CHAPTER 5

Quality Improvement: Creating Breakthroughs in Performance

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About This Chapter

The purpose of this chapter is to explain the nature of breakthrough and its relation to attaining superior results. This chapter deals with the universal and fundamental concepts that define the methods to create "breakthroughs in current performance." The Six Sigma Model for Performance Improvement, popularized by Motorola and GE, is the most widely used method for attaining breakthrough. Although this is covered in detail in Chapter 12, Six

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Sigma: Improving Process Effectiveness, we will focus on setting a foundation, presenting key terms, and making critical distinctions between similar, but different, contemporary methods to improve performance. This chapter will focus on leadership's role in creating a strategy that enables the organization to continue to improve year after year.

High Points of This Chapter

1. A breakthrough in current performance aims to eliminate failures such as excessive number of defects, excessive delays, excessively long time cycles, and the high costs of poor quality due to poorly performing processes.
2. The Juran Universal Sequence for Breakthrough, identified in the 1950s, consists of six steps to achieve superior results. The steps are
   a. Nominate and identify problems. (Management does this.)
   b. Establish a project and team. (Management does this.)
   c. Diagnose the cause(s). (The project team does this.)
   d. Remedy the cause(s). (The project team plus the work group where the cause[s] originate do this.)
   e. Hold the gains. (The project team and affected operating forces do this.)
   f. Replicate results and nominate new projects. (Management does this.)
3. All improvement happens project by project. To achieve breakthrough requires leaders to define goals and projects that are resourced to ensure completion and results.
4. It is upper management's responsibility to mandate breakthrough. Specifically, upper management must
   a. Establish multifunctional councils or steering teams to prioritize projects.
   b. Nominate and select breakthrough projects.
   c. Create project charters that include problem and goal statements.
   d. Provide resources, especially people and time, to carry out the project.
   e. Assign teams, team leaders, facilitators, "Black Belts" to projects.
   f. Review progress, remove barriers, and manage cultural resistance.
   g. Provide recognition and rewards.
5. Project selection requires expertise and practice on the part of management, so "doable" projects are identified so that the team clearly understands both the problem and the goal.
6. To attain a breakthrough in current performance requires two "journeys": the diagnostic journey and the remedial journey. These journeys represent the application of the fact-based method to solve the performance problems.
7. The diagnostic journey proceeds as follows:
   a. From problem to symptoms of the problem
   b. From symptoms to theories of causes of the symptoms
   c. From theories to testing of the theories
   d. From tests to establishing root cause(s) of the symptoms

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8. The remedial journey proceeds as follows:
   a. From root cause(s) to design of remedies of the cause(s)
   b. From design of remedies to testing and proving the remedies under operating conditions
   c. From workable remedies to dealing with predictable resistance to change
   d. From dealing with resistance to establishing new controls on the remedies to hold the gains
9. There have been numerous efforts to create simpler and less intensive improvement methods. Most of them failed to deliver the results. The Six Sigma DMAIC Improvement Model has gained wide acceptance and is the most widely used. This will be covered in more detail in Chapter 12, Six Sigma: Improving Process Effectiveness. It follows these basic steps:
   a. Select the problem and launch a project. (Management does this.)
   b. Define the problem. (Champions and Management do this.)
   c. Measure the magnitude of the symptoms. (The project team does this.)
   d. Analyze information to discover the root cause(s). (The project team does this.)
   e. Improve by providing a remedy for the cause(s). (Project teams do this.)
   f. Control to hold the gains. (Project team and departments do this.)
10. All projects and teams will encounter obstacles when making changes. Objections will be raised by various sources. There may be delaying tactics or rejection by a manager, the work force, or the union. We refer to this as resistance to change. All managers must understand how to overcome this resistance.

The Universal Sequence for Breakthrough

Improvement happens every day, in every organization—even among the poor performers. That is how businesses survive—in the short term. Improvement is an activity in which every organization carries out tasks to make incremental improvements, day after day. Improvement is different from breakthrough improvement. Breakthrough requires special methods and support to attain significant changes and results. It also differs from planning and control. Breakthrough requires taking a "step back" to discover what may be preventing the current level of performance from meeting the needs of its customers. This chapter focuses on attaining breakthrough improvement and how leaders can create a system to increase the rate of improvement. By attaining just a few (the Pareto principle) vital breakthroughs year after year, the organization can outperform its competitors and meet stakeholder needs.

As used here, "breakthrough" means "the organized creation of beneficial change and the attainment of unprecedented levels of performance." Synonyms are "quality improvement" or "Six Sigma improvement." Unprecedented change may require attaining a Six Sigma level (3.4 ppm) or 10-fold levels of improvement over current levels of process performance. Breakthrough results in significant cost reduction, customer satisfaction enhancement, and superior results that will satisfy stakeholders.

"The concept of a universal sequence evolved from my experience first in Western Electric Organization (1924–1941) and later during my years as an independent consultant, starting in 1945. Following a few preliminary published papers, a universal sequence was published in

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book form (Juran 1964). This sequence then continued to evolve based on experience gained from applications by operating managers.

The creation of the Juran Institute in 1979 led to the publication of the videocassette series *Juran on Breakthrough* (Juran 1981). This series was widely received and was influential in launching breakthrough initiatives in many organizations. These organizations then developed internal training programs and spelled out their own versions of a universal sequence. All of these have much in common with the original sequence published in 1964. In some cases, the organizations have come up with welcome revisions or additions."

Breakthrough means change: a dynamic, decisive movement to new, higher levels of performance. In a truly static society, breakthrough is taboo, forbidden. There have been many such societies, and some have endured for centuries. During those centuries, their members either suffered or enjoyed complete predictability. They knew precisely what their station in life was—the same as that lived out by their forebears—but this predictability was, in due course, paid for by a later generation. The price paid was the extinction of the static society through conquest or another takeover by some form of society that was on the move. The threat of extinction may well have been known to the leaders of some of these static societies. Some gambled that the threat would not become a reality until they were gone. It was well stated in Madame de Pompadour's famous letter to Louis XV of France: "After us, the deluge."

History is vital to today's leaders. The threat to the static society stems from basic human drives: the drive for more of everything—knowledge, goods, power, and wealth. The resulting competition is what makes breakthrough important (Juran 1964).

There is an unvarying sequence of events by which we break out of the old levels of performance and into the new. The details of this sequence are important. The starting point is the attitude that a breakthrough is both desirable and feasible. In human organizations, there is no change unless there is first an advocate of change. If someone does not want change, there is a long, hard road before change is finally achieved. The first step on that road is someone's belief that a change—a breakthrough—is desirable and feasible. That change is desirable is mainly an act of faith or belief. Feasibility requires some digging. This leads to the second step.

The second step is to see whether a breakthrough is likely to happen if we mobilize for it—a feasibility study or demonstration project. This study will help separate the problem into major parts, the vital few from the useful many. I call this the Pareto analysis. These vital few problems then become the subject of a drive for new knowledge. But the creation of new knowledge does not just happen—we must organize for it. This leads to the next step.

Organization for breakthrough in knowledge is next. It requires that we appoint or create two systems: one that directs or guides the breakthrough, and one that does the fact-gathering and analysis. We call them the steering arm and the diagnostic arm, respectively. For breakthrough in knowledge, both of these arms are necessary. Neither one alone is sufficient. When both are in place, diagnosis begins. Facts are collected and examined, and new knowledge gained. At this stage, a breakthrough in knowledge has been achieved.

However, a breakthrough in knowledge does not automatically create a breakthrough in performance. Experience has shown that the technical changes needed usually affect the status, habits, beliefs, etc., of the people involved. Anthropologists have given the name "cultural pattern" to this collection of human beliefs, practices, etc.

Breakthroughs in the cultural pattern are in this way an added essential step. Before new levels of performance can be reached, we must discover the effect of the proposed changes on the cultural pattern and find ways to deal with the resistances generated. This turns out at times to be a difficult and important problem.

Finally, a breakthrough in performance can be achieved. This is the result we had set out to attain. To sustain it, we must rely on controls to maintain the status quo until another breakthrough comes along.

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Two Kinds of Breakthrough

Breakthrough can be aimed at both sides of quality.

1. *Having higher-quality product and service features* provides customer satisfaction and revenue for the producing organization. These product features drive revenue.
2. *Achieving freedom from failures will reduce* customer dissatisfaction and nonvalue-added waste. To the producing organization, reducing the product failures, which reduce costs, is a target for breakthrough.

Breakthrough is applicable to any industry, problem, or process. To better understand why so many organizations create extensive quality improvement programs such as Lean Six Sigma we must contrast planning versus improvement. In the previous chapter, we discussed the quality planning process to design features.

Breakthrough to reduce excess failures and deficiencies may consist of such actions as

- Increase the yield of production processes
- Reduce error rates of administrative reports
- Reduce field failures
- Reduce claim denials
- Reduce the time it takes to perform critical patient clinical procedures

The result in both cases is performance improvement, which can lead to performance excellence. However, the rate of improvement required to attain market leadership needs to move at a revolutionary rate, and this often eludes most organizations. The methods and tools used to secure superior results are fundamentally different from day-to-day improvement methods, and for subtle reasons.

Creating breakthrough to increase revenue starts by setting strategic goals, such as new product development goals to provide best-in-class features, or reducing cycle times to beat the competition. Meeting such new goals requires a systematic "quality planning" process (Juran 1999). Multiple levels of quality planning are needed. An organization needs to plan new products or to design for quality. Other forms of quality planning are to design for manufacturing, Design for Six Sigma, and even Design for Green and Lean.

Quality planning differs from most product and service development methods in that it is carried out through a universal series of steps focusing on understand the "voice of the customers" (internal and external) and incorporating it into the design of the product. The best design methods always begin with an identification of who we are designing for. In other words, who are the "customers?" This is often followed by determining the needs of those customers, then developing the product or service features required to meet those needs, and so on. Collectively, this series of steps is the "quality planning or quality by design roadmap." Creating breakthroughs in design is covered in Chapter 4, Quality Planning: Designing Innovative Products and Services.

Many organizations maintain an organized approach for evolving new products and services, year after year. Under this organized approach

- Product development projects are a part of the business plan.
- A new product development function maintains business surveillance over these projects.
- Full-time product and process development departments are equipped with personnel, laboratories, and other resources to carry out the technological work.

- There is clear responsibility for carrying out the essential technological work.
- A structured procedure is used to process the new developments through the functional departments.
- The continuing existence of this structure favors new product development on a year-to-year basis.

This special organizational structure, while necessary, is not sufficient to ensure good results. In some organizations, the cycle time for getting new products to market is lengthy, the new models compete poorly in the market, or new chronic wastes are created. Such weaknesses usually are traceable to weaknesses in the planning process.

In the case of too many nonvalue-added tasks or too high a cost associated with chronic waste, the product or service is already in production, the goals are already in place. The processes for meeting those goals and the means to maintain them are being carried out by the workforce. However, the resulting products (goods and services) do not always meet the goals. Consequently, the approach to reducing these nonvalue-added tasks or chronic waste is different from the design or planning methods. Instead, to attain breakthroughs in current levels of performance, we must first have management commit to a program of quality improvement such as Six Sigma. This program can provide the means to identify the problems and then discover their causes. The organization must make the time to carry out a diagnosis of the current process. Once the causes are uncovered, remedies can be applied to remove the causes. It is this approach—to attain breakthroughs—that is the subject of this chapter.

Continuing to attain breakthrough is needed to meet the changing needs of customers, which are a moving target. Competitive prices are also a moving target. However, breakthroughs in improvement usually lag behind breakthroughs in design. They have progressed at very different rates. The chief reason is that many upper managers give a higher priority to increasing revenue from other means than on focusing resources on attaining breakthroughs by achieving unprecedented levels of performance in this way. This difference in priority is usually reflected in the respective organizational structures. An example is seen in the approach to new product development.

Historically, the efforts to meet the competition and improve performance proceeded along two lines based on two very different philosophies:

- Political leaders focused on traditional political solutions—import quotas, tariffs, legislation on "fair trade," and so on.
- Business leaders increasingly became convinced that the necessary response to competition was to become more competitive. This approach required applying the lessons learned from the role models across the entire national economy. Such a massive scaling up has extended well into the twenty-first century.

The experience of recent decades has led to an emerging consensus that managing for quality (planning, control, and improvement) is one of the most cost-effective means to deal with the threats and opportunities, and provide a means of actions that need to be taken. As it relates to breakthrough, the high points of this consensus include the following:

- Global competition has intensified and has become a permanent unpleasant fact. A needed response is to create a high rate of breakthrough, year after year.
- Customers are increasingly demanding improved products from their suppliers. These demands are then transmitted through the entire supplier chain. The demands may go beyond product breakthrough and extend to improving the system of managing for quality.

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- The chronic wastes can be huge in organizations that do not have a strategic program aimed at reducing them. In many organizations during the early 1980s, about a third of all work consisted of redoing what was done previously, due to deficiencies. By the end of the 1990s, this number improved to only 20 to 25 percent (estimated by the authors). The emerging consensus is that such waste should not continue, since it reduces competitiveness and profitability.
- Breakthroughs must be directed at all areas that influence an organization's performance: all business, transactional, and manufacturing processes.
- Breakthroughs should not be left solely to voluntary initiatives; they should be built into the strategic plan and DNA of a system. They must be mandated.
- Attainment of market leadership requires that the upper managers personally take charge of managing for quality. In organizations that did attain market leadership, the upper managers personally guided the initiative. The authors are not aware of any exceptions.

Unstructured Reduction of Chronic Waste

In most organizations, the urge to reduce costs has been much lower than the urge to increase sales. As a result:

- The business plan has not included goals for the reduction of chronic waste.
- Responsibility for such breakthroughs has been vague. It has been left to volunteers to initiate action.
- The needed resources have not been provided, since such breakthroughs have not been a part of the business plan.

The lack of priority by upper managers is traceable in large part to two factors that influence the thinking processes of many upper managers:

- Not only do many upper managers give top priority to increasing sales, but some of them even regard cost reduction as a form of lower-priority work that is not worthy of the time of upper managers. This is especially the case in high-tech industries.
- Upper managers have not been aware of the size of the chronic waste, nor of the associated potential for high return on investment. The "instrument panel or scorecards" available to upper managers have stressed performance measures such as sales, profit, cash flow, and so on, but not the size of chronic waste and the associated opportunities. The managers have contributed to this unawareness by presenting their reports in the language of specialists rather than in the language of management—the language of money.

Breakthrough Models and Methods

Breakthrough addresses the question, How do I reduce or eliminate things that are wrong with my products, services, or processes and the associated customer dissatisfaction? Breakthrough models must address problems that create customer dissatisfaction, products and services of poor quality, and failures to meet the specific needs of specific customers, internal and external.

Based on my research, attaining breakthroughs in current performance by reducing customer-related problems has one of the greatest returns on investment and usually comes down to correcting just a few types of things that go wrong, including

- Excessive number of defects
- Excessive numbers of delays or excessively long time cycles
- Excessive costs of the resulting rework, scrap, late deliveries, dealing with dissatisfied customers, replacement of returned goods, loss of customers and clients, loss of goodwill, etc.
- High costs and ultimately high prices, due to the waste

Effective breakthrough models require that

- Leaders mandate it, project by project year after year
- Projects be assigned to teams that must discover root causes of the problems to sustain the gains
- Teams devise remedial changes to the "guilty" processes to remove or deal with the cause(s)
- Teams work with functions to install new controls to prevent the return of the causes
- Teams look for ways to replicate the remedies to increase the effect of the breakthrough
- All teams must follow a systematic fact-based method, which requires making two journeys:
  - *The diagnostic journey.* From symptoms (evidence a problem exists) to theories about what may cause the symptom(s); from theories to testing of the theories; from tests to establishing root cause(s). Once the causes are found, a second journey takes place.
  - *The remedial journey*. From root causes to remedial changes in the process to remove or deal with the cause(s); from remedies to testing and proving the remedies under operating conditions; from workable remedies to dealing with resistance to change; from dealing with resistance to establishing new controls to hold the gains.
- Regardless of what your organization calls or brands its improvement model, breakthrough results only occur after the completion of both journeys.

It has been more than 50 years since I first published articles on the universal sequence for breakthrough. Over that stretch of time, I have witnessed many models and many organizations trying to simplify, reengineer, and rename this simple method called breakthrough. Some have worked; some have not.

