

2003 Crosby on Management
Quality: How Imperfect People Achieve Perfect Results

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Executive Summary

This paper compares the overall philosophies espoused by the three “gurus” of quality management (W.E. Deming, J.M. Juran, P.B. Crosby) and concludes that the simplest and most practical application of quality, *conformance to requirements*, emanates from the “Crosby” camp. While Deming and Juran have achieved, perhaps, a higher level of fame, their methods allow for “degrees of perfection” and “economies of quality,” which offer corporations a means of coming up short of achieving full conformance to requirements. The Crosby philosophy, on the other hand, illustrates through empirical financial measurement that the cost of quality is reduced as the attainment of “conformance” approaches 100-percent. Crosby thus concludes that *Quality Is Free* – or that any effort expended toward achieving complete conformance to requirements, by preventing defects and errors, pays for itself.

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Introduction

If you want proof that people will settle for nothing less than perfection, look no further than a corporate payroll office on payday. Make the slightest error on someone's paycheck and the consequences are grim. Yet, the same company will often allow the output from other departments to be sub-par because the CEO thinks the company saves money by not insisting on perfection.

During the last fifty years, Japanese industrialists out-performed their American counterparts and deeply penetrated United States markets by insisting that their products and services be free of defects. During a time when American automobiles, for example, were subject to recalls and post-production modifications, the Japanese quietly ate America's lunch by selling flawless, efficient cars at competitive prices. Granted, the work ethic and honor-based culture among Japanese employees fostered an attitude toward quality that could not be duplicated in America's Union-based environment. But, the Japanese learned that the American consumer would flock to the "better mouse trap," and that producing defect-free products directly translated into increased profits.

Sadly, most American businesses still pay mere lip service to the subject of quality, possibly, because their executives were not instilled with the quality ethic by U.S. management schools – at least, until recently.

Just for fun, I did an inventory on all the durable products I have purchased in the last three years - from computers to cars. The goal of this exercise was to calculate the percentage of these products, upon delivery, that conformed to the advertised specifications. I found that most of the products costing \$1,000 or more arrived with one or more defects, requiring a replacement part or an adjustment of some kind. My car, for example, had one recall notice waiting for it before I picked it up, and another one within six months. Other flaws were fixed as I discovered them on my own. One of my computers had a defective hard drive and a non-functioning modem. Another computer's monitor didn't work. Most of these products were made (and/or assembled) in America. Certainly, the vendors were happy to remedy these defects and the after-sale service was superb. But, how much money could these vendors have saved by making their products right the first time, reducing the need for an army of after-sale service personnel?

Closer to my space – the information technology industry – how many commercial software applications designed to run in Microsoft Windows™ are "bug-free" upon installation? The "nerd" response would be, "that would depend on whether or not

you are bounds-checking.”¹ The typical customer has no way of knowing why programs fail, or why their system “freezes” for no apparent reason. In truth, the vast majority of Windows-based applications are defective, but run “reliably enough” to satisfy most customers. Thus, the extra programming effort necessary to produce a perfect application is not considered to be – by most software publishers – worth the investment.

Any commitment to quality – no matter how it is defined – must begin at the top. Unfortunately, defective products and services are too-often blamed on the lowest-level employees involved, not on those responsible for establishing and enforcing the product requirements. This is the lesson that the “fathers” of modern quality management have tried to instill in the minds of corporate executives worldwide. Many corporations have adopted and applied the lessons of quality, and now find themselves at the top of their industries (go figure). The rest make excuses, mostly based upon the notion of the “economics of quality,” which allows for mediocre results if the customer is still willing to pay for it.

This document will compare the general doctrines of quality management as taught by Philip B. Crosby, W. Edwards Deming, and Joseph M. Juran – considered to be the “quality gurus” of our time. The Appendices contain brief biographies of these men. We will then expose the simplest and most practical method of implementation, or the method *most likely* to be implemented. You see, human nature dictates that corporate executives (like anyone else) will choose the path of least resistance. If change is too complicated, it won’t happen. Likewise, if the CEO doesn’t believe that improving quality will increase the bottom-line, change won’t happen.

Therefore, the goal of this paper is to give CEOs something they can believe in by giving them a simple, measurable, and profitable reason to “do it right the first time.” Still, as Crosby, Deming, and Juran would attest, it is difficult to change the mindset of corporate America, because, we are predisposed to believe certain things, true or not. Crosby put it this way:

“We are conditioned throughout our private lives to accept the fact that people are not perfect and will therefore make mistakes. By the time we seek a business life, this belief is firmly rooted. It becomes fashionable to say, ‘People are humans, and humans make mistakes. Nothing can be perfect as long as people take part in it.’ And people do make mistakes, particularly those who expect to make some each day and do not become upset when they do. You

¹ When computer programs run, the operating system allocates a certain amount of memory within which the applications may execute. If a poorly-written application attempts to use a portion of memory outside its allocated space, we say it is “out of bounds.” Unfortunately, most software developers simply disable “bounds-checking” rather than completely debug their programs. This results in an unstable computing environment as multiple programs step on each other’s operations.

might say they have accepted a standard that requires a few mistakes in order to be certified as human.”²

So, by some magical formula, do quality management methods provide insight on how to correct the imperfections of humanity and prevent all mistakes? No. Only the Deity can perform such a feat, and, as of this writing, He seems to have withheld the “formula” from corporate managers. Instead, the goal is to educate management on ways to achieve defect-free products and error-free services, *despite* the frailty of the “human condition,” and to justify the effort by simultaneously reducing the cost of quality.

