for using the above-mentioned tools are:

- Analogous thinking for analogies
- Random search methods for stimulating terms and associations.
Tool Box #6: Complex Analogies and Associations
Target tool: TILMAG

This tool box contains whole methodologies that rely on several layers of analogies and associations. They allow the transfer of ideas to concepts of solution. Most importantly, they build on the tool boxes previously presented. The target tool TILMAG was developed by Dr. Helmut Schlicksupp in the early 1970s. Although TILMAG is not new in Germany, it is a relatively new introduction to the United States. TILMAG is conducted in three major macro steps that can be each performed by the same team or three separate teams:

- Creating the Ideal Solution Elements (ISE’s) for the problem
- Generating customized or “Optimum” associations using the ISE’s and an Association Matrix
- Applying the principles in the associations back to the original problem.

These three macro steps replicate on a cognitive level how one arrives at new ideas. The Association Matrix, pictured in Figure 6, is part of the three macro steps used in TILMAG.

Figure 6. An Association Matrix
**Tool Box #7: Morphology**

**Target tool: Morphological Box**

The Morphological Tool Box is a specific set of tools for systematic creative thinking. Morphology is the study of structures and shapes and how they are “built up.” When looking at all types of solutions for any given problem, two essential questions come to mind:

- What things do these different solutions have in common?
- What causes these different solutions (alternatives)?

By identifying essential independent parameters for a problem (the things that different solutions have in common), options (the alternatives inside a parameter) can be creatively combined and interpreted for a total solution. We naturally think in parameters and these tools add structure and insights into this creative process. The Morphological Box is fundamental in understanding the concept of morphology and is also the target tool in this tool box. GOAL/QPC has used the Morphological Box in a wide variety ways, from creating future scenarios for the Air Force to designing college curriculums. The number of possible solutions from a simple Morphological Box is astounding. The Morphological Box for the construction of a house shown in Figure 7 is capable of generating 45,000 solutions!

**Figure 7. A Morphological Box for the Construction of a House**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation Shingles</td>
<td></td>
</tr>
<tr>
<td>Roof Structures</td>
<td></td>
</tr>
<tr>
<td>Second Floor Position</td>
<td></td>
</tr>
<tr>
<td>Roofing Material</td>
<td>Asphalt</td>
</tr>
<tr>
<td>Siding Material</td>
<td>Stucco</td>
</tr>
<tr>
<td>Turret</td>
<td></td>
</tr>
<tr>
<td>Window Structure</td>
<td></td>
</tr>
</tbody>
</table>

Here are some general guidelines for using the Seven Creativity Tool Boxes:

- The Seven Creativity Tool Boxes are not organized for linear flow. One does not necessarily start with Heuristic Redefinition and conclude an idea generation with a Morphological Box.
Guidelines for using the seven creativity tool boxes, continued

- Not all tools are for all problems. Picture Projection might be better suited for a problem than TILM AG.
- Not all people are comfortable with all tools. Brainwriting might be a more appropriate tool for a quieter, more contemplative group than an extroverted brainstorming session.
- On average, three to four tool boxes are usually applied to most problems. There are multiple innovation tools in each box.
- Brainstorming and/or Brainwriting needs to be part of the initial phases of idea generation and must precede advanced tools such as Imaginary Brainstorming, TILM AG, Picture Projection, Stimulating Word Analysis, Catalogue Technique, or Morphological Box.

Author information

Janice Marconi is a creatologist and innovation coach in company-wide creativity. In addition to her work with Dr. Helmut Schlicksupp, she is a primary researcher for GOAL/QPC in creativity and innovation. Her studies also involve inventors and their processes including the inventive problem solving methodology of Genrich S. Altshuller from Russia. She is an honorary member of the Inventors Association of Connecticut, and is an examiner for the Connecticut Award for Excellence. She is the author of the Baldrige Self-Assessment Workbook and a contributor to the Coach’s Guide to the Memory Jogger™ II. She holds a bachelor’s degree from the University of Connecticut and a master’s degree in business administration from Rensselaer Polytechnic Institute.

Editor’s note

This article was taken from a highly-rated all-day workshop at GOAL/QPC’s 13th Annual Conference, November 21, 1996 in Orlando, Florida. It is intended to give the reader an introduction to some of the tools being used to facilitate creativity. We are including it in the Journal because there is a lot of interest in creativity and innovation tools, even though we recognize the fact that no article could do an adequate job of teaching a reader how to do it. A full-day tutorial is needed for a minimal understanding and a two-day workshop is essential for a basic working knowledge of the Seven Creativity Tool Boxes, how they work and how they can be applied to one’s particular problems. For more information on such training, please contact GOAL/QPC toll free at (800) 643-4316.
Living and Breathing a Customer-Centered Culture

Authors

Christine Kelly, M.A., M.T. (ASCP), CLS, Director of Laboratory, HealthSystem Minnesota, Minneapolis, Minnesota
Elizabeth Lentz, B.S., M.T. (ASCP), Regional Laboratory Manager, Park Nicollet Clinic, HealthSystem Minnesota, Minneapolis, Minnesota

Brief background on Park Nicollet Clinic

The Park Nicollet Clinic, HealthSystem Minnesota, is a 400 physician multi-specialty group practice with 19 individual clinics located in Minneapolis and throughout its suburbs. In 1993 Park Nicollet Clinic merged with Methodist Hospital HealthSystem Minnesota, a 426-bed facility located a half-mile from the clinic's main campus. HealthSystem Minnesota also includes the Primary Physical Network, consisting of 9 clinics and 36 physicians, the Institute for Research and Education, the Foundation (a fund raising entity), and all of the 1,000 physicians with admitting privileges to Methodist Hospital.

The 17 Park Nicollet Clinic Laboratories and the Methodist Hospital Laboratory have also recently merged. The Laboratory system now consists of over 220 technical and nontechnical personnel who collect and perform diagnostic testing on patient specimens. The Quality Improvement initiatives of the clinic and hospital labs are just now beginning to be integrated. This article describes the activities that have occurred in the Park Nicollet Clinic Lab over the last seven years.

The Quality Improvement journey

Park Nicollet Laboratory has been on a journey of Quality Improvement for the last seven years. We have been continuously learning about Dr. Deming's principles and trying to incorporate them into our daily work processes. A major challenge in trying to integrate our efforts consistently throughout the entire laboratory system is the fact that many clinic lab sites are so geographically diverse.

Traditional changes, then a move toward a real transformation

Park Nicollet began its Quality journey in December of 1989 when a group of top clinic leaders participated in a formal week-long seminar. Afterward, a half-day training session was developed to introduce Quality Improvement to the rest of the clinic staff. However, teams were formed primarily as a reactive response to variation and special causes in the system. Many members of our staff viewed these meetings and the new talk about Quality Improvement as something external to the daily process, draining their energy from already busy days.
In 1993 the organization started to move away from a traditional approach to Quality Improvement to one of “transformation.” In a transformed organization, there is continuous learning about Quality Improvement through application in daily work processes rather than separate, disconnected training sessions. There is a global understanding of the organization’s systems and processes, as well as the capabilities of the current systems. The organization identifies key strategic goals that are essential to its survival. An example is: “Providing service so good that our patients refuse to go elsewhere.” Steps are taken to proactively build processes that support the goals and ensure they are attained. Key measurements are taken of the daily work processes so process corrections can be implemented to stay the course. With transformation, everyone focuses on total quality in every aspect of their jobs. (Figure 1)

**Figure 1. A Timeline from Continuous Quality Improvement to Transformation**

<table>
<thead>
<tr>
<th>CQI:</th>
<th>Transformation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• &quot;One shot&quot; skills training via courses</td>
<td>• Continuous education through daily work.</td>
</tr>
<tr>
<td>• Solve obvious problems—reactive response to variation</td>
<td>• Detect hidden problems by understanding systems and process capability. Proactive response to variation</td>
</tr>
<tr>
<td>• Quality is a “certain percent” of the job.</td>
<td>• Quality 100% of the job.</td>
</tr>
</tbody>
</table>

A timeline for Quality Improvement

The Laboratory has paralleled the learning curve of the rest of the clinic, and this is shown in Figure 2. The italicized items indicate education activities we have participated in, or informally designed ourselves, to move our lab team along our own learning curve. The items in bold text are different teams that we started. The first teams, UA TAT (Urine Analysis Turnaround Time), CHEM TAT (Chemistry Turnaround Time) and MICRO Team (Microbiology Team) were teams formed as a “reaction” to
customer/physician service complaints about test turnaround times. Later, in 1993 when we began to understand transformation, teams like the I (Integration) Team and the BP (Best Process) Team were formed to proactively look at our processes and make improvements before receiving customer complaints.