The most recent success is Six Sigma or Six Sigma DMAIC. Six Sigma has become the most effective "brand" of improvement since the Motorola Corporation first began using the quality improvement method I espoused in the late 1970s. Six Sigma methods and tools employ many of these universal principles. They have been combined with the rigor of statistical and technological tools to collect and analyze data.

GE's former chairman, Jack Welch, defined Six Sigma in this way: "Six Sigma is a quality program that, when all is said and done, improves your customers' experiences, lowers your costs and builds better leaders" (Welch 2005).

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We will discuss Six Sigma in detail and fill in the blanks on its steps: Define, Measure, Analyze, Improve, and Control in Chapter 12, Six Sigma: Improving Process Effectiveness.

A Breakthrough Improvement Case

The following is the outline of the anatomy of a breakthrough improvement project. Because this book is written as a guide, we will limit our detailed discussions to some of the more important activities that are carried out by management. Each of the following topics that are outlined contains a large body of technical knowledge, tools, and techniques.

Identify a project (Management does this):

- Nominate projects.
- Evaluate projects.
- Select a project.
- Determine if this is a design project, an improvement project, or another type, such as a lean project.

Establish the project (the champions do this):

- Prepare a problem statement and a goal statement.
- Select a facilitator, or in a Six Sigma Program, a Black Belt or expert (see Chapter 12, Six Sigma: Improving Process Effectiveness).
- Select and launch a team.

Diagnose the cause (the project team and Black Belts do this):

- Analyze symptoms.
- Confirm and quantify or modify the goal.
- Formulate theories of causes.
- Test likely theories of causes.
- Identify root cause(s).

Remedy the cause (the project team and the workgroup where the cause[s] originate do this, perhaps with assistance from many others who are affected by, or who contribute to, the remedy):

- Evaluate alternative remedial changes.
- Design the solution, remedy, and changes needed to eliminate the root causes.
- Design new controls to hold the gains.
- Design for the culture (prevent or overcome resistance to the remedial changes).
- Prove the effectiveness of the remedy under operating conditions.
- Implement the remedial changes.

Hold the gains (the project team and the affected operating forces do this):

- Design and implement effective controls.
- Mistake-proof the process, as necessary.
- Audit the controls.

Replicate results and nominate new projects (Management does this):

- Replicate the results (clone, perhaps with modifications, the remedy).
- Nominate new projects based on lessons learned from the last project.
- Organize leaders into "performance excellence" or "quality councils."
- Select problems or new goals that need to be improved, and establish projects for them.
- Create project charters: problem and goal statements.
- Provide resources: training, staff, expertise, coaching, and especially time to complete the improvement.
- Assign teams and projects to teams to stimulate remedies and controls.
- Review progress and provide recognition and rewards.

The Mysterious Damage to Linoleum in Manufactured Housing

Here is a brief case of a straightforward, relatively simple (yet valuable) project that illustrates the breakthrough improvement methodology.

Nearly half of the residential single-family dwelling units built in the United States are manufactured on moving production lines. The modular units are transported to remote locations, joined together there, and set upon prepared foundations on the home purchaser's lot. It is hard to tell the difference between an assembled manufactured house and a stick-built house once they are finished and landscaped.

A large manufacturer of modular housing units was dissatisfied with the level of very expensive rework some of its factories in various locations around the country were experiencing. Customer dissatisfaction was rising; profits were eroding. Quality councils consisting of the general manager and all direct reports were formed at each factory. They received training in quality improvement, identified the most expensive rework, formed and trained teams in quality improvement, and set them to reducing the amount of rework. This is the story of one such improvement project. We begin by identifying the problem.

Identify the Problem: One Factory's Quality Council Listed and Prioritized Its Rework Problems Using the Pareto Analysis

The Pareto distribution (arranged in descending order of cumulative percent) of their most costly rework types during the past six months looked as follows (learn more about the Pareto analysis in Chapter 18, Core Tools to Design, Control, and Improve Performance):

- Replacing damaged linoleum: 51 percent
- Repairing cut electrical wires in walls: 15 percent
- Replacing missing fixtures at the site: 14 percent
- Repairing leaks in water pipes: 12 percent
- Repairing cracks in drywall: 8 percent

Based on the Pareto analysis, the quality council selected public enemy number one: replacing damaged linoleum. This problem is expensive to repair. Often, walls had to be removed and new linoleum laid, followed by replacing the wall. The next step was to establish a legitimate project with responsibility to resolve the problem.

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Establish the Project

- A problem statement was formulated: *"The excess number of occurrences of replacing damaged linoleum accounts for 51 percent of all rework."*
- The goal statement was provided to the team as to the direction they should take: *"Reduce the number of occurrences of replacing damaged linoleum."*

Note that both the problem and goal are described and the variable and unit of measure in the problem statement and goal statement are identical. This is important because the problem statement tells the team what problem it is trying to solve. The rest of the project focuses on whatever the council selects as the problem; if they do not match, the team may carry out the goal and not solve the problem. The council chartered a project team consisting of representatives of the workstations where the linoleum was installed and where the damaged linoleum was observed. The council appointed a worker in one of those workstations to be the project team leader. The project team leader received training not only in quality improvement, but also in leading a project team. A trained facilitator coached the team in the breakthrough improvement methodology. The team began its diagnostic journey: the journey from symptom to cause.

Diagnose the Cause

The team's first task was to analyze the symptoms. (Symptoms are outward evidence of the problem.) The primary symptom was, of course, the number of occurrences of replacing damaged linoleum. Secondary symptoms were the cost of replacement, the various types of damage, the location where the damage showed up, downtime due to replacement, overtime to do the replacement, and the like. The symptoms were analyzed by *defining* them, *quantifying* them, and *visualizing* them. What follows is an analysis of the primary symptom.

Various types of damage were identified and defined as gouges, scrapes, cuts, gaps, and smears. A flow diagram was constructed showing all operations in all workstations that related to linoleum or replacement of linoleum. The flow diagram also identified the workstations where damage showed up. Several Pareto analyses were performed. The first Pareto was "by type of damage." It showed

- Gouges (dents): 45 percent
- Scrapes: 30 percent
- Cuts: 21 percent
- Gaps: 4 percent
- Smears: 2 percent

Accordingly, the team now focused temporarily on the top priority: gouges.

A second Pareto analysis of gouges by location in the house was performed. It showed which areas of the home had the most occurrences of damage:

- Kitchen: 38 percent
- Interior hall: 21 percent
- Bathroom 1: 18 percent
- Bathroom 2: 14 percent
- Laundry: 9 percent

Now the team refocused their attention on gouges in kitchens to the temporary exclusion of all the other symptoms. The Pareto principle states that for any given effect (an output of a process or a symptom in this case), there are a number of contributors. These contributors make unequal contributions. By far, a relatively few contributors make the greatest contribution. These are called the "vital few." Some contributors occur less often and are called the "useful many." Following the Pareto analysis, the team concentrated on the vital few contributors to the problem to get the greatest return for the least effort.

A third Pareto analysis of gouges in kitchens by work shift showed no difference in occurrences between shifts, indicating that "shift" is not a contributor to gouges in kitchens. Based on the experience of the team, they next generated a list of theories (or hypotheses) about what causes gouges in kitchens. They generated a long list of theories. The most compelling ones were

- Dropping heavy, sharp objects (tools)
- Dragging objects across the floor
- Grit on boots of employees
- Careless employees
- No protection for the new linoleum

In the manufactured housing industry, it is known that the first three theories, if they in fact occur, cause gouges in linoleum. Those theories did not need testing. What about "lack of protection"? The only way to test that theory is first to correlate gouges in kitchens with the presence or absence of protection. The team arranged that all reports of linoleum damage or replacement would include an indication if protection was "present."

When this was done, it was discovered that virtually all cases of gouge damage to linoleum occurred when floor protection was missing. Furthermore, the team discovered that there was no formal control plan for protection to be installed. Consequently, no quality inspections or quality assurance checks revealed that no controls were being exercised and that none even existed! Floor protection was a haphazard phenomenon at best.

Remedy the Cause

Workers, purchasing personnel, and engineers went to work to select and procure material that was strong and economical to lay on freshly installed linoleum. All agreed that the operator would be responsible for laying it immediately after each job, and that supervisors would check to see that it happened. Incidents of gouge damage—and other types of damage—to linoleum went down dramatically. (It seemed several damage types had common causes, one of which was no protection.) For a few weeks, damage to linoleum almost entirely disappeared. Celebrations were held. The plant manager began to look forward to granting bigger bonuses—and getting one himself!

At the weekly meeting of the factory management team a few weeks later, the quality manager reported the mysterious reappearance of gouge damage. This news was greeted with incredulity and disappointment. "We thought we had gouge damage licked!" Indeed they had, except for a couple of "small details."

Hold the Gains

When the team investigated, it discovered that (1) no formal control plan for providing protection had been devised and published; (2) there had been a turnover of workers in the various workstations who had not been trained in the procedure; and (3) the new workers had not been trained because there was no published plan; what's more, there also was no

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formal training program (with controls to ensure that training actually happened). Consequently, no training could or did take place. It became apparent that the "factory" operated more like a construction site under a roof, with standards upheld by the skill and pride of artisans. A factory, by contrast, is characterized by more formal procedures and controls. All this was a valuable lesson learned for all concerned, and led to a number of additional new improvement and planning projects, new attitudes toward the work, and a maturing of the plant as it evolved from construction site to factory. Controls and training were formalized.

Initiatives of the Past

In response to a crisis or economic downturns, many organizations, especially in the United States, undertake "improvement" initiatives to improve their performance. For various reasons, many of these initiatives fall far short of their goals. Some of the methods selected were doomed from the beginning; however, a few organizations made stunning breakthroughs, improved their performance, and became the role models, the market leaders in best practices.

The methods used by these role models have been analyzed and provide us with some lessons learned—the actions that are needed to attain breakthrough and market leadership and what methods and tools must be used to enable those results to happen.

Breakthrough Lessons Learned

My analysis of the actions taken by the successful organizations shows that most of them carried out many or all of the following tasks or strategies:

1. They enlarged the business plan at all levels to include annual goals for breakthrough and customer satisfaction.
2. They implemented a systematic process for making breakthroughs and set up special infrastructure or organizational machinery to carry out that process.
3. They adopted the big Q concept—they applied the breakthrough methods to all business processes, not just the manufacturing processes.
4. They trained all levels of personnel, including upper management, in the methods and tools to carry out their respective goals.
5. They enabled the workforce to participate in making breakthroughs in their daily work practices.
6. They established measures and scorecards to evaluate progress against the breakthrough goals.
7. The managers, including the upper managers, reviewed progress against the breakthrough goals.
8. They expanded the use of recognition and revised the reward system to recognize the changes in job responsibilities and using the new methods and tools.
9. They renewed their programs every few years to include changes to their programs as their performance improved.
10. They created a "rate of improvement" that exceeded the competition's.

The Rate of Breakthrough Is Most Important

The tenth lesson learned is an important one. Just having a system of breakthrough may not be enough. This lesson learned demonstrated that the annual rate of breakthrough

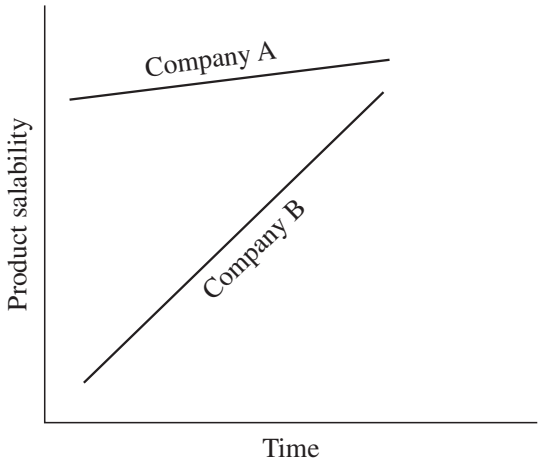

Figure 5.1 Two contrasting rates of improvement. (*Juran Institute, Inc., 2009.*)

determines which organizations will emerge as the market leaders. Figure 5.1 shows the effect of differing rates of breakthrough.

In this figure, the vertical scale represents product salability, so what goes up is good. The upper line shows the performance of Organization A, which at the outset was the industry leader. Organization A kept getting better, year after year. In addition, Organization A was profitable. Organization A seemed to face a bright future.

The lower line shows that Organization B, a competitor, was at the outset not the leader. However, Organization B is improving at a rate much faster than that of Organization A. Organization A is now threatened with loss of its leadership when Organization B surpasses them. The lesson is clear:

> **The most decisive factor in the competition for market leadership is the rate of breakthrough an organization maintains.**
>
> **–Joseph M. Juran**

The sloping lines of Figure 5.1 help to explain why Japanese goods attained market leadership through quality in so many products. The major reason was that the Japanese organizations' rate of breakthrough was for decades revolutionary when compared with the evolutionary rate of the West. Eventually, they had to surpass the evolutionary rate of the Western organizations. The result was an economic disaster for many U.S. organizations in the early 1980s. Today, U.S. automobile manufacturers have made great strides in quality while Toyota has had recalls. Figure 5.2 shows my estimate of the rates of breakthrough in the automobile industry from 1950–1990.

There are also lessons to be learned from the numerous initiatives to improve competitiveness during the 1980s, some of which failed to produce bottom-line results. The introduction of quality circles, employee involvement teams, TQM, reengineering, and National Quality Awards all were methods used to respond to the Japanese quality revolution. Some were not sustainable and failed. Each of them may have helped the organization that used them at that point in time. An important lesson does stand out. The initiatives showed us that attaining a revolutionary rate of breakthrough is not simple at all. It takes a strategic focus to sustain market leadership. Only the National Quality Awards continue today in most parts of the world. Organizations that made statements like, Quality is dead or TQM

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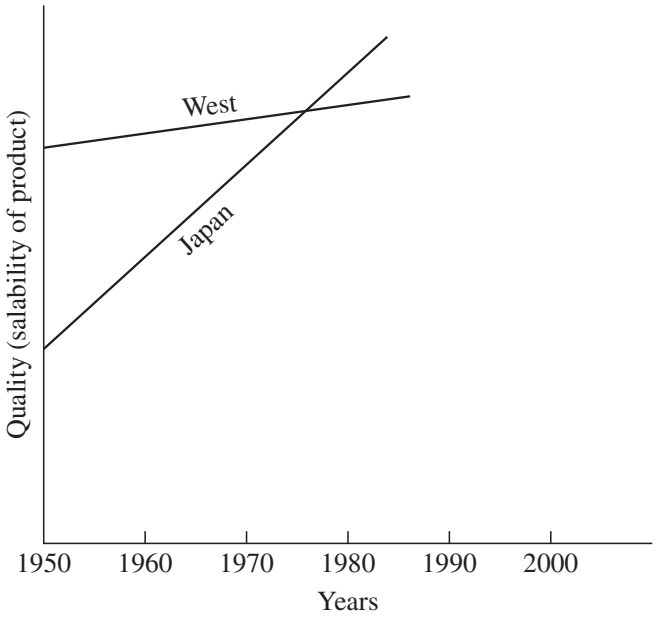

Figure 5.2 Estimate of rates of quality improvement in the automobile industry. (*Juran Institute, Inc., 1994. Used by permission.*)

did not work, blamed the methodology for their failures. This was only partially true. In some cases, the wrong method was selected and in others, their own management did not deal with the numerous obstacles and cultural resistance that prohibited these methods from working in the first place. These obstacles and the means to manage them will be discussed throughout this chapter.

The Breakthrough Fundamentals

Creating breakthroughs rests on just a few fundamental concepts. For most organizations and managers, annual breakthrough is not only a new responsibility; it is also a radical change in the style of management—a change in the organization's culture. Therefore, it is important to grasp the basic concepts before getting into the breakthrough process itself.

Breakthrough Distinguished from Design and Control

Breakthrough improvement differs from design (planning) and control. The trilogy diagram (Figure 5.3) shows this difference. In this figure, the chronic waste level (the cost of poor quality) was originally about 23 percent of the amount produced. This chronic waste was built into the process—"It was planned that way." Later, a breakthrough improvement project reduced this waste to about 5 percent. Under my definition, this reduction in chronic waste is a breakthrough—it attained an unprecedented level of performance.

