Out of the Crisis

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About the Author

W. Edwards Deming is the internationally renowned consultant whose work led Japanese industry into new principles of management and revolutionized their quality and productivity. The adoption of Dr. Deming's 14 points for management could help industry in the United States. Dr. Deming has enjoyed a worldwide practice for 40 years.

In recognition of his contribution to the economy of Japan, the Union of Japanese Science and Engineering (IJUSE) instituted the annual Deming Prizes for contributions to quality and dependability of product. The Emperor of Japan awarded him in 1950 the Second Order Medal of the Sacred Treasure. Dr. Deming has received numerous other awards, including the Stewhart Medal from the American Society for Quality Control in 1956 and the Samuel S. Wilks Award from the American Statistical Association in 1983.

The Metropolitan section of the American Statistical Association established in 1980 the annual Deming Prize for improvement of quality and productivity.

Dr. Deming was elected in 1983 to the National Academy of Engineering, and has been awarded the doctorates L.L.D. or Sc.D. honoris causa by the University of Wyoming, Rivier College, Ohio State University, University of Maryland, Clarkson College of Technology, and the George Washington University.
Principles for Transformation of Western Management

How poor are they that have not patience.—Iago to Roderigo, in Shakespeare’s Othello, II. iii.

Aim and Preamble

Purpose of this chapter. Western style of management must change to halt the decline of Western industry, and to turn it upward. The purpose of this chapter and the next one is to explain the elements of the transformation that must take place. There must be an awakening to the crisis, followed by action, management’s job.

This chapter and the next also provide criteria by which anyone in the company may measure the performance of management. Everyone in the company will now have a basis by which to answer the question: “How is our management doing?” Union leaders may ask the same question, and judge management by the same criteria.

The transformation can only be accomplished by man, not by hardware (computers, gadgets, automation, new machinery). A company can not buy its way into quality.

Best efforts not sufficient.

By everyone doing his best. *(Wrong)*

This is the answer that came forth in a meeting of management of a company in response to my question: “And how do you go about it to improve quality and productivity?”

1. Where do you hope to be five years from now?
2. How may you reach this goal? By what method?

What is needed is sustained involvement and participation *(William A. Golomski again).*
Hopes without a method to achieve them will remain mere hopes (Lloyd S. Nelson, next section). The 14 points of this chapter, and removal of the deadly diseases and obstacles explained in the next chapter, furnish a method.

Guidance from questions and pronouncements of Lloyd S. Nelson. (Dr. Nelson is Director of Statistical Methods for the Nashua Corporation.)

1. The central problem of management in all its aspects, including planning, procurement, manufacturing, research, sales, personnel, accounting, and law, is to understand better the meaning of variation, and to extract the information contained in variation.

2. If you can improve productivity, or sales, or quality, or anything else, by (e.g.) 5 per cent next year without a rational plan for improvement, then why were you not doing it last year?

3. The most important figures needed for management of any organization are known and unknowable (see Ch. 3).

4. In the state of statistical control, action initiated on appearance of a defect will be ineffective and will cause more trouble. What is needed is improvement of the process, by reduction of variation, or by change of level, or both. Study of the sources of product, upstream, gives powerful leverage on improvement (p. 355).

The reader of this book will find on nearly every page application of Dr. Nelson’s pronouncements.

Short-term profits are no index of ability. Short-term profits are not a reliable indicator of performance of management. Anybody can pay dividends by deferring maintenance, cutting out research, or acquiring another company.

Dividends and paper profits, the yardstick by which managers of money and heads of companies are judged, make no contribution to material living for people anywhere, nor do they improve the competitive position of a company or of American industry. Paper profits do not make bread: improvement of quality and productivity do. They make a contribution to better material living for all people, here and everywhere.

People that depend on dividends to live on should be concerned, not merely with the size of the dividend today, but also with the question of whether there will be dividends three years from now, five years from now, ten years from now. Management has the obligation to protect investment.

Support of top management is not sufficient. It is not enough that top management commit themselves for life to quality and productivity. They must know what it is that they are committed to—that is, what they must do. These obligations cannot be delegated. Support is not enough: action is required.

"... and if you can’t come, send nobody."

These are the words in a letter that William E. Conway (president and chief executive officer of the Nashua Corporation) wrote to a vice-president in response to the latter’s request for an invitation to visit the Nashua Corporation.

In other words, Mr. Conway told him, if you don’t have time to do your job, there is not much that I can do for you.

A quality program for a community, launched by ceremonies with a speech by the governor, raising of flags, beating of drums, badges, all with heavy applause, is a delusion and a snare.

Wrong way. It is a common supposition that quality and productivity can be achieved by putting on the screws, and by installing gadgets and new machinery. A new book explains how
“Motivate your people to work at top speed!” Beat horses, and they will run faster—for a while.

A letter went out from a committee of the U.S. Senate to a number of companies to stress the importance of quality and productivity, and to announce a contest. Entrants would be judged on:

- Machinery
- Automation and robotics
- Better information
- Profit sharing and other incentives
- Training
- Job enrichment
- QC-Circles
- Word processing
- Suggestion programs
- Zero defects
- Management by objective

Truth is stranger than fiction. Haven’t we a right to expect something better from a Senate committee? But they were only doing their best.

I have never heard of a word-processor that would generate an idea nor of one that would make a relative pronoun agree in gender and number with its antecedents.

The aim of a new film is to scare the wits out of factory workers, to point out to them what will happen to them if poor quality gets out and into the hands of the purchaser. As is already clear from Chapter 1, the factory worker anywhere has always known what will happen, but is in many places helpless, forced by the system that he works in to turn out poor quality.

MBWA (management by walking around, a term that I learned from Lloyd S. Nelson) is hardly ever effective. The reason is that someone in management, walking around, has little idea about what questions to ask, and usually does not pause long enough at any spot to get the right answer.

Condensation of the 14 Points for Management

Origin of the 14 points. The 14 points are the basis for transformation of American industry. It will not suffice merely to solve problems, big or little. Adoption and action on the 14 points are a signal that the management intend to stay in business and aim to protect investors and jobs. Such a system formed the basis for lessons for top management in Japan in 1950 and in subsequent years (see pp. 1-6 and the Appendix).

The 14 points apply anywhere, to small organizations as well as to large ones, to the service industry as well as to manufacturing. They apply to a division within a company.

1. Create constancy of purpose toward improvement of product and service, with the aim to become competitive and to stay in business, and to provide jobs.

2. Adopt the new philosophy. We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership for change.

3. Cease dependence on inspection to achieve quality. Eliminate the need for inspection on a mass basis by building quality into the product in the first place.

4. End the practice of awarding business on the basis of price tag. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.

5. Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.

6. Institute training on the job.

7. Institute leadership (see Point 12 and Ch. 8). The aim of supervision should be to help people and machines and gadgets to do a better job. Supervision of management is in need of overhaul, as well as supervision of production workers.

8. Drive out fear, so that everyone may work effectively for the company (see Ch. 3).
9. Break down barriers between departments. People in research, design, sales, and production must work as a team, to foresee problems of production and in use that may be encountered with the product or service.

10. Eliminate slogans, exhortations, and targets for the workforce asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the workforce.

11a. Eliminate work standards (quotas) on the factory floor. Substitute leadership.

b. Eliminate management by objective. Eliminate management by numbers, numerical goals. Substitute leadership.

12a. Remove barriers that rob the hourly worker of his right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality.

b. Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, *inter alia*, abolishment of the annual or merit rating and of management by objective (see Ch. 3).

13. Institute a vigorous program of education and self-improvement.

14. Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

**Elaboration on the 14 Points**

1. **Create constancy of purpose for improvement of product and service.** There are two problems: (i) problems of today; (ii) problems of tomorrow, for the company that hopes to stay in business. Problems of today encompass maintenance of quality of product put out today, regulation of output so as not to exceed immediate sales by too far, budget, employment, profits, sales, service, public relations, forecasting, and so forth. It is easy to stay bound up in the tangled knot of the problems of today, becoming ever more and more efficient in them, as by (e.g.) acquisition of mechanized equipment for the office.

Problems of the future command first and foremost constancy of purpose and dedication to improvement of competitive position to keep the company alive and to provide jobs for their employees. Are the board of directors and the president dedicated to quick profits, or to the institution of constancy of purpose? The next quarterly dividend is not as important as existence of the company 10, 20, or 30 years from now. Establishment of constancy of purpose means acceptance of obligations like the following:

2a. **Innovate.** Allocate resources for long-term planning. Plans for the future call for consideration of:

- New service and new product that may help people to live better materially, and that will have a market
- New materials that will be required; probable cost
- Method of production; possible changes in equipment for production
- New skills required, and in what number?
- Training and retraining of personnel
- Training of supervisors
- Cost of production
- Cost of marketing; plans for service; cost of service
- Performance in the hands of the user
- Satisfaction of the user

One requirement for innovation is faith that there will be a future. Innovation, the foundation of the future, can not thrive unless the top management have declared unshakable commitment to quality and productivity. Until this policy can be enthroned as an institution, middle management and everyone else in the company will be skeptical about the effectiveness of their best efforts.
b. Put resources into:

   Research
   Education

c. Constantly improve design of product and service. This obligation never ceases. The consumer is the most important part of the production line.

   It is a mistake to suppose that efficient production of product and service can with certainty keep an organization solvent and ahead of competition. It is possible and in fact fairly easy for an organization to go downhill and out of business making the wrong product or offering the wrong type of service, even though everyone in the organization performs with devotion, employing statistical methods and every other aid that can boost efficiency.

   Your customers, your suppliers, your employees need your statement of constancy of purpose—your intention to stay in business by providing product and service that will help man to live better and which will have a market.

   Top management should publish a resolution that no one will lose his job for contribution to quality and productivity.

2. Adopt the new philosophy. We are in a new economic age, created by Japan. Deadly diseases afflict the style of American management (see Ch. 3). Obstacles to the competitive position of American industry created by government regulations and anti-trust activities must be revised to support the well-being of the American people, and not to depress it. We can no longer tolerate commonly accepted levels of mistakes, defects; material not suited for the job, people on the job that do not know what the job is and are afraid to ask, handling damage, antiquated methods of training on the job, inadequate and ineffective supervision, management not rooted in the company, job hopping in

   management, buses and trains late or even canceled because a driver failed to show up. Filth and vandalism raise the cost of living and, as any psychologist can aver, lead to slovenly work and to dissatisfaction with life and with the workplace.

   American style of management rode along unchallenged between 1950 and 1968, when American-manufactured products held the market. Anyone anywhere in the world was lucky for the privilege to buy an American product. By 1968, forces of competition could no longer be ignored. What had happened in Japan could have happened in America, but did not. The thought still lingers: “We must have been doing something right.” This is not an inevitable conclusion.

   The cost of living varies inversely with the amount of goods and services that a given amount of money will buy. Delays and mistakes raise costs. Alternative plans in expectation of delays are costly. The economy of a single plan that will work is obvious. As an example, I may cite a proposed itinerary in Japan:

   1725 h Leave Taku City.
   1923 h Arrive Hakata.
       Change trains.
   1924 h Leave Hakata [for Osaka, at 210 km/hr].

   Only one minute to change trains? You don’t need a whole minute. You will have 30 seconds left over. No alternate plan was necessary.

   My friend Bob King, director of GOAL (Growth Opportunity Alliance of Greater Lawrence, Mass.), while in Japan in November 1983 received these instructions to reach by train a company that he was to visit:

   0903 h Board the train. Pay no attention to trains at 0858, 0901.
   0957 h Off.