The Quality Leadership Team made the biggest impact

As we began to create a cultural transformation in July of 1993, all lab staff needed to understand Quality Improvement Principles and make them a part of the laboratory culture. It had to become the way we go about doing our daily work. The Quality Leadership Team (QLT) was formed, in the hopes that this group of people would become the critical mass needed to move our efforts forward. The activities of the QLT have been some of our most exciting accomplishments.

The QLT consisted of 18 people, which is larger than normally recommended for teams. However, we felt strongly that all lab supervisors needed to participate because, as Dr. Deming taught, the commitment must first come from management. We wanted to balance the team with an equal number of front-line staff. Everyone on the team is considered an equal; there are no titles.

We meet for two hours each month. The first hour is an education piece, such as viewing a videotape from the Deming tape library, followed by discussion on relating the theory to our laboratory. The second hour is spent working on the current initiative. We have also used a subcommittee format to get things done between the monthly meetings.

The QLT has had the biggest impact on the laboratory, and has become the foundation of all our Quality Improvement efforts.
The first initiative: Redesign of the old Quality of Service Evaluation (QSE) system

The first QLT initiative was to revise the Quality of Service Evaluation (QSE), a documentation form for problems and errors that had been in place for many years. It was perceived by staff as a very punitive system. For instance, the first question at the top of the form was, “Who was involved in this incident?” It also promoted system changes for special causes. Staff also viewed the forms as going into a black hole. Once completed, they were turned into the supervisor and reviewed by the lab management team. However, there were no mechanisms for reporting back to staff. Needless to say, there was very low compliance in the use of the QSE form.

Opportunity statement

It became apparent early in our discussions that we needed to broaden our focus beyond just the problems of the QSE form. We decided to create a comprehensive foundation for all Quality Improvement efforts. Our opportunity statement was to design a process that would include promoting opportunities for staff involvement, educating them on the process, redesigning those tools to document Quality Improvement activities, and building in a clear mechanism for following through and providing feedback to staff (Figure 3).

Figure 3. Quality Leadership Team Opportunity Statement

To design a process for laboratory personnel to identify problems and improve systems.

The process we design will include the following:
- Promote opportunities for staff involvement in the improvement process
- Staff education on the improvement process
- Redesigned tools
- A clear mechanism for feedback and follow-through.

Surveying staff, gaining feedback and identifying gaps

First, the QLT surveyed the staff on the problems with QSE system, from which we received about 10 pages of additional negative comments. Then, we flowcharted the current process. The flowchart was very complicated, which illustrated why the QSE was ineffective. The gaps in the system were identified from the surveys and flowchart and categorized into five groups:
- Education/Responsibilities
- Tools
- Timeliness
- Outcomes/Closure
- Universal Application.

Conversation is the fine art of mutual consideration and communication about matters of common interest that basically have some human importance. —Ordway Tead
CASE STUDY

Living and Breathing a Customer-Centered Culture

The list of system gaps that needed to be addressed was quite extensive. Therefore, we decided to form three subcommittees from the QLT members. The Procedure subcommittee’s charge was to design a new process for documenting problems and errors. The Tools subcommittee would then design a documentation tool or form related to the new process. Because these two issues overlapped, the Procedure subcommittee members actually continued on to become the Tools group. The Education subcommittee was responsible for developing a training session that would teach all lab staff about the new QSE process and instruct them on how to complete the new documentation form.

Forming subcommittees

The Procedure subcommittee identified three general categories of quality improvements that can occur: (1) Suggestions for Process Improvements; (2) Problems of Immediate and/or Important Nature; and (3) Recurring Problems. For each category, a flowchart was designed that outlined the steps an employee would take to resolve a problem or bring forward an improvement idea. A new documentation tool called a Systems Process Improvements Form (SPIF) was also designed related to each category. The SPIF has the flowchart right on it to make it easy for the employee to follow each of the steps.

Employees write their suggestion or state the problem on the SPIF form and discusses it with their supervisor. The supervisor plays a key mentoring role and ensures that the employee actively participates in the improvement process. However, a copy of the SPIF is also sent to the QLT who keeps track of what is happening globally throughout the lab system and also ensures that no suggestions get undermined due to lack of support from a supervisor. There is a mechanism to report back to the initiator so they understand if there is a good reason an idea is not implemented. Once all the flowchart steps are accomplished, the completed SPIF form is again forwarded to the QLT which collates all SPIF activity and reports it back to all staff.

Systems Process Improvements Flowcharts

The “Suggestion for Process Improvement” flowchart (SPIF 1), shown in Figure 4 on the following page, outlines the steps to be taken when an employee has an improvement idea. Everyone in the lab is encouraged to identify ways they can do the job better, simplify systems and improve the quality of lab services we provide by asking questions such as, “Why do we do it this way?” “Wouldn’t it be better if...?” or simply “I don’t have any ideas to make it better, but I know that what we’re doing just doesn’t work!” A goal is to facilitate process improvements as quickly as possible. So, this flowchart has two pathways. One accommodates quick, “no brainer” ideas that everyone quickly agrees on. The other uses the Joiner 7 Step Method for more detailed planning of the improvement.

SPIF 1: “Suggestion for Process Improvement”
The “Problem with Immediate and/or Important Nature” flowchart (SPIF 2), shown in Figure 5, is used when a problem/issue occurs that needs an immediate resolution in order to provide appropriate customer service. For instance, perhaps a patient is unhappy because he felt he had to wait too long to get his blood drawn. Another example is that we collected a patient blood specimen in a wrong container and we need to correct it immediately because the physician is going to be looking for the test results right away. Documenting problems of this type is similar to the previous QSE process. These problems are often one time “special causes,” but are monitored over time to determine if there is a recurring problem requiring a change in the system.
The “Recurring Problem” flowchart (SPIF 3), shown in Figure 6, is a way to handle problems that seem to never go away. For instance, someone might say, “It seems like this is the third time this week I’ve received an unsatisfactory specimen from a medical department.” Or, the QLT may notice a pattern of the same type of problem that occurs globally throughout the lab system. For instance, twice a week a particular lab test is ordered incorrectly by the nurses and it happens at each clinic site. Initially, that might not seem to be significant from the viewpoint of one site. However, when you multiply that error across all 19 clinic sites, it becomes a bigger system-wide problem. This flowchart always uses the Joiner 7 Step Method because if a problem has been recurring, it warrants an in-depth approach to solving it.
Once the Procedures and Tools subcommittee defined the three flowcharts and accompanying SPIFs, the Education subcommittee developed a 1 1/2 hour training session. The purpose of this was to review some basic concepts of Quality Improvement, explain the three System and Process Improvement flowcharts that were developed and have the staff learn how to complete each of the three SPIFs. The QLT members were the trainers. We broke up into teams of two trainers and all 132 people throughout the lab sites attended one of the sessions.

We started the session by emphasizing that quality improvement is an ongoing process. We cited examples of various lab teams and improvements that had already been accomplished. We told people who Dr. Deming was and spent time talking about the 14 points—we related them to real life examples within the laboratory and tried to categorize them as relating to “everyone tries to do their best” and “look at systems, don’t blame people.”

Next, we introduced the Joiner 7 Step Method. We role-played a teenager learning how to drive and look ahead down the road. This was to emphasize that we want to be proactive and look ahead to spot potential roadblocks that prevent us from...
Developing a training program, continued

doing a good job. The 7 Step Method helps us move away from reactive putting-out fires, to implementing improvements that really work.