Figure 5.3 also shows a "sporadic spike"—a sudden increase in waste to about 40 percent. Such spikes are unplanned—they arise from various unexpected sources. The personnel promptly got rid of that spike and restored the previous chronic level of about 23 percent. This action did not meet the definition of a breakthrough. It did not attain an unprecedented level of performance. It removed the spike and returned performance to the planned level. This is referred to as root-cause analysis, taking corrective action, or "firefighting."

Creating breakthroughs in current performance differs from creating breakthroughs in design. Current performance has well-known customer needs and targets. New product or

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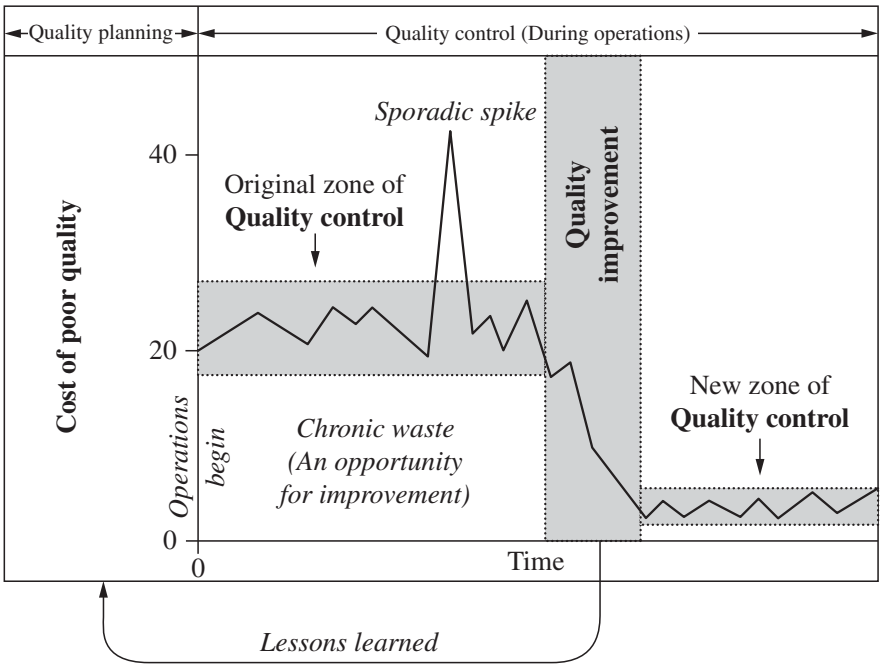

Figure 5.3 The Juran Trilogy®. (*Juran Institute, Inc., 1986.*)

service development is trying to create something new that meets a new need of the customer. It is new, innovative, and requires proper planning.

All three—design, control, and improvement—result in better performance, and all use teams to get there. It is only the steps that must be carried out that are different. This is analogous to a carpenter, electrician, and a plumber. Each tradesperson works on building a home or solving a problem (leaky pipes, rotted wood, failed circuit breaker). They have common methods and use similar tools, but at different times and for different purposes.

All Breakthrough Takes Place Project by Project

There is no such thing as breakthrough in a general way. All breakthrough takes place project by project and in no other way.

As used here, "breakthrough" means "the solving of a chronic problem by scheduling (launching a project) to find a solution." Since the word breakthrough has multiple meanings, the organization should create a glossary and educate all employees on what it means. The definition is helped by presenting a few examples that were carried out successfully in your organization.

Breakthrough Is Applicable Universally

The huge numbers of projects carried out during the 1980s and 1990s demonstrated that breakthrough is applicable to all:

- Service industries as well as manufacturing industries
- Business processes as well as manufacturing processes
- Support activities as well as operations
- Software- and information-based industries

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During this period, breakthrough was applied to virtually all industries, including government, education, and health. In addition, breakthrough has been applied successfully to the entire spectrum of organization functions: finance, product development, marketing, legal, and so on.

In one organization, the legal vice president doubted that breakthrough could be applied to legal work. Yet within two years, she reduced by more than 50 percent the cycle time of filing for a patent. (For elaboration and many more case examples, see the Juran Institute e-Lifeline at www.juran.com.)

Breakthrough Expands to Many Parameters

Published reports of breakthroughs show that the effects have extended to all parameters:

- *Productivity*. The output per person-hour.
- *Cycle time*. The time required to carry out processes, especially those that involve many steps performed sequentially in various departments. Chapter 8, Business Process Management: Creating an Adaptable Organization, elaborates on breakthrough as applied to such processes.
- *Human safety*. Many projects improve human safety through mistake-proofing, fail-safe designs, and so on.
- *The environment*. Similarly, many projects have been directed at protecting the environment by reducing toxic goals and so on.

Some projects provide benefits across multiple parameters. A classic example was the color television set. The Japanese Matsushita Organization had purchased an American color television factory (Quasar). Matsushita then made various breakthroughs, including

- Product redesign to reduce field failures
- Process redesign to reduce internal defect rates
- Joint action with suppliers to improve purchased components

The results of these and other changes are set out in the before and after data:

	1974	1977
Fall-off rate, i.e., defects (on assembled set) requiring repair	150 per 100 sets	4 per 100 sets
Number of repair and inspection personnel	120	15
Failure rate during the warranty period	70%	10%
Cost of service calls	$22 million	$4 million

The manufacturer benefited in multiple ways: lower costs, higher productivity, more reliable deliveries, and greater salability. The ultimate users also benefited—the field failure rate was reduced by more than 80 percent.

The Backlog of Breakthrough Projects Is Never-Ending

The existence of a huge backlog of problems to solve is evident from the numbers of breakthroughs actually made by organizations that carried out successful initiatives during the 1980s and 1990s. Some reported making breakthroughs by the thousands, year after year. In very large organizations, the numbers are higher still, by orders of magnitude.

The backlog of breakthrough projects exists in part because of internal and external factors. Internally, the planning of new products and processes has long been deficient. In effect, the planning process has been a dual hatchery. It hatched out new plans. It also hatched out new chronic wastes, and these accumulated year after year. Each such chronic waste then became a potential breakthrough project.

A further reason for a huge backlog is the nature of human ingenuity—it seems to have no limit. Toyota Motor Corporation has reported that its 80,000 employees offered four million suggestions for breakthrough during a single year—an average of 50 suggestions per person per year (Sakai 1994).

Externally, the constantly changing needs of customers and our society will always challenge the status quo. Targets today are not good enough for tomorrow. This creates a never-ending backlog of projects.

Breakthrough Does Not Come Free

Breakthrough and the resulting reduction of chronic waste do not come free—they require an expenditure of effort in several forms. It is necessary to create an infrastructure to mobilize the organization's resources toward annual breakthrough. This involves setting specific goals to be reached, choosing projects to be tackled, assigning responsibilities, following progress, and so on.

There is also a need to conduct extensive training in the nature of the breakthrough improvement methods and tools, how to serve on breakthrough teams, how to use the tools, and so on.

In addition to all this preparatory effort, each breakthrough improvement project requires added effort to conduct diagnoses to discover the causes of the chronic waste and provide remedies to eliminate the causes. This is the time it takes for all the people involved in the team to solve the problem.

The preceding adds up to a significant front-end outlay, but the results can be stunning. They *have* been stunning in the successful organizations, the role models. Detailed accounts of such results have been widely published, notably in the proceedings of the annual conferences held by the U.S. National Institute for Standards and Technology (NIST), which administers the Malcolm Baldrige National Award.

Reduction in Chronic Waste Is Not Capital-Intensive

Reduction in chronic waste seldom requires capital expenditures. Diagnosis to discover the causes usually consists of the time of the breakthrough project teams. Remedies to remove the causes usually involve fine-tuning the process. In most cases, a process that is already producing more than 80 percent good work can be raised to the high 90s without capital investment. Such avoidance of capital investment is a major reason why reduction of chronic waste has a high return on investment (ROI).

In contrast, projects to create breakthroughs in product design and development to increase sales can involve costly outlays to discover customer needs, design products and processes, build facilities, and so on. Such outlays are largely classified as capital expenditures and thereby lower the ROI estimates. There is also a time lag between investing in design and receiving revenue from the sale of the new designs.

The Return on Investment for Breakthrough Improvement Is High

This is evident from results publicly reported by national award winners in Japan (Deming Prize), the United States (Baldrige Award), Europe, and elsewhere. More and more organizations have been publishing reports describing their breakthroughs, including the gains made.

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It has been noted that the actual return on investment from breakthrough projects has not been well researched. My own research conducted by examining papers published by organizations found that the average breakthrough project yielded about $100,000 of cost reduction (Juran 1985). The organizations were large—sales in the range of over $1 billion per year.

I have also estimated that for projects at the $100,000 level, the investment in diagnosis and remedy combined runs to about $15,000 or 15 percent. The resulting ROI is among the highest available to managers. It has caused some managers to quip, "The best business to be in is breakthrough." Today, breakthrough projects return many more dollars, but the cost of attaining breakthrough has not changed from the 15 percent investment level.

I am astounded by some of the recent organizations that have become world quality leaders using the project-by-project approach of Six Sigma. One of them is Samsung Electronics.

Samsung Electronics Co. (SEC) of Seoul, Korea, has perfected its fundamental improvement approach using Six Sigma as a tool for innovation, efficiency, and quality. SEC was founded in 1969 and sold its first product, a television receiver, in 1971. Since that time, the company has used tools and techniques such as total quality control, total process management, product data management, enterprise resource management, supply chain management, and customer relationship management. Six Sigma was added to upgrade these existing innovations and improve SEC's competitive position in world markets. The financial benefits made possible by Six Sigma, including cost savings and increased profits from sales and new product development, are expected to approach $1.5 billion.

SEC completed 3,290 Six Sigma improvement projects in the first two years; 1,512 of these were Black Belt-level projects. By the third year, 4,720 projects are expected to be completed, 1,640 of them by Black Belts.

SEC's Six Sigma projects have also contributed to an average of 50 percent reduction in defects. There is no thought of improvement in quality and productivity without Six Sigma. These impressive numbers have certainly played a major role in Samsung's recent growth. Some indications of this include the following:

- By 2001, SEC had earned a net income of $2.2 billion on total revenues of $24.4 billion. Market capitalization stood at $43.6 billion.
- According to SEC's 2001 annual report, SEC now is one of the top 10 electronic and electrical equipment manufacturing companies in the world, with the best operating profit ratios and superior fiscal soundness.
- The report also says the debt-to-equity ratio is lower than that of any top ranking company, and the shareholders' equity-to-net-assets ratio surpasses the average.
- SEC says its technological strengths, Six Sigma quality initiatives, and product marketability helped increase its share of the memory chip market in 2001 to 29 percent, monitors to 21 percent, and microwave ovens to 25 percent of those sold worldwide.

Despite a downturn in the world economy and a reduction in exports to the United States, credit for SEC's current operating profit margin of 8.5 percent is due mostly to quality improvements and Six Sigma deployment.

SEC's quality and innovative strategy helped it reach the number-one position in the *BusinessWeek* 2002 information technology guide. The guide noted SEC's computer monitors, memory chips, telephone handsets, and other digital products, focusing on four Standard & Poor's criteria: shareholder return, return on equity, revenue growth, and total revenues.

The *BusinessWeek* ranking was also due to SEC's employees' belief that quality is the single most important reason for the company's higher sales, lower costs, satisfied customers, and profitable growth. Only a few years ago, SEC's products were virtually unknown by Americans or were known as the cheaper, lower-quality substitute for Japanese brands. This perception is changing. The U.S. market now represents 37 percent of SEC's total sales.

The Major Gains Come from the Vital Few Projects

The bulk of the measurable gains comes from a minority of the breakthrough projects—the "vital few." These are multifunctional in nature, so they need multifunctional teams to carry them out. In contrast, the majority of the projects are in the "useful many" category and are carried out by local departmental teams. Such projects typically produce results that are orders of magnitude smaller than those of the vital few.

While the useful many projects contribute only a minor part of the measurable gains, they provide an opportunity for the lower levels of the hierarchy, including the workforce, to participate in breakthrough. We will discuss the useful many projects in Chapter 11, Lean Techniques: Improving Process Efficiency. In the minds of many managers, the resulting gain in work life is as important as the tangible gains in operating performance.

Breakthrough—Some Inhibitors

While the role-model organizations achieved stunning results through breakthrough, most organizations did not. Some of these failures were due to honest ignorance of how to mobilize for breakthrough, but there are also some inherent inhibitors to establishing breakthrough on a year-to-year basis. It is useful to understand the nature of some of the principal inhibitors before setting out.

Disillusioned by the Failures

The lack of results mentioned earlier has led some influential journals to conclude that breakthrough initiatives are inherently doomed to failure. Such conclusions ignore the stunning results achieved by the role-model organizations. (Their results prove that these are achievable.) In addition, the role models have explained how they got those results, thereby providing lessons learned for other organizations to follow. Nevertheless, the conclusions of the media have made some upper managers wary about going into breakthrough.

Higher Quality Costs More

Some managers hold a mindset that "higher costs more." This mindset may be based on the outmoded belief that the way to improve is to increase inspection so that fewer defects escape to the customer. It also may be based on the confusion caused by the two meanings of the word.

Higher in the sense of improved product features (through product development) usually requires capital investment. In this sense, it does cost more. However, higher in the sense of lower chronic waste usually costs less—a lot less. Those who are responsible for preparing proposals for management's approval should be careful to define the key words—which kind are they talking about?

The Illusion of Delegation

Managers are busy people, yet they are constantly bombarded with new demands on their time. They try to keep their workload in balance through delegation. The principle that "a good manager is a good delegator" has wide application, but it has been overdone as applied

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to breakthrough. The lessons learned from the role-model organizations show that going into annual breakthrough adds minimally about 10 percent to the workload of the entire management team, including the upper managers.

Most upper managers have tried to avoid this added workload through sweeping delegation. Some established vague goals and then exhorted everyone to do better—"Do it right the first time." In the role-model organizations, it was different. In every such organization, the upper managers took charge of the initiative and personally carried out certain nondelegable roles.

Employee Apprehensions

Going into breakthrough involves profound changes in a organization's way of life—far more than is evident on the surface. It adds new roles to the job descriptions and more work to the job holders. It requires accepting the concept of teams for tackling projects—a concept that is alien to many organizations and that invades the jurisdictions of the functional departments. It requires training on how to do all this. Collectively, the megachange disturbs the peace and breeds many unwanted side effects.

To the employees, the most frightening effect of this profound set of changes is the threat to jobs and/or status. Reduction of chronic waste reduces the need for redoing prior work and hence, the jobs of people engaged in such redoing. Elimination of such jobs then becomes a threat to the status and/or jobs of the associated supervision. It should come as no surprise if the efforts to reduce waste are resisted by the workforce, the union, the supervision, and others.

Nevertheless, breakthrough is essential to remaining competitive. Failure to go forward puts all jobs at risk. Therefore, the organization should go into breakthrough while realizing that employee apprehension is a logical reaction of worried people to worrisome proposals. A communication link must be opened to explain the why, understand the worries, and search for optimal solutions. In the absence of forthright communication, the informal channels take over, breeding suspicions and rumors.

Additional apprehension has its origin in cultural patterns. (The preceding apprehensions do not apply to breakthrough of product features to increase sales. These are welcomed as having the potential to provide new opportunities and greater job security.)

Securing Upper Management Approval and Participation

The lessons learned during the 1980s and 1990s included a major finding: Personal participation by upper managers is indispensable to getting a high rate of annual breakthrough. This finding suggests that advocates for initiatives should take positive steps to convince the upper managers of

- The merits of planning for annual breakthrough
- The need for active upper management to provide resources
- The precise nature of the needed upper management participation

Proof of the Need

Upper managers respond best when they are shown a major threat or opportunity. An example of a major threat is seen in the case of Organization G, a maker of household appliances.

Model Number	2000	2001	2002	2003
1	G	G	R	R
2	R	R	R	R
3	G	G	G	R
4	T	R	R	R

TABLE 5.1 Suppliers to a Major Customer

Organization G and its competitors, R and T, were all suppliers to a major customer involving four models of appliances. (See Table 5.1.) This table shows that in 2000, Organization G was a supplier for two of the four models. Organization G was competitive in price, on-time delivery, and product features, but it was definitely inferior in the customer's perception of the chief problem being field failures. By 2002, lack of response had cost Organization G the business on model number 1. By 2003, Organization G also had lost the business on model number 3.