But, before we proceed with the philosophies of quality management, we must agree upon a basic *definition* of quality, from the corporate perspective. The quality experts we will consult in the following pages differ somewhat in their definitions. Understanding the distinctions is important if your mission is to find the right quality management philosophy for your company. What you say, how you say it, and how you define your terms, will determine if and how the message will be received and successfully adopted into your corporate lexicon.

² Philip B. Crosby, 1999. “Quality and Me: Lessons from an Evolving Life” (Jossey-Bass Publishers, San Francisco, CA), pp. 76,77.

What is Quality?

To most people, “quality” is “goodness.” To consumers, for example, a “quality” car is equated with luxury; a Rolls Royce is considered to be a “higher quality” product than a Yugo; Sterling silver eating utensils are believed to be of a “higher quality” than stainless steel eating utensils. In the corporate world, however, the term “quality” is used to describe a product that meets its specifications and conforms to every requirement. In other words, if a Rolls Royce is driven off the assembly line in compliance with every requirement, and it functions precisely in conformance to specifications, then it is said to have achieved “quality.”

Although at the opposite extreme of the luxury scale from a Rolls Royce, the Yugo is considered to have achieved “quality” status if it, too, rolls off the assembly line in conformance to specifications and required functionality. If a Yugo is designed to be a cheap car, and performs as it was designed, then it has achieved the “perfect result” intended by its makers and required by its customers. Thus, while people might term “quality” as the weight, luxury, material, or market value of a product or service, business holds that quality goods and services are simply those that conform to requirements. Put another way, if a product or service lives up to its advertising, then it is a “quality” product or service.

Some would say that *quality is defined by the customer*, and this is ultimately true. Customers decide whether a product or service meets their requirements and gives them the desired value for the price. Thus, “meeting the requirements” is still the issue, no matter who defines those requirements. But, now that you’ve read *my* definition of quality, let’s see what the experts say.

Juran’s Definition

Joseph M. Juran defines quality as fitness for use. He stresses a balance between product features and products free from deficiencies. As used by Juran, the word “product” refers to the output of any process, and that includes goods as well as services.³ By features, he does not mean luxury items (e.g., leather seats, power windows) but technological properties of a product (e.g., fuel consumption of a vehicle) designed to meet the customer's needs. Service organizations also possess features, such as promptness of delivery or courtesy extended.

The second element of Juran's definition of quality addresses products free from deficiencies (e.g., errors in invoices, factory scrap, late deliveries). According to Juran, these failures make trouble for the customers and, as a consequence, they become dissatisfied. Juran's definition of quality reflects his strong orientation to meeting customer's expectations. Anyone affected by the product is considered a customer, according to Juran. This group includes those who deal with the product during its developmental stages, the internal customers, and those who deal with the finished product, the external customers.

³ Joseph M. Juran and F. M. Gryna (Editors), 1988. “The Quality Control Handbook” (McGraw-Hill Book Company, New York, NY, 4th ed.)

Deming's Definition

W. Edwards Deming does not define quality in a single phrase. He asserts that the quality of any product or service can *only* be defined by the customer. Quality is a relative term that will change in meaning depending on the customer's needs. To meet or exceed the customer's needs, managers must understand the importance of consumer research, statistical theory, statistical thinking, and the application of statistical methods to processes.

Definitions extracted from his writings reflect this emphasis on quantitative methods, the application of which results in products having (1) a predictable degree of uniformity resulting from reduced variability, (2) lower cost, and (3) suitability for the market.⁴ In *Out of the Crisis*, he is cautious in defining quality and characterizes the difficulty of achieving it. The difficulty in defining quality is to translate future needs of the user into measurable characteristics, so that a product can be designed and turned out to give satisfaction at a price that the user will pay.⁵

Crosby's Definition

Philip B. Crosby's definition of quality is, simply, "conformance to requirements."⁶ Quality must be defined in measurable and clearly stated terms to help the organization take action based on tangible targets, rather than on hunch, experience, or opinions.

To Crosby, quality is either present or not present. There is no such thing as a varying "degree" of quality. Management must measure quality by continually tracking the cost of doing things wrong. Crosby refers to this as the price of nonconformance. Some today call it the "cost of poor quality" (CPQ). To aid managers in tracking the cost of quality, Crosby developed the following formula:⁷

$$\text{Cost of Quality (COQ)} = \text{Price of Conformance (POC)} + \text{Price of Nonconformance (PONC)}$$

The POC refers to the cost of getting things done right the first time. PONC provides management with information regarding the wasted cost and a visible indication of progress as the organization improves. Obviously, the goal is to reduce both POC and PONC over time (more on these variables later).