The rest of the training session was spent explaining each of the flowcharts and using some real laboratory problems to practice filling out the SPIFs. We now repeat this training session on a quarterly basis for all new employees so they are indoctrinated into this culture very early on.

Feedback to staff and follow-through on SPIFs

One of the goals in the Opportunity Statement was to provide a clear mechanism for feedback and follow through of the SPIFs. The QLT members also serve on two subcommittees that meet outside of the monthly QLT meeting. The “A-Team” is responsible for monitoring the SPIF 1s. The “B-LTs Team” collates the SPIF 2s and SPIF 3s. Each SPIF is assigned a QLT member as a facilitator to mentor the person who initiated the SPIF through each of the flowchart steps and ensure that the SPIF makes continuous progress until completion. The A-Team and B-LT Team keep track of all the SPIFs on a spreadsheet which lists the following:

- Origination date of the SPIF
- The improvement suggestion or problem that occurred
- QLT member assigned as facilitator
- Progress on what’s been done to date
- Further action items identified
- Mechanism to be used to report outcome to staff (e-mail, meeting, etc.)
- Date of closure for the particular SPIF
- Any future follow up actions that are needed.

Communicating results

We publish a newsletter, the Quality Connection, to inform staff about the outcomes of the SPIFs and eliminate the “black hole.” We hope the newsletter also reinforces Quality Improvement as a part of the daily lab culture. The Quality Connection includes an education section and columns written by both the A-Team and B-LTs Team highlighting process improvements that were implemented. We attach a copy of the SPIF spreadsheets described above so the staff can see everything that is going on and hopefully be encouraged to think of additional ideas.

Celebrating successes

The QLT also organized the first annual “Celebrate Our Success” evening. It included a light dinner, and various staff members made presentations of the SPIFs they initiated, the process they took to implement changes, and the final outcomes. The evening was another way to eliminate the “black hole” for feedback, and an opportunity to pat ourselves on the back for improving laboratory services.
Examples of changes made from this process

This article will now describe three examples of changes that were made because of suggestions made by front-line employees using the SPIF process. These examples help demonstrate the buy-in of the staff and the transformation in their thinking. The examples illustrate eliminating rework, understanding systems and improved customer service.

1. Eliminating rework

Because we are geographically diverse, there are significant differences between the satellite labs and the central lab. In order for employees to better understand the processes at other locations, a program of job shadowing was initiated. Staff from the central lab can spend a day at a satellite lab and vice versa.

It was while job shadowing that a satellite lab employee noticed that there was duplication of work in the processing of 24-hour urines (See figure 7).

A 24-hour urine collection results in a large volume of liquid. At the satellite lab, the total volume is measured and then a small portion (aliquot) is transferred to a test tube that is sent to the central lab. In the processing area of the central lab, the specimen was transferred again to a smaller test tube in order to continue processing.

There did not appear to be a good reason why the specimen could not be put into the correct size test tube at the satellite lab. A one month pilot program was tried and there were no problems. The change was then implemented throughout the system. The specimen transport procedure was revised and the change was communicated to all staff. Estimated cost savings for a year is a little over $1,100 in supplies and labor.

Figure 7. Specimen Handling

<table>
<thead>
<tr>
<th>Issues:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Satellite lab employee noticed rework in handling of specimens while job shadowing in specimen processing</td>
</tr>
<tr>
<td>• Eliminating interim container would result in less handling &amp; expense.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Procedure change developed</td>
</tr>
<tr>
<td>• No problems encountered during one-month pilot</td>
</tr>
<tr>
<td>• Recommendation made to use throughout lab system.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Specimen transport procedure revised</td>
</tr>
<tr>
<td>• Change communicated to all staff</td>
</tr>
<tr>
<td>• Cost savings of $1,130 per year in supplies and labor.</td>
</tr>
</tbody>
</table>

2. Understanding systems

When only a small amount of blood is needed for a laboratory test, we use a micro-specimen collection device. The staff was not satisfied with the one we were using. They felt that there must be something better, but no one had an answer as to what that “something” was (see Figure 8).
There were several problems with the collection device. It appeared that many of the specimens we collected could not be analyzed and had to be rejected. Calling a patient and asking them to come back and have their blood drawn again is very unpleasant for everyone involved.

Secondly, the devices were difficult to mix. They had to be mixed with a snapping motion and after employees had done that several times a day, many of them complained of wrist pain.

An interdepartmental team was formed, and they used the Joiner 7-Step Method to investigate several different collection devices. The team selected one because of its ease of collection and mixing to be tested by several sites. Test results from both the old and proposed device were statistically evaluated to determine any variation. The technicians evaluated the new device on its ease of draw, ease of mixing and number of rejected specimens, and then submitted comments on which device they preferred.

The benefits have been numerous. Once they were trained on how to use the new, different collection device, the employees liked it. Since it is less costly than the previous one, we anticipate a savings of about $813 per year. There is also the potential savings from preventing employee injury and the benefits of better customer service. Recalling patients is costly in time, supplies, and especially customer satisfaction.

### Figure 8. Micro-Specimen Collection Device

<table>
<thead>
<tr>
<th>Issues:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Staff dissatisfied with current micro-specimen collection device</td>
</tr>
<tr>
<td>• Many specimens are rejected</td>
</tr>
<tr>
<td>• Difficulty in mixing has resulted in wrist pain for some employees.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interdepartmental team formed</td>
</tr>
<tr>
<td>• “Joiner 7 Step Method” used</td>
</tr>
<tr>
<td>• New, less expensive device selected and tested at selected sites</td>
</tr>
<tr>
<td>• Proposed collection device met criteria.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Staff trained in using new device</td>
</tr>
<tr>
<td>• Procedure revised</td>
</tr>
<tr>
<td>• Supply cost savings of $813 per year</td>
</tr>
<tr>
<td>• Potential staff injury prevented</td>
</tr>
<tr>
<td>• Fewer patients recalled because of specimen rejection.</td>
</tr>
</tbody>
</table>

### 3. Customer service

A new employee noticed that we seemed to draw a lot of blood on all of our patients (See Figure 9). Patients had also made that comment, but we did not pay too much attention to them. Since she generated a SPIF, an investigation was done to determine if we were collecting more blood than we really needed.

The first thing that was discovered was that our Laboratory Information System (LIS) was programmed to generate one label per test. Therefore, whoever was drawing the blood was usually drawing one tube of blood for each test. The first action taken was
Next steps: Shifting to a Customer Centered Focus

Once we felt that we had a good system in place, it was time to move on to the next level and shift to a Customer Centered Focus. Our employees knew how the system worked and how to improve processes that weren't working. Everybody was very enthusiastic about the SPIF process, were comfortable with the forms and were using them. However, we realized that we needed to do more than merely satisfy the customer in order to be successful. The health care industry is very competitive, particularly in the Minneapolis/St. Paul area, and we needed to make sure that our customers were not just satisfied, but delighted.

The next steps were not as easy as we thought they would be. We had a vision of what we wanted to do but we had taken too big of a leap for some of the QLT members. We needed to regroup and determine what the obstacles were.
Some initial obstacles

One barrier was the strong technical bias in the laboratory. We are very analytical by training. We focus on numbers, on output, on things that are easily measured. The laboratory staff needed to move from producer-centered thinking to a Customer Centered Focus. Producer-centered thinking focuses first on the process, then the product (test results), and finally the outcome. We are very good at what we do, but we needed to “get out of the box” and realize that correct, timely and accurate results are not enough.

Education was essential

We started by educating the QLT members so that they could start looking from the “Outside In” or with customer centered thinking. A customer looks at the outcome first, then they look at the product, but they usually don’t care about the process that was used to get the product.

The three rings of service

We used the “Three rings of Service” concept that is found in Chapter 2 “What is Customer Service” of Jim Clemmer’s book, Firing on all Cylinders (See Figure 10). According to Clemmer, there are three rings of service. The inner ring is the basic product or service, the next ring is support, and the last ring is enhanced service, or the “delighters.” At an inservice for the QLT members, we listed all the products or services that we do for our customers. We then placed these products or services in the ring we felt was appropriate. To our surprise, we discovered that most of our products/service are in the first two rings. We had only one item in the third ring. This was the “ah ha” that the QLT members needed. They began to realize that we do a good job and have a good product, but we need to do a better job on enhancing service.