Awareness also can be created by showing upper managers other opportunities, such as cost reduction through cutting chronic waste.

The Size of the Chronic Waste

A widespread major opportunity for upper managers is to reduce the cost of poor quality or the costs associated with poorly performing processes. In most cases, this cost is greater than the organization's annual profit, often much greater. Quantifying this cost can go far toward proving the need for a radical change in the approach to breakthrough. An example is shown in Table 5.2. This table shows the estimated cost of poor quality for an organization in a process industry using the traditional accounting classifications. The table brings out several matters of importance to upper managers:

The order of magnitude. The total of the costs is estimated at $9.2 million per year. For this organization, this sum represented a major opportunity. (When such costs have never before been brought together, the total is usually much larger than anyone would have expected.)

The areas of concentration. The table is dominated by the costs of internal failures—they are 79.4 percent of the total. Clearly, any major cost reduction must come from the internal failures.

Category	Amount, $	Percent of Total
Internal failures	7,279,000	79.4
External failures	283,000	3.1
Appraisal	1,430,000	15.6
Prevention	170,000	1.9
	9,162,000	100.0

TABLE 5.2 Analysis of Cost of Poor Quality

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COPQ versus Cost Reduction

Company X wanted to reduce operating costs by 10 percent. It began with a mission to have each executive identify where costs could be cut in business units. The executives created a list of 60 items, including things like eliminating quality audits, changing suppliers, adding new computer systems, reducing staff in customer services, and cutting back R&D.

The executives removed functions that provide quality and services to meet customer needs. They bought inferior parts and replaced computer systems at great expense. They disrupted their organization, particularly where the customers were most affected, and reduced the potential for new services in the future.

After accomplishing this, most of the executives were rewarded for their achievements. The result? Their cost reduction goal was met, but they had dissatisfied employees, upset customers, and an organization that still had a significant amount of expense caused by poor performance.

The financial benefit to the bottom line of an organization's balance sheet by improving the cost of quality is not always fully appreciated or understood. This misunderstanding stems from old misconceptions that improving quality is expensive.

However, this misconception is partially true. For example, if an organization provides a service to clients for a given price and a competitor provides the same basic service with enhanced features for the same price, it will cost your organization more to add those features that the competitor already provides.

If your organization does not add those features, it may lose revenue because customers will go to a competitor. If you counteract by reducing the price, you may still lose revenue. In other words, the quality of your competitor's service is better.

For your organization to remain competitive, it will have to invest in developing new features. This positively affects revenue. To improve quality, features have to be designed in—or in today's terminology, a new design must be provided at high Sigma levels.

Because of this historical misconception, organizations do not always support the notion that improving quality will affect costs and not add to them. They overlook the enormous costs associated with poor performance of products, services, and processes—costs associated with not meeting customer requirements, not providing products or services on time, or reworking them to meet the customer needs. These are the costs of poor quality (COPQ) or the cost of poorly performing processes (COP^3).

If quantified, these costs will get immediate attention at all management levels. Why? When added together, costs of poor quality make up as much as 15 to 30 percent of all costs. Quality in this complete sense, unlike the quality that affects only income, affects costs. If we improve the performance of products, services, and processes by reducing deficiencies, we will reduce these costs. To improve the quality of deficiencies that exist throughout an organization, we must apply breakthrough improvements.

A Six Sigma program focused on reducing the costs of poor quality due to low Sigma levels of performance and on designing in new features (increasing the Sigma levels) will enable management to reap increased customer satisfaction and bottom-line results. Too many organizations reduce costs by eliminating essential product or service features that provide satisfaction to customers, while ignoring poor performance that costs the bottom line and shareholders millions of dollars.

A Better Approach

Company Y approached its situation differently than did Company X, as described at the beginning of this section. The executives identified all costs that would disappear if everything worked better at higher Sigma levels. Their list included costs associated with credits or

allowances given to customers because of late delivery, inaccuracy or errors in billings, scrap and rework, and accounts payable mistakes caused by discount errors and other mistakes.

When this company documented its costs of poor quality, the management team was astounded by the millions of dollars lost due to poor quality of performance within the organization.

This total cost of poor quality then became the target. The result? Elimination of waste and a return to the bottom line from planned cost reductions and more satisfied customers. Why? Because the company eliminated the reasons these costs existed in the first place. There were process and product deficiencies that caused customer dissatisfaction. Once these deficiencies were removed, the quality was higher and the costs were lower.

While responding to customer demands for improved quality in everything an organization does is becoming essential, organizations should not overlook the financial impact of poor performance. In fact, these costs should be the driver of the project selection process for Six Sigma.

In other words, the cost of poor quality provides proof of why changes must be made. The need to improve an organization's financial condition correlates directly with the process of making and measuring quality improvements. Regardless of the objective you start with, enhancing features as well as reducing costs of poor quality will affect the continuing financial success of an operation.

While there is a limit to the amount quality can be improved when cost effectiveness and savings are measured against the costs of achieving them, it's not likely this will occur until you approach Five or Six Sigma levels. A business must pursue the next level of quality based on what is of critical importance to its customers. If customers demand something, chances are it must be done to keep the business. If they do not, there's time to plan.

Driving Bottom-Line Performance

If you accept the reality that customers and the marketplace define quality, then your organization must have the right product or service features and lower your deficiencies to create loyal customers.

With a competitive price and market share strongly supported by fast cycle time, low warranty costs, and low scrap and rework costs, revenue will be higher and total cost lower. The substantial bonus that falls to the profit column comes, in effect, from a combination of enhancing features and reducing the costs of poor quality.

Before getting into specific ways to identify, measure, and account for the impact of costs of poor quality on financial results, look at what to do first if you are trying to understand how the costs of quality can drive a financial target.

For example, if your organization sets a cost reduction target to save $50 million, there is a simple methodology to determine how many improvement projects it will take to reach that goal. The organization can then manage the improvement initiative more effectively if it puts some thought behind how much activity it can afford. The answer will help determine how many experts or Black Belts are needed to manage the improvements and how much training will be required.

The methodology includes the following six steps:

1. Identify your cost reduction goal of $50 million over the next two years—$25 million per year.
2. Using an average return of $250,000 for each improvement, calculate how many projects are needed to meet the goal for each year. For this example, we would need an incredible 200 projects—100 per year.

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3. Calculate how many projects per year can be completed and how many experts will be required to lead the team. If each project can be completed in four months, that means one Black Belt on two projects per four months. Hence, one Black Belt can complete six projects in one year. We will then need about 17 black belts.
4. Estimate how many employees will be involved on a part-time basis to work with the Black Belts to meet their targets. Assume four per Black Belt per four months. We would need about 200 employees involved at some level each year, possibly as little as 10 percent of their time.
5. Identify the specific costs related to poor performance, and select projects from this list that are already causing your organization to incur at least $250,000 per deficiency. If you haven't created this list, use a small team to identify the costs and create a Pareto analysis prior to launching any projects.
6. Use this method and debate each variable among the executive team to ensure the right amount of improvement can be supported. All organizations make improvements, but world-class organizations improve at a faster rate than their competition.

Where to Find Costs of Poor Performance

To put targets of opportunity into perspective, look at the traditional costs of poor quality and, even more critically, the hidden costs of poor quality, as shown in Figures 5.2 and 5.3. The hidden costs must be quantified to get a complete picture of losses due to poor performance. These costs of poor quality could disappear entirely if every activity were performed without deficiency every time.

Three major categories of costs of poor quality exist in organizations. You can focus your efforts better if you put them into the following three categories:

- Appraisal and inspection costs
- Internal failure costs
- External failure costs

Appraisal and Inspection Costs

Appraisal and inspection costs are costs associated with inspection—checking or assuring that deficiencies are discovered before customers are affected.

Examples include

- Testing products or checking documents before providing them to customers
- Reviewing documents and correcting errors before mailing
- Inspecting equipment or supplies
- Proofreading reports or correspondence
- Auditing customer bills prior to sending invoices
- Retooling due to poor design

Discovering deficiencies at this stage avoids serious failure costs later and helps develop more effective and efficient inspection methods. There will always be some costs in this category because some level of auditing will be needed to ensure consistent performance. The point is to avoid excessive costs.

Internal Failure Costs

Failure costs within an organization are attributed to the repair, replacement, or discarding of defective work the customer does not see.

Examples include

- Replacing metal stampings that do not meet specifications during production
- Repainting scratched surfaces
- Making up for unplanned computer downtime
- Replacing components damaged when being moved from one station to another
- Rewriting parts of a proposal
- Working overtime to make up for slippage
- Correcting database errors
- Stocking extra parts to replace defective components
- Scrapping products that do not meet specifications
- Spending excess accounts-payable time to correct supplier invoice errors
- Engineering change notices to correct errors in specifications or drawings

These costs may affect customer service indirectly.

External Failure Costs

External failure affects customers directly; these usually are the most expensive failures to correct. External failure costs may result from

- Satisfying warranty claims
- Investigating complaints
- Offsetting customer dissatisfaction with a recovery strategy
- Collecting bad debts
- Correcting billing errors
- Processing complaints
- Expediting late shipments by purchasing more expensive means of transportation
- Replacing or repairing damaged or lost goods
- Housing stranded passengers from cancelled flights
- Paying interest or losing discounts for late payments to vendors
- Providing on-site assistance to customers when field problems occur
- Providing credits and allowances to clients for lack of performance or late deliveries

Efforts to correct external failures usually focus on regaining customer confidence or lost sales. Both are debatable costs that may or may not be fully calculated.

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Interpreting the Costs of Poor Quality

The costs of poor quality at this stage are determined by educated estimates used to guide organizational decisions. They should not be part of a monthly financial analysis, although understanding these costs may affect the way financial and cost accounting data are compiled and interpreted.

The precision required to identify the costs of poor quality varies depending on how data are used. When used to help select an improvement project, data need not be as precise as those used in developing new budgets for a process after it has been approved.

When you are evaluating projects, data on poor quality help identify, charter, and support projects with the greatest potential for reducing costs. Black Belts and teams may select some projects because of the impact on customers or internal culture, but data must show where costs are highest so that focus can be concentrated on the vital few.

The amount of cost reduction provided by a remedy is another indicator of project effectiveness. When planning for a remedy, a task force should develop supportable estimates of costs that will be eliminated by the remedy and use those estimates to develop a budget for the revised process.

There are four major steps in measuring the costs of poor quality:

1. Identify activities resulting from poor quality.
2. Decide how to estimate costs.
3. Collect data and estimate costs.
4. Analyze results and decide on the next steps.

Identify Activities Resulting from Poor Quality

Activities are categorized as resulting from poor quality only if they exist solely because of deficiencies assessed when doing appraisals, inspections, and internal or external cost estimates.

A project team usually begins by measuring the obvious costs of a problem's primary symptom, such as discarded supplies, customer complaints, or erroneous shipments. After a flow diagram of the process in question has been created and further analysis has been conducted, additional activities are usually identified as those required, for example, to dispose of and replace returned items.

Efforts to identify remedial activities are generally more global since the focus is on costs of poor quality throughout an organization. This effort is best undertaken by one or a small number of analysts working with a team of midlevel and senior managers experienced in key areas.

The task force usually launches its efforts by identifying major organizational processes and their customers. For each process, the task force brainstorms major activities associated with poor quality and expands the list through carefully constructed interviews with individuals representing different levels within the most critical functions. At this point, the objective is to prepare a list of activities related to poor quality, not estimate costs.

Project teams and task forces find it easier to explain what they are looking for if they have a full list of typical examples associated with poor quality. The examples described earlier fall into major categories of poor quality costs. Using key words such as rework, waste, fix, return, scrap, complaint, repair, expedite, adjust, refund, penalty, waiting, and excess usually stimulates a healthy response, too.

Decide How to Estimate Costs

When a specific activity related to poor quality is identified, two strategies help estimate its costs: total resources and unit costs. These strategies can be used individually or together.

An example of the total resource approach is how an operational unit calculated the human resource time to process customer complaints and the dollar value of that time. This approach requires two pieces of data: total resources consumed in a category and the percentage of those resources consumed for activities associated with poor quality.

An example of the unit cost approach is when a project team calculates the annual cost of correcting erroneous shipments. To find that cost, the team should estimate the cost of correcting an average erroneous shipment and how many errors occurred in one year, and then multiply the average cost by the annual number of errors.

Data for calculating the total resources used in a category might come from a variety of sources, such as accounting, time reporting, other information systems, informed judgment, special time reporting, special data collections, and unit costs. These sources are described in the section "Calculating Resources Used."

Collect Data and Estimate Costs

Procedures for collecting data on costs of poor quality are generally the same as those for any good data collection:

- Formulate questions to be answered.
- Know how data will be used and analyzed.
- Determine where data will be collected.
- Decide who will collect it.
- Understand data collectors' needs.
- Design a simple data collection form.
- Prepare clear instructions.
- Test forms and procedures.
- Train data collectors.
- Audit results.

To estimate the costs of poor quality, it is sometimes necessary to collect personal opinions and judgments about relative magnitudes of time spent or costs. Even though precise numeric data is not required for such estimates, it is important to plan carefully. The manner in which opinions are solicited affects responses.

Sampling works when the same activity is performed often in different parts of an organization. All field sales offices, for example, perform similar functions. If a company has 10 field sales offices, estimates from one or two would provide a reasonable value for calculating overall costs of poor quality.

Analyze Results and Decide on the Next Steps

Collecting data on costs of poor quality helps make decisions such as

- Selecting the most important quality improvement projects
- Identifying the most costly aspects of a specific problem
- Identifying specific costs to be eliminated

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The Results

Of note is the fact that every organization that has adopted Six Sigma and integrated the discipline throughout its operations has produced impressive savings that were reflected on the bottom line. More customers were satisfied and became loyal, and revenues, earnings, and operating margins improved significantly.

For example, Honeywell's cost savings have exceeded $2 billion since implementing Six Sigma in 1994. At General Electric, the Six Sigma initiative began in 1996 and produced more than $2 billion in benefits in 1999. Black & Decker's Six Sigma productivity savings rose to about $75 million in 2000, more than double the prior year's level, bringing the total saved since 1997 to over $110 million.

A more revealing insight into the cost of poor quality as a function of Six Sigma performance levels is the following:

- When +/− 3 Sigma of the process that produces a part is within specification, there will be 66,807 defects per million parts produced. If each defect cost $1,000 to correct, then the total COPQ would be $66,807,000.
- When an organization improves the process to within +/− 4 Sigma, there will be only 6210 defects per million at a COPQ of $6,210,000.
- At +/− 5 Sigma, the cost of defects declines to $233,000 per million, a savings of $66,574,000 more than the savings at a process capability of +/− 3 Sigma.
- At the near perfection level of +/− 6 Sigma, defects are almost eliminated at $3400 per million parts produced.

After all data are collected and tabulated, and decisions are made, no study of the cost of poor quality should end without a continuing action plan to eliminate a major portion of the costs that have been identified. There is no need to use a complex accounting method for measuring costs because it would be expensive and waste valuable effort. Simple methods are sufficient.

The most important step in developing useful COPQ data is simply to identify activities and other factors that affect costs. Any consistent and unbiased method for estimating costs will yield adequate information that will identify key targets for quality improvement. More refined estimates may be needed for specific projects when diagnosing the cause of a specific problem or identifying specific savings.

Calculating Resources Used

Data for calculating the total resources used in an expense category come from a variety of sources, as the following sections explain.

Accounting Categories

Financial and cost accounting systems often contain specific categories that can be allocated partly or totally to costs of poor quality. Typical examples include scrap accounts, warranty costs, professional liability, discarded inventory, and total department operating costs.

Time Reporting

Many organizations routinely ask employees to report how much time they spend on specific activities. This makes it possible to assign some or all of the time in a category to a specific cost of poor quality.

Other Information Systems

Other information systems include cost accounting, activity-based cost accounting, materials management, sales, or similar reports.