   No further instruction was needed.
The following paragraph from a personal letter is illustrative of waste in a service industry. Correction of the error in the bill, and replacement of the defective notebook, must have wiped out the profit on the sale and left the customer with a resolution to try some other stationer on future orders.

I ordered from a bookstore one case of twenty-four count 1/2 inch ring notebooks. Instead, twelve came. On complaint, the bookstore sent the other twelve. I inspected every notebook and found one where the rings were stationary in the open position, useless to me. Twenty-four notebooks qualified me for a discount. The store charged me the full price, with the explanation, when I mentioned this, that the girl that took the order was anew.

A manufacturer of beer that I talked to had no problem with cans, he said, because the supplier of cans replaces free any load of cans that are found to be faulty. It had not occurred to him that he is paying for the defective cans, plus the cost of halting production and replacing cans. It had not occurred to him that his customers are footing the bill.

After passing through tight security at the offices and plant of one of America's largest chemical companies, someone observed that (1) the name on the pass that the guard gave to him was wrong and (2) the date was wrong. Otherwise, the pass was in good order.

Transformation is required—adoption of the 14 points, and riddance of the deadly diseases and obstacles described in Chapter 3.

3. Cease dependence on mass inspection. Routine 100 per cent inspection to improve quality is equivalent to planning for defects, acknowledgment that the process has not the capability required for the specifications.

- Inspection to improve quality is too late, ineffective, costly.

When product leaves the door of a supplier, it is too late to do anything about its quality. Quality comes not from inspection, but from improvement of the production process. Inspection, scrap, downgrading, and rework are not corrective action on the process.

Rework raises costs. No one likes to do repair work. A pile of items set aside for rework grows and grows, and too often, in desperation downstream for parts, are not repaired at all, but are commandeered and used just as they are.

We must note that there are exceptions, circumstances in which mistakes and duds are inevitable but intolerable. An example is, I believe, manufacture of complicated integrated circuits. Separation of good ones from bad ones is the only way out. Calculations and other paperwork in a bank or in an insurance company is another example. It is important to carry out inspection at the right point for minimum total cost (to be treated in Ch. 15).

\(\checkmark\)a. Inspection does not improve quality, nor guarantee quality. Inspection is too late. The quality, good or bad, is already in the product. As Harold F. Dodge said, "You can not inspect quality into a product."

\(\checkmark\)b. Mass inspection is with rare exceptions of the kind noted unreliable, costly, ineffective. It does not make a clean separation of good items from bad items.

\(\checkmark\)c. Inspectors fail to agree with each other until their work is brought into statistical control. They fail to agree with themselves. Test instruments, cheap or costly, require maintenance and study. (Examples appear in Chs. 8, 11, and 15.) Routine inspection becomes unreliable through boredom and fatigue. A common excuse of anyone on the job, when confronted with data on the number of defectives that he has made, is that the instruments used for the tests are unreliable. Automatic inspection and recording require constant vigil.

\(\checkmark\)d. In contrast, the inspection of small samples of product for control charts to achieve or to maintain statistical control can be
a professional job. Inspectors of vendor and customer have time to compare their instruments and tests, to learn to speak the same language.

Put on four more inspectors. This is a commonly accepted reaction to a problem in quality—a sure road to more trouble.

Inspector: A certain critical part here is inspected and signed by five inspectors, or so goes the rule, with five signatures. What do I do? If I am Number One, I inspect the item and sign the record. If I am not Number One, I make the supposition that the first man that signed the record inspected the item, so I just go ahead and sign it.

Incidentally, 200 per cent inspection, as usually carried out, is less reliable than 100 per cent inspection for the simple reason that each inspector depends on the other to do the job. Divided responsibility means that nobody is responsible. (Cf. "Administration of inspection for extra high quality," p. 261.)

My friend David S. Chambers told me about a printing company that proofread everything 11 times. Why do you think the manager called on Mr. Chambers for help? You guessed it: he was plagued with mistakes and complaints from customers. None of the 11 proofreaders had a job: each one depended on the other 10 to do it.

Wrong way. A division in the civil service of a state has the task of preparing titles to automobiles. The foreman of the group described the mistakes that are made: misspelling of name of owner, mistakes in address, mistakes in serial number, in model, and many others—few in number, but costly. She estimates that only one in seven of the mistakes made ever comes back for correction, yet correction of these mistakes costs the state a million dollars per year.

She learned that she could purchase for $10,000 software that would indicate an inconsistency while a title is being typed. Correction could be made at once—in fact would be required. This one-time purchase would eliminate errors and would pay a dividend of a million dollars per year, every year from here onward, she thought.

A better way, in my opinion, would be to improve the forms for clarity and ease; also to introduce training to help the typists to understand what constitutes a mistake and its consequences. When the typists have reached the point where they have no need of the software, then buy it, and constantly improve it. It would then be a wise investment. The output would then be quality to be proud of.

Another example.

Q. Who is responsible for the quality of incoming parts and materials?

A. Our quality control department. It is their job to inspect incoming materials and parts and to make sure that nothing goes out our door that is faulty.

Wrong way.

More details on the evils of routine dependence on inspection will appear in Chapter 3.

Remark. It is a fact, though, that realization of minimum total cost may call for 100 per cent inspection of some items (Ch. 15).

Also in instances of low yield, as of completed integrated circuits, 100 per cent may be a necessary step in the manufacturing process.

4. End the practice of awarding business on the basis of price tag alone. We can no longer leave quality, service, and price to
the forces of competition for price alone—not in today’s requirements for uniformity and reliability.²

Price has no meaning without a measure of the quality being purchased.³ Without adequate measures of quality, business drifts to the lowest bidder, low quality and high cost being the inevitable result. American industry and the U.S. government, civil and military, are being rooked by rules that award business to the lowest bidder.

The aim in purchase of tools and other equipment should be to minimize the net cost per hour (or year) of life. But this would require long-term thinking, not just cheapest price tag for purchase today. The necessary figures for initial cost, maintenance, and length of life for each important tool are on hand, albeit scattered, and could be assembled. Automatic assembly of such figures for current use is an important project for today.

A buyer’s job has been, until today, to be on the alert for lower prices, to find a new vendor that will offer a lower price. The other vendors of the same material must meet it.

The buyer is not at fault. That has been his job for 20 years. Can you blame him for doing his job? The management is at fault for maintaining terms of reference that are outdated.

The policy of forever trying to drive down the price of anything purchased, with no regard to quality and service, can drive good vendors and good service out of business.

He that has a rule to give his business to the lowest bidder deserves to get rooked.

Municipal transit authorities are an example of legitimate plunder, inviting thievery by their policy of doing business with the lowest bidder. They are forced into this policy, in the United States, by the Urban Mass Transit Administration, which grants funds only to the lowest bidder.

A few bad experiences in mass transit because of erratic performance of equipment, purchased on the basis of the price tag alone, may have retarded by a generation expansion of mass transit in the United States.

It is my understanding that the government sometimes awards to the lowest bidder contracts for demographic, social, and scientific research and development.

One can find advertisements for the teaching of control charts, at lowest price. Anyone that engages teaching by hacks deserves to be rooked.

The following flagrant example is an actual request, from a government agency, for professional help, to be awarded to the lowest bidder:

For delivery and evaluation of a course on management for quality control for supervisors... An order will be issued on the basis of price.

Sister Jeanne Perreault, president of Rivier College, repeated to the author the words of her business manager: “We can not afford to purchase equipment and buildings at the lowest price. We have to be careful.”

Purchasing managers have a new job. Economists teach the world that competition in the marketplace gives everyone the best deal. This may have been so in days gone by, when the baker had his customers, the tailor his, the cheese-maker his, and so forth. In those days, it was fairly easy to make an intelligent purchase.

It is different today. The price tag is still easy to read, but an understanding of quality requires education.

The purchasing department must change its focus from lowest initial cost of material purchased to lowest total cost. This means
education in purchasing. It is also necessary to learn that specifications of incoming materials do not tell the whole story about performance. What problems does the material encounter in production? (Cf. the section "The supposition that it is only necessary to meet specifications," Ch. 3, p. 139.)

Materials and components may all be excellent, each by itself, yet not work well together in production or in the finished product. It is thus necessary to follow a sample of materials through the whole production process into complex assemblies, and onward, finally, to the customer. There was nothing wrong with the glass in a large building in Boston, nor with the steel. Both met the specifications. Yet somehow they did not work well together in service. Glass windows fell from the steel frames to the ground below.

In one instance, the man in charge of procurement of materials, in attendance at a seminar, declared that he has no problems with procurement, as he accepts only perfect materials. (Chuckled I to myself, "That's the way to do it.") Next day, in one of his plants, a superintendent showed me two pieces of a certain item from two different suppliers, same item number, both beautifully made; both met the specifications, yet they were sufficiently different for one to be usable, the other usable only with costly rework, a heavy loss to the plant.

The explanation was that one supplier understood what the blocks were to be used for, the other did not—he merely satisfied the specifications.

It seems that difficulties like this lead one to seek solace in one or both of the following remarks:

This is the kind of problem that we see any day in this business.

or

Our competitors are having the same kind of problem.

What would some people do without their competitors?

The manager of a plant that belongs to one of America's finest corporations lamented to me that he spends most of his time defending good vendors. A typical problem runs like this. A vendor has not for years sent him a defective item, and his price is right. The corporate purchasing department proposed to award the business to a new and untried vendor because he offers a better price. These parts go into repeaters. The telephone company might incur a cost of several thousand dollars to dig up the pavement and replace a defective repeater. The plant manager, trying to protect the company and the whole system, must spend many hours in argument to hold on to the vendor that knows his business.

Advantages of a single source and long-term relationship. A long-term relationship between purchaser and supplier is necessary for best economy. How can a supplier be innovative and develop economy in his production processes when he can only look forward to short-term business with a purchaser?

There are also operational advantages. Even though two suppliers send excellent materials, there will be differences. Anyone in production knows that change in material from one vendor to material from another causes loss of time. The loss may be only 15 minutes. It may be 8 hours in a stamping mill. It may be weeks. This is so even though both vendors send good material. "Both good but unequal," a factory worker put it. From another factory worker: "The parts from the two different sources were both excellent, but only one was compatible with our needs."

Lot-to-lot variation from any one supplier is usually enough to give fits to manufacturing. It is reasonable to expect that variation between lots from two suppliers will give even more trouble.

Heard on the factory floor. With every new lot of S-T material that comes in (from the same vendor), our troubles with point-defects shoot upward, with a whole new set of problems to conquer. Material from two suppliers would drive us out of our wits.
Moreover, one should not overlook the simplification in the accounting and paperwork from decrease in number of suppliers and fewer shipping points.

A worthy customer should expect his suppliers, if they are wise and looking ahead with constancy of purpose, to compete for selection as the single supplier.

A supplier should himself work toward a single supplier for any one item.

A second source, for protection, in case ill luck puts one vendor out of business temporarily or forever, is a costly policy.

There is lower investment and lower total inventory with a single vendor than with two. (Charles E. Clough, Nashua Corporation.)

Japanese management had a head start in 1950 on the need to improve incoming materials, and on advice to establish with every vendor a long-term working relationship of loyalty and trust.

Uncertainty about date of delivery and quality drives some customers to engage two or three vendors in the hope that one of them will come through. My friend Barbara Kuklewicz, of San Jose, who counsels management, related to me that she asked a vendor if it would not be a good idea to inform the customer that his order will come late. No, he would get mad. Well, what happens when you deliver the order late? He gets mad. Then why didn’t you tell him in advance, so that he could prepare? He would get mad twice.