Crosby, being the youngest of our gurus, had the benefit of learning from the deficiencies of earlier theories, and, although not gaining the respect of the corporate world until the mid-1980s, Crosby's definition has proven to be most

⁴ T. A. Lowe, and J. M. Mazzeo, September 1986. "Three Preachers, One Religion" (Quality, 25(9), 22-25)

⁵ W. Edwards Deming, 1986. "Out of the Crisis" (Massachusetts Institute of Technology, Center for Advanced Engineering Study, Cambridge, MA), p. 169.

⁶ Philip B. Crosby, 1979, "Quality Is Free" (McGraw-Hill, New York, NY), p. 8.

⁷ Philip B. Crosby, 1984. "Quality Without Tears: The Art of Hassle-Free Management" (McGraw-Hill Book Company, New York, NY), pp. 85-86.

useful and easily implemented. In March, 2000, about a year before his death, Crosby responded to a request on *Quality Digest's* website for a definition of quality from its readers. His bristling response follows:

"The problem with the quality business has always been the lurking impression that we're talking about varying degrees of 'goodness.' In the secular world, people refer to 'high-quality' restaurants and 'low-quality' products and everyone pretends to know what that means. It's OK for anyone to use words any way they wish. That's their privilege. But those of us who have to make quality happen must have a definition that's manageable and measurable. 'Goodness' is neither. I have always defined quality as 'conformance to requirements'; the ISO 9000 procedures use that definition also. This lets us measure the price of nonconformance (PONC) and place quality management on the same level as everything else that's measured financially. Then we can see progress or lack of it; we can see where the problems originate and can contribute to the organization's financial success. ...It's not based on feeling good or knowing quality when you see it or exceeding customer's expectations or being excellent. None of those have meaning that can be communicated, and they aren't measurable. This is not some intellectual exercise. This is about real life and being useful as a quality professional. Very few organizations do their work properly. Unless they know the value of integrity (conforming to requirements) and can measure it in real money, they'll never care enough to do things right the first time."⁸

⁸ Philip B. Crosby, March 2000. "Define Quality?"
(www.philipcrosby.com/pca/C.Articles/articles/year.2000/article00_03.htm)

Success Story 1: Bama Pie, Ltd.

Have you ever wondered where those little “hot apple pies” at fast-food restaurants come from? Here’s a taste of what quality management can do when added to the biscuit recipe. “Grandma Bama,” and her son, Paul, founded *Bama Pie, Ltd.* in 1937. Since then, Bama Pie has grown from selling pies at a corner drugstore to supplying the *McDonald's*, *Pizza Hut*, and *Nabisco* companies with a variety of fresh, frozen bakery products. Today, Paul Marshall's daughter, Paula Marshall-Chapman, serves as CEO of *Bama Pie*.

It seems that *McDonald's* issued an ultimatum to improve *Bama's* product quality and reduce pastry “defects.” *McDonald's* suggested that Paula implement a plan that would increase the number of inspectors at the end of the production process. But, such a plan would have increased costs without affecting the quality of the product. So Paula set out to find alternative ways to solve *Bama's* problem. In her search for potential solutions, Paula discovered Philip Crosby’s book, *Quality Is Free*.⁹ Paula found that she could satisfy *McDonald's* requirements and reduce costs concurrently. Subsequently, the company as a whole took the Crosby philosophy and tailored it to the company’s specific needs, creating the “Bama Quality Process” (BQP).

Generally, BQP focuses on customer satisfaction and continuous improvement. Specifically, the Quality Process utilizes *Bama's* mission, vision, and values in conjunction with quick customer response, employee empowerment, and long term, comprehensive planning.

As a result of the BQP, *Bama* has achieved significant results. The company has increased the number of employee training hours from 0 to over 9,000. Customer satisfaction of all biscuit products has increased to 93 percent. Inventory has been reduced by 90 percent and accident rates have been cut in half. Because of a reduction in the *Cost of Quality (COQ)*, *Bama* even managed to cut its baked apple pie price by 10 percent.¹⁰

To put these figures into perspective, it is necessary to explore the philosophy of quality management, because that’s what it is – a philosophy, not a “program,” per se. Educating the company on the issues of quality will fail if the approach is to simply “motivate” employees; however, communicating the tangible results of meeting requirements and producing defect-free products and services, is self-motivating.

⁹ Philip B. Crosby, 1979. "Quality Is Free: The Art of Making Quality Certain" (McGraw-Hill Book Company, New York, NY)

¹⁰ "Spotlight on Bama Pie, Ltd." (www.geocities.com/WallStreet/3267/Bama.htm)

Crosby on Quality

The foundation of Crosby's approach is *prevention*. His approach to quality is best described by the following concepts, gleaned from two decades of his published works.