Figure 10. The Three Rings of Service
Some positive reaction

We are really starting to see some changes from all the staff. There is much more buy-in to fixing systems and less blaming of people. We asked our staff to tell us one good thing that they learned from a SPIF training session. When we read those comments, a small sampling of which appear in Figure 8, we realized that we’re on the right track.

Figure 8. Employee Comments

“This system explains why this is a better place to work than my previous place of employment, it’s worked even in its beginning and should improve."

“A good feeling about our job, an eagerness to be a good employee as there is reward for doing a job well."

“It’s nice to know that if I take the time to think through a problem and fill out the form, something will be done about it; someone cares. I appreciate that.”

Author information

Christine Kelly founded the Laboratory Quality Leadership Team in July, 1993, and served as the first team leader. She was the Director of Laboratory Operations for Park Nicollet Medical Center from 1992-1995, and is currently the Director of Laboratory for parent company HealthSystem Minnesota. Her current responsibilities include leading and managing all laboratory operations in 17 clinics and one hospital campus.

Elizabeth Lentz is currently a Regional Laboratory Manager at Park Nicollet Clinic HealthSystem Minnesota. She is responsible for the overall direction and supervision of eight clinic laboratory sites which include 34 employees. As the leader of the Quality Leadership Team for the past 1 1/2 years, Ms. Lentz has been instrumental in teaching Quality Improvement principles to staff and promoting a customer-centered laboratory culture.
Using Quality to Manage Merger Mania in Health Care

Introduction

The Lahey Hitchcock Clinic has shown that Total Quality and Continuous Improvement are effective ways of managing the chaos that occurs during a merger. The organization officially came into being in December of 1994, when the Lahey Clinic in Burlington, Massachusetts, and the Hitchcock Clinic in Lebanon, New Hampshire, joined forces. Both organizations used Quality tools and techniques to prepare for and respond to many different facets of the merger.

Focus of this article

This article will begin with a brief background on the two clinics prior to 1994 and will describe the basic structure and characteristics of the new organization. Then Dr. Campion, former Medical Director for Quality Resources at Lahey, will cover aspects of the merger from an organization-wide perspective. Finally, Dr. DeMatteo, Medical Director, and Kathleen Iannacchino, Manager of Improvement Education and Development, will comment on measurement tools used in the Keene Division of the Lahey Hitchcock Clinic.

Background on the Lahey Clinic

The Lahey Clinic conducted its operations in three downtown Boston buildings from about 1912 to 1982. It then moved about 20 miles north to its current location in Burlington to build its first, 270-bed hospital. Lahey was a multi-specialty referral center with 285 physicians. They would see patients from every state in the country in any one year, with about 25 percent of those patients coming from outside Massachusetts in any given year.

Background on the Keene Division of the Hitchcock Clinic

The Keene Division of the Lahey Hitchcock Clinic was originally a separate
Background on the Keene Division of the Hitchcock Clinic, continued

entity, the Keene Clinic, founded in 1948 in Keene, New Hampshire. It was a physician owned, for-profit corporation until 1993, when it decided to join a larger organization, the Hitchcock Clinic of Lebanon, New Hampshire. The Hitchcock Clinic had previously comprised the entire medical staff of the Dartmouth/Hitchcock Medical Center, which is affiliated with Dartmouth Medical School. Keene Clinic physicians primarily admit patients to a 171-bed community hospital, the Cheshire Medical Center. About 85 percent of Keene’s primary care patients live within 20 miles of the facility, but specialty care patients generally come to Keene from greater distances.

The merging of the two separate entities

Lahey Clinic and Hitchcock Clinic began discussions of collaboration in 1993. Both clinics were large, multi-speciality group practices with common cultures and similar size. The two campuses are 120 miles apart, and their service areas were contiguous at the state border.

However, their concentration of medical and surgical specialists and testing services relied on referral patients, which was being threatened by the limitations of managed care insurance plans. Both clinics had begun alliances and affiliations with other hospitals, primary care networks and smaller group practices. Merging increased their coverage area, expanded services available to patients, and improved opportunities to bid on contracts.

The two clinics merged in 1994, with a common Board of Trustees and management structure. The Lahey-Hitchcock Clinic now consists of three separate regions, each with its own board of governors—the Northern New Hampshire, Southern New Hampshire, and Massachusetts regions. The Keene Division is one of the four divisions that make up the Southern New Hampshire Region.

Francis X. Campion, M.D.

When Lahey and Hitchcock began to consider a merger, we started to think about a strategy for integrating clinical quality measurement in the two organizations (see Figure 1). We had some similarities in terms of our physician driven multi-specialty group practice culture. One of the principle working premises was that both organizations had a current high quality of care. That was pretty well recognized by our customers and by our payers. Our goal was to maintain that.

We wanted to establish an integrated governance which would require merging our boards of trustees and also the development of regional boards of governors comprised primarily of physicians. In fact, Hitchcock had already started the development of regionalization. They had developed a northern region and southern region in New Hampshire. We added a Massachusetts region at the time and so there are now actually three regions to the Lahey-Hitchcock Clinic. Each region has its own board of governors and there is one board of trustees for the entire organization.

Journal of Innovative Management
Integrating operations

The next step was integrating operations—the business aspects of delivering services, keeping our doors open, and paying the utility bills—which should be easy to merge, but we know never are. Human Resources varied from institution to institution as you might imagine. Just evolving that over time to develop a common culture and common benefits is challenging to say the least. It is something that is probably going to take a few more years to reconcile. Professional Liability Insurance—each organization has its own captive self insured malpractice entity which is being merged. Hospital and physician practice affiliation—I already mentioned that both organizations had already developed a network of primary care physicians and there was no overlap at the time. Indeed, one of our goals was to fill in the geographic gap between the two tertiary hospital sites.

Clinical Quality Planning

Finally, there was Clinical Quality Planning (see Figure 2), where I really want to focus the rest of my comments. Clinical Quality does not just happen, it has to be planned for. While merging our Information Systems and Human Resources, we can't take for granted that our quality will stay as good as it is, or guarantee to be state of the art in the future. So very purposely there is a plan for managing clinical quality and new programs.

Quality in hospital care

Hospital care is where most of the action has traditionally been regarding measuring quality, but the concept of hospital care is quickly changing. Today, what was traditionally called “acute care” is delivered not only in the hospital, but in the home setting or in a skilled nursing facility. There is even the hope that patients who are well at home can, to a certain extent, take charge of their own health and provide self care. We need to measure the performance of all these care delivery venues. For this reason, we are developing measures of ambulatory care and system performance for diseases regardless of where care is delivered.
CASE STUDY
Using Total Quality to Manage Merger Mania in Health Care

Quality in hospital care, continued

Table 2. Clinical Quality Planning

<table>
<thead>
<tr>
<th>Measures of System Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient satisfaction, employee satisfaction</td>
</tr>
<tr>
<td>Utilization and finance</td>
</tr>
<tr>
<td>Access</td>
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<table>
<thead>
<tr>
<th>Hospital Care</th>
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<tbody>
<tr>
<td>Integrated Quality Improvement Plan</td>
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<tr>
<td>Top 20 Diagnostic Related Groups (DRGs)</td>
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<tr>
<td>Accelerated Clinical Improvement (ACI) teams</td>
</tr>
<tr>
<td>Key performance measures</td>
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<tr>
<th>Ambulatory Care</th>
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<tbody>
<tr>
<td>HEDIS Criteria</td>
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<td>ACI Teams</td>
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<tr>
<td>Patient Education</td>
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I will first present Lahey’s Integrated Quality Improvement planning, our selection criteria for Diagnostic Related Groups (DRGs) to focus on, Hitchcock’s Accelerated Clinical Improvement team project, and then the development of key performance measures for hospital based care.