No manufacturer that I know of possesses enough knowledge and manpower to work effectively with more than one vendor for any item.

The purchasing department of one of my clients showed in three years the following record of advancement:

Now, only 1 item in 20 has two or more vendors.
(One in 20 may be close to an irreducible minimum.)
A year ago the proportion was 1 in 16.

Two years ago the proportion was 1 in 12.
Three years ago the proportion was 1 in 2.

Ninety-two per cent of critical parts for three and four years ahead are now in development by teams composed of the chosen supplier, design engineer, purchasing, manufacturing, sales. The price will be settled later, all books open, everybody working toward a common aim, all in conformity with “Today,” p. 41.

A company that adopts the recommendations made here will have wide influence. The suppliers that serve one company also serve other companies, and will deliver to all of them better and better quality with better and better economy. Everybody will come out ahead.

It is pleasing to see that this advice is taking wide form and substance (from the Wall Street Journal, 6 May 1983, p. 2), adopted from the Pontiac Motor Division of General Motors:

GM Is Said to Seek Long-Term Accords with Steelmakers
By AMAL NAG
Staff Reporter of THE WALL STREET JOURNAL

DETROIT—General Motors Corp., unhappy with its new bidding system for steel purchases, is said to be considering negotiating with individual companies on long-term price and supply contracts.

Last year, in a much-publicized move aimed at cutting costs and improving the efficiency of suppliers, GM required steelmakers to bid
annually for its business. The No. 1 U.S. auto company is the steel industry’s largest customer.

By giving fewer suppliers most of its business, GM hopes to cut their production costs through economies of scale and other joint efforts, resulting in lower prices.

In return for steelmakers’ cooperation with GM in its cost-cutting objectives, the auto maker is expected to reward suppliers with multi-year contracts.

In one instance, some people in a company supposed that they were conforming to the recommendation of only one supplier for a given item; because though they had arrangements with six suppliers, they ordered the item from only one of them at a time.

Commodities and services. Purchase of commodities and services should also move to the single supplier. The same commodity may be obtainable from several sources at different prices. However, consideration of inventory and ability to deliver the goods within a reasonable time, and with certainty of date, are important to the customer. Important also are the right freight car or type of trailer for haul of a commodity in or out, and its condition in respect to cleanliness and state of repair. In instances of materials that are difficult to handle, a good wholesaler may send a man to assist with the unloading and storage of goods purchased. Thus, choice of a single vendor for a given commodity may accordingly be a wise procedure. Likewise, choice of a single carrier for outbound shipments from a specific location may also be wise.

A purchasing manager told me that this course

(single shipper) lifted off her shoulders the burden of shopping around for cheaper transportation, with the hazards of poor service and irresponsibility. She uses to advantage the time saved.

As she anticipated, however, some of her customers complained that they knew how to get lower prices for the carriage. The fact is that anyone can find something at a lower price for almost anything. Anybody could have bought tires at a cheaper price than the ones that came on his automobile. What would he get for his money? Inferior quality. One must take into account the time spent in dickering for lower prices at every turn. In the long run, one comes out ahead by working with the single supplier, provided that he upholds his responsibility for continual improvement.

One vendor, multiple shipping points. I am indebted to James K. Bakken of the Ford Motor Company for the observation that two shipping points from the same vendor give the same problems as material from two vendors. The following question and answer were recorded in a visit to a plant. “What about two shipping points from the same vendor?” I asked a plant manager. “Just as bad as two suppliers,” was his answer.

A supplier with two shipping points may serve a customer with two plants by specifying one shipping point for one plant, the other shipping point for the other, no substitution or mixing.

How does a supplier qualify? Almost every company has a manual by which to “qualify” vendors. Military Standard 9858A is an example. Teams of unqualified examiners visit suppliers to rate them.

A better plan would be to discard these manuals and teams and let suppliers compete to be the chosen one, not on price tag, but at the right stage, on the basis of qualifications that have meaning. Let suppliers present evidence of active involvement of
their management with the 14 points, especially Point 5, never-ending improvement of processes, along with abolition of the diseases to be learned in Chapter 3. The same criteria that would be good for rating a division of a corporation apply equally to choice of supplier (p. 121).

One may also include, as a basis for choice of supplier:

1. Budgeted expense for research and development.
2. Past record for development of product.

(Contributed by Norbert Keller, General Motors.)

Beware of conference-room promises. (Ronald Moen.)

Heard in a seminar. We as a supplier must be qualified for services that our customer requires—extra parts for 15 years, tests of our product, delivery. We must be able to participate in tests of our product in the assembly that our customer turns out.

Single purchase contrasted with continuing delivery of material.
It is important that buyers know the difference between a single-time purchase and continuing delivery. An example of a single-time purchase could be the grand piano, the furniture and fittings for the office force, furniture and fittings to go into a hotel, two hundred small motors for two hundred refrigerators of a special kind. The selection of the grand piano or of two hundred small motors—examples of a one-time purchase—will be based on the manufacturer's reputation, along with previous experience with him.

Necessity for mutual confidence and aid between purchaser and vendor. What one company buys from another is not just material: it buys something far more important, namely, engineering and capability. These requirements of a supplier must be estab-

lished long before he produces any material. The customer that waits for delivery of material to learn what he has bought will take what he gets.

Components, small and large, change rapidly in some industries, for example, in communication, switching, and transmission of voice and of data. The component gives problems, or it does well, only to be succeeded by something else in six months.

The big problem is engineering design of subassemblies and assemblies. Engineering changes are costly, and are in some cases impossible. This is true for any product.

Some individual parts may nevertheless be nearly the same over a long stretch of time. They may come in by the thousand. Constant improvement of their incoming quality is possible, along with reduction in price, if vendor and purchaser work together.

Once again, the quality of parts is built in before they leave the vendor's door.

Traditional: Engineers formulate the design of a part or subassembly.

Purchasing people let contracts for the parts.

Some of the contracts went to the company's own allies, other contracts went to outside vendors. Difficulties in manufacture and faults in assemblies led to many engineering changes. Engineering changes led to increases in cost, and have been, by tradition, a way of life.

Today: Example 1

Teams composed of experts from the supplier chosen for this material (part or component): plus your own design engineer, process engineer,
manufacturing, sales, or any other knowledge that is needed.

Long lead time, enough to do the job right.

Result: Better and better quality as time goes on, with lower and lower costs.

Example 2. A team for development of paper for facsimile printing

The chosen manufacturer of the paper
- His chemist
- His buyer of raw materials (wood pulp, chalk, aluminum oxide, titanium oxide, other)
- His manager of production

Customer
- His senior scientist, in charge of research and development
- His chemist
- His manager of production
- His manager of marketing

The following paragraphs may indicate that in Japan a steady dependable source, responsive to needs, on a long-term arrangement, is more important than price.

A final point made by American firms is that the large markups generated by Japan’s multilayered distribution system often eliminate whatever price advantages imports have at dockside.

The Japanese respond that problems can be better understood as an extension of the long-standing customer–supplier relationship in Japan. Buyers expect suppliers to be a reliable source of merchandise, to understand their needs and respond quickly to them, and to offer reliable after-sales service. The relationship depends heavily on these factors, to the exclusion of such economic considerations as lowest cost in the quality range required. Thus, although a firm customer–supplier relationship is not intended to shut out competitive foreign firms, working within the system can be frustrating. (Japan Economic Institute, Japan’s Import Barriers: Analysis of Divergent Bilateral Views, Washington, 1982.)

Japanese management learned in 1950, with the flow diagram of Fig. 1 (p. 4) on the blackboard, that the best solution to improvement of incoming materials is to make a partner of every vendor, and to work together with him on a long-term relationship of loyalty and trust.

Dialogue between customer and producer. (Robert Brown, Nashua Corporation, 1985.)

This is what I can do for you.
Here is what you might do for me.

American companies find it difficult to understand that price is of little consideration in an attempt to open up negotiations with Japanese firms. More important than price in the Japanese way of doing business is continual improvement of quality, which can be achieved only on a long-term relationship of loyalty and trust, foreign to the American way of doing business.

A supplier has a duty to himself and to his customer to insist that he be the sole supplier. The sole supplier needs the whole attention of his customer, not divided attention (Mary Ann Gould, President of Janbridge, Inc., Philadelphia).

Cost-plus. There is a bear trap in the purchase of goods and services on the basis of price tag that people don’t talk about. To run the game of cost-plus in industry, a supplier offers a bid so low that the is almost sure to get the business. He gets it. The customer discovers that an engineering change is vital. The supplier is extremely obliging, but “regrets,” he discovers, that this change will double the cost of the items. It is too late for the
customer to try to make other arrangements. Production is under way and must be continued without interruption. The vendor comes out ahead.

Excerpts from a Report
Japanese Automotive Stamping
Written by a Team, December 1981

A. FACILITIES

1. Plant and equipment. ... Stamping presses are conventional in design. They are densely spaced, served by more complete transfer and handling systems (often mechanized), and exhibit few special features, except capability for quick change of die.

2. Extraordinary housekeeping. The extreme, cleanliness in every area of the plants was a striking feature. Clear aisles, clean equipment, spotless painted concrete floors, employees in clean white or pastel shop uniforms and caps were the rule. Floors were absolutely free of spilled lubricant, rags, hand tools, scrap, slugs, butts and other debris—everywhere.

The Japanese strongly believe that an atmosphere of cleanliness adds to quality.

B. PRODUCTION OPERATIONS

2. Minimum inventory and storage. The widely publicized just-in-time delivery system (known as the Kanban plan at Toyota, and by other names elsewhere) was observed universally. Shipments of stampings, subassemblies and assemblies are made directly to the auto assembly line several times a day. Side-loading

4 I am indebted to Mr. Ralph E. Stinson, president of the Bettcher Manufacturing Corporation, for a copy of this report.

Ch. 2 PRINCIPLES FOR TRANSFORMATION

trucks drive into the assembly plant and containers of parts are dropped off at the appropriate work-station on the line without incoming inspection and counting. Parts are assembled into the automobiles, as received.

The virtual absence of inventory results in an estimated space saving of 30 per cent as compared with comparable U.S. auto operations.

The same low-inventory philosophy is followed at the contract stamping plants. Coil and strip stock is received several times a week from steel suppliers. Relatively little plant area is devoted to storage, and inventory is typically turned over in less than a week.

3. Quick changes of dies. Dies are typically changed three to five times a shift in even the largest presses. Dedication to quick change reaches almost unbelievable proportions. Extraordinarily rapid die changes are made possible by use of standardized die sets, standardized bolster plates and adaptor plates, standardized press shut heights, frequent use of rolling bolsters, and mechanical handling equipment.

During changes of die even the largest presses are rarely out of service for more than 12–15 minutes. As an example, a line of 5 presses, including one 500-ton press, was converted to produce a completely different part in the remarkable time of just 2½ minutes.

4. High utilization of equipment. Relatively high rates of utilization—estimated at 90 to 95 per cent—are the rule. Observations covering nearly 1,000 presses revealed very few idle or standby presses, no presses disassembled for repair, and no die repairing in the press. There was strong evidence of effective preventive maintenance.

5. No wasteful lubrication. Stock is lubricated only to the absolute minimum extent necessary for successful production. Spot
lubrication is widely practiced, and use of pre-lubricated material (wax or oil base) is common. Resultingly, little lubricant is wasted, part cleaning requirements are reduced, and lubricant is not splattered on equipment, employees or the floor.