Do It Right the First Time

Crosby's approach focuses on doing things right the first time and every time. There is no place in his philosophy for differing levels of quality or categories of quality (e.g., high/low, good/poor). He believes there should be no reason for planning and investing in strategies that are designed in case something does not conform to requirements and goes wrong. He stresses that the way to manage quality is by prevention, not detection and testing.

Crosby finds it interesting that companies build an empire around after-sale field service, "post-production assembly," and large customer service networks with the charter to resolve preventable problems. Within such companies, Crosby found, the cost of nonconformance can run as high as 25 or 30 percent of sales, when it should be less than three percent. To Crosby, any product that falls within its design specifications is a quality product.

Zero Defects

The ultimate goal of Crosby's quality improvement process is *Zero Defects* or "defect-free" products and services. Contrary to what is generally believed, *Zero Defects* is not just a motivational slogan, but an attitude and commitment to prevention. *Zero Defects* does not mean that the product has to be perfect. It does mean that every individual in the organization is committed to meet the requirement the first time, every time, and that not meeting the requirement is unacceptable. To get everyone involved in the process of quality improvement, Crosby stresses individual conformance to requirements. To Crosby, when people are asked to do "it" right the first time, the "it" is the established requirements.

Four Absolutes of Quality

Quality improvement begins with what Crosby calls the four absolutes of quality management, considered by him to be the core concepts of the quality improvement process. These absolutes help management focus on quality improvement and, more importantly, help them make the shift from what Crosby calls conventional wisdom (the idea that if quality goes up, so does the cost) to the idea that quality and costs are not in competition with each other. As quality increases, cost decreases - thus, quality doesn't cost. This reasoning led to Crosby's famous statement, "Quality is free. It's not a gift, but it is free."¹¹

Absolute One: Quality is Conformance to Requirements

All the actions necessary to run an organization, produce a product and/or service, and deal with customers must be met and agreed. If management wants people to

¹¹ Ibid, Crosby, 1979, p. 1.

do it right the first time, they must clearly communicate what "it" is and help them achieve it through leadership, training, and fostering a climate of cooperation.

Absolute Two: The System of Quality is Prevention

The system that produces quality is prevention (i.e., eliminating errors before they occur). Training, discipline, example, and leadership produce prevention. Management must consciously commit to a prevention-oriented work environment. Crosby says,

“The most visible of the expenses of conventional quality practice lie in the area of appraisal. ...Appraisal, whether it is called checking, inspection, testing, or some other name, is always done after the fact. ...Checking and sorting and evaluating only sift what is done. What has to happen is prevention. The error that does not exist cannot be missed.”¹²

Absolute Three: The Performance Standard is Zero Defects

The performance standard is Zero Defects ("Do it right the first time"): The attitude of "close enough" is not tolerated in Crosby's approach. Errors are too costly to ignore. Leaders must help others in their pursuit of conforming to requirements by allocating resources for training, providing time, tools, etc., to all employees. "Companies try all kinds of ways to help people *not* meet the requirements,"¹³ explains Crosby. He then describes some of the ways, including SPQL (shipped-product quality level), which plans for a certain number of errors; and AQL (acceptable quality level), which is designed to establish the acceptance plan for inspection or test people, but really sets the number of nonconforming items that will be accepted. Crosby adds,

“Conventional wisdom says that error is inevitable. As long as the performance standard requires it, then this self-fulfilling prophecy will come true.”¹⁴

Crosby then describes what happened after he introduced the *Zero Defects* concept to some Japanese industrialists in 1961:

“The Japanese thought it was great and have been using it all these years to explain what management wants people to do. The U.S. could have been working on learning how to do things right during that time period instead of searching for that elusive ‘economics of quality.’”¹⁵

Finally, Crosby explains his response to critics of the *Zero Defects* principle, or those within a company who believe it isn't practical to enforce it:

“Somewhere in the world, there is a test manager who can get me a [product or service] with no defects in it.”¹⁶

¹² Ibid, Crosby, 1984, pp. 66-67.

¹³ Ibid, Crosby, 1984, p. 75.

¹⁴ Ibid, Crosby, 1984, p. 76.

¹⁵ Ibid, Crosby, 1984, p. 77.

¹⁶ Ibid, Crosby, 1984, p. 82.

Absolute Four: The Measurement of Quality is the Cost of Nonconformance

Nonconformance is a management tool for diagnosing an organization's effectiveness and efficiency. Essentially, quality comes down to cold, hard cash, which is the ultimate quality measurement. The cost of quality is divided into two parts – the price of nonconformance (PONC) and the price of conformance (POC). The PONC includes all expenses involved in doing things wrong, such as the efforts to correct salesperson's orders when they come in, to correct the procedures designed to implement orders, and to correct the product or service along the way, to do work over, and to pay for warranty and related claims.