The need for an Integrated Quality Improvement Plan

We started the Integrated Quality Improvement Plan (Figure 3) in 1992 at Lahey, and it was born out of necessity. There was the need to pass a Joint Commission on Accreditation of Healthcare Organizations (JCAHO) review one year hence. I had become the Medical Director for Quality just about a year before our 1993 survey. I recognized that the way we had been doing our quality assurance was not going to fulfill the criteria of the JCAHO review, which had advanced the concept of people talking to each other for cross-functional improvement. We had, at the time, a very traditional medical staff committee structure for managing quality assurance information.

Figure 3. A Summary of the Integrated Quality Improvement Plan

| Developed as single hospital model but is applicable to multi-hospital plan |
| Bridges “old QA” to new “QI” |
| Coordinates existing hospital committees |
| Tissue, infection control, blood bank |
| Utilization management |
| Pharmacy and therapeutics |
| Outcomes based and relevant for physicians |
| Clinical outcomes, e.g. mortality, infection rates |
| Process measures, e.g. length of stay, blood use, drug use |
| Fulfills JCAHO requirements |
Changing CEOs

Our tradition and our culture had been one of very strong departmental chiefs, very smart people and at the time we had just transitioned to a new CEO, Dr. Bruce Steinhauser, who came from Henry Ford Clinic and was starting to speak of “multispecialty planning” and “collaborative team approaches.” Prior to that we had a physician CEO who had been an officer in the armed services— he had a management style that you would expect from someone with a traditional military background, and we were successful. No doubt about it. But again, the world was changing pretty rapidly.

Example of the Quality Improvement in clinical areas

We simply looked at our current quality assurance program and decided how we could create some internal communication. We put together a grid entitled “Integrated Quality Improvement Plan” (see Figure 4) that describes several clinical areas, lists the key quality assurance committees which worked with the routine QA functions, and then listed the key indicators that we wanted to measure over a course of one year by clinical topic. Previously, the Pharmacy and Therapeutic Committee decided what it wanted to do, the Blood Bank Committee decided what it wanted to do, the Tissue Committee decided what it wanted to do, but the committees never spoke to each other. That was the way it was done for a long time. Nevertheless we needed to be a little bit smarter, and hopefully put some information back into the hands of our customers, our physicians, who needed it so that they could self-improve. Prior to that time they received rather disjointed information. Even if they got a blood utilization report in September, and three months later received an infection control report summarizing their infection rates for the year, and then maybe three months after that received something from finance about cost and charges and length of stay, there was no consistency or integration of that information.

Figure 4. An Example of the Integrated Quality Improvement Plan

<table>
<thead>
<tr>
<th></th>
<th>Surgical Case Review</th>
<th>Blood Bank</th>
<th>Utilization Management</th>
<th>Infection Control</th>
<th>Pharmacy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mastectomy</strong></td>
<td>indication for partial vs. complete mastectomy</td>
<td>packed red blood cell (PRBC) use, pre-op testing for blood bank</td>
<td>length of stay (LOS), total and cost center profile</td>
<td>wound infections</td>
<td>peri-op antibiotics</td>
</tr>
<tr>
<td><strong>Total Hip Arthroplasty</strong></td>
<td>indications for procedure</td>
<td>autologous vs. homologous PRBC</td>
<td>LOS, cost profile, discharge destination</td>
<td>wound infections, prosthesis infections</td>
<td>peri-op antibiotics</td>
</tr>
<tr>
<td><strong>Coronary Artery Bypass Grafting</strong></td>
<td>indications for procedure</td>
<td>PRBC and cryoprecipitate</td>
<td>LOS, cost profile, payor profile</td>
<td>wound infections, pneumonias, urinary tract infections</td>
<td>peri-op antibiotics, helsen, albumen</td>
</tr>
<tr>
<td><strong>Laparoscopic Cholecystectomy</strong></td>
<td>indications for procedure and conversion rate to open procedure</td>
<td>preoperative testing for blood bank</td>
<td>LOS, cost profile, OR time comparison, payor profile</td>
<td>wound infections</td>
<td>peri-op antibiotics</td>
</tr>
</tbody>
</table>
Another thing we have done is to try to select important DRGs (see Figure 5), and most hospitals have done this in recent years. The idea is that the majority of our business occurs with a relatively small number of DRGs and that we have to focus on the “vital few,” so to speak, which often numbers around 20.

Figure 5. Hospital Care Planning: Top 20 Diagnostic Related Groups (DRGs)

- Focus on major discharges by frequency and utilization impact
- Apply Clinical Pathways/Case Management
- Apply Integrated Quality Improvement Plan
- Movement towards “Product Line” planning
  - Cardiovascular care; cancer care
  - Orthopedic/rheumatologic care

Those concepts that I just covered were mostly home grown at Lahey/Burlington. But there is one concept that we have adopted system-wide after the merger, which we call the Accelerated Clinical Improvement (ACI) project (see Figure 6). ACI projects put the tenants of CQI in a workflow process. We have launched six ACI teams. One was surrounding major joint replacement, one colon surgery, one normal vaginal delivery, and the latest few on ambulatory care (low back pain, urinary tract infection etc). Six total teams represent the three regions of the organization, and we start them off with a full day orientation and benchmarking, and after six months we have a conference to celebrate all the improvements.

Figure 6. Accelerated Clinical Improvement (ACI) Projects

- Six teams representing hospitals or regions
- Hospital or Ambulatory care planning
  - Major joint surgery, vaginal delivery, etc.
  - Low back pain, UTI, URI
- One full day orientation for all participants
  - CQI principles, benchmarking, brainstorming
  - Internal and external data scan
  - Each team develops a local strategy
- Monthly teleconference, local work meetings
- Meeting at six months to celebrate improvement

Removing the faults in a stage-coach may produce a perfect stage-coach, but it is unlikely to produce the first motor car. —Edward de Bono
Finally, there are key performance measures, which have not yet been implemented at Lahey/Hitchcock. It is a panel of hospital and ambulatory care outcome measures, promulgated by the Maryland Hospital Association and commonly referred to as the “Maryland Indicators” (see Figure 7). The beauty of it is that it describes definitions that we hope everyone can buy into, which then allows for benchmarking organization by organization. There are 10 hospital indicators and a report every three months on those indicators. And then locally we get a measurement of our performance, which we can compare with 30 other hospitals who are also participating in Massachusetts.

Figure 7. Maryland Quality Indicator Project: Inpatient Indicators

<table>
<thead>
<tr>
<th>Inpatient Indicators:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I  Hospital Acquired Infections</td>
</tr>
<tr>
<td>II Surgical Wound Infections</td>
</tr>
<tr>
<td>III Total Inpatient Mortality</td>
</tr>
<tr>
<td>IV Neonatal Mortality</td>
</tr>
<tr>
<td>V  Perioperative Mortality, Inpatient</td>
</tr>
<tr>
<td>VI Cesarean Sections</td>
</tr>
<tr>
<td>VII Unscheduled Readmissions</td>
</tr>
<tr>
<td>VIII Unscheduled Admissions Following Ambulatory Procedure</td>
</tr>
<tr>
<td>IX Unscheduled Returns to a Special Care Unit</td>
</tr>
<tr>
<td>X  Unscheduled Returns to the Operating Room</td>
</tr>
</tbody>
</table>

Carl S. DeMatteo, M.D.

Most of us at Keene were shocked when we went from being a local small group practice to being part of a 900 physician, 5,000 employee, multi-state, multi-site organization. With our own previous corporate culture, what was going on with reform in the health care market, and such wide variation in practice style in our own organization, we concluded that not only did we have to merge with a larger system but we probably had to merge with ourselves a little bit more than we had ever before.

One theme that kept coming up was Total Quality Improvement. In 1988 the Keene Clinic had made an organizational commitment to TQI, and while we had modest success, especially on the administrative side, we realized we needed to fully integrate quality improvement into all of our employees, clinical workers and otherwise. The Hitchcock Clinic had previously made a similar commitment, so this was one of the things that drew us to choose them as a partner for merger.

The major advances in civilization are processes which all but wreck the societies in which they occur. — Alfred North Whitehead
Upon merging we got into the measures of system performance, and this began to establish a baseline of information for us that we could use to benchmark within our own system, as well as with other systems. The Measure of System Performance Program was brought to the Hitchcock Clinic and initiated at Keene in 1993, when we joined the Hitchcock Clinic, the Mary Hitchcock Memorial Hospital, and the Matthew Thornton Health Plan (HMO), who began the program. We now have about 8 or 10 data points available to us, and we are starting to get more useful information.