6. Health and safety. Rules for eye protection were strictly observed and hard hats were common. Other protective clothing included heavy aprons in spot welding and die making areas.

In general, machine guarding involved relatively few barrier guards, but use of presence sensing devices was widespread. No pull-back devices were seen. It was noted that die setting practices commonly require little inching or jogging of the press. No ram props were seen.

7. Hours of operation. Typically the plants operated two 8-hour shifts, with the shifts separated by 4-hour intervals during which preventive maintenance, housekeeping and major die repairs were accomplished. During periods of increased production the workday consists of two 10-hour shifts separated by intervals of 2 hours.

8. Production and quality control. Stamping equipment is operated at normal rates of speed, but because press downtime is held to remarkably low levels, the output per man-hour is much higher than in the U.S. Emphasis on mechanization and widespread use of simple transfer devices further contribute to productivity.

Quality control is an obsession. Equipment operators share direct responsibility for the quality of their production. Scrap rates and rejects are regularly held to near 1 per cent, and are often lower.

C. WORK FORCE

1. Training. In general, plant employees were clearly better trained, more widely skilled, and more flexible in their job assignments than their U.S. counterparts. Machine operators regularly make minor repairs, perform maintenance work, record machine performance data, and check parts for quality.

Companies obviously regard their employees as their most significant competitive asset and provide good general orientation as well as training in specific skills which far exceed normal practice in the U.S.

2. Employee involvement. Production workers regularly participate in operating decisions, including planning, goal setting, and monitoring of performance. They are encouraged to make suggestions and take a relatively high degree of responsibility for overall performance.

The well-known “Quality Circle” concept, involving small teams of 5–15 employees, was widely observed. A positive team spirit, along with intense loyalty and high motivation, are further enhanced by effective management communication. Visual communications in the plant—posters, signs, graphs—were extremely numerous.

Company unions are the rule, instead of industry-wide unions, and it is clearly understood that the interests of the union are tied to the success of the company. Work practices, therefore, seem less restrictive and appear to enhance personal productivity.

D. CUSTOMER RELATIONSHIPS

1. Make or buy? According to our hosts, the Japanese auto manufacturer buys 70–80 per cent, by dollar volume, of his stamping requirements from contract metal stampers, and makes 20–30 per cent of his requirements. The reverse is true in the U.S.

Japanese auto makers apparently assume that quality, delivery, inventories, and related costs can be better governed by the purchasing department in a buy situation, than by making it yourself.

2. “Arms around” relationship. Auto makers and their vendors
have an extremely close “arms around” rather than “arm’s length” relationship in which control by the customer is the key concept. In some cases the auto maker insists that the contract stamper supply him exclusively. This tends to concentrate production in relatively few, long-term suppliers, and builds a type of captive relationship in which the favored suppliers become so-called “business associates.”

This close-knit, dependent relationship between customer and supplier presumably provides the supplier with ample rewards for achievement. The penalty for failure, however, is devastating.

Production contracts are usually long-term (as long as six years), and may include requirements for product design and testing. They invariably contain demanding expectations. The expectations include: (1) exceptional quality requirements; (2) reliable just-in-time delivery; (3) exact quantities—no over- or under-runs; and (4) continuously improving productivity resulting in long-term cost reductions.

Steel prices are generally firm for an entire year.

E. IMPLICATIONS

It was repeatedly observed that the positive working relationships between steel suppliers, contract stampers, unions, and auto manufacturers reinforce productivity rather than interfere with it, as is often the case in the more adversarial relationship existing between these groups in the U.S. There is a common, unified dedication to competitive excellence throughout the Japanese industrial structure which is largely absent here.

This dedication extends from the top executive of the largest company to the lowest employees of the smallest company and directs all their efforts toward a common goal. Thus they are driven to minimize waste in every form: (1) human, physical and financial resources; and (2) time.

They capitalize on their principal competitive resource—people—and train, motivate, and manage them with particular effectiveness.

5. Improve constantly and forever the system of production and service. A theme that appears over and over in this book is that quality must be built in at the design stage. It may be too late, once plans are on their way. Every product should be regarded as one of a kind; there is only one chance for optimum success. Teamwork in design, as illustrated on page 41, is fundamental. There must be continual improvement in test methods (p. 142), and ever better understanding of the customer’s needs and of the way he uses and misuses a product.

We repeat here from page 5 that the quality desired starts with the intent, which is fixed by management. The intent must be translated into plans, specifications, tests, in an attempt to deliver to the customer the quality intended, all of which are management’s responsibility.

Downstream, there will be continual reduction of waste and continual improvement of quality in every activity of procurement, transportation, engineering, methods, maintenance, locations of activities, sales, methods of distribution, supervision, retraining, accounting, payroll, service to customers. With continual improvement, the distributions of the chief quality-characteristics of parts, materials, and service become so narrow that specifications are lost beyond the horizon.

We in America have worried about specifications; meet the specifications. In contrast, the Japanese have worried about uniformity, working for less and less variation about the nominal value—e.g., diameter 1 cm. (Contributed by John Betti, Ford Motor Company.)

This statement is in accord with a formal model introduced by
G. Taguchi years ago, which leads to lower and lower costs as quality is improved. (Continued on p. 139.)

Mere allocation of huge sums of money for quality will not bring quality. There is no substitute for knowledge. But the prospect of use of knowledge brings fear (Point 8, p. 59).

The management of a company, seized with determination to change, will continue to try to master the meaning of the 14 points and to understand and eradicate the deadly diseases and obstacles of Chapter 3. (Continued in Point 14, p. 86.)

Everyone might well ask himself every day what he has done this day to advance his learning and skill on this job, and how he has advanced his education for greater satisfaction in life.

Is every job in a job shop done better than the one before? Is there continual improvement in methods to understand better each new customer’s needs? Is there continual improvement of materials, of selection of new employees, of the skills of people at work on the job, and of repeated operations?

Overheard with Dr. Nelson.

Manager of a job shop. We make only about twenty-five at a time. How can we use quality control?

Dr. Nelson. You are thinking the wrong way. You are thinking about measuring waste and productivity at the end. It is better to work on the processes, and on equipment and on materials and components that go into your product, and on your procedures for testing these components before they go into the final product. Also—most important—your tests of the final

product: Are these tests in statistical control? If not, they will mislead you.

Every hotel just completed (building and furnishings) should be better than the last one just completed, better than one completed a year ago, and better than one completed two years ago. Is it? Why not? Why repeat over and over the same mistakes? Why are old hotels preferred to new ones?

Does a company engaged in construction, as of hotels, hospitals, office buildings, apartment houses, show continual improvement in planning and in operation? (Continued on pp. 95 and 96 and in Ch. 7.)

Do these clerks in a trucking company or in a railway improve year by year? (More on p. 195.)

Never-ending improvement in manufacturing means continual work with vendors and eventual reduction to one vendor and one shipping point for any one item (Point 4).

Improvement of the process includes better allocation of human effort. It includes selection of people, their placement, their training, to give everyone, including production workers, a chance to advance their learning and to contribute the best of their talents. It means removal of barriers to pride of workmanship both for production workers and for management and engineers (Point 12).

Putting out fires is not improvement of the process. Neither is discovery and removal of a special cause detected by a point out of control. This only puts the process back to where it should have been in the first place (an insight of Dr. Joseph M. Juran, years ago).

Improvement of a process may require study of records to learn more about the effects of changes in temperature, pressure, speed, change of material. Engineers and chemists, aiming to improve the process, may introduce changes and observe the effects.
The cause of a fault that appears periodically or seems to be associated with some recurring event is usually easy to trace. Periodic appearance of any characteristic should be traced.

Adjustment of a process that is in statistical control, initiated on appearance of a faulty item or a mistake, as if it arose from an obvious immediate cause, will only create more trouble, not less (a theorem due to Lloyd S. Nelson; see p. 20; also p. 110). Specifications limits are not action limits (see Ch. 11).

The great advantage of the Kanban system (delivery just in time) is the discipline behind it—processes in control; quality, quantity, and regularity predictable.

6. Institute training. Training must be totally reconstructed. Management needs training to learn about the company, all the way from incoming material to customer. A central problem is need for appreciation of variation.

Management must understand and act on the problems that rob the production worker of the possibility of carrying out his work with satisfaction (Point 12a).

Japanese management has by nature important advantages over management in America. A man in Japanese management starts his career with a long internship (4 to 12 years) on the factory floor and in other duties in the company. He knows the problems of production. He works in procurement, accounting, distribution, sales.

People learn in different ways. Some have difficulty to learn by written instructions (dyslexia). Others have difficulty to learn by the spoken word (dysphasia). Some people learn best by pictures; others by imitation; some by a combination of methods.

How many men have been cashiered out of the army in disgrace for alleged disobedience of (verbal) instruction, when they could not understand the spoken word?

Production worker (recorded): They give you no instruction.

What they do is to set you down at a machine and tell you to go to work.

There is nobody to teach you?

My colleagues help me, but they have their own work to do.

Don’t you have a foreman?

He knows nothing.

Isn’t his job to help you to learn yours?

If you need help, you don’t go to somebody that looks dumber than you are, do you? He wears a necktie, but he doesn’t know anything.

But the necktie helps, doesn’t it?

No.

A big problem in training and in leadership in the United States arises from a flexible standard of what is acceptable work and what is not. The standard is too often dependent on whether the foreman is in difficulty to meet his daily quota in terms of numbers.

The greatest waste in America is failure to use the abilities of people. One need only listen to a tape of a meeting with production workers to learn about their frustrations and about the contribution that they are eager to make (pp. 79–81). Anyone would be impressed to observe how articulate most production workers are, in spite of criticisms of our schools.

Money and time spent for training will be ineffective unless inhibitors to good work are removed (Point 12). Training for a job must teach the customer’s needs; see Point 14, page 86. (Contributed by William W. Scherkenbach.)

It should be noted further in connexion with Points 6 and 13 that money spent on training, retraining, and education does not show on the balance sheet; it does not increase the tangible net worth of a company. In contrast, money spent for equipment is on the balance sheet, and increases the present net worth of the company. (Contributed by Brian L. Joiner.)

Note. There is an important distinction between
Points 6 and 13. Point 6 refers to the foundations of training for the management and for new employees. Point 13 refers to continual education and improvement of everyone on the job—self-improvement.