Data for calculating the percentage of resources used for cost of poor quality activities can be obtained through a variety of techniques, including

- *Informed judgment.* Supervisors and experienced employees can make adequate judgments about what proportion of a department's time is spent on an activity. This is especially true if the unit performs very few distinct functions or if the effort consumes a very large or small portion of total time.
- *Special time reporting.* This method has been used to calculate costs for processing computer complaints. A special short-term collection of time distribution data may be appropriate if a department performs many different functions, activity is neither unusually small nor large, or there is uncertainty or significant disagreement among informed individuals as to the percentage of time or money allocated to a specific activity. A significant disagreement would typically be one of more than 10 percent of the total amount allocated.
- *Special data collections.* Besides collecting data on how much employee time is spent on an activity, an organization might also collect data on the amount of time a computer network is inoperative, the volume of items consumed or discarded, or the amount of time special equipment or other resources are not used.

In all these examples, the general calculation to determine costs of poor quality is:

$$\text{Cost of poor quality} = (\text{cost of total resources in a category}) \times (\text{percentage of resources in category used for activities related to poor quality})$$

Unit Cost

An example of this strategy occurs when a project team calculates the annual cost of correcting erroneous shipments. To find out the cost, the team should estimate the cost of correcting an average erroneous shipment, estimate how many such errors occurred in one year, and then multiply the average cost by the annual number of errors.

Focusing on unit cost requires two pieces of data: the number of times a particular deficiency occurs and the average cost for correcting and recovering from that deficiency when it does occur.

This average cost, in turn, is computed from a list of resources used to make corrections, on the amount used of each resource, and on the cost of each resource unit.

Unit cost is often the most appropriate strategy when deficiencies occur rarely and may be costly, when deficiencies are complex and require the participation of many departments to correct, or when deficiencies occur frequently and correcting them is so routine that those involved may not realize their pervasiveness.

Data on frequency of a deficiency may come from any of the following:

- Quality assurance
- Warranty data
- Customer surveys
- Field service reports
- Customer complaints

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- Management engineering studies
- Internal audit reports
- Operational logs
- Special surveys

Estimating the cost of a single occurrence usually requires some analysis. A flowchart showing various rework loops associated with a deficiency can often help identify all-important resources used.

When searching for resources, consider hours worked by occupation and level, contracted services, materials and supplies, capital equipment and facilities, and cost of money for borrowed or uncollected funds.

To find out how much of each resource is used, check the following sources:

- Time reporting systems
- Cost accounting systems
- Various administrative logs
- Management engineering studies
- Informed judgment
- Special data collections

When a team has identified the amount of each resource used, it is ready to calculate the cost for each and add up costs for all resources. The finance or engineering functions typically will have standard methods for calculating the unit costs a team might require.

Here are hints to remember when calculating unit costs:

- Include benefits as well as wages and salaries.
- Include allocated capital costs for major equipment and facilities. While this is a minor consideration for many activities that can be safely ignored, it is vital for some activities.

Do not be misled by the argument that capital costs are fixed and would exist even if deficiencies did not occur. This is a typical example of the cost of poor quality being hidden by standard practices. If computers were used more efficiently, it would be possible to process more jobs without buying additional equipment. Idle capital or misused capital resources are a cost of poor quality just as surely as discarded paper from a faulty print job.

Be sure to include penalties or misused discounts for late payments and premium prices paid for rush orders or shipments.

Other Methods

Still other methods can be developed for special projects. For example, with regard to lost supplies, the organization should calculate the cost that would have been consumed if there had been no defects and the cost of supplies had actually been consumed. The difference between the two is the cost of poor quality. This type of approach might also be applied in comparing actual outcomes with the best outcomes others have achieved.

Special circumstances may lead a team to develop still other approaches that are appropriate to the specific problem. For example, a greater investment in prevention would be cost-effective.

The Potential Return on Investment

A major responsibility of upper managers is to make the best use of the organization's assets. A key measure of judging what is best is return on investment (ROI). In general terms, ROI is the ratio of (1) the estimated gain to (2) the estimated resources needed. Computing ROI for projects to reduce chronic waste requires assembling estimates such as

- The costs of chronic waste associated with the projects
- The potential cost reductions if the projects are successful
- The costs of the needed diagnosis and remedy

Many proposals to go into breakthrough have failed to gain management support because no one has quantified the ROI. Such a goal is a handicap to the upper managers—they are unable to compare (1) the potential ROI from breakthrough with (2) the potential ROI from other opportunities for investment.

Managers and others who prepare such proposals are well advised to prepare the information on ROI in collaboration with those who have expertise in the intricacies of ROI. Computation of ROI can be complicated because two kinds of money are involved—capital and expenses. Each is money, but in some countries (including the United States) they are taxed differently. Capital expenditures are made from after-tax money, whereas expenses are paid out of pretax money.

This difference in taxation is reflected in the rules of accounting. Expenses are written off promptly, thereby reducing the stated earnings and hence, the income taxes on earnings. Capital expenditures are written off gradually—usually over a period of years. This increases the stated earnings and hence, the income taxes on those earnings. This means it is advantageous for proposals to go into breakthrough because breakthrough is seldom capital-intensive. (Some upper managers tend to use the word *investment* as applying only to capital investment.)

Getting Cost Figures

Organization accounting systems typically quantify only a minority of the costs of poor quality. The majority are scattered throughout the various overheads. As a result, specialists have looked for ways to supply what is missing. Their main efforts toward solution have been as follows:

- *Make estimates*. This is the "quick and dirty" approach. It is usually done by sampling, and involves only a modest amount of effort. It can, in a few days or weeks, provide (a) an evaluation of the approximate cost of chronic waste and (b) indicate where this is concentrated.
- *Expand the accounting system*. This is much more elaborate. It requires a lot of work from various departments, especially accounting, and it runs into a lot of calendar time, often two or three years.

> *In my experience, estimates involve much less work, can be prepared in far less time, and yet are adequate for managerial decision making.*
>
> —J.M. Juran

Note that the demand for "accuracy" of the cost figures depends on the use to which the figures will be put. Balancing the books demands a high degree of accuracy. Making managerial decisions sometimes can tolerate a margin of error. For example, a potential

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breakthrough project has been estimated to incur about $300,000 in annual cost of poor quality. This figure is challenged. The contesting estimates range from $240,000 to $360,000—quite a wide range. Then someone makes an incisive observation: "It doesn't matter which estimate is correct. Even at the lowest figure, this is a good opportunity for breakthrough, so let's tackle it." In other words, the managerial decision to tackle the project is identical despite a wide range of estimate.

Languages in the Hierarchy

A subtle aspect of securing upper management approval is the choice of language. Industrial organizations make use of two standard languages—the language of money and the language of things. (There are also local dialects, each peculiar to a specific function.) However, as seen in Figure 5.4, use of the standard languages is not uniform.

Figure 5.4 shows the use of standard languages in different levels of a typical hierarchy. At the apex, the principal language of the top management team is the language of money. At the base, the principal language of the first-line supervisors and the workforce is the language of things. In between, the middle managers and the specialists need to understand both principal languages—*the middle managers should be bilingual.*

It is quite common for chronic waste to be measured in the language of things: percent errors, process yields, hours of rework, and so on. Converting these measures into the language of money enables upper managers to relate them to the financial measures that have long dominated the management "instrument panel."

Years ago, I was invited to visit a major British manufacturer to study its approach to managing for quality and to provide a critique. I found that the organization's cost of poor quality was huge, that it was feasible to cut this in two in five years, and that the resulting return on investment would be much greater than that of making and selling the organization's products. When I explained this to the managing director, he was most impressed—it

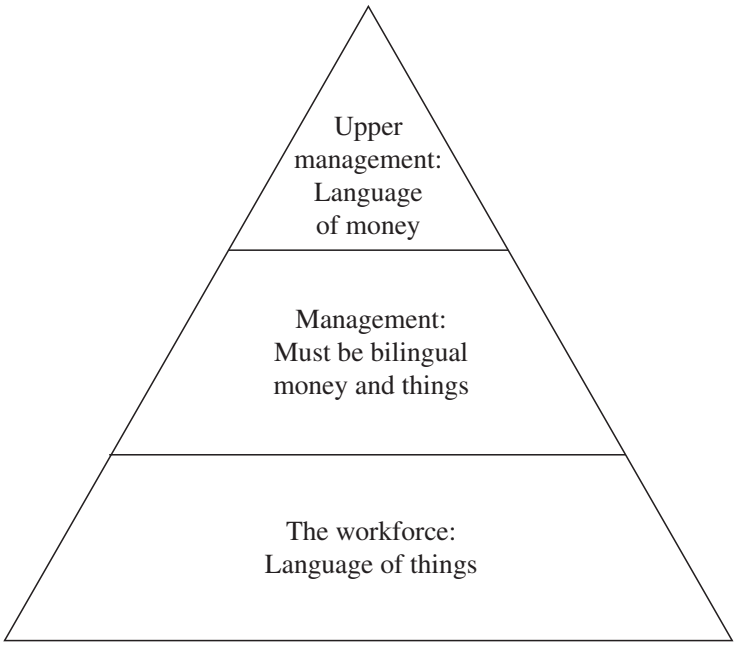

Figure 5.4 Common languages in the hierarchy. (*Juran Institute, Inc., 1994.*)

was the first time that the problem of chronic waste had been explained to him in the language of return on investment. He promptly convened his directors (vice presidents) to discuss what to do about this opportunity.

Presentations to Upper Managers

Presentations to upper managers should focus on the goals of the upper managers, not on the goals of the advocates. Upper managers are faced with meeting the needs of various stakeholders: customers, owners, employees, suppliers, the public (e.g., safety, health, environment), and so on. It helps if the proposals identify specific problems of stakeholders and estimate the benefits to be gained.

Upper managers receive numerous proposals for allocating the organization's resources: invade foreign markets, develop new products, buy new equipment to increase productivity, make acquisitions, enter joint ventures, and so on. These proposals compete with each other for priority, and a major test is ROI. It helps if the proposal to go into breakthrough includes estimates of ROI.

An explanation of proposals is sometimes helped by converting the supporting data into units of measure that are already familiar to upper managers. For example:

- Last year's cost of poor quality was five times last year's profit of $1.5 million.
- Cutting the cost of poor quality in half would increase earnings by 13 cents per share of stock.
- Thirteen percent of last year's sales orders were canceled due to poor quality.
- Thirty-two percent of engineering time was spent in finding and correcting design weaknesses.
- Twenty-five percent of manufacturing capacity is devoted to correcting problems.
- Seventy percent of the inventory carried is traceable to poor quality.
- Twenty-five percent of all manufacturing hours were spent in finding and correcting defects.
- Last year's cost of poor quality was the equivalent of our operation making 100 percent defective work during the entire year.

Experience in making presentations to upper management has provided some useful dos and don'ts:

- *Do* summarize the total of the estimated costs of poor quality. The total will be big enough to command upper management's attention.
- *Do* show where these costs are concentrated. A common grouping is in the form of Table 5.2. Typically (as in that case), most of the costs are associated with failures, internal and external. Table 5.2 also shows the fallacy of trying to start by reducing inspection and test. The failure costs should be reduced first. After the defect levels come down, inspection costs can be reduced as well.
- *Do* describe the principal projects that are at the heart of the proposal.
- *Do* estimate the potential gains, as well as the return on investment. If the organization has never before undertaken an organized approach to reducing related costs, then a reasonable goal is to cut these costs in two within a space of five years.
- *Do* have the figures reviewed in advance by those people in finance (and elsewhere) to whom upper management looks for checking the validity of financial figures.

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- *Don't* inflate the present costs by including debatable or borderline items. The risk is that the decisive review meetings will get bogged down in debating the validity of the figures without ever discussing the merits of the proposals.
- *Don't* imply that the total costs will be reduced to zero. Any such implication will likewise divert attention from the merits of the proposals.
- *Don't* force the first few projects on managers who are not really sold on them or on unions who are strongly opposed. Instead, start in areas that show a climate of receptivity. The results obtained in these areas will determine whether the overall initiative will expand or die out.

The needs for breakthrough go beyond satisfying customers or making cost reductions. New forces keep coming over the horizon. Recent examples have included growth in product liability, the consumerism movement, foreign competition, legislation, and environmental concerns of all sorts. Breakthrough has provided much of the response to such forces.

Similarly, the means of convincing upper managers of the need for breakthrough go beyond reports from advocates. Conviction also may be supplied by visits to successful organizations, hearing papers presented at conferences, reading reports published by successful organizations, and listening to the experts, both internal and external. However, none of these is as persuasive as results achieved within one's own organization.

A final element of presentations to upper managers is to explain their personal responsibilities in launching and perpetuating breakthrough.

Mobilizing for Breakthrough

Until the 1980s, breakthrough in the West was not mandated—it was not a part of the business plan or a part of the job descriptions. Some breakthrough did take place, but on a voluntary basis. Here and there, a manager or a nonmanager, for whatever reason, elected to tackle some breakthrough project. He or she might persuade others to join an informal team. The result might be favorable, or it might not. This voluntary, informal approach yielded few breakthroughs. The emphasis remained on inspection, control, and firefighting.

The Need for Formality

The crisis that followed the Japanese revolution called for new strategies, one of which was a much higher rate of breakthrough. It then became evident that an informal approach would not produce thousands (or more) breakthroughs year after year. This led to experiments with structured approaches that in due course helped some organizations become role models.

Some upper managers protested the need for formality: "Why don't we just do it?" The answer depends on how many breakthroughs are needed. For just a few projects each year, informality is adequate; there is no need to mobilize. However, making breakthroughs by the hundreds or the thousands requires a formal structure.

As it has turns out, mobilizing for breakthrough requires two levels of activity, as shown in Figure 5.5. The figure shows the two levels of activity. One of these mobilizes the organization's resources to deal with the breakthrough projects collectively. This becomes the responsibility of management. The other activity is needed to carry out the projects individually. This becomes the responsibility of the breakthrough teams.

Activities by Management	Activities by Project Teams
Establish infrastructure: quality councils	Verify problem
Select problems; determine goals and targets	Analyze symptoms
Create project charters and assign teams	Theorize as to causes
Launch teams and review progress	Test theories
Provide recognition and rewards	Discover causes
	Stimulate remedies and controls

Figure 5.5 Mobilizing for breakthrough.

The Executive "Quality Council"

The first step in mobilizing for breakthrough is to establish the organization's council (or similar name). The basic responsibility of this council is to launch, coordinate, and "institutionalize" annual breakthrough. Such councils have been established in many organizations. Their experiences provide useful guidelines.

Membership and Responsibilities

Council membership is typically drawn from the ranks of senior managers. Often, the senior management committee is also the council. Experience has shown that councils are most effective when upper managers are personally the leaders and members of the senior councils.

In large organizations, it is common to establish councils at the divisional level as well as at the corporate level. In addition, some individual facilities may be so large as to warrant establishing a local council. When multiple councils are established, they are usually linked together—members of high-level councils serve as chairpersons of lower-level councils. Figure 5.6 is an example of such linkage.

Experience has shown that organizing councils solely in the lower levels of management is ineffective. Such organization limits breakthrough projects to the "useful many" while neglecting the "vital few" projects—those that can produce the greatest results. In addition, councils solely at lower levels send a message to all: "Breakthrough is not high on upper management's agenda."

It is important for each council to define and publish its responsibilities so that (1) the members agree on their goal and (2) the rest of the organization can become informed relative to upcoming events.

Many councils have published their statements of responsibility. Major common elements have included the following:

- Formulate the policies, such as focus on the customer has top priority, breakthrough must go on year after year, participation should be universal, or the reward system should reflect performance on breakthrough.
- Estimate the major dimensions, such as the status of the company's quality compared with its competitors, the extent of chronic waste, the adequacy of major business processes, or the results achieved by prior breakthroughs.
- Establish processes for selecting projects, such as soliciting and screening nominations, choosing projects to be tackled, preparing goal statements, or creating a favorable climate for breakthrough.