We receive a Measures of System Performance (MSP) Report every month, and it represents a compilation of a monthly survey done by an independent marketing group (see Figure 8 for a model). The survey is conducted on 30 of our patients that were seen in the clinic that month, 30 community people selected at large using a random digit dialing technique, and 30 of our own employees. It is a phone survey using a standardized tool by this organization.

Figure 8. A Model for the Measures of System Performance Report

The aim of the MSP Program (Figure 9) is to promote systemness, reinforce our mission, monitor outcome trends, identify drivers of outcome to foster learning. The MSP is to be a continuously improving tool— a lot of time and effort is put into talking to employees, getting their feedback, asking them “what would you like to see on this that would help you do your work better.” So it is a very dynamic process, and we think for that reason it is very appreciated by all staff members.
Figure 9. The Aim of the MSP Program

Measures of System Performance (MSP) will be used by LHC to:
• Promote systemness
• Reinforce Mission
• Monitor outcome trends
• Identify drivers of outcomes
• Foster learning and cooperation
• Guide wise actions aligned with strategy

The MSP must be continually improved to:
• Better meet the needs of LHC users
• Provide better value

Uses of the MSP program

Specific uses of the MSP program include assessing performance related to the mission of the larger organization, evaluating successes of strategic action both system and local, monitoring core processes, and identifying drivers of satisfaction, and “push down–pop up effects”—when you “push down” in one department and an unexpected, unplanned-for effect “pops up” somewhere else (see Figure 10).

Figure 10. Some uses of the MSP

• Assess performance related to MISSION
• Evaluate success of STRATEGIC ACTION
• Monitor a CORE PROCESS
• Identify DRIVERS of satisfaction
• Identify “push down – POP UP” effects

Keeping score in several key areas

One of the reports distributed every month is an instrument panel with headings such as access, patient satisfaction, community image, employee satisfaction, functional health status, management process and information systems. The average maximal achievable score from several questions related to those specific areas are outlined or are enumerated in the monthly questionnaire.

Comparing results with other divisions

We also receive every month a panel that is compiled from the all four of the divisions in the Southern New Hampshire Region. This has been going on for some time, so we have quite a number of data points. We can compare ourselves to other divisions under various categories, or headings. Some of the other divisions have also
Comparing results with other divisions, continued added additional headings that suit their purposes, and we have the opportunity to do the same as we go forward.

Obtaining and analyzing information on specific daily processes

We can also get breakdown information on specific processes. In Figure 11, you see outlined an instrument panel (and this is data that was collected prior to our division joining the network). Each division has looked at the process of appointment scheduling from the patient’s perspective and phone call handling. They looked at the time taken to answer the phone, to be put on hold or transferred, to reach the person they wanted, to get their call back, to speak to the person they wanted, and to make their appointment. One division seemed to be doing quite a good job of getting the phone answered right away, putting fewer people on hold, handling transfers better, and connecting people to the person they want to speak with right away. Maybe there is something about how they handled this process that we ought to go over, talk with them about, and find out what they are doing. Maybe we can transport that process over to our division and get an accelerated boost in this particular process without having to reinvent it ourselves. We think this process is particularly useful when it gets us down to this level. When you have this quality of information, and you show this to physicians and managers, they start to respond to it, because it is very much related to the daily work flow in the organization.

Figure 11. Instrument Panel for Access in the Southern Region
The MSP Program helps bring people together

The MSP Program really seems to hold a lot of promise for us in terms of improving our processes and comparing them to other areas. It gets us talking with the other parts of the network, feeling like we are part of the same team, and really working together to share information and ideas. We have trained our employees with two and three day courses on topics such as Statistical Process Control and Gaining Customer Knowledge, where people learn a lot more about how to make better use of measures in general. Attendees are people from all over the network coming together to take these programs and meeting each other, which is very reinforcing.

Measurement is critical to assessing care delivery

We think with all of this input, our physician leaders and staff managers have begun to really appreciate the full value of measurement. Physicians have always appreciated the value of measurement in clinical care. But now they recognize the value of measurement in assessing our process of care delivery. That is an area, we think, that has been greatly ignored in medicine. This really is very useful along those lines.

Measurement is also a driver for organizational change

We have also found that we could use measurement as a great tool to drive our organizational transformation (Figure 12). We have participated in all the Accelerated Clinical Improvement (ACI) teams, and listened to the very, very positive results that came out of those. Teams from our organization go out and meet and work with teams from other organizations and then get back together to share ideas. It is an ongoing effort. We also have a Provider Specific Survey Program, surveying 10 patients seen by every provider in our division each month.

Figure 12. Measurement as a Tool for Organizational Transformation and Change

- ACI Teams
- Provider Specific Survey
- Focused Market Studies
- Department and Process Redesign
- Clinical Teams
- Administrative Restructuring
- Case Management
- Information System

Studying the market

Finally, we have done some Market Focus Studies revolving around primary care and obstetrical care to get a better idea of what people in our community are looking for from us. This information has been very useful in stimulating restructuring and change.
Studying the market, continued

Viewing the division as a system within a system

Our participation in all of this has lead to our viewing the Keene division as a system. And more and more, the people who are doing the work every day are starting to see that. We see ourselves as a system within a larger system and certainly the MSPs have helped us do that. We have started a three-year division level planning process, which calls for us to focus on our core business, which is the delivery of quality primary and specialty care to the people in our population. We see the role of this really being driven by teams of physicians working with mid-level providers, nurses, receptionists, working as a team. We are doing a lot to emphasize teamwork.

Conclusion: Information is critical

Our job as administrators and leaders is to provide the physical information and facilitation resources that assists our process. Our vision is that when the teams are continuously provided with information regarding the quality, cost and customer satisfaction with their work, continuous and spontaneous improvement will be generated and driven down to the level that the work is done.

Author information

Francis X. Campion, M.D., is the Vice President for Clinical Integration for the Caritas Christi Health Care System. He is the former Medical Director for Quality Resources at Lahey Hitchcock Clinic in Burlington, Massachusetts. He currently practices general internal medicine at St. Elizabeth's Medical Center in Boston.

Carl S. DeMatteo, M.D., is the Medical Director of the Keene, New Hampshire division of the Lahey Hitchcock Clinic. He joined the clinical staff of the Keene division in 1985. He is certified in internal medicine and infectious disease, and has participated in many community and state directed initiatives.

Kathleen L. Iannacchino, R.N., M.S., is the Manager of Improvement Education and Development, Keene, New Hampshire division of the Lahey Hitchcock Clinic. She joined the clinic in 1981 and has worked in the area of continuous improvement in Keene since 1988.
Self-Directed Work:
A Strategy for Continuous Improvement

Peter McGarry, Director of Operations, Interconnect Division, M/A-COM, Waltham, Massachusetts
Jeff Sopel, Manufacturing Manager, Interconnect Division, M/A-COM, Waltham, Massachusetts
Mary Caira, Interconnect Division, M/A-COM, Waltham, Massachusetts
Brian McDonald, President, MOR Associates, Watertown, Massachusetts

Peter McGarry:
M/A-COM, an AMP company, is a supplier of RF and microwave connector components and subassemblies for the commercial and military markets. We have 57 offices, worldwide distribution, and manufacturing sites in both U.S. and Europe. Our sales in 1993 were about $340 million, and we have a shade under 4,000 employees. We're organized into four business units: The Microelectronics Division; The Semiconductor Division; The Antenna and Cable Division; and the Interconnect Division. Representing about 20% of the total M/A-COM sales, the Interconnect Division has 600 employees and five manufacturing locations: England, Puerto Rico, Waltham and Watertown, Massachusetts, and Hudson, New Hampshire. We will be focusing on the Waltham-Watertown operations, where we have 260 employees.