7. Adopt and institute leadership. The job of management is not supervision, but leadership. Management must work on sources of improvement, the intent of quality of product and of service, and on the translation of the intent into design and actual product. The required transformation of Western style of management requires that managers be leaders. Focus on outcome (management by numbers, MBO, work standards, meet specifications, zero defects, appraisal of performance) must be abolished, leadership put in place. Some suggestions follow.

a. Remove barriers that make it impossible for the hourly worker to do his job with pride of workmanship (Point 12).

b. Leaders must know the work that they supervise. They must be empowered and directed to inform upper management concerning conditions that need correction (inherited defects, machines not maintained, poor tools, fuzzy definitions of acceptable workmanship, emphasis on numbers and not on quality). Management must act on the corrections proposed. In most organizations, this idea is only an idle dream, as the supervisor knows nothing about the job.

c. A further common fallacy of leadership may be illustrated here, an example related to me by my friend David S. Chambers. A supervisor held out for examination and discussion the defective items that her seven people made during the day. She would spend the last half-hour of the day with her seven people for examination and scrutiny, with great patience and compassion, of every defective item produced that day. Her seven people thought that she was a great supervisor, and so did everyone else. The fact is that the system was stable.

d. The manager of a plant assembles every morning his 30 supervisors to recount with German thoroughness all that went wrong the day before. He was making the same mistake, treating every fault and every blemish as a special cause, not working on improvement of the system. They were applying Rule 2 or Rule 3 with the funnel (p. 328), making things worse, not better, and guaranteeing forever this elevated level of trouble. We shall see more examples of this same fault—people only doing their best. How could they know? Clarification will come in Chapters 8 and 11.

e. There was a time, years ago, when a foreman selected his people, trained them, helped them, worked with them. He knew the job. Today, 19 foremen out of 20 were never on the job that they supervise. They have no part in the selection of their people. They cannot train them nor help them, as the job is as new to the foreman as it is to his people. He can count. Hence, his job gravitates to numbers, quotas, get out so many pieces today, so many for the month. At the end of the month, everything counts, ship it no matter what. Some foremen try to learn something about their work, and this effort helps to soften the adversarial relationship between production worker and supervisor. Most do not gain the confidence of the people that they supervise because they can only be concerned about numbers, unable to help the production worker improve his work. (Contributed by James K. Bakken, Ford Motor Company.)

f. Supervision on the factory floor is, I fear, in many companies, an entry position for college boys and girls to learn about the company, six months here, six months there. They are smart enough, and some of them do indeed try to learn the work, but
how can anyone learn it in six months? It is easy to understand an hourly worker who stated that if he goes to his foreman with a problem, he (the foreman) just smiles and walks away. He does not understand the problem, and could get nothing done about it if he did.

g. Much supervision could be described as supervision by ordinal numerics and percentages. Examples of fallacies:

\[\text{Anybody whose production is below average is causing loss.}\]
\[\text{Anybody whose average proportion defective is above average is causing loss.}\]
\[\text{Everyone should come up to the average.}\]

Some leaders forget an important mathematical theorem that if 20 people are engaged on a job, 2 will fall at the bottom 10 per cent, no matter what. It is difficult to overthrow the law of gravitation and laws of nature. The important problem is not the bottom 10 per cent, but who is statistically out of line and in need of help (Ch. 3).

Examples from everyday life. Half of our presidents have been above average (from the San Diego Union, 21 February 1983, p. C-2):

Historians Rate America’s Leaders Past and Present

By Bob Dvorachak

“In general, we have been blessed with above-average leadership,” said Robert K. Murray, who is tabulating the responses of 970 historians questioned in the survey.

“Wel’ve been remarkably lucky, considering the relatively haphazard way we select a president. Historians have determined that almost one out of every four has been great or near great, and over half are above average,” said the professor of history at Pennsylvania State University.

Note. Greatness is achieved by a place in the top 25 per cent.

One may ponder over the meaning of a report ascribed to the Nuclear Regulatory Commission (Wall Street Journal, 14 September 1981; brought to my attention by Robert E. Lewis, writing in the New York Statistician, May–June 1982):

NRC Study Rates 15 Nuclear Plants ‘Below Average’

By a WALL STREET JOURNAL STAFF REPORTER

WASHINGTON—Nuclear reactors at 15 of the nation’s 50 power plant sites have failed on a Nuclear Regulatory Commission “report card” and will get closer attention from federal inspectors.

The NRC staff, based on studies concluded at the end of last year, found the 15 power plants “below average” in overall performance, including maintenance, radiation and fire protection and management control.
An NRC spokesman said, "... the purpose of the study was to make sure we focus our inspections on plants showing below-average performance."

"Below average" in the report of the Nuclear Regulatory Commission\(^6\) apparently means unsatisfactory, the definition of which is not clear. Apparently the NRC had not the benefit of the methods set forth in Chapters 3 and 11 for decision on which installations are out of line. Nor did they propose constant improvement of all installations.

The aim of a system of supervision of nuclear power plants or of anything else should be to improve all plants. No matter how successful this supervision, there will always be plants below average. Specific remedial action would be indicated only for a plant that turned out, by statistical tests, to be an outlier.

Another example (reported to the author by a manager of marketing). An automotive company has three dealers in Dayton. One of them is below the average of the three (no fooling). His performance is obviously inferior. Something must be done. Perhaps we ought to urge him to sell his business so that we may get a replacement.

Examples of suggestions for ways to improve leadership appear throughout the book.

Still another. (From the Wisconsin State Journal, 11 March 1983, contributed by Brian L. Joiner.)

Half still under median
Despite the increase, union officials said, more than half the league's players earned less than the league-wide median of $75,000 a year.

Next step, bring the lower half up to the median. Or at least reduce to half the proportion below the median.

And another. My friend Heero Hacquebord of Pretoria told me that the teacher at the school that his little girl entered gave two examinations and called father to report that his little girl was below average in both of them. He told the teacher that failure of eight consecutive examinations would be cause for concern, but hardly two. One must nevertheless appreciate the good intentions of the teacher.

The educational system in a country that I recently worked in puts children of age 15 through examinations, and by design passes 50 per cent of them. Advertisements for help specify "School certificate required." The system of grading thus brands as failures for life half of the children.

Guests in some hotels are informed that the maid is responsible for all the towels and sheets in the room. In other words, the maid is held liable for what somebody else may elect to carry away. Is this a good way for the management to build up loyalty and trust with the employees?

8. Drive out fear.\(^7\) No one can put in his best performance unless he feels secure. Se comes from the Latin, meaning without, cure means fear or care. Secure means without fear, not afraid to express ideas, not afraid to ask questions. Fear takes on many faces. A common denominator of fear in any form, anywhere, is loss from impaired performance and padded figures (p. 264).

There is widespread resistance of knowledge. Advances of the


\(^7\) I am indebted to William J. Latzko for pointing out to me long ago the prevalence of fear and the economic losses therefrom.
kind needed in Western industry require knowledge, yet people are afraid of knowledge. Pride may play a part in resistance to knowledge. New knowledge brought into the company might disclose some of our failings. A better outlook is of course to embrace new knowledge because it might help us to do a better job.

Some people may wonder whether at this stage of life they can learn something new. If there were a change, where would I be?

New knowledge would cost money. Would we get our money back? When?

New business, for export or for the domestic market, comes from fundamental research, followed by development of new levels of quality and of new product. Fundamental research, to be effective, requires infusion of knowledge. It is interesting to note that 83% per cent of funds for fundamental research in the United States come from government sources, the rest from private industry. The percentages are the reverse in Japan.

Some actual expressions of fear follow.

I am afraid that I may lose my job because the company will go out of business.

I have a feeling that Dave (higher up) may move to another company. If he does, what will happen to me?

✓ I could do my job better if I understood what happens next.

✓ I am afraid to put forth an idea. I'd be guilty of treason if I did.

✓ I am afraid that my next annual rating may not recommend me for a raise.

✓ If I did what is best for the company, long term, I'd have to shut down production for a while for repairs and overhaul. My daily report on production would take a nosedive; and I'd be out of a job.

✓ I am afraid that I may not always have an answer when my boss asks something.

✓ I am afraid to contribute my best efforts to a partner or to a team, because someone else, because of my contribution, may get a higher rating than I get.

✓ I am afraid to admit a mistake.

My boss believes in fear. How can he manage his people if they don't hold him in awe? Management is punitive.

The system that I work in will not permit me to expand my ability.

I'd like to understand better the reasons for some of the company's procedures, but I don't dare to ask about them.

We mistrust the management. We can't believe their answers when we ask why we do it this way. The management have a reason, but tell us something else.

I may not make my quota today (hourly worker or plant manager).

I do not have time to take a careful look at my work. I must turn this job out, and start on another one (engineer).

More on fear. Another loss from fear is inability to serve the best interests of the company through necessity to satisfy specified rules, or the necessity to satisfy, at all costs, a quota of production.

An example appears in Chapter 8 (p. 268), where the foreman dared not halt production for repairs. He knew what was best for the company, but he could only push ahead on his quota of castings for the day, at the risk of breakdown. Sure enough, the bearing froze. He not only failed to put out his quota; worse, the whole line went down for four days for repairs. Other examples appear in Chapter 8.

A department had failed miserably for months to produce enough items for the market. The general manager appointed a task force (one man) to discover what was wrong. What he found was inspectors overpowered with fear. They had taken the idea into their heads that if the customer found an item to be faulty, the inspector that passed the item would lose his job. As a consequence, the inspectors held up almost the total output. They were incorrect about the consequences of passing a faulty item, but it is rumor that runs an organization. (Contributed by J. J. Keating of Richland, Washington.)
Some managers say that a certain amount of fear is necessary to get the work done.

The production workers did not wish a mistake of a continuing nature to be discovered. They were hiding it, afraid that management would find it out.

Fear amongst salaried workers may be attributed in large part to the annual rating of performance (see Ch. 3).

Wrong way to manage. A manager looks at a report of complaints by category. His eye falls on the highest figure on the paper; takes the telephone to wade in on the poor devil that is responsible for that category. This is another form of management by fear, and of management by numbers. Management’s first step should be to discover by calculation, not by judgment, whether this category is out of control with respect to the others. If yes, then this category requires his special attention and help. He must also work on the system to reduce all complaints. (Contributed by William W. Scherkenbach.)

9. Break down barriers between staff areas. People in research, design, purchase of materials, sales, and receipt of incoming materials must learn about the problems encountered with various materials and specifications in production and assembly. Otherwise, there will be losses in production from necessity for rework caused by attempts to use materials unsuited to the purpose. Everyone in engineering design, purchase of materials, testing materials, and testing performance of a product has a customer, namely, the man (e.g., a plant manager) that must try to make, with the material purchased, the thing that was designed. Why not get acquainted with the customer? Why not spend time in the factory, see the problems, and hear about them?

A new president came in, talked with the heads of sales, design, manufacturing, consumer research, and so forth. Everybody was doing a superb job, and had been doing so for years.

Nobody had any problems. Yet somehow or other the company was going down the tube. Why? The answer was simple. Each staff area was suboptimizing its own work, but not working as a team for the company. It was the new president’s job to coordinate the talents of these men for the good of the company.

Servicemen learn from customers a great deal about their products. There may unfortunately be in some companies no routine procedure for use of this information. In one instance, the service department, in response to frantic calls from customers, had routinely cut off a tube that conveys abrasive material to a downward outlet, and reversed the auger beyond the outlet. The problem was that the auger jammed the material into the end of the tube. The manufacturing department kept right on making the auger as always before, while the service department, on a call from a customer, routinely made the correction. The management were unaware of the lack of teamwork between manufacturing and service, and of the loss. (Contributed by Kate McKeown.)

People in design worked with people in sales and with engineers to design a new style. Salesmen, showing prototypes to wholesalers, piled up orders. The outlook was bright until the bad news came—the factory could not make the item economically. Small changes in style and specifications turned out to be necessary for economic production. These changes caused delay in the factory. Moreover, the salesman had to explain the changes to the wholesalers that had signed up for the product. The result was loss of time and loss of sales in a changing market. Teamwork with the manufacturing people at the start would have avoided these losses.

Management often complicate the work of the people in design by making last-minute changes in style and engineering, after the plans are submitted and production is ready, leaving to the design and production engineers only a few weeks to do a year’s work.