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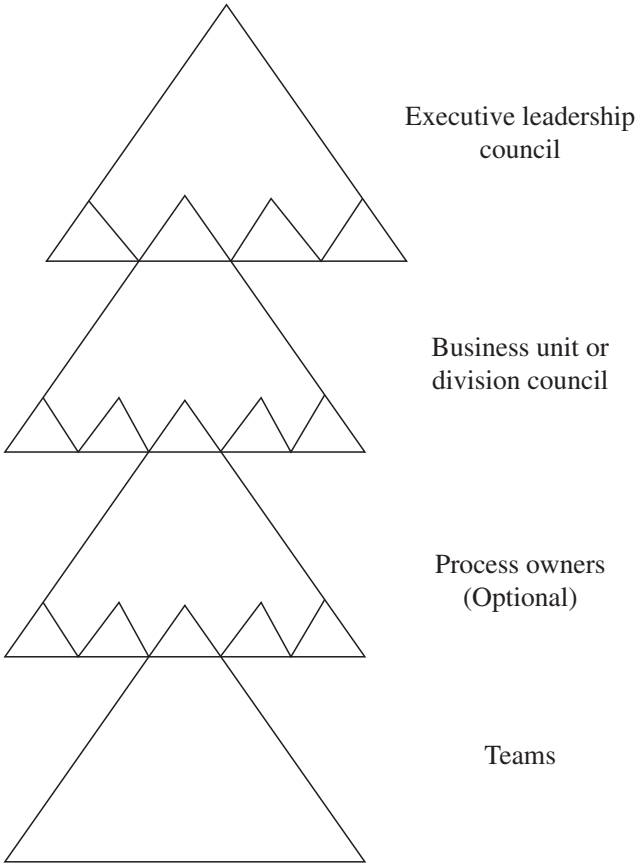

FIGURE 5.6 Quality councils are linked together. (*Juran Institute, Inc., 1994.*)

- Establish processes for carrying out the projects, such as selecting team leaders and members or defining the role of project teams.
- Provide support for the project teams, such as training time for working on projects, diagnostic support, facilitator support, or access to facilities for tests and tryouts.
- Establish measures of progress, such as effect on customer satisfaction, effect on financial performance, or extent of participation by teams.
- Review progress, assist teams in the event of obstacles, and ensure that remedies are implemented.
- Provide for public recognition of teams.
- Revise the reward system to reflect the changes demanded by introducing annual breakthrough.

Councils should anticipate the troublesome questions and, to the extent feasible, provide answers at the time of announcing the intention to go into annual breakthrough. Some senior managers have gone to the extent of creating a videotape to enable a wide audience to hear the identical message from a source of undoubted authority.

Leaders Must Face Up to the Apprehensions about Elimination of Jobs

Employees not only want dialogue on such an important issue, they also want assurance relative to their apprehensions, notably the risk of job loss due to improvements. Most upper

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managers have been reluctant to face up to these apprehensions. Such reluctance is understandable. It is risky to provide assurances when the future is uncertain.

Nevertheless, some managers have estimated in some depth the two pertinent rates of change:

- The rate of creation of job openings due to attrition: retirements, offers of early retirement, resignation, and so on. This rate can be estimated with a fair degree of accuracy.
- The rate of elimination of jobs due to reduction of chronic waste. This estimate is more speculative—it is difficult to predict how soon the breakthrough rate will get up to speed. In practice, organizations have been overly optimistic in their estimates.

Analysis of these estimates can help managers judge what assurances they can provide, if any. It also can shed light on the choice of alternatives for action: retrain for jobs that have opened up, reassign to areas that have job openings, offer early retirement, assist in finding jobs in other organizations, and/or provide assistance in the event of termination.

Assistance from the Quality and/or Performance Excellence Functions

Many councils secure the assistance of the performance excellence and quality departments. These are specialists that are skilled in the methods and tools to attain high quality. They are there to

- Provide inputs needed by the council for planning to introduce breakthrough
- Draft proposals and procedures
- Carry out essential details such as screening nominations for projects
- Develop training materials
- Develop new scorecards
- Prepare reports on progress

It is also usual for the quality directors to serve as secretaries of the council.

Breakthrough Goals in the Business Plan

Organizations that have become the market leaders—the role models—all adopted the practice of enlarging their business plan to include quality goals. In effect, they translated the threats and opportunities faced by their organizations into goals, such as

- Increase on-time deliveries from 83 to 100 percent over the next two years.
- Reduce the cost of poor quality by 50 percent over the next five years.

Such goals are clear—each is quantified, and each has a timetable. Convincing upper managers to establish such goals is a big step, but it is only the first step.

Deployment of Goals

Goals are merely a wish list until they are deployed—until they are broken down into specific projects to be carried out and assigned to specific individuals or teams who are then provided with the resources needed to take action. Figure 5.7 shows the anatomy of the

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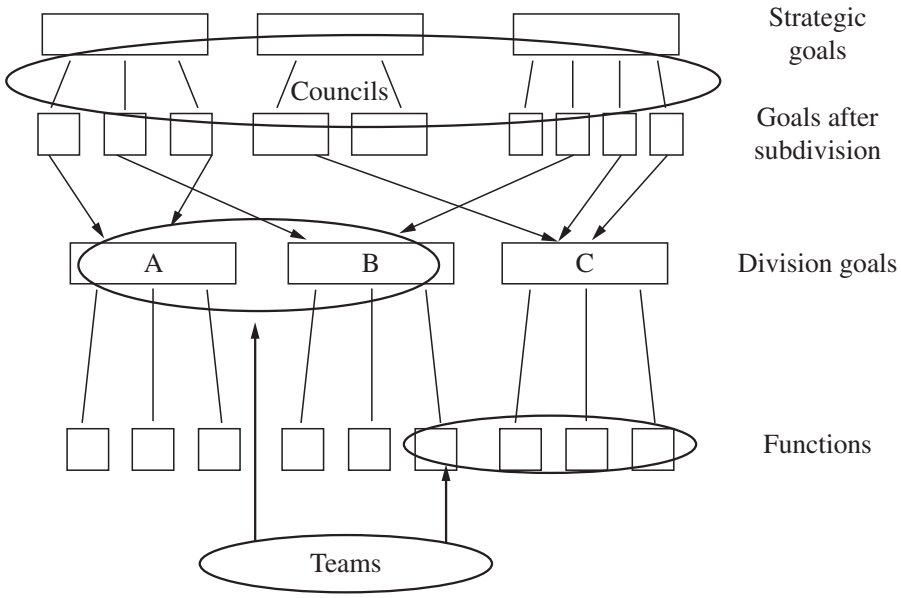

FIGURE 5.7 Anatomy of the deployment process. (*Juran Institute, Inc.*)

deployment process. In the figure, the broad (strategic) goals are established by the council and become a part of the organization's business plan. These goals are then divided and allocated to lower levels to be translated into action. In large organizations, there may be further subdivision before the action levels are reached. The final action level may consist of individuals or teams.

In response, the action levels select breakthrough projects that collectively will meet the goals. These projects are then proposed to the upper levels along with estimates of the resources needed. The proposals and estimates are discussed and revised until final decisions are reached. The end result is an agreement on which projects to tackle, what resources to provide, and who will be responsible for carrying out the projects.

This approach of starting at the top with strategic goals may seem like a purely top-down activity. However, the deployment process aims to provide open discussion in both directions before final decisions are made, and such is the way it usually works out.

The concept of strategic goals involves the vital few matters, but it is not limited to the corporate level. Goals also may be included in the business plans of divisions, profit centers, field offices, and still other facilities. The deployment process is applicable to all of these. (For added discussion of the deployment process, see Chapter 7, Strategic Planning and Deployment: Moving from Good to Great.)

The Project Concept

As used here, a project is a chronic problem scheduled for solution. The project is the focus of actions for breakthrough. All breakthrough takes place project by project and in no other way.

Some projects are derived from the goals that are in the organization's business plan. These are relatively few in number, but each is quite important. Collectively, these are among the vital few projects (see "Use of the Pareto Principle"). However, most projects are derived not from the organization's business plan but from the nomination-selection process, as discussed later.

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Use of the Pareto Principle

A valuable aid to the selection of projects during the deployment process is the Pareto principle. This principle states that in any population that contributes to a common effect, a relative few of the contributors—the vital few—account for the bulk of the effect. The principle applies widely in human affairs. Relatively small percentages of the individuals write most of the books, commit most of the crimes, own most of the wealth, and so on.

Presentation of data in the form of a Pareto diagram greatly enhances communication of the information, most notably in convincing upper management of the source of a problem and gaining support for a proposed course of action to remedy the problem. (For an account of how Dr. Juran came to name the Pareto principle, see Appendix in this Handbook.)

The Useful Many Problems and Solutions

Under the Pareto principle, the vital few projects provide the bulk of the breakthrough, so they receive top priority. Beyond the vital few are the useful many problems. Collectively, they contribute only a minority of the breakthrough, but they provide most of the opportunity for employee participation. The useful many projects are made through the application of workplace improvement teams, quality circles, the lean 5S tools, or self-directed work teams. See Chapter 26, Empowering the Workforce to Tackle the "Useful Many" Processes.

The Nomination and Selection Process

Most projects are chosen through the nomination and selection process, involving several steps:

- Project nomination
- Project screening and selection
- Preparation and publication of project goal statements

Sources of Nominations

Nominations for projects can come from all levels of the organization. At the higher levels, the nominations tend to be extensive in size (the vital few) and multifunctional in their scope. At lower levels, the nominations are smaller in size (the useful many) and tend to be limited in scope to the boundaries of a single department.

Nominations come from many sources. These include

- *Formal data systems*, such as field reports on product performance, customer complaints, claims, returns, and so on; accounting reports on warranty charges and on internal costs of poor quality; and service call reports. (Some of these data systems provide for analyzing the data to identify problem areas.)
- *Special studies*, such as customer surveys, employee surveys, audits, assessments, benchmarking against competitors, and so on.
- *Reactions from customers* who have run into product dissatisfactions are often vocal and insistent. In contrast, customers who judge product features to be not competitive may simply (and quietly) become ex-customers.
- *Field intelligence* derived from visits to customers, suppliers, and others; actions taken by competitors; and stories published in the media (as reported by sales, customer service, technical service, and others).

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- *The impact on society*, such as new legislation, extension of government regulation, and growth of product liability lawsuits.
- *The managerial hierarchy*, such as the council, managers, supervisors, professional specialists, and project teams.
- *The workforce* through informal ideas presented to supervisors, formal suggestions, ideas from circles, and so on.
- *Proposals* relating to business processes.

Effect of the Organizationwide or Big Q Concept

Beginning in the 1980s and continuing for the near future, the scope of nominations for projects broadened considerably under the big Q concept. The breadth of the big Q concept is evident from the wide variety of projects that have already been tackled:

- Improve the precision of the sales forecast.
- Reduce the cycle time for developing new products.
- Increase the success rate in bidding for business.
- Reduce the time required to fill customers' orders.
- Reduce the number of sales cancellations.
- Reduce the errors in invoices.
- Reduce the number of delinquent accounts.
- Reduce the time required to recruit new employees.
- Improve the on-time arrival rate (for transportation services).
- Reduce the time required to file for patents.

The Nomination Process

Nominations must come from human beings. Data systems are impersonal—they make no nominations. Various means are used to stimulate nominations for breakthrough projects:

- *Call for nominations*. Letters or bulletin boards are used to invite all personnel to submit nominations, either through the chain of command or to a designated recipient, such as the secretary of the council.
- *Make the rounds*. In this approach, specialists (such as engineers) are assigned to visit the various departments, talk with the key people, and secure their views and nominations.
- *The council members themselves*. They become a focal point for extensive data analyses and proposals.
- *Brainstorming meetings*. These are organized for the specific purpose of making nominations.

Whatever the method used, it will produce the most nominations if it urges use of the big Q concept—the entire spectrum of activities, products, and processes.

Nominations from the Employees at All Levels

The workforce is potentially a source of numerous nominations. Workers have extensive residence in the workplace. They are exposed to many local cycles of activity. Through this exposure, they are well poised to identify the existence of problems and to theorize about their causes. As to the details of goings-on in the workplace, no one is better informed than the workforce. "That machine hasn't seen a maintenance man for the last six months." In addition, many workers are well poised to identify opportunities and to propose new ways.

Workforce nominations consist mainly of local useful many projects along with proposals of a human relations nature. For such nominations, workers can supply useful theories of causes as well as practical proposals for remedies. For projects of a multifunctional nature, most workers are handicapped by their limited knowledge of the overall process and of the interactions among the steps that collectively make up the overall process.

In some organizations, the solicitation of nominations from the workforce has implied that such nominations would receive top priority. The effect was that the workforce was deciding which projects the managers should tackle first. It should have been made clear that workers' nominations must compete for priority with nominations from other sources.

Joint Projects with Suppliers and Customers

All organizations buy goods and services from suppliers; over half the content of the finished product may come from suppliers. In earlier decades, it was common for customers to contend. The supplier should solve his problems. Now there is growing awareness that these problems require a partnership approach based on

- Establishing mutual trust
- Defining customer needs as well as specifications
- Exchanging essential data
- Direct communication at the technical level as well as the commercial level

Project Screening

Calls for nominations can produce large numbers of responses—numbers that are beyond the digestive capacity of the organization. In such cases, an essential further step is screening to identify those nominations that promise the most benefits for the effort expended.

To start with a long list of nominations and end up with a list of agreed-upon projects requires an organized approach—an infrastructure and a methodology. The screening process is time-consuming, so the council usually delegates it to a secretariat, often the department. The secretariat screens the nominations—it judges the extent to which the nominations meet the criteria set out below. These judgments result in some preliminary decision-making. Some nominations are rejected. Others are deferred. The remainder is analyzed in greater depth to estimate potential benefits, resources needed, and so on.

The councils and/or the secretariats have found it useful to establish criteria to be used during the screening process. Experience has shown that there is a need for two sets of criteria:

- Criteria for choosing the first projects to be tackled by any of the project teams
- Criteria for choosing projects thereafter

Criteria for Projects

During the beginning stages of project-by-project breakthrough, everyone is in a learning state. Projects are assigned to project teams, who are in training. Completing a

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project is a part of that training. Experience with such teams has evolved a broad set of criteria:

- The project should deal with a *chronic problem*—one that has been awaiting a solution for a long time.
- The project should be *feasible*. There should be a good likelihood of completing it within a few months. Feedback from organizations suggests that the most frequent reason for failure of the first project has been failure to meet the criterion of feasibility.
- The project should be *significant*. The end result should be sufficiently useful to merit attention and recognition.
- The results should be *measurable*, whether in money or in other significant terms.
- The first projects should be winners.

Additional criteria to select projects are aimed at what will do the organization the most good:

- *Return on investment*. This factor has great weight and is decisive, all other things being equal. Projects that do not lend themselves to computing return on investment must rely for their priority on managerial judgment.
- *The amount of potential breakthrough*. One large project will take priority over several small ones.
- *Urgency*. There may be a need to respond promptly to pressures associated with product safety, employee morale, and customer service.
- *Ease of technological solution*. Projects for which the technology is well developed will take precedence over projects that require research to discover the needed technology.
- *Health of the product line*. Projects involving thriving product lines will take precedence over projects involving obsolescent product lines.
- *Probable resistance to change*. Projects that will meet a favorable reception take precedence over projects that may meet strong resistance, such as from the labor union or from a manager set in his or her ways.

Most organizations use a systematic approach to evaluate nominations relative to these criteria. This yields a composite evaluation that then becomes an indication of the relative priorities of the nominations. (For more detail and an example of a project selection matrix, see Chapter 12, Six Sigma: Improving Process Effectiveness.)

Project Selection

The result of the screening process is a list of recommended projects in their order of priority. Each recommendation is supported by the available information on compatibility with the criteria and potential benefits, resources required, and so on. This list is commonly limited to matters in which the council has a direct interest.

The council reviews the recommendations and makes the final determination on which projects are to be tackled. These projects then become an official part of the organization's business. Other recommended projects are outside the scope of the direct interest of the council. Such projects are recommended to appropriate subcouncils, managers, and so on. None of the preceding prevents projects from being undertaken at local levels by supervisors or by the workforce.

Vital Few and Useful Many

Some organizations completed many projects. Then, when questions were raised—"What have we gotten for all this effort?"—they were dismayed to learn that there was no noticeable effect on the bottom line. Investigation then showed that the reason could be traced to the process used for project selection. The projects actually selected had consisted of

- *Firefighting projects*. These are special projects for getting rid of sporadic "spikes." Such projects did not attack the chronic waste and hence, could not improve financial performance. (See Chapter 13, Root Cause Analysis to Maintain Performance)
- *Useful many projects*. By definition, these have only a minor effect on financial performance but have great effect on human relations.
- *Projects for improving human relations*. These can be quite effective in their field, but the financial results are usually not measurable.