Crosby claims that typical nonconformance costs add up to 20 percent or more of sales in manufacturing companies and 35 percent of operating costs in service companies. The POC is what a company must spend to make things come out right, including professional quality functions, prevention efforts, and quality education. Procedural and product qualification costs are also included. POC typically represents 3 to 4 percent in well-run companies, according to Crosby.¹⁷ He summarizes the calculation as follows:

“...the rule is: take everything that would not have to be done if everything were done right the first time and count that as the price of nonconformance.”¹⁸

There are four generally accepted cost measurements associated with quality management: *prevention*, *appraisal*, *internal failure*, and *external failure*. Under Crosby's philosophy, prevention receives priority in all efforts, while the appraisal process should be eliminated (which can only happen by doing things right the first time). Internal failures can also be reduced, or eliminated, through prevention. External failures are associated with field services (which can also be eliminated by prevention) and material suppliers (who can be replaced if they don't provide defect-free materials).

Most quality managers warn that the costs of prevention should be kept separate from other measurements from which employee incentives are based, in order to discourage the reduction of preventative activities by employees who just want to get the “quality costs” down. While Crosby does not make this warning directly, companies who follow the Crosby methods have learned to keep all incentives compatible.

Many studies have been performed on companies adopting the Crosby (and Juran) methods of measuring the cost of nonconformance (PONC) or cost of poor quality (CPQ), with the goal of determining the most appropriate costs to include in these variables. The applicable costs typically fall into the categories below. The total of these sixteen categories can then be divided by annual sales to determine the CPQ as a percentage of revenues.

¹⁷ Ibid, Crosby, 1984, pp. 85-86.

¹⁸ Ibid, Crosby, 1984, p. 86.

- **Waste:** If you buy a 6-ft. length of lumber, but only need a 5-ft. 8-in. piece, the extra 4 in. you cut off and discard is waste. Assuming you planned for it in your pricing, waste does not detract from your profits, but too much can drive your prices up, impairing your competitive advantage.
- **Scrap:** If you sand your 5-ft. 8-in. piece of wood, engrave something on it, and stain it, and then it warps or cracks, it becomes scrap. Not only do you lose the price of the material, you also lose the value of all the labor that has gone into the product up until that point.
- **Rework:** If a worker forgets to drill the 0.25-inch hole that the specifications say should be in the middle of a steel plate, the cost to fix the mistake is rework. Spending, for example, six minutes to measure where the hole should be, drill it, clean it out, and give it back to the inspector may not sound like much, but if the worker's wage plus benefits is, say, \$30 per hour, it costs the company \$3.00 every time this mistake happens, which can add up over a year.
- **Repair:** If, instead, the worker accidentally drilled a hole in the steel plate where none should be, the cost for him to weld the hole shut would count as repair. If the weld is not in a critical spot, your customer may still accept the repaired part, but if mistakes like this happen too often, your customer may ask for concessions.
- **Concessions:** Your customers don't want second-class products. If you send them mistakes, like the one mentioned above, they may only agree to accept the parts in exchange for a reduction in price. That is known as a concession.
- **Inspection and Acceptance:** If everything is being done right the first time, these costs are minimal. Any equipment and labor specifically dedicated to product acceptance processes is considered a direct cost of quality.
- **Re-inspection:** If a part has to be inspected again after being reworked or repaired, both the administrative and the direct costs are categorized here.
- **Warranty:** Most manufacturers offer a warranty, which means they set aside a percentage of funds to replace products that customers return. If your company set aside a 2-percent reserve for warranty costs, but by the end of the year you had used 3-percent, the extra percent comes straight out of profits.
- **Replacement:** When the company has to replace a bad product, it has to pay for the material for the replacement.
- **Additional overhead:** This includes extra overhead costs incurred due to returned products, for example, the cost of purchasing replacement materials.
- **Shipping and packing for returned products:** Packaging and shipping the replacement parts also costs the company money.

- **Claims adjustments:** This includes adjustments made to accounts receivable to compensate for returned goods and concessions.
- **Goodwill:** Although difficult to establish as a dollar figure, this category includes the loss of customer goodwill due to inferior-quality products. Will the customer buy from you again, or recommend your company to others?
- **Field Service:** Except for routine maintenance, field service personnel exist to repair and replace nonconforming products and services. Thus, the salaries and travel expenses associated with the non-routine portion of these services must be measured as costs of poor quality.
- **Change:** Engineering changes, retooling, methods improvement, process change, purchase order changes, re-keying costs, software correction costs, and other disruptive actions caused by failure to meet requirements are included in this category. Such costs include labor, travel, supplies, clerical support, administrative, and special equipment.
- **Internal Services:** Late or incorrect reports, computer input errors, network failures, system or equipment downtime, drafting errors, billing errors, payable errors, payroll errors, missed deductions or discounts, contract errors, advertising errors, order description errors, late receipt of materials, and rejections due to incomplete descriptions, are just a few examples of poor quality events that cost money and should be measured.

Another calculation, not specifically covered by Crosby, but related to the above calculations, is the overall return on investment (ROI) of quality expenditures. Note that these expenditures are primarily the “positive” ones, those related to quality education and prevention efforts, however, an ROI of the total quality effort can be derived from the savings resulting from overall reduction of nonconformance costs.