Engineers get blamed perennially for engineering changes. I
may be illustrated by service to the company that could be rendered by the credit department. The credit department may be the earliest source in the company to learn about troubles that customers have for shortage, late delivery, demurrage, damaged goods, poor quality. The customer with such a complaint may send his cheque with a deduction and explanation therefor. The credit department can help to put out fires by rapid referral of such complaints to the right people in customer service, to salesmen, and to people in manufacturing.

As we shall learn on page 179, and as anybody knows, study of complaints gives a biased picture of quality. Nevertheless this information from the credit department, if used with intelligence, can contribute to improvement of quality and service.

10. Eliminate slogans, exhortations, and targets for the work force. Eliminate targets, slogans, exhortations, posters, for the work force that urge them to increase productivity. “Your work is your self-portrait. Would you sign it?” No—not when you give me defective canvas to work with, paint not suited to the job, brushes worn out, so that I can not call it my work. Posters and slogans like these never helped anyone to do a better job.

It was reported that one company assembled top management of their 240 top suppliers to tell them that beginning next month this company would accept no defective parts. This sounds great, but such a program can only be a farce. How can suppliers make such a sudden change? How will the customer know that he is receiving no defects? How may a supplier understand what the customer needs, except by the two working together as partners? Time is required.

Sign a pledge:

I will hereafter make no defects.

(signature)

The poster shown in Fig. 3 strikes production workers as ridiculous.
"Do it right the first time." A lofty ring it has. But how could a man make it right the first time when the incoming material is off-gauge, off-color, or otherwise defective, or if his machine is not in good order, or the measuring instruments not trustworthy? This is just another meaningless slogan, a cousin of zero defects.

"Getting better together." Production workers have told me that this slogan makes them furious. Together! What is that when no one will listen to our problems and suggestions? Another useless poster, a cruel joke:

Be a quality worker.
Take pride in your work.

What is wrong with posters and exhortations? They are directed at the wrong people. They arise from management’s supposition that the production workers could, by putting their backs into the job, accomplish zero defects, improve quality, improve productivity, and all else that is desirable. The charts and posters take no account of the fact that most of the trouble comes from the system. Calculations that indicate what propor-

Stable system of defective items. I saw in the cafeteria of a company the charts in Fig. 4. Great idea. Set goals. Give people something to work toward. These are typical. What do they accomplish? Nothing? Wrong: their accomplishment is negative.

This poster exhibits a stable system of output and a stable system of production of defective items (Ch. 11). The management naturally wishes to see higher production and fewer defective items. Their method was to entreat the production workers.

The poster talks to the wrong people. The production workers may not have studied this book, but as they see it, the management are asking them (production workers) to do what they are unable to do. The effect is fear and mistrust of the management.

The improvement in production at the 20th week, perhaps obvious from the chart, arose from installation of two new machines. This increase in production led to a new goal. The new goal will create questions and resentment among production
workers. Their first thought is that the management is never satisfied. Whatever we do, they ask for more. Here are the fruits of exhortations:

1. Failure to accomplish the goal
2. Increase in variability
3. Increase in proportion defective
4. Increase in costs
5. Demoralization of the work force
6. Disrespect for the management

Posters that explain to everyone on the job what the management is doing month by month to (for example) purchase better quality of incoming materials from fewer suppliers, better maintenance, or to provide better training, or statistical aids and better supervision to improve quality and productivity, not by working harder but by working smarter, would be a totally different story: they would boost morale. People would then understand that the management is taking some responsibility for hangups and defects and is trying to remove obstacles. I have not yet seen any such posters.

An individual will of course have his own goals. A man may set his heart on a college education. He may resolve to study harder to pass a course or an examination. I resolve to finish this chapter before morning; I give myself a deadline. Goals are necessary for you and for me, but numerical goals set for other people, without a road map to reach the goal, have effects opposite to the effects sought.

The company will of course have goals—for example, constancy of purpose and never-ending improvement.

Exhortations may be found in daily bulletins issued by companies. An example follows, from a Navy yard:

I want to reemphasize that improved quality of work is critical to every one of our jobs. True productivity should translate into increased production of an acceptable professional product. Shoddy work does not improve productivity no matter how quickly [sic] or in what quantity it is completed. We would only discredit ourselves and deserve the public by turning out poor quality work.

The importance of the concept of accountability of individuals, and the power of a pervasive human knowledge among the workers, supervisors, managers and that each individual will be held accountable for his work products can not be overstressed. Audit trails must be maintained that document completed work...
and the supervisors responsible for such work. People
generally want to do the right thing, but in a large
organization they frequently don’t really understand
what is the right thing. Management must make crys-
tal clear what is expected from each employee and that
personal performance is essential to holding a job or
to being promoted. When instructions and expecta-
tions are made absolutely clear, and follow-up ac-
tion is taken swiftly where failures occur, compliance
will result. Proper managerial conduct will result in a
loyal, highly motivated and very capable work force
with tremendous surge capability. The managerial
ability to pull all of this together in a manner that sup-
ports human development is a vital ingredient in our
shipyards. We should intensively and analytically
evaluate how to handle compliance (holding work-
men, supervisors, and managers accountable) and to
deal with failure in a manner that will have the highest
payoff in improving quality and productivity.

Words like these sound persuasive. Hold people accountable!
For what? What is meant by “crystal clear”? What is failure?
Whose failure—the employee’s failure or the system’s failure?

We shall learn in Chapter 9 that the only communicable mean-
ing of any word, specification, instruction, proclamation, or
regulation is not what the writer thereof had in mind, but is in-
stead, the result of application. How does the instruction work in
practice? What happens?

**11a. Eliminate numerical quotas for the work force.** Numerical
quotas for hourly workers are sometimes known as measured
day work; also as rates, or as work standards. Naturally, the
comptroller (or accountant) needs to have in hand prediction of
costs. Industrial engineers try to estimate this cost. This cost then
becomes a standard cost, a work standard, a rate, a quota.

Rates for production are often set to accommodate the
average worker. Naturally, half of them are above average, and
half below. What happens is that peer pressure holds the upper
half to the rate, no more. The people below the average can not
make the rate. The result is loss, chaos, dissatisfaction, and turn-
over. Some rates are set for the achiever, which is even worse.

A quota is a fortress against improvement of quality and pro-
ductivity. I have yet to see a quota that includes any trace of a
system by which to help anyone to do a better job. A quota is
totally incompatible with never-ending improvement. There are
better ways.

The intent of application of a work standard is noble: predict
costs; establish a ceiling on costs. The actual effect is to double
the cost of the operation and to stifle pride of workmanship.
There are more engineers engaged in construction of work stan-
dards, and people counting production, than there are people en-
gaged in actual production.

One will see any day in hundreds of factories, men and women
standing around the last hour or two of the day, waiting for the
whistle to blow. They have completed their quotas for the day;
they may do no more work, and they can not go home. Is this
good for the competitive position of American industry? These
people are unhappy doing nothing. They would rather work.

A bank that I worked with had just engaged a consulting firm
to set work standards. The consulting firm came up with figures
on the number of customers that a teller ought to handle in an
hour, the number of computations of interest and penalty that
someone ought to compute in an hour, and a figure for every
other activity, but not a word about quality of workmanship,
and not a suggestion for improvement.

One of my students told the class that he worked in a bank in
which everybody made note of every action—a telephone call, a
calculation, use of a computer, waiting on a customer, etc. There
was a standard time for every act, and everybody was rated every
day. Some days this man would make a score of 50, next day 260,
etc. Everybody was ranked on his score, the lower the score, the higher the rank. Morale was understandably low.

"My rate is 155 pieces per day. I can’t come near this figure—and we all have the problem—without turning out a lot of defective items." She must bury her pride of workmanship to make her quota, or lose pay and maybe also her job. It could well be that with intelligent supervision and help, and with no inherited defects, this operator could produce in a day and with less effort many more good items than her stated rate.

Some people in management claim that they have a better plan: dock her for a defective item. This sounds great. Make it clear that this is not the place for mistakes and defective items. Actually, this may be cruel supervision. Who declares an item to be defective? Is it clear to the worker and to the inspector—both of them—what constitutes a defective item? Would it have been declared defective yesterday? Who made the defective item? The worker, or the system? Where is the evidence? (Cf. Ch. 11.)

Piece work is more devastating than work standards. Incentive pay is piece work. The hourly worker on piece work soon learns that she gets paid for making defective items and scrap—the more defectives she turns out, the higher her pay for the day. Where is her pride of workmanship?

There is no piece work in factories in Japan.

Work standards, rates, incentive pay, and piece work are manifestations of inability to understand and provide appropriate supervision. The loss must be appalling. Bonus for extra achievement backfires and burns out.

Management that is interested in raising dividends will take immediate, decisive steps to eliminate work standards, rates, and piece work, to put in their place intelligent supervision, following principles and examples in this book. They will remove the barriers that stand between the production worker and his pride of workmanship (Point 12).

A woman in my class at the Graduate School of Business Administration of New York University described her job with an airline, which was to answer the telephone, to make reservations, and to give information. She must make 25 calls per hour. She must be courteous, don’t rush callers. She is continually plagued by obstacles: (a) the computer is slow in delivery of information that she asks for; (b) it sometimes reports no information, whereupon she is forced to use directories and guides. Christine, what is your job? Is it:

To make 25 calls per hour?

or

To give callers courteous satisfaction; no brushoff?

It can not be both. How can she take pride in her work when she does not know what her job is? Yet the accountant must have in advance a figure for his budget.

Here are suggestions on the outline of a possible plan by which to improve economy and service. Pride of workmanship would follow naturally, as everyone would have a part in the improvement.

These suggestions are only preliminary. A statistician on the job will of course modify and revise them to suit his own inclinations and local conditions.

1. Give to the accountant a figure for his budget, to be revised.
2. Make it clear to every one of the 500 people on this job that the aim is to give satisfaction to the customer, to take pride in her work.
3. Everybody will keep a record of calls made. The record would show the time of day when a call comes, and the time finished; also for each call the delay in seconds for any display of information requested, and the number of seconds spent on manual methods to acquire information. A dozen code-keys could record the type of enquiry. Most of this record can be automatic.
4. Each worker will turn over to the supervisor a customer
Ch. 2 PRINCIPLES FOR TRANSFORMATION

that has a special problem, out of the ordinary, not a regular part of the job. For example, a customer wishes to travel to Buffalo (no problem), but then wishes, after a few days, to go on to London from Toronto via Canadian Pacific Air. The customer needs information on departure and fares from Toronto to London; also on departures from Buffalo to Toronto.

5. At the end of a week, draw a sample of 100 stations. Plot the distribution. There may be information in a run chart plotted point by point again; age of incumbent, or length of service, or by some other characteristic.

6. Repeat Steps 2, 3, 4, 5 for several more weeks, a new sample each week.

7. Study the results. Compare weeks. Compare people. What patterns emerge?

8. Establish a continuing study following the above steps, but on a reduced basis.

There will be a distribution of performance. Half the operators will be above average, half below. Study of the results would provide continuing improvement of quality and service. The record would provide data for charts and calculations that would indicate which people if any are outside the system with respect to (e.g.) number of calls referred to the supervisor, number of calls completed per hour on any code, hence in need of special help or attention of the leader (Chs. 3, 8, 11).

In the end, the accountant will have year by year a reasonable figure for prediction of costs (the budget). Every operator will know that her job is to give service, not to meet a quota, yet she will know that she is rendering service at minimum reasonable cost. Everyone will have a part in improvement of service and reduction of cost. This is the best kind of quality of work life.

The above suggestions can be modified and applied in any activity, in any kind of industry, governmental included.