We started the Continuous Improvement process back in 1985 when a group of senior managers went to Winter Park, Florida, to spend a week with Phil Crosby. When we came back to the plant, we formed a steering committee and developed a base measurement so we could track our progress over successive years. We also formed cross functional task teams and made Statistical Process Control (SPC) a part of all the operations in Waltham and Watertown. The opportunities for implementing these things were plentiful, and we certainly made significant gains over those four years, but we were only focusing our efforts on internal issues.

In 1989 the improvement curve slowed, so at that point we adopted a TQM philosophy to help us focus externally. We asked certain crucial questions: What's
Measurements: The Quality Index
With regard to the bottom line we’ve made significant gains over the past several years. In 1988 net income was at $58,000 per employee. In 1994 it was up to $104,000 per employee. During that time, total sales have remained constant (or flat), which proves that our efforts are paying off.

Why self-directed work?
There are several reasons for implementing self-directed work:
• It drives continuous improvement which increases profitability.
• It focuses all employees on customers which improves customer satisfaction.
• It gives employees the opportunity to use their knowledge, experience, talents, and creativity.
• It provides for the development of a highly skilled and flexible workforce.
• It helps create a satisfying work environment.

Results! Why, man, I have gotten a lot of results. I know several thousand things that won’t work. —Thomas A. Edison
Self-Directed Work: A Strategy for Continuous Improvement

The three phases of implementation

Jeff Sopel:

Self-directed work was implemented in three phases:
1. To learn what self-directed work is and how it could work at M/A-COM.
2. To develop a plan and anticipate the changes necessary as we move along. That involved defining the roles for members of our workforce, whether they were supervisors or individual contributors.
3. Implementing the plan. That's where the Plan Do Check Act cycle helps in learning from previous mistakes. You find that things change quite a bit over time. What you expect to see may not be what you actually see, you see many things that you would not have anticipated.

The most important thing we did was send our managers to seminars in order to learn what self-directed work is all about. We talked to people who had done this before to find out what kinds of problems, if any, they had experienced. We also visited actual sites at Motorola in Chicago and Colgate Palmolive in New Jersey, where they were actually working in self directed teams. That was extremely useful, because it helped clarify how self-directed work could function in our own organization.

Implementing such a new and different system like self-directed work can create concerns and even fear in the workplace. Workers may be unsure how to do their jobs. They might wonder if they will continue to even have a job. Supervisors could be nervous about how their roles might change. People who have been with the company for a long time might be uneasy with what the future holds. However, we found that a key to calming everyone's fears was having a plan, from which organizational decisions are made. We had to develop a framework to work from.

We found that three of the companies that we do business with use standard forms through which they communicate their plans. They say what they are going to do and during what time period. That seemed to be helpful. So quite frankly, we borrowed a few ideas from them and added our own thoughts and developed a package that gives everyone information on what to expect.

Individual and team responsibilities were identified in accordance with a timeline. Basic responsibilities they were expected to “own” in the first six months were identified. During the year that followed, and the second and third year, additional duties were included. The timeline is a good way to measure our progress.

Phase 1: Learning about teams through seminars and site visits

Phase 2: Calming employee anxiety with planning and role definition

Developing and distributing the plan

Discussing a timeline for progress
Phase 3: Early efforts at self-directed work

Early efforts generally involved our indirect areas, where we chose to start with the planning materials group. There we saw the value of training our own people as well as the teams. Individual team missions and goals were developed. Ground rules were agreed to, in regard to how people would be treated and listened to, the frequency and duration of the meetings, etc. These proved to be extremely helpful in managing the breakdowns that will occur.

Daily huddles

Certain activities or “practices” proved critical. The daily huddle/meeting, which is very brief and can happen at any time, were essential. Those are as important at a management level as they are at the operational level.

Coaching

A change to a coaching style on the part of supervisors and managers was another critical practice. That style needs to become the norm if the teams are to develop and handle the difficulties encountered in the day-to-day operation.

Coaches, team members all meet together

The coaches meet on a monthly basis to discuss overall progress. They talk about what people/teams are doing, what is working well and what needs improving. That simple practice keeps us focused on improvement. Teams are focused in different areas. There are 20-25 teams throughout the company with clear goals and measures. Those measures are important because they provide some structure, and that helps calm people’s anxieties regarding managing themselves.

The meetings are an important thing to make a habit, so that the coaches and the managers huddle on a regular basis. Whenever we have allowed the heat of daily activities to postpone or cancel huddles, performance has suffered. I can watch it bounce right back the minute we reaffirm the discipline of the huddles. Even if you miss one or two you will see the effects.

The teams huddle for 15 minutes every day, they meet for a half hour every week, and they meet as a department for an hour every month. I meet every week with my own staff, but we rarely go beyond 15 minutes since we have gotten more efficient.

Daily operation of the teams

How do the teams operate on a daily basis? They organize their activities around goals and they track their performance daily, whether their measure is an output, turnaround, packets or engineering designs. The role of the coach is to provide direction, not tell people what to do. The key here is that people who are working in a facilitation role now assist the processes. The people are making the decisions of running the business, and over time they become more competent at doing that. Many times they’ll make a better decision. The coach needs to become comfortable with asking team members...
what would happen if they did things differently, or what might be possible. You'd be surprised, sometimes, at how easily the answers come forth.

**Daily operation of the teams**

On an operating level, we have seen significant improvements in our performance. For example, one might think that by allowing people to determine when they're going to work overtime, they're just going to do whatever they can to increase their paychecks. That's not what happened. In one cell, output is up over 30 percent from what it used to be, with improved quality, less people, and almost no overtime. In the first eight months of this year, this same cell had experienced 45 rejections over an eight month period. They began to focus on quality and they now have had only one rejection in the last nine weeks.

**Improved output and quality**

Flexibility and versatility of the operators has certainly improved. Team leaders rotate within teams and meet collectively once or twice per week in the early part of the month. They meet daily during the last week of the month, checking first thing in the morning to see if other departments need help in making their on-time delivery commitments.

As an example, one department typically had six operators working in it. One day I noticed there was nobody working in that department. I asked the supervisor what was going on, but he didn't know where the operators went. It turned out that they met in the morning and there was a cell upstairs that was having a hard time making its on-time commitment. They simply shifted their people up to that other cell to help out. It was done quickly, the on-time commitment was met, and a supervisor didn't have to get involved.

**Improved flexibility**

We had a particular job where we were waiting for a part that went into an assembly and it was late coming from our supplier. Our customer needed the delivery on a Saturday. We didn't get the part until Thursday, and it looked like it would be impossible to get it done in time. There were only three people working on this operation—two in the day, one at night.

The day shift people called the night shift person for help, and he said he would come in early. They made calls and arranged for their children to have baby-sitters stay longer. The two ladies on the day shift stayed until past 9:00 P.M. the first day. The night shift person came in early in the afternoon. On Friday they finished the job sometime after 9:00 P.M. They were prepared to stay until midnight to get the job done, but there was no supervisor involved. Now there's a lot of overtime involved there, but at the end of the month, if you look at our costs in that department, we still had a positive variance.
Those were some of the successful things that have happened. The operators working with their manufacturing engineer have actually redesigned some of their tools. They've changed technical processes that have improved the quality, output, and yield of our operation. The teams interact with other teams now. We might have a team leader leave the assembly floor and walk down to the planning area to check out a delivery schedule and deal with the planner. Or he might go into engineering and ask a design question. Or go into customer service and ask about a special requirement on a part. No supervisor involvement.

Managers can now act on value-added activities. The time pressure has eased for myself and for many people, but it takes time. It is a lot more work at first. You can tell someone to do something in a few seconds. To coach them, provide direction, raise possibilities can take 10-15 minutes, and you're going to feel that pressure, especially in a negative situation, at first. However, I can tell you from my experiences that it is worth the effort in the long run. In Figure 3 below, you can see the positive results of our annual climate survey.