This is especially valuable for companies that want to make sure their large quality budgets are well spent. It may be that the quality programs are working quite well, but there are a lot of influences working against the efforts. It may be that even though quality has gone down, it would have gone down a lot more if the programs had not been implemented.

First, when calculating your quality ROI, you must determine the scope of your analysis. If you have just implemented a whole new quality system, how long a payback period should you expect from that system? Six months? Two years? It depends on your situation and your system. Once you settle on a timeframe that seems reasonable, you'll track all of your quality-related costs and benefits for that period.

Your list of applicable costs might include: the salary, benefits, and office support of the quality staff; the cost of designing and implementing any new measurement systems; the cost of time, space, and materials for quality-related meetings; training expenses; and the cost of quality books, guides, or software. If you purchased any major equipment as a result of your quality program, you can depreciate that cost over a period of time, rather than calculating it as a one-time

lump sum. Benefits might include improvements in productivity, rejects, cycle time, or any of the areas listed in the CPQ study, as described earlier.

When calculating benefits, take care to establish which are really the result of your quality program and which may be due to some other influence. If productivity has gone up 20%, can you take all the credit, or might an equipment upgrade have had something to do with it? Sometimes you can isolate benefits by comparing your results to those in a different plant or department that does not use your quality methods. You can also analyze a previous year's trends to try to predict what would have happened if you had never implemented your quality improvements.

Finally, convert the data to monetary values. If reject rates have gone down 30 percent, what is that worth? Multiply the cost of one reject by the number of rejects eliminated. If you have already been tracking your CPQ, you already know the cost of many areas that your quality system might improve. Once you know how much you've spent and how much you've gained, one simple mathematical formula will show how your quality efforts affected your company's bottom line:

$$\text{(QualityBenefits - CostOfQuality)} \div \text{CostOfQuality} \times 100 = \% \text{ ROI}$$

For example, suppose you spent \$100,000 last year to implement a new quality program, and \$50,000 this year to maintain it. You decide to track your results over the two-year period, so your total investment (CostOfQuality) is \$150,000. When you track the monetary benefits (QualityBenefits) directly related to your quality initiative over those two years, you find they amount to \$300,000. Applying the ROI formula, you get:

$$(\$300,000 - \$150,000) \div \$150,000 \times 100 = 100\%$$

An ROI of 100% means that in two years, you got your investment back, plus the same amount again as profit. Compared to the 6% or 7% you might get from a bank, your quality program was quite a valuable investment.

Prevention Process

Crosby's approach addresses prevention rather than inspection and correction of errors. He says that prevention involves thinking, planning, and analyzing processes to anticipate where errors could occur, and then taking action to keep them from occurring. Problems usually arise because product or service requirements are either lacking or in error. The prevention process begins by establishing the product or service requirement, developing the product or service, gathering data, comparing the data to the requirement, and taking action on the result. Crosby suggests this is a continuing activity. He makes no distinction between manufacturing and service employees. In fact, he asserts that all employees perform "services," even on the assembly line:

"The only employees not in the service business are those who are professional blood donors; they are a resource."¹⁹

¹⁹ Ibid, Crosby, 1984, pp. 123-124.

The Six C's

To Crosby, education is a multi-stage process that every organization must go through, a process he calls the "Six C's":²⁰

1. *Comprehension* addresses the importance of understanding what is meant by quality. Comprehension must begin at the top and eventually include all employees. Without comprehension, quality improvement will not occur.
2. *Commitment* must also begin at the top and represents the stage when managers establish a quality policy.
3. *Competence* comes through the development of education and training plans, which are critical to implementing the quality improvement process in a methodical way.
4. *Communication*; all efforts must be documented and success stories published so that complete understanding of quality by all people in the corporate culture is achieved.
5. *Correction* focuses on prevention and performance.
6. *Continuance* emphasizes that the process must become a way of life in the organization. Continuance is based on the fact that it is never cheaper or quicker to do anything right the second time, so quality must be integrated into all day-to-day operations.

The 14 Steps

Crosby offers a 14-step process by which top management becomes educated and committed to the Crosby principles, by which the commitment is communicated to all employees, and by which specific programs and measurements are implemented to achieve the quality management goals.²¹ Note that the first six steps are management actions, further emphasizing the need for top management's adoption of the philosophies of quality before expecting any improvements.

1. *Management Commitment* – the brass must agree that quality improvement is necessary and a practical way to profit improvement.
2. *Quality Improvement Team* – representatives from each department form a team to become educated and to commit their operations to action.
3. *Quality Measurement* – the status of quality throughout the company is determined, and new measurements are established where none previously existed.
4. *Cost of Quality Evaluation* – the CFO validates all measures. The cost of quality is not an absolute performance measurement; it is an indication of where corrective action will be profitable for a company. The higher the cost, the more corrective action is necessary.