For example, an official of the postal service was continually

annoyed because the people that sort mail make so many mistakes. How do you pay them? I asked. "Sort 15,000 pieces of mail per day. That is his job." The source of his problem is obvious. With this method of payment, there will never be improvement in sorting mail, nor will costs of sorting mail decrease. Suggestions parallel to those just made for the airline would continually reduce mistakes in sorting mail, would improve productivity, and give the sorters some basis for pride of workmanship.

The job of management is to replace work standards by knowledgeable and intelligent leadership. Leaders must have some understanding of the job, and of the principles expounded in Chapters 8 and 11. Wherever work standards have been thrown out and replaced by leadership, quality and productivity have gone up substantially, and people are happier on the job.

11b. Eliminate numerical goals for people in management. Internal goals set in the management of a company, without a method, are a burlesque. Examples: (1) Decrease costs of warranty by 10 per cent next year; (2) Increase sales by 10 per cent; (3) Improve productivity by 3 per cent next year. A natural fluctuation in the right direction (usually plotted from inaccurate data) is interpreted as success. A fluctuation in the opposite direction sends everyone scurrying for explanations and into bold forays whose only achievements are more frustration and more problems.

For example, the manager of a purchasing department declared that his people are going to increase productivity 3 per cent next year, by which they meant to increase by 3 per cent the average number of purchase orders accomplished per man-year. When I inquired about methods, they admitted that they had no plan. As Lloyd S. Nelson said (p. 20): "If they can do it next year with no plan, why didn't they do it last year?" They must have been goofing off. And if one can accomplish improvement
of 3 per cent with no plan, why not 6 per cent? Moreover, it was numbers only; no plan for all-out effort to minimize total cost.

A man in the Postal Service told me that his organization intends to improve productivity 3 per cent next year. Enquiry about the plan or method for this accomplishment brought forth the usual answer: no plan—they were simply going to improve.

If you have a stable system, then there is no use to specify a goal. You will get whatever the system will deliver. A goal beyond the capability of the system will not be reached.

If you have not a stable system, then there is again no point in setting a goal. There is no way to know what the system will produce; it has no capability. Study of Chapter 11 will help here. (Contributed by Edward M. Baker, Ford Motor Company.)

To manage, one must lead. To lead, one must understand the work that he and his people are responsible for. Who is the customer (the next stage), and how can we serve better the customer? An incoming manager, to lead, and to manage at the source of improvement, must learn. He must learn from his people what they are doing and must learn a lot of new subject matter. It is easier for an incoming manager to short-circuit his need for learning and his responsibilities, and instead to focus on the far end, to manage the outcome—get reports on quality, on failures, proportion defective, inventory, sales, people. Focus on outcome is not an effective way to improve a process or an activity.

As we have already remarked, management by numerical goal is an attempt to manage without knowledge of what to do, and in fact is usually management by fear.

Anyone may now understand the fallacy of "management by the numbers."

The only number that is permissible for a manager to dangle in front of his people is a plain statement of fact with respect to survival. Examples: (1) Unless our sales improve 10 per cent next year, we shall be out of business. (2) The average level of carbon monoxide in an area, over an 8-hour period, must not exceed 8 parts per million. Reason: 9 or more parts per million has been declared injurious to health.

12. Remove barriers that rob people of pride of workmanship. These barriers must be removed from two groups of people. One group is management or people on salary. The barrier is the annual rating of performance, or merit rating, to be treated in Chapter 3. The other group is hourly workers, which we proceed into herewith.

The production worker in America is under handicaps that are taking a terrific toll in quality, productivity, and competitive position. Barriers and handicaps rob the hourly worker of his birthright, the right to be proud of his work, the right to do a good job. These barriers exist in almost every plant, factory, company, department store, government office in the United States today.

How can anyone on the factory floor take pride in his work when he is not sure what is acceptable workmanship, and what is not, and can not find out? Right: yesterday; wrong today. What is my job?

People, whether in management or on the factory floor, have become, to management, a commodity. I met with 40 skilled tradesmen in a company that is doing well. Their main complaint was that they do not know till Thursday of any week whether they will work the next week. "We are a commodity," one of them said. That is the word that I had been seeking—commodity. The management may hire them at the price posted, or may not, depending on need. If not needed next week, they go back on the market.

People in management are accustomed to long hours, faced with declining sales, declining quarterly dividends, increases in costs of almost everything. They have plenty to worry about. They can face these problems, but are helpless to face the problems of people. They shrug off problems of people with crab walk and wishful thinking, hoping that the problems will go
away. They establish employee involvement, employee participation, quality of work-life, all as smoke screens. All these hopes wither away in a few months where the management is not ready to take action on suggestions.

A production worker told me that instructions for every job where she works are printed and visible, but that nobody ever read them more than halfway through. Anyone by the time she is halfway through is already so confused that she is afraid to go on; she could only be more confused.

How can a production worker take pride in his work when there are problems with inspection—inspectors not sure what is right, instruments and gauges out of order, and the foreman pushed from above to meet a daily quota of numbers, not quality?

How can he, when he must spend time trying to correct or hide defective workmanship or off-gauge material in a previous operation or handling damage?

How can he, when his job is to produce $X$ number of items as a day’s work (work standard), good, defective, and scrap, all combined willy-nilly?

How can he, when the machine is out of order, and no one listens to his plea for adjustment?

How can he, when, after stopping his machine to adjust it because it was making only defective product, the foreman comes along and orders him in two words, “Run it.” In other words, “Make defective product.”

The man (production worker) that told me about this incident described it as failure of communication:

“Failure of communication?” I asked. “You understood what the foreman said, didn’t you?” Reply: “He ordered me to make defectives. Where is my pride of workmanship?”

How can a production worker take pride in her work when she must spend a substantial fraction of her time changing tools—“soft, low-quality,” she explained.

“But the company saves money by buying cheap tools,” I remarked. “Yes,” she said, “and loses ten times what they save because the tools wear out and use up our time.”

“But you get paid for your time; what is the problem?”

“I could turn out much more work were it not for those poor tools.”

Some more examples of actual conversations:

Hourly production worker (recorded): The superintendent is afraid to make a decision. If he does nothing, he has nothing to explain to his superiors. No explanation is required of a man in management for doing nothing. How can anything improve if he passes the buck?

What about productivity?

We can’t get productivity when the conveyor is not working right, and we have to handle most of the stuff by hand. The stuff is hot and raises blisters if we handle it by hand as fast as it comes out. We have to slow down. We can’t get any action from the management.

How long has this been going on?

Seven years.

Another production worker (recorded): A supervisor comes in and is gone in five weeks. Another one comes in. He likewise knows nothing about this job, and has no intention to learn much about it, as he too will move on any day.

Another production worker (recorded): We [sic] had for years a contract for one-and-a-half million linear feet of our product. Our management decided to cut costs, improve profits. They gave us poorer and poorer materials to work with. We lost that business. That loss made a deep cut in our profit margin. We can’t produce quality with inferior materials.
Production workers told me about the machine that they were trying to use, bought new two years ago, still a disappointment. Other hourly workers showed me machines badly maintained. The maintenance man had for years cannabilized discarded machines instead of using new parts. Penny wise, pound foolish.

*Production worker* (recorded): Hoses come in too long, and we have to cut them off.
All the hoses?
All of them for a while, then a batch comes in all right; then too long again.
What difference does it make? You get paid the same.
We get paid the same but we [sic] lose money.

*Production worker* (recorded): You can’t build quality by inspection, but when the quality is not there, inspection may be the only answer.

*Production worker* (recorded): Our work is difficult because so many people are absent. We have to try to do their work, and ours too. We have a hard time to keep up, and the quality suffers.
Why are people absent?
They don’t like the work.
Why not?
We can’t do good work.
Why can’t you do good work?
Too much rush. Anything goes. The foreman must meet his quota. We don’t like it that way, so some people stay home.

*Comment*: Absenteeism is largely a function of supervision. If people feel important to a job, they will come to work.

*Production worker* (recorded): My machine, programmable logic, is down a lot of the time, and I can’t do my work when it is down.

But you get paid for your time, whether you work or not, so what is the problem?
I can’t work when the machine is down.
Can’t you repair it?
Hardly ever. I repair it when I know how. I send for the technician when I don’t. He is a long time coming.
But you get paid for your time. What is the problem?
Money can not pay me for the stress that I endure, waiting for that man to come.

*Production worker* (recorded): Our foremen are college boys that have studied human relations. They know nothing about the job here. They can not help us.

*Production worker* (recorded): What good comes of making a suggestion to your foreman? He just smiles and walks away.

*Comment*: What else could he do? He does not understand the problem, and could get nothing done if he did. A job of foreman is an entry position for college boys and girls.

*Production worker* (recorded): Our machines run till they burn up; then we lose time. There is insufficient preventive maintenance.

*Foreman* (recorded): I fill out a report when anything goes wrong. Someone from management, I was told, would come and take a look at the problem. No one has ever come.

*Another example.* This one occurred in a factory that makes electrical equipment. The most visible and absorbing activity seemed to be inspection. “What proportion of your capital equipment is invested in gauges, instruments, and computers?” I asked.

“About eighty per cent,” was the answer, “including printing of reports.”
"What proportion of your payroll goes for inspection?"

"Between fifty-five and sixty per cent. We have to be sure of our quality. We have a reputation to maintain."

A memory chip on each finished piece of apparatus held information that could print out the serial number of every one of the 1100 parts in the piece of apparatus, with indication of whether this item was accepted on first test or was a replacement for items that had failed.

"Because of so much inspection," the engineer in charge explained to me, "we don't need quality control."

Later, in a meeting with union representatives, two of the women present enquired thus: "Why do we have to spend so much of our time straightening out these plastic plates before we can work on them? A third of them come in warped."

"Why do they come in warped?" I asked.

"Handling damage, we think."

"What difference does it make to you? You get paid by the hour."

"Yes, but we could turn out more work if we didn't have to spend our time straightening out those warped plates," they said—and couldn't I do something about it?

"How long have you had this problem?" I asked.

"I have been screaming about it for three years, but nothing has happened."

One may wonder what she and her people thought of the management, taking no heed of her cries for help to eliminate this cause of waste.

Later on with the top management, I put to them this question: why is it that with 80 per cent of your capital equipment in gauges, instruments, and computers printing piles of machine sheets, and with 55 per cent of your man-hours going for inspection, no one except the production workers knew about the warped plates?

You are concerned because one of your best customers is look-
I spoke with 45 production workers about the inhibitors that stand in their way to improvement of quality and productivity.

Inadequate training in technology: “I do not understand what my job is.”
Delays and shortages of components.
Inadequate documentation on how to do the job.
Rush jobs (bad planning).
Outdated drawings.
Inadequate design (drawings changed after job completed, leading to rework and repair).
Foremen do not have sufficient knowledge to give leadership.
Inadequate and wrong tools and instruments.
No lines of communication between them and management.
Poor working environment (cold in winter, hot in summer, inadequate extraction of gasses).
“I do not know how my performance is measured. The merit rating is a farce.”
“Defective items come in from the suppliers and hold up my job.”
Struggle to get technical help from engineers.

I discussed these problems with the manager, and he promised to do something about them. He may do so, as he attended your seminar in Pretoria.

Another example. Salaried employees took over production during a strike of hourly employees. The manager of a department reported that he found machines out of order, some badly so, some badly in need of maintenance, one a candidate for outright replacement. Production doubled when he tuned up the machines. Were it not for the strike, he should never have known about the sad state of the machines, and production would have continued at half the capability of the process.