To achieve a significant effect on the bottom line requires selecting the "vital few" projects as well as the "useful many." It is feasible to work on both, since different people are assigned to each.

There is a school of thought emerging that contends that the key to market leadership is "tiny breakthroughs in a thousand places"—in other words, the useful many Another school urges focus on the vital few. In my experience, neither of these schools has the complete answer. Both are needed—at the right time.

The vital few projects are the major contributors to leadership and to the bottom line. The useful many projects are the major contributors to employee participation and to the quality of work life. Each is necessary; neither is sufficient.

The vital few and useful many projects can be carried out simultaneously. Successful organizations have done just that by recognizing that while there are these two types of projects, they require the time of different categories of organization personnel.

The interrelation of these two types of projects is shown in Figure 5.8. In this figure, the horizontal scale is time. The vertical scale is chronic waste. What goes up is bad. The useful

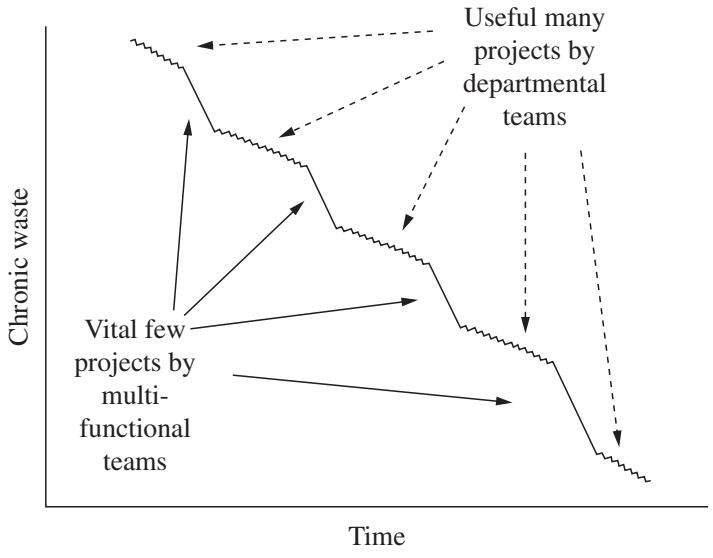

Figure 5.8 Interrelation of projects. (*Juran Institute, Inc., 1994.*)

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many breakthroughs collectively create a gradually sloping line. The vital few breakthroughs, though less frequent, contribute the bulk of the total breakthrough.

Cost Figures for Projects

To meet the preceding criteria (especially that of return on investment) requires information on various costs:

- The cost of chronic waste associated with a given nomination
- The potential cost reduction if the project is successful
- The cost of the needed diagnosis and remedy

Costs versus Percent Deficiencies

It is risky to judge priorities based solely on the percentage of deficiencies (errors, defects, and so on). On the face of it, when this percentage is low, the priority of the nomination also should be low. In some cases this is true, but in others it can be seriously misleading.

Elephant-Sized and Bite-Sized Projects

There is only one way to eat an elephant: bite by bite. Some projects are "elephant-sized"; that is, they cover so broad an area of activity that they must be subdivided into multiple "bite-sized" projects. In such cases, one project team can be assigned to "cut up the elephant." Other teams are then assigned to tackle the resulting bite-sized projects. This approach shortens the time to complete the project, since the teams work concurrently. In contrast, use of a single team stretches the time out to several years. Frustration sets in, team membership changes due to attrition, the project drags, and morale declines.

A most useful tool for cutting up the elephant is the Pareto analysis. For an application, see the paper mill example earlier, under "Use of the Pareto Principle." For elephant-sized projects, separate goal statements are prepared for the broad coordinating team and for each team assigned to a bite-sized project.

Replication and Cloning

Some organizations consist of multiple autonomous units that exhibit much commonality. A widespread example is the chains of retail stores, repair shops, hospitals, and so on. In such organizations, a breakthrough project that is carried out successfully in one operating unit logically becomes a nomination for application to other units. This is called cloning the project.

It is quite common for the other units to resist applying the breakthrough to their operation. Some of this resistance is cultural in nature (not invented here, and so on). Other resistance may be due to real differences in operating conditions. For example, telephone exchanges perform similar functions for their customers. However, some serve mainly industrial customers, whereas others serve mainly residential customers.

Upper managers are wary of ordering autonomous units to clone breakthroughs that originated elsewhere. Yet cloning has advantages. Where feasible, it provides additional breakthroughs without the need to duplicate the prior work of diagnosis and design of remedy.

What has emerged is a process as follows:

- Project teams are asked to include in their final report their suggestions as to sites that may be opportunities for cloning.
- Copies of such final reports go to those sites.
- The decision of whether to clone is made by the sites.

However, the sites are required to make a response as to their disposition of the matter. This response is typically in one of three forms:

- We have adopted the breakthrough.
- We will adopt the breakthrough, but we must first adapt it to our conditions.
- We are not able to adopt the breakthrough for the following reasons.

In effect, this process requires the units to adopt the breakthrough or give reasons for not doing so. The units cannot just quietly ignore the recommendation.

A more subtle but familiar form of cloning is done through projects that have repetitive application over a wide variety of subject matter.

A project team develops computer software to find errors in spelling. Another team evolves an improved procedure for processing customer orders through the organization. A third team works up a procedure for conducting design reviews. What is common about such projects is that the result permits repetitive application of the same process to a wide variety of subject matter: many different misspelled words, many different customer orders, and many different designs.

Project Charters: Problem and Goal Statements for Projects

Each project selected should be accompanied by a written problem and goal statement that sets out the intended focus and the intended result of the project. Upon approval, this statement defines the actions required of the team assigned to carry out the project.

The Purpose of the Project Charter

The problem and goal statement serves a number of essential purposes:

- It defines the problem and the intended result and so helps the team know when it has completed the project.
- It establishes clear responsibility—the goal becomes an addition to each team member's job description.
- It provides legitimacy—the project becomes official organization business. The team members are authorized to spend the time needed to carry out the goal.
- It confers rights—the team has the right to hold meetings, ask people to attend and assist the team, and request data and other services germane to the project.

Perfection as a Goal

There is universal agreement that perfection is the ideal goal—complete freedom from errors, defects, failures, and so on. The reality is that the absence of perfection is due to many kinds of such deficiencies and that each requires its own breakthrough project. If a organization tries to eliminate all of them, the Pareto principle applies

- The vital few kinds of deficiencies cause most of the trouble but also readily justify the resources needed to root them out. Hence, they receive high priority during the screening process and become projects to be tackled.
- The remaining many types of deficiencies cause only a small minority of the trouble. As one comes closer and closer to perfection, each remaining kind of deficiency

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becomes rarer and rarer and hence, receives lower and lower priority during the screening process.

All organizations tackle those rare types of failure that threaten human life or that risk significant economic loss. In addition, organizations that make breakthroughs by the thousands year after year tackle even the mild, rare kinds of deficiency. To do so, they enlist the creativity of the workforce.

Some critics contend that publication of any goal other than perfection is proof of a misguided policy—a willingness to tolerate defects. Such contentions arise out of a lack of experience with the realities. It is easy to set goals that demand perfection now. Such goals, however, require organizations to tackle failure types so rare that they do not survive the screening process.

Nevertheless, there has been progress. During the twentieth century, there was a remarkable revision in the unit of measure for deficiencies. In the first half of the century, the usual measure was in percent defective, or defects per hundred units. By the 1990s, many industries had adopted a measure of defects per million units and use Sigma metrics and calculations. The leading organizations now do make thousands of breakthroughs year after year. They keep coming closer to perfection, but it is a never-ending process.

While many nominated projects cannot be justified solely on their return on investment, they may provide the means for employee participation in the breakthrough process, which has value in its own right.

The Project Team

For each selected project, a team is assigned. This team then becomes responsible for completing the project. Why a team? The most important projects are the vital few, and they are almost invariably multifunctional in nature. The symptoms typically show up in one department, but there is no agreement on where the causes lie, what the causes are, or what the remedies should be. Experience has shown that the most effective organizational mechanisms for dealing with such multifunctional problems are multifunctional teams.

Some managers prefer to assign problems to individuals rather than to teams. ("A camel is a horse designed by a committee.") The concept of individual responsibility is in fact quite appropriate if applied to control. ("The best form of control is self-control.") However, breakthrough, certainly for multifunctional problems, inherently requires teams. For such problems, assignment to individuals runs severe risks of departmental biases in the diagnosis and remedy.

A process engineer was assigned to reduce the number of defects coming from a wave soldering process. His diagnosis concluded that a new process was needed. Management rejected this conclusion on the grounds of excess investment. A multifunctional team was then appointed to restudy the problem. The team found a way to solve the problem by refining the existing process (Betker 1983).

Individual biases also show up as cultural resistance to proposed remedies. However, such resistance is minimal if the remedial department has been represented on the project team.

Appointment of Teams/Sponsors

Project teams are not attached to the chain of command on the organization chart. This can be a handicap in the event that teams encounter an impasse. For this reason, some organizations

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assign council members or other upper managers to be sponsors (or "champions") of specific projects. These sponsors follow team progress (or lack thereof). If the team does run into an impasse, the sponsor may be able to help the team get access to the proper person in the hierarchy.

Teams are appointed by sponsors of the projects, process owners, local managers, or others. In some organizations, workforce members are authorized to form teams (circles and so on) to work on breakthrough projects. Whatever the origin, the team is empowered to make the breakthrough as defined in the goal statement.

Most teams are organized for a specific project and are disbanded on completion of the project. Such teams are called ad hoc, meaning "for this purpose." During their next project, the members will be scattered among several different teams. There are also "standing" teams that have continuity—the members remain together as a team and tackle project after project.

Team Responsibilities

A project team has responsibilities that are coextensive with the goal statement. The basic responsibilities are to carry out the assigned goal and to follow the universal breakthrough process. In addition, the responsibilities include

- Proposing revisions to the goal statement
- Developing measurements as needed
- Communicating progress and results to all who have a need to know

Membership

The team is selected by the sponsor after consulting with the managers who are affected. The selection process includes consideration of (1) which departments should be represented on the team, (2) what level in the hierarchy team members should come from, and (3) which individuals in that level.

The departments to be represented should include:

- *The ailing department*. The symptoms show up in this department, and it endures the effects.
- *Suspect departments*. They are suspected of harboring the causes. (They do not necessarily agree that they are suspect.)
- *Remedial departments*. They will likely provide the remedies. This is speculative, since in many cases, the causes and remedies come as surprises.
- *Diagnostic departments*. They are needed in projects that require extensive data collection and analysis.
- *On-call departments and subject matter experts (SMEs)*. They are invited in as needed to provide special knowledge or other services required by the team.

This list includes the usual sources of members. However, there is need for flexibility.

Choice of level in the hierarchy depends on the subject matter of the project. Some projects relate strongly to the technological and procedural aspects of the products and processes. Such projects require team membership from the lower levels of the hierarchy. Other projects relate to broad business and managerial matters. For such projects, the team members should have appropriate business and managerial experience.

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Finally comes the selection of individuals. This is negotiated with the respective supervisors, giving due consideration to workloads, competing priorities, and so on. The focus is on the individual's ability to contribute to the team project. The individuals need

- *Time* to attend the team meetings and to carry out assignments outside the meetings—"the homework."
- A *knowledge base* that enables the individual to contribute theories, insights, and ideas, as well as job information based on his or her hands-on experience.
- *Training* in the breakthrough process and the associated tools. During the first projects, this training can and should be done concurrently with carrying out the projects.

Most teams consist of six to eight members. Larger numbers tend to make the team unwieldy as well as costly. (A convoy travels only as fast as the slowest ship.)

Should team members all come from the same level in the hierarchy? Behind this question is the fear that the biases of high-ranking members will dominate the meeting. Some of this no doubt takes place, especially during the first few meetings. However, it declines as the group dynamics take over and as members learn to distinguish between theory and fact.

Once the team is selected, the members' names are published, along with their project goal. The act of publication officially assigns responsibility to the individuals as well as to the team. In effect, serving on the project team becomes a part of the individuals' job descriptions. This same publication also gives the team the legitimacy and rights discussed earlier.

Membership from the Workforce

During the early years of using breakthrough teams, organizations tended to maintain a strict separation of team membership. Teams for multifunctional projects consisted exclusively of members from the managerial hierarchy plus professional specialists. Teams for local departmental projects (such as quality circles and employee involvement teams) consisted exclusively of members from the workforce. Figure 5.9 compares the usual features of these teams with those of multifunctional teams.

Experience then showed that as to the details of operating conditions, no one is better informed than the workforce. Through residence in the workplace, workers can observe local changes and recall the chronology of events. This has led to a growing practice of securing such information by interviewing the workers. The workers become can be "on call" or full-time team members. In a hospital, a doctor can be considered in the same way. Removing a worker tied directly to the production of a product must minimize their time away from their work or patients.

One result of all this experience has been a growing interest in broadening worker participation generally. This has led to experimenting with project teams that make no distinction as to rank in the hierarchy. These teams may become the rule rather than the exception. (For further discussion on the trends in workforce participation, see Chapter 26, Empowering the Workforce to Tackle the "Useful Many" Processes.

Upper Managers on Teams

Some projects, by their very nature, require that the team include members from the ranks of upper management. Here are some examples of breakthrough projects actually tackled by teams that included upper managers:

- Shorten the time to put new products on the market.
- Improve the accuracy of the sales forecast.
- Reduce the carryover of prior failure-prone features into new product models.

Feature	Department Teams or Quality Circles	Breakthrough Teams
Primary purpose	To improve departmental processes and human relations	To improve performance by creating breakthroughs across multiple departments
Secondary purpose	To improve quality	To improve teamwork and participation
Scope of project	Within a single department	Across multiple departments
Size of project	One of the useful many	One of the vital few
Membership	From a single department	From multiple departments
Basis of membership	Voluntary or mandatory	Mandatory
Hierarchical status of members	The manager, staff in any department	Management, subject matter experts, and the workforce
Continuity	Team remains intact, project after project	Team is ad hoc, disbands after project is completed

FIGURE 5.9 Contrast departmental teams and quality circles to multifunctional teams. (*From Making Quality Happen, Juran Institute, Inc., 1998.*)

- Establish a teamwork relationship with suppliers.
- Develop the new measures needed for strategic planning.
- Revise the system of recognition and rewards for breakthrough.

There are some persuasive reasons urging all upper managers to personally serve on some project teams. Personal participation on project teams is an act of leadership by example. This is the highest form of leadership. Personal participation on project teams also enables upper managers to understand what they are asking their subordinates to do, what kind of training is needed, how many hours per week are demanded, how many months it takes to complete the project, and what kinds of resources are needed. Lack of upper management understanding of such realities has contributed to the failure of some well-intentioned efforts to establish annual breakthrough.

Model of the Infrastructure

There are several ways to show in graphic form the infrastructure for breakthrough—the elements of the organization, how they relate to each other, and the flow of events. Figure 5.10 shows the elements of the infrastructure in pyramid form. The pyramid depicts a hierarchy consisting of top management, the autonomous operating units, and the major staff functions. At the top of the pyramid are the corporate council and the subsidiary councils, if any. Below these levels are the multifunctional breakthrough teams. (There may be a committee structure between the councils and the teams.)

At the intradepartmental level are teams from the workforce—circles or other forms. This infrastructure permits employees in all levels of the organization to participate in breakthrough projects, the useful many as well as the vital few.