²⁰ Ibid, Crosby, 1984, pp. 92-93.

²¹ Ibid, Crosby, 1979, pp. 112-119.

5. *Quality Awareness* – management begins to share with employees the measurements of what “nonquality” is costing. Supervisors are trained to educate their employees.
6. *Corrective Action* – as people are encouraged to talk about their problems, opportunities for corrective action arise. As management demonstrates it is facing and resolving the problems, all personnel develop the habit of identifying and correcting them.
7. *Establish Ad Hoc Committee for Zero Defects Program* – Zero Defects is not a motivational program, but a literal requirement for each product and service. The committee explores ways to implement and communicate the Zero Defects concept.
8. *Supervisor Training* – a formal orientation with all levels of management should be conducted prior to implementation of all steps.
9. *Zero Defects Day* – the Zero Defects performance standard is communicated to all employees simultaneously, so that all employees understand it the same way. At the same time, management demonstrates its commitment to the standard. It’s a “new attitude” day.
10. *Goal Setting* – as quality is discussed in meetings, supervisors begin to establish more and more concrete goals to correct each problem. Each goal should have a completion date and should be clearly measurable.
11. *Error Cause Removal* – individuals are asked to describe any problem that keeps them from performing error-free work. Management must respond within 24 hours, if possible. Once employees have confidence that the system works, they will be motivated to continue the process.
12. *Recognition* – award programs to recognize those who meet quality goals or perform outstanding acts are established. Selection should be done by each recipient’s peers, not by supervisors. All corrected problems should be treated equally. Recognition is what is important, not necessarily the value of the award given.
13. *Quality Councils* – regular meetings among quality professionals and quality teams and committees are important to keep improving quality. The key is continuous communication of cost of quality issues and problem resolutions.
14. *Do It Over Again* – the typical program takes 12 to 18 months, at which point, a fresh batch of team members should be chosen, and the entire process repeated. Quality must be engrained into the organization to remain perpetual.

Quality Vaccine

Crosby sees problems as bacteria of nonconformance that must be vaccinated with antibodies to prevent problems. He has formulated a "quality vaccine" that consists of three distinct management actions - determination, education, and

implementation. Top management is responsible for continually administering the vaccine.

Determination surfaces when management sees the need to change and recognizes that change requires management action. *Education* is the process of providing all employees with the common language of quality, helping them to understand what their role is in the quality improvement process, as well as helping them to develop a knowledge base for preventing problems. The third action is *implementation*, which consists of the development of a plan, the assignment of resources, and the support of an environment consistent with a quality improvement philosophy. In this phase, management must lead by example and provide follow-up education.²²

Crosby Summary

Philip Crosby's main point is that quality is achieved by preventing defects and conforming to requirements. Requirements must be agreed upon, employees must know how to achieve them, and management must not impede the employees' progress. The monetary cost of quality is the focus of measurement, and the formula provides for continuously measuring the cost of waste versus the lower cost of doing things right the first time, which is his performance standard. The ultimate goal of his approach is to provide defect-free products and services to the customers.

²² Ibid, Crosby, 1984, pp. 155-171.

Success Story 2: Nelson Nameplate Company

Nelson Nameplate Company, located in Los Angeles, California, with over 300 employees, produces membrane switches, nameplates, graphic overlays, and lenses. Nelson began its Quality Improvement Process (QIP) based on Philip Crosby's concepts in 1990 because their senior management had a strong desire to move from an appraisal-based quality system to one that emphasized prevention and continuous improvement.

The QIP has created a significant cultural change throughout the organization. "Before our QIP, an employee would often hide errors or problems in order to avoid being blamed for the problem. Now when a problem occurs, it is viewed as an opportunity to improve our processes,"²³ say Co-Presidents Tom Cassutt and Dave Lazier.

Nelson Nameplate employees are empowered to stop jobs that have quality problems. As an example, Berna Mendoza and Maria DeGross of the Membrane Department were assembling parts when they noticed the graphics looked a little different from previous parts. They compared the graphics with some older parts in stock, and realized that a color was missing. Because the color was used only in a small area, the difference was very subtle. Berna and Maria's attention to detail and commitment to conformance to requirements saved the company from building thousands of parts that would have been rejected by the customer.

The Nelson QIP program has produced dramatic results:

- Revenue has tripled over the past 10 years.
- Employee turnover has dropped fourfold. The average length of employment for employees averages over 10 years. The education and training process increases promotion from within. Every manufacturing supervisor began work at Nelson as an entry-level employee.
- Customers receive their parts right the first time and on time. Returns from customers have been reduced threefold over the past decade.
- Quality improvement success stories are shared with suppliers through a monthly quality council meeting. As a result, there has been an improvement in suppliers' quality and on-time performance. In addition, suppliers have benefited from Nelson's growth through increased business.
- Customers that visit Nelson's plant see the evidence of the QIP through the hundreds of diplomas that fill our walls, the measurements that are displayed on the walls, and the many signs of employee recognition.