**Figure 3. Climate Survey Results**

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<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Rules do not restrict new ideas</td>
<td>40</td>
<td>52</td>
<td>61</td>
</tr>
<tr>
<td>Work group members help co-workers</td>
<td>61</td>
<td>61</td>
<td>74</td>
</tr>
<tr>
<td>Motivated by enjoyment of work</td>
<td>39</td>
<td>37</td>
<td>49</td>
</tr>
<tr>
<td>Encouraged to make routine decisions</td>
<td>60</td>
<td>76</td>
<td>84</td>
</tr>
<tr>
<td>Work together to beat competition</td>
<td>57</td>
<td>67</td>
<td>74</td>
</tr>
</tbody>
</table>

Mary Caira:

I've been with M/A-COM for over 15 years. During most of that time, changes were seldom made on the machines or in the blueprints, so rework and inspection was very high. In 1993 I became a part of a self-directed work team.

When the training started most of us had mixed feelings. We wanted things to improve but were apprehensive about the teams taking on so much responsibility. There are six people on my team, and we all have different personalities and our own way of working. The first six months of training was difficult. Our facilitator coached us on
Mixed feelings and early difficulties

following the ground rules and in respecting each person. She also helped us set goals, agree on roles, and solve problems.

How self-directed teams work today

We are now responsible for the operation of our entire department. We have renumbered, relabeled, and organized our tooling. We also work with our manufacturing engineer on production process, designing fixtures to improve quality and cycle time. Every week we rotate a team leader who handles all functions for the week, such as running our daily huddle, taking attendance, logging work orders in and out of our department. We also meet with other team leaders to discuss the jobs that are due, and if any departments need our help. Our daily huddles are in the morning. We decide who will work on what jobs. We discuss any problems or new ideas. Do we need overtime? Do other departments need our help? We are also very committed to our on-time delivery. We have cross training where everyone is learning how to run all the processes. Everyone sets up his own job and can work in any area of the department.

Challenges are worth the effort

Self directed work is a challenge, but we enjoy making it work. Coworkers have a better attitude about their work and accomplishing their goals.

Three ways to get people connected

Brian McDonald, MOR Associates:

People who are connected to something that they care about will change their personal schedules and make accommodations to do some incredible things. However, when trying to implement self-directed work and create those connections, there are three things you need to emphasize: (1) Internal and external customer focus; (2) Coaching and facilitating; (3) Practices or habits.

1. Internal and external customer focus

First of all, people get connected to the customer, so they should understand who their customer is and what their customer needs. That can be facilitated by interactions with customers, both internal and external. One of the things you run into immediately is the conflict between what the customer wants and what we actually measure. For example, a machine shop might measure machine utilization, which doesn’t have a lot to do with what the customer wants, particularly if you’re not running very good parts off that machine. So right away you’ll run into a problem because the systems have been set up to capture data, most of which is irrelevant to or in conflict with the customer. You may want to run that machine less if we don’t have it within control standards.

A leader is a dealer in hope. —Napoleon Bonaparte

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2. Coaching and facilitation

The second thing is that employees need to understand the coaching element. Often-times training gets lost as people go back to the workplace and are distracted by all of the other demands of their jobs. To combat this problem, we developed a coaching track that reinforces the training. It starts typically with a two day workshop where people learn about the skills and behaviors that go with coaching. The wonderful part about it though is that they come back in 6-8 weeks. Those who go back to the workplace and forget about what they learned, come back and get a reminder. It's like a wake-up call that this isn't just a program that came along, was a blip on the scale, and left. I find that almost half of the people do some coaching after that first training session. The rest don't do any—the major explanation from them is that they don't have the time to do it. Since they come back every 6-8 weeks, they realize that this is real, and then they start to apply at least some of it. It almost becomes like a clinic, where once a month they get together for a few hours to talk about how their coaching is evolving, what are the difficulties, how do they coach someone with a bad attitude, or skeptics who don't believe that this is going to happen. Those kinds of issues get dealt with early on in the process of developing self-directed work. The coaching track makes that happen, they begin to see the changes, and then they can talk to each other about how to make things happen.

3. Practices or habits

The third thing is the practices. We had been trying to change the culture of the organization for a long time, but were unsuccessful. People just went back from the coaching course into the old culture that demanded them to be directive instead of to provide direction. We needed to build habits that would in fact create the new culture. A practice is nothing other than a habit, a routine, an activity that takes place almost as the breaks take place. Most workers take breaks, but they don't talk about it because it's just a habit.

We developed a whole litany of practices from which teams can choose that go with the natural rhythm of the business. The five-minute huddle, for example, typically starts at the beginning of the shift. They have a coordinator rotation, which is another practice. We don't want the coordinator to be the same person all the time, because that person will become the de facto supervisor. So once a week, or once a month, whatever they decide, they have a practice of rotating. They have a scoreboard that focuses on the results they're trying to achieve. They have a meeting weekly or biweekly when they talk about the trends in performance, because in their daily huddle they only look at yesterday and today. There are a variety of practices that have really changed the culture of the company for the better.

Changing the culture of an organization

I once had a plant manager at another company say to me, “You know, when we started self-directed teams I worried about whether we were really going to be able to
Changing the culture of an organization, continued

sustain it when new employees come in, because we have about a 20 percent turnover rate. But I don't worry about it any more because the new employees just come in now and they join the huddle. The next thing you know they're doing what everyone else is doing. We may need to do a little skill-building once in a while, or communication, or facilitation, but by and large, they just fall into place with everybody else.” Aristotle said “We are what we do.” Excellence is not an act, but it’s a habit. If we can build habits for people then we don't have to worry about holding them accountable, or reminding them about doing it over time.

A way to get everyone focused

Everyone needs to be focused on where the organization is headed and what needs to be accomplished. Self-directed work is a means to do that. Cross functional teams often-times keep at a certain level in an organization. But when you can push it down to the workroom floor, it's a way of getting everybody to think about what we need to do.

Direction and vision are critical

You also need the leader to talk about the vision, the values, the direction of the organization. When you do that it creates the context in which people can understand what is expected of them. Those people then get connected and will do incredible things to achieve those ends.

Information needs to be available, relations need to be open

Information is critical to people, especially for self-directed teams. M/A-COM does a wonderful job sharing their financial information each quarter, so people understand the business and what it takes to be successful. I think information also has to be readily available, with immediate feedback systems and teams reporting daily on what they did. There was one team that was trying to do their huddle at 9 a.m. because the information that they needed wasn't available at 7 a.m. But that broke the natural rhythm, which was to come in at 7 a.m. and plan the day. So we had to change the system to make information available for 7 a.m. Otherwise, we are force-fitting rather than going with the natural rhythm of the business. People need all kinds of information— they'll tell you what's helpful to them. There's also information that's not so helpful, but access is critical.

Open relationships are also critical. One measure of success I use with a team is whether you are able to pick up a phone and talk with whomever you need to talk to, about whatever you need to talk to them about, without going through all levels of the organization.

All men by nature desire to know. —Aristotle
Conclusion

I believe that American ingenuity and American initiative wasn't exported. It was simply stifled by the type of leadership and systems we put in place—the command and control hierarchical systems. What we've seen over the last few years is a rather fundamental change in organizations, from the hierarchical, functional structure to a more integrated one. Obviously, with direct support groups like maintenance or materials or engineering, it makes sense to integrate. That obviously leads to a more decentralized model requiring a more participative leadership style. People are more empowered to make decisions. Self-directed work is a good strategy for enrolling people in your strategic direction. It not only helps build a more effective organization, but obviously it builds a healthier organization for people. People crave dignity and respect. When you create an environment of self-directed work, treating people like adults, you can accomplish extraordinary things with quite ordinary people like ourselves.

Author information

Peter McGarry has been with M/A-COM since 1984, and is the Director of Operations for the Interconnect Division. Since joining the division in 1988 he has led the journey of Continuous Improvement, other aspects of TQM and now Self-Directed Teams.

Jeff Sopel has had 25 years of manufacturing engineering and management experience, and has been with M/A-COM for the past 9 years managing assembly and electroplating operations.

Mary Caira has been with M/A-COM for 15 years working primarily in the furnace brazing and heat treatment department as a member of a self-directed team.

Brian McDonald is the president of his own consulting and training organization, Maximizing Organizational Resources, or MOR Associates. He has helped companies as diverse as M.I.T., M/A-COM, NEBS, the U.S. Postal Service, the State of New York, and Ford Motor Company, in developing their Quality Employee Involvement and Self Directed Work Team processes.