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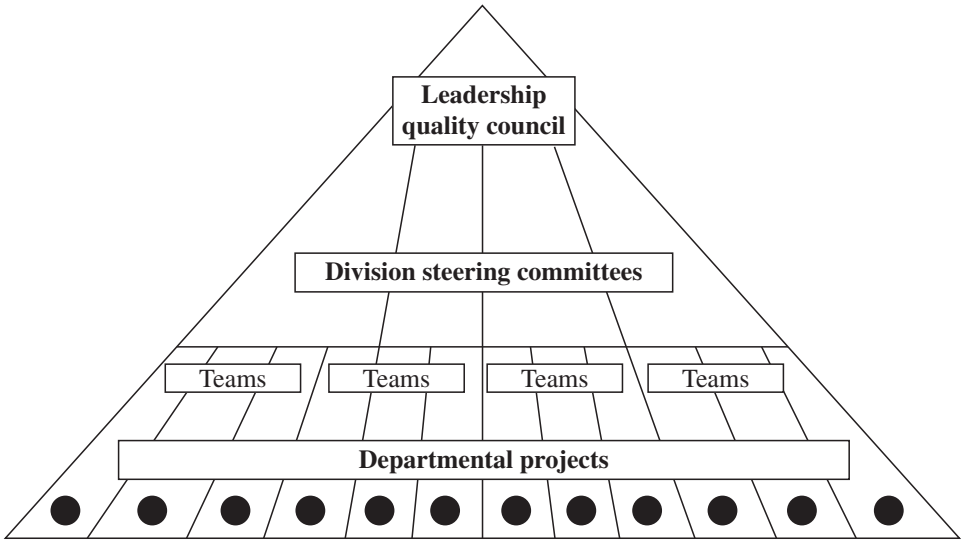

FIGURE 5.10 Model of the infrastructure for breakthrough quality improvement. (*Juran Institute, Inc.*)

Team Organization

Breakthrough teams do not appear on the organization chart. Each "floats"—it has no personal boss. Instead, the team is supervised *impersonally* by its goal statement and by the breakthrough roadmap.

The team does have its own internal organizational structure. This structure invariably includes a team *leader* (chairperson and so on) and a team *secretary*. In addition, there is usually a *facilitator*.

The Team Leader

The leader is usually appointed by the sponsor—the council or other supervising group. Alternatively, the team may be authorized to elect its leader.

The leader has several responsibilities. As a team member, the leader *shares* in the responsibility for completing the team's goal. In addition, the leader has administrative duties. These are *unshared* and include

- Ensuring that meetings start and finish on time
- Helping the members attend the team meetings
- Ensuring that the agendas, minutes, reports, and so on are prepared and published
- Maintaining contact with the sponsoring body

Finally, the leader has the responsibility of *oversight*. This is met not through the power of command—the leader is not the boss of the team—it is met through the power of leadership. The responsibilities include

- Orchestrating the team activities
- Stimulating all members to contribute
- Helping to resolve conflicts among members
- Assigning the homework to be done between meetings

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To meet such responsibilities requires multiple skills, which include

- A trained capability for leading people
- Familiarity with the subject matter of the goal
- A firm grasp of the breakthrough process and the associated tools

The Team Members

"Team members" as used here includes the team leader and secretary. The responsibilities of any team member consist mainly of the following:

- Arranging to attend the team meetings
- Representing his or her department
- Contributing job knowledge and expertise
- Proposing theories of causes and ideas for remedies
- Constructively challenging the theories and ideas of other team members
- Volunteering for or accepting assignments for homework

Finding the Time to Work on Projects

Work on project teams is time consuming. Assigning someone to a project team adds about 10 percent to that person's workload. This added time is needed to attend team meetings, perform the assigned homework, and so on. Finding the time to do all this is a problem to be solved, since this added work is thrust on people who are already fully occupied.

No upper manager known to me has been willing to solve the problem by hiring new people to make up for the time demanded by the breakthrough projects. Instead, it has been left to each team member to solve the problem in his or her own way. In turn, the team members have adopted such strategies as

- Delegating more activities to subordinates
- Slowing down the work on lower-priority activities
- Improving time management on the traditional responsibilities
- Looking for ongoing activities that can be terminated. (In several organizations, there has been a specific drive to clear out unneeded work to provide time for breakthrough projects.)

As projects begin to demonstrate high returns on investment, the climate changes. Upper managers become more receptive to providing resources. In addition, the successful projects begin to reduce workloads that previously were inflated by the presence of chronic wastes.

Facilitators and Black Belts

Most organizations make use of internal consultants, usually called "facilitators" or "Black Belts," to assist teams. A facilitator like a Black Belt does not have to be a member of the team and may not have any responsibility for carrying out the team goal. (The literal meaning of the word facilitate is "to make things easy.") The prime role of the facilitator is to help the team to carry out its goal. The usual roles of facilitators consist of a selection from the following:

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Explain the organization's intentions. The facilitator usually has attended briefing sessions that explain what the organization is trying to accomplish. Much of this briefing is of interest to the project teams.

Assist in team building. The facilitator helps the team members to learn to contribute to the team effort: propose theories, challenge the theories of others, and/or propose lines of investigation. Where the team concept is new to an organization, this role may require working directly with individuals to stimulate those who are unsure about how to contribute and to restrain the overenthusiastic ones. The facilitator also may evaluate the progress in team building and provide feedback to the team.

Assist in training. Most facilitators have undergone training in team building and in the breakthrough process. They usually have served as facilitators for other teams. Such experiences qualify them to help train project teams in several areas: team building, the breakthrough roadmap, and/or use of the tools.

Relate experiences from other projects. Facilitators have multiple sources of such experiences:

- Project teams previously served on
- Meetings with other facilitators to share experiences in facilitating project teams
- Final published reports of project teams
- Projects reported in the literature

Assist in redirecting the project. The facilitator maintains a detached view that helps him or her sense when the team is getting bogged down. As the team gets into the project, it may find itself getting deeper and deeper into a swamp. The project goal may turn out to be too broad, vaguely defined, or not doable. The facilitator usually can sense such situations earlier than the team and can help guide it to a redirection of the project.

Assist the team leader. Facilitators provide such assistance in various ways:

- Assist in planning the team meetings. This may be done with the team leader before each meeting.
- Stimulate attendance. Most nonattendance is due to conflicting demands made on a team member's time. The remedy often must come from the member's boss.
- Improve human relations. Some teams include members who have not been on good terms with each other or who develop friction as the project moves along. As an "outsider," the facilitator can help to direct the energies of such members into constructive channels. Such action usually takes place outside the team meetings. (Sometimes the leader is part of the problem. In such cases, the facilitator may be in the best position to help.)
- Assist on matters outside the team's sphere of activity. Projects sometimes require decisions or actions from sources that are outside the easy reach of the team. Facilitators may be helpful due to their wider range of contacts.

Support the team members. Such support is provided in multiple ways:

- Keep the team focused on the goal by raising questions when the focus drifts.
- Challenge opinionated assertions by questions such as, Are there facts to support that theory?
- Provide feedback to the team based on perceptions from seeing the team in action.

Report progress to the councils. In this role, the facilitator is a part of the process of reporting on progress of the projects collectively. Each project team issues minutes of its meetings. In due course, each also issues its final report, often including an oral presentation to the council.

However, reports on the projects collectively require an added process. The facilitators are often a part of this added reporting network.

The Qualifications of Facilitators and Black Belts

Facilitators undergo special training to qualify them for these roles. The training includes skills in team building, resolving conflicts, communication, and management of quality change; knowledge relative to the breakthrough processes, for example, the breakthrough roadmap and the tools and techniques; and knowledge of the relationship of breakthrough to the organization's policies and goals. In addition, facilitators acquire maturity through having served on project teams and providing facilitation to teams. This topic is covered in more detail in Chapter 12, Six Sigma: Improving Process Effectiveness.

This prerequisite training and experience are essential assets to the facilitator. Without them, he or she has great difficulty winning the respect and confidence of the project's team.

Most organizations are aware that to go into a high rate of breakthrough requires extensive facilitation. In turn, this requires a buildup of trained facilitators. However, facilitation is needed mainly during the startup phase. Then, as team leaders and members acquire training and experience, there is less need for facilitator support. The buildup job becomes a maintenance job.

This phased rise and decline has caused most organizations to avoid creating full-time facilitators or a facilitator career concept. Facilitation is done on a part-time basis. Facilitators spend most of their time on their regular job.

In many larger organizations, Black Belts are full-time specialists. Following intensive training in the breakthrough process, these persons devote all their time to the breakthrough activity. Their responsibilities go beyond facilitating project teams and may include

- Assisting in project nomination and screening
- Conducting training courses in the methods and tools
- Coordinating the activities of the project team with those of other activities in the organization, including conducting difficult analyses
- Assisting in the preparation of summarized reports for upper managers

A team has no personal boss. Instead, the team is supervised impersonally. Its responsibilities are defined in

- *The project charter*. This goal statement is unique to each team.
- *The steps or universal sequence for breakthrough*. This is identical for all teams. It defines the actions to be taken by the team to accomplish its goal.

The project team has the principal responsibility for the steps that now follow—taking the two "journeys." The diagnostic and remedial journeys are as follows:

- The diagnostic journey from symptom to cause. It includes analyzing the symptoms, theorizing as to the causes, testing the theories, and establishing the causes.
- The remedial journey from cause to remedy. It includes developing the remedies, testing and proving the remedies under operating conditions, dealing with resistance to change, and establishing controls to hold the gains.

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Diagnosis is based on the factual approach and requires a firm grasp of the meanings of key words. It is helpful to define some of these key words at the outset.

Leaders Must Learn Key Breakthrough Terminology

A "defect" is any state of unfitness for use or nonconformance to specification. Examples are illegible invoices, scrap, and low mean time between failures. Other names include "error," "discrepancy," and "nonconformance."

A "symptom" is the outward evidence that something is wrong or that there is a defect. A defect may have multiple symptoms. The same word may serve as a description of both defect and symptom.

A "theory" or "hypothesis" are unproved assertions as to reasons for the existence of defects and symptoms. Usually, multiple theories are advanced to explain the presence of defects.

A "cause" is a proved reason for the existence of a defect. Often there are multiple causes, in which case they follow the Pareto principle—the vital few causes will dominate all the rest.

A "dominant cause" is a major contributor to the existence of defects and one that must be remedied before there can be an adequate breakthrough.

"Diagnosis" is the process of studying symptoms, theorizing as to causes, testing theories, and discovering causes.

A "remedy" is a change that can eliminate or neutralize a cause of defects.

Diagnosis Should Precede Remedy

It may seem obvious that diagnosis should precede remedy, yet biases or outdated beliefs can get in the way.

For example, during the twentieth century, many upper managers held deep-seated beliefs that most defects were due to workforce errors. The facts seldom bore this out, but the belief persisted. As a result, during the 1980s, many of these managers tried to solve their problems by exhorting the workforce to make no defects. (In fact, defects are generally over 80 percent management-controllable and under 20 percent worker-controllable.)

Untrained teams often try to apply remedies before the causes are known. ("Ready, fire, aim.") For example:

- An insistent team member "knows" the cause and pressures the team to apply a remedy for that cause.
- The team is briefed on the technology by an acknowledged expert. The expert has a firm opinion about the cause of the symptom, and the team does not question the expert's opinion.
- As team members acquire experience, they also acquire confidence in their diagnostic skills. This confidence then enables them to challenge unproved assertions.
- Where deep-seated beliefs are widespread, special research may be needed.

In a classic study, Greenridge (1953) examined 850 failures of electronic products supplied by various organizations. The data showed that 43 percent of the failures were traceable to product design, 30 percent to field operation conditions, 20 percent to manufacture, and the rest to miscellaneous causes.

Institutionalizing Breakthrough

Numerous organizations have initiated breakthrough, but few have succeeded in institutionalizing it so that it goes on year after year. Yet many of these organizations have a long history of annually conducting product development, cost reduction, productivity

breakthrough, and so on. The methods they used to achieve such annual breakthrough are well known and can be applied to breakthrough. They are

- Enlarge the annual business plan to include goals for breakthrough.
- Make breakthrough a part of everyone's job description. In most organizations, the activity of breakthrough has been regarded as incidental to the regular job of meeting the goals for cost, delivery, and so on. The need is to make breakthrough a part of the regular job.
- Establish upper management audits that include review of progress on breakthrough.
- Revise the merit rating and reward system to include a new parameter—performance on breakthrough—and give it proper weight.
- Create well-publicized occasions to provide recognition for performance on breakthrough.

Review Progress

Scheduled, periodic reviews of progress by upper managers are an essential part of maintaining annual breakthroughs. Activities that do not receive such review cannot compete for priority with activities that do receive such review. Subordinates understandably give top priority to matters that are reviewed regularly by their superiors.

There is also a need for regular review of the breakthrough process. This is done through audits that may extend to all aspects of managing for quality. (Refer to Chapter 16, Using International Standards to Ensure Organization Compliance.)

Much of the database for progress review comes from the reports issued by the project teams. However, it takes added work to analyze these reports and to prepare the summaries needed by upper managers. Usually, this added work is done by the secretary of the council with the aid of the facilitators, the team leaders, and other sources such as finance.

As organizations gain experience, they design standardized reporting formats to make it easy to summarize reports by groups of projects, by product lines, by business units, by divisions, and for the corporation. One such format, used by a large European organization, determines for each project:

- The original estimated amount of chronic waste
- The original estimated reduction in cost if the project were to be successful
- The actual cost reduction achieved
- The capital investment
- The net cost reduction
- The summaries are reviewed at various levels. The corporate summary is reviewed quarterly at the chairperson's staff meeting (personal communication to the author).

Evaluation of Performance

One of the objectives of progress review is evaluation of performance. This evaluation extends to individuals as well as to projects. Evaluation of individual performance on

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breakthrough projects runs into the complication that the results are achieved by teams. The problem then becomes one of evaluating individual contribution to team efforts. This new problem has as yet no scientific solution. Thus, each supervisor is left to judge subordinates' contributions based on inputs from all available sources.

At higher levels of an organization, the evaluations extend to judging the performance of supervisors and managers. Such evaluations necessarily must consider results achieved on multiple projects. This has led to an evolution of measurement (metrics) to evaluate managers' performance on projects collectively. These metrics include

- Numbers of breakthrough projects: initiated, in progress, completed, and aborted
- Value of completed projects in terms of breakthrough in product performance, reduction in costs, and return on investment
- Percentage of subordinates active on project teams
- Superiors then judge their subordinates based on these and other inputs.

Training for Breakthrough

Throughout this chapter, there have been numerous observations on the needs for training employees. These needs are extensive because all employees must understand the methods and tools employed to attain breakthrough. Project-by-project breakthrough may be new to the organization, turnover may be high, or employees may be assigned new responsibilities. To carry out these new responsibilities requires extensive training.

So far in this decade, many organizations made significant investments in training their workforces in the methods and tools to attain performance excellence. According to *iSix Sigma* and the American Society for Quality (ASQ), more than 100,000 people were trained as Black Belts. Another 500,000 may have been trained as Green Belts. A new certification process has been added at the ASQ and at many firms like the Juran Institute to ensure that these exerts are qualified and competent to drive results. A Black Belt training program may consist of up to six weeks of training plus time to be certified.

This trend has been reversed from the 1990s. Training budgets were cut to reduce costs. Today, training is an investment in the future. This will benefit us as organizations move into the future.

Acknowledgments

This chapter of the handbook has drawn extensively from various training materials published by the Juran Institute, Inc., and Juran, J. M., ed. (1955), A History of Managing for Quality, sponsored by the Juran Foundation, Inc., ASQ Press, Milwaukee. I am also grateful to the Juran Institute, Inc.

References

Betker, H. A. (1983). "Breakthrough Program: Reducing Solder Defects on Printed Circuit Board Assembly." *The Juran Report*, No. 2, November, pp. 53–58.

Greenridge, R. M. C. (1953). "The Case of Reliability vs. Defective Components et al." *Electronic Applications Reliability Review*, No. 1, p. 12.

Juran, J. M. (1964). *Managerial Breakthrough*. McGraw-Hill, New York. Revised edition, 1995.

Juran, J. M. (1975). "The Non-Pareto Principle; Mea Culpa." Progress. May, pp. 8–9.
Juran, J. M. (1981). "Juran on Breakthrough," a series of 16 videocassettes on the subject. Juran Institute, Inc., Wilton, CT.
Juran, J. M. (1985). "A Prescription for the West—Four Years Later." European Organization for Quality, 29th Annual Conference. Reprinted in *The Juran Report*, No. 5, Summer 1985.
Juran, J. M. (1993), "Made in USA, a Renaissance in Quality." *Harvard Business Review*, July-August, pp. 42–50.
Juran, J. M., and Godfrey, A. B. (1999). "Juran's Quality Handbook, Fifth Edition," McGraw-Hill, NY.
Juran, J. M. "Juran on Quality Leadership," A video package, Juran Institute, Inc., Wilton, CT
Welch, J. (2005). Winning. Harper Collins, New York, NY

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