“Well, Hal,” I said, “you know whose fault it was, don’t you?”
Yes, he knows. It won’t happen again. From now on, there will be a system by which employees may report trouble with machines or with materials and by which these reports will receive attention.

What happens? In my experience, people can face almost any problem except the problems of people. They can work long hours, face declining business, face loss of jobs, but not the problems of people. Faced with problems of people (management included), management, in my experience, go into a state of paralysis, taking refuge in formation of QC-Circles and groups for EI, EP, and QWL (Employee Involvement, Employee Participation, and Quality of Work Life). These groups predictably disintegrate within a few months from frustration, finding themselves unwilling parties to a cruel hoax, unable to accomplish anything, for the simple reason that no one in management will take action on suggestions for improvement. These are devastatingly cruel devices to get rid of the problems of people. There are of course pleasing exceptions, where the management understands their responsibilities, where the management participates with advice and action on suggestions for removal of barriers to pride of workmanship.

The possibility of pride of workmanship means more to the production worker than gymnasiums, tennis courts, and recreation areas.

Give the work force a chance to work with pride, and the 3 per cent that apparently don’t care will erode itself by peer pressure.
13. Encourage education and self-improvement for everyone. What an organization needs is not just good people; it needs people that are improving with education.

In respect to self-improvement, it is wise for anyone to bear in mind that there is no shortage of good people. Shortage exists at the high levels of knowledge, and this is true in every field. One should not wait for promises of reimbursement for a course of study. Moreover, study that is directed toward immediate need may not be the wisest course.

There is widespread fear of knowledge, as we saw in Point 8, but advances in competitive position will have their roots in knowledge.

We have already seen that everybody has responsibilities in the reconstruction of Western industry, and needs new education. Management must go through new learning.

People require in their careers, more than money, ever-broadening opportunities to add something to society, materially and otherwise.

**Plan for Action**

14. Take action to accomplish the transformation. 8

1. Management in authority will struggle over every one of the above 13 points, the deadly diseases, the obstacles (Ch. 3). They will agree on their meaning and on the direction to take. They will agree to carry out the new philosophy.

2. Management in authority will take pride in their adoption of the new philosophy and in their new responsibilities. They will have courage to break with tradition, even to the point of exile among their peers.

3. Management in authority will explain by seminars and other means to a critical mass of people in the company why change is necessary, and that the change will involve everybody.

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8 I thank Dr. Phyllis Sobo of Philadelphia for help on this plan of action.

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Enough people in the company must understand the 14 points, the deadly diseases, and the obstacles of Chapter 3. Management is helpless otherwise.

This whole movement may be instituted and carried out by middle management, speaking with one voice.

4. Every activity, every job is a part of a process. A flow diagram of any process will divide the work into stages. The stages as a whole form a process. The stages are not individual entities, each running at maximum profit. A flow diagram, simple or complex, is an example of a theory—an idea.

\[ \rightarrow \text{Stage 1} \rightarrow \text{Stage 2} \rightarrow \text{Stage 3} \rightarrow \]

Work comes into any stage, changes state, and moves on into the next stage. Any stage has a customer, the next stage. The final stage will send product or service to the ultimate customer, he that buys the product or the service. At every stage there will be:

- Production—change of state, input changes to output.
  - Something happens to material or papers that come into any stage. They go out in a different state.
  - Continual improvement of methods and procedures, aimed at better satisfaction of the customer (user) at the next stage.

Each stage works with the next stage and with the preceding stage toward optimum accommodation, all stages working together toward quality that the ultimate customer will boast about. We recall these words from page 43:

This is what I can do for you.
Here is what you might do for me.

I could do a much better job (fewer mistakes) if I knew what the program is to be used for. The
5. Start as soon as possible to construct with deliberate speed an organization to guide continual improvement of quality, as recommended in Chapter 16.

The Shewhart cycle (Fig. 5) will be helpful as a procedure to follow for improvement of any stage; also as a procedure for finding a special cause detected by statistical signal (Ch. 11).

The reason to study the results of a change is to try to learn how to improve tomorrow's product, or next year's crop. Planning requires prediction. The results of a change or test may enhance our degree of belief for prediction, for planning.

Step 4 of the Shewhart cycle (study the results; what did we learn from the change?) will lead (a) to improvement of any stage, and (b) to better satisfaction of the customer for that stage. The results may of course indicate no change at all, at least for now.

If the results of the change or test are favorable, we may decide to go through the cycle again, preferably under different environmental conditions, to learn whether the favorable results of the first cycle were spurious or are valid over a range of environmental conditions.

Any step in the Shewhart cycle may need guidance of statistical methodology for economy, speed, and protection from faulty conclusions from failure to test and measure the effects of interactions.

The effect of a change that is suggested may sometimes be studied by calculation on paper, or by simulation, or by change of an engineering drawing, avoiding actual experimentation. Examples appear in Chapter 15, where simple arithmetic combined with simple theory of probability indicates whether and where to carry out inspection in order to minimize total cost.

Another simple example of a change was suggested by Dr. Ivor S. Francis at a seminar at the W. Edwards Deming Institute of New Zealand in August 1985: lengthen the coffee break from 15 minutes to 30 minutes. Result: time saved; commotion avoided. Explanation: 15 minutes is not enough time for 350 people to get their coffee and return. Given 30 minutes, they have time and are ready.

A loop may now be thrown around three or more stages, to improve everything by study of interaction of changes in one or more stages, again by the Shewhart cycle.

6. Everyone can take part in a team. The aim of a team is to improve the input and the output of any stage. A team may well
be composed of people from different staff areas. A team has a customer.

Everyone on a team has a chance to contribute ideas, plans, and figures; but anyone may expect to find some of his best ideas submerged by consensus of the team. He may have a chance on the later time around the cycle. A good team has a social memory.

At successive sessions, people may tear up what they did in the previous session and make a fresh start with clearer ideas. This is a sign of advancement.

7. Embark on construction of organization for quality as described by Fig. 61 on page 467, and in the accompanying text. This step will require participation of knowledgeable statisticians.

A group, a team, should have an aim, a job, a goal. A statement thereof must not be specific in detail, else it stifle initiative.

By working in this way, everyone will see what he can do and what only top management can do. The following questions for this purpose were contributed by Edward M. Baker of the Ford Motor Company.

Questions to help a team to start

Your organization:

a. Where in the total organizational structure does your department fit?

b. What products and services does it provide?

c. How does it provide these products and services; i.e., what processes are used?

d. What would be the effect if your organization (unit, section, department) stopped producing its products and services?

You:

a. Where do you fit in your department? What is your job?

b. What do you create or produce; i.e., what are the results of your work?

c. How do you do this? (E.g., give a general description of what you do.)

d. How do you know if you produce good results or poor results; i.e., are there standards or criteria of good performance?

e. How were these standards established?

Concerning your customers:

a. Immediate customers

i. Who receives directly the products or services that you produce? (He is your customer.)

ii. How does your customer use what you produce?

iii. What would happen if you did not do your job right?

iv. How do your errors affect them?

v. How do you find out if you are not meeting the needs or requirements of your customers (e.g., from customer, boss, reports)?

b. Intermediate and ultimate customer

i. How far beyond your immediate customer can you trace the effect of what you do?

Concerning your suppliers:

a. How is your work initiated (e.g., assignment from boss, request of customer, self-initiated)?

b. Who supplies you with material, information, services, and other information that you need to do
Types of gaps in information about the performance of incoming materials. Any batch of material sent to a plant falls into one of four categories.

1. Used in production with no problem.
2. Used in desperation, being unsuited to the requirements of manufacture and finished product, invariably with waste of material or cost of rework, or both. Example: a block, dished out at the top. Should be flat for cement. Requires rework before use. Another example is a panel (veneer or hide) of nonuniform color. Some of the material must be discarded, with loss of time and material, or risk that the finished product will be condemned.

In another example, there was only one vendor capable of supplying the right material, but to meet a large contract the company ordered the same material from other vendors, which, as it turned out, were not able to produce the grade desired. This material was used, nevertheless, in desperation, with the consequences of rework and waste.

3. Totally unusable, in the judgment of the plant manager. A way to decide what to do on this problem is to call a meeting attended by the plant manager and the buyer, possibly also by an expert from the laboratory. These men may decide:

That the plant manager was justified in his complaint, the material is unfit for use; return it to the vendor.

or

That he did not understand the requirements of the finished product, that he may find it possible to use the material.

or

That the trouble lies in specifications that did not make sense for the use intended. Hold the material for other uses, or try to sell it; possibly sell it back to the vendor (usually at a loss). Procure the right material for the purpose.

4. Material in inventory. This consists of the following: (i) Material bought, held for use. Unfortunately, material in inventory, held for use, comes in many instances from sources unknown. Some of it turns out to be defective. With origin unknown, the only safe course is 100 per cent inspection. A better way is to avoid inventory except for protection against a rise in price or against an imminent strike. (ii) Material bought for use, not to be used. Examples: (a) Product discontinued. (b) Customer canceled the order before work started. (c) Customer contracted for 2000 items; there is enough material for only 1000; he can not use 1000, and can not wait for attempts to procure more material, so he cancels the order. (d) The product
would reach the customer too late; the season will be over; customer cancels the order. There are several possible solutions to this class of item. One is to sell it back to the vendor. Another is to put it into inventory, hoping to find use for it later. Still another is to call up your competitor: he may be looking for precisely this material.

The accounting department of the company will have exact figures on Categories 3 and 4, but few companies have any clear idea about the magnitude of Categories 1 and 2.

In my experience, Category 3 (totally unusable) is very small, less than 1 per cent of the dollar value of materials bought. The dollar value of Category 2 (used in desperation), large as it may be, must be far less than the waste of effort spent in trying to use it.

One of a Kind

Everything is one of a kind. There are more products characterized as one of a kind than one might suppose. As a matter of fact, nearly everything that is made is one of a kind, as we saw in Point 5. We commonly think of a home as one of a kind, and so it is; likewise the rug on the floor of this office, and the grand piano in your home. A job shop is a producer of one of a kind, although the shop may make one or it may make two hundred of the same thing. A certain model of automobile is one of a kind: once in production, little can be done about resistance to purchase, any more than one can remodel a battleship once built. A company may build 6 aeroplanes of specified design, or 37 of them. They are one of a kind. A building, once under construction, is pretty well fixed. Changes are costly.

Machinery, once bought, becomes a fixture. So it is with a home, a grand piano, a building, an automobile, an aeroplane.

I owe to my friend William A. Golomski the perception that a large portion of products and of service as well are one of a kind. I am indebted to him also for some of the examples in this section.
the problem by sense of touch. No one, so far as I could learn, spent the night in the corridor, failing to gain access to his room. What architect would be so completely oblivious to the customer? One was. What purchaser of the building would have the same failing? One did. (More in Ch. 7.)

Example 4. A conveyor belt, two feet off the floor, carries glass jars of food. Jars fall off, break, and spill messy contents on to the floor. Some of the mess runs under the conveyor. To clean it up, a man must be under two feet in height or else crawl on his knees over broken glass to reach under the conveyor. What architect or engineer would suppose that there would never be need to clean house? One did.

Example 5. What company would build an aeroplane with no individual reading lights for passengers? The aeroplane costs millions of dollars, and is well designed (I hope) with respect to engineering and aerodynamics, but it seems that the airline traded dollars for comfort of passengers. What airlines would buy several of these aeroplanes without thought of the needs of the passenger? One did.