Education

All Nelson employees receive in-depth quality education. In fact, the company's motto is "Every employee of the company must have a complete education in the

²³ "Nelson Nameplate Company - on a Quality Quest" (www.philipcrosby.com)

understanding of quality and what it means to him or her and the company." However, Nelson's commitment to education goes even deeper. In 1992, the company made the decision that all employees would become English literate. The workforce was tested and over 100 employees were not English literate. A teacher from a local community college came in two afternoons a week for two hours per day to teach English to employees. In 1995, the final employee passed his English literacy exam. In addition, several Nelson employees that were eligible for U.S. citizenship but were previously reluctant to pursue it because of poor English skills have since gone on to become American citizens.

Error Cause Removal (ECR)

Nelson has received over 500 ECRs from employees over the past ten years, from all levels of the organization (455 have been closed). This is an important part of the improvement process, removing many hassles from day-to-day work. Each person in the company can, with very little effort, identify problems, errors, waste, opportunity, or any other concern to top management quickly and receive an answer. For example,

- The Paint Department was having problems with contamination causing defects in the finish of parts they painted. An investigation determined that the root cause was the aerosol lubricant used in an adjoining department. As a result of the ECR, an air filter was attached to the punch press to remove any over-spray. Now the air is cleaner and the Paint Department is able to meet their customer's requirements.
- Quality Control was having a problem with tooling checks. Many of the jobs were coming through without tolerances. Time was being spent trying to determine what the customer wanted, sometimes resulting in late jobs. As a result of the ECR, Quality Control can now meet their requirements on time due to a newly created standard.

In an attempt to make the ECR system even more-user friendly, employees can call in an ECR to a designated voice mail box as well as fill out a form, located in the lunchroom.

Big Savings

Over the past ten years, Nelson's Cost of Quality has decreased from over 30 percent of sales to less than 18% of sales. This reduction is the primary reason the company was able to move into a state-of-the-art 117,000 square foot building in October 1999.

QIP Evolution

Nelson has integrated ISO 9002 into their QIP, achieving initial certification in November 2000. They are now pursuing AS9100 certification.

The QIP is kept fresh by changing the QIP step leaders every two years. This reinvigorates the process. Every two years they celebrate their progress by holding a *Zero Defects Day* celebration. The plant is shut down for half a day and all

employees are bussed to a local park where they enjoy a catered lunch and reaffirm their commitment to quality through a variety of recreational activities.

Mr. Cassutt advises, "It is important to stick with the QIP. During the first two years of our QIP, our COQ actually went up as employees became more relaxed about bringing new problems to the surface. We have since seen a steady reduction in our COQ over the past nine years."

Nelson promotes a team atmosphere by practicing "open book" management, where the financials of the company are shared with employees on a monthly basis. Employees may ask any question that they wish about the company at these meetings. In addition, the company shares 20 percent of its annual profits with the employees. Employee bonuses are based on overall company profitability and therefore team performance, not individual performance.

Crosby vs. Juran and Deming

There is considerable debate in the industry over which “guru” is right, Crosby, Juran, or Deming. Deming and Juran were first to market with their theories, and Crosby seems to have become – pardon the baseball metaphor - the clean-up hitter, clearing the bases with a simple and direct approach. Of the three, Deming uses the most psychology and statistical variability, while Juran and Crosby stick to absolutes where possible. Despite the divergent histories of these experts, they do agree on many principles.

Where the Gurus Agree

Crosby, Deming, and Juran agree that it is management's responsibility to establish an organizational culture in which commitment to quality is the main focus. The mission of the organization must be clear to everyone, and every management action must lead to fulfillment of that mission. This culture should be characterized by commitment from the top of the organization. They agree that continuous education and training at all levels is necessary to foster a common language of quality and to develop employee skills and knowledge. Effective communication, cooperation, and teamwork throughout the organization are essential.

The experts further agree that more than 85 percent of all problems associated with quality can be attributed to management policy or action. This means that management action is required to achieve improvements. In addition, they agree that the pursuit of customer-focused quality is a long-term process that will not produce results overnight. The improvements will be evident over time in terms of reduced costs, but, more importantly, organizations will eventually be able to anticipate and prevent problems.²⁴

They agree that improvements should not be viewed in terms of final products, and they agree that current inspection methods to achieve quality are not effective in producing a quality product at an affordable price. They say that there are some processes where inspection will always be required (e.g., for reasons of safety such as flying an airplane after conducting an overhaul), but that it is important to eliminate inspection as a means to achieving quality. They agree that cost and quality are not in competition with one another.

The three gurus distinguish clearly between internal and external customers, and all support the practice of involving the suppliers in the quality effort. It is impossible to achieve quality when products or services provided by suppliers are inferior. These approaches also require the use of measurement and problem-solving techniques, but the emphasis on their use varies.

The approaches of Crosby, Deming, and Juran do not represent "programs" in the usual sense of the word; they do not have starting and ending dates. These are management philosophies aimed at long-term improvements through adoption of

²⁴ Lowe, T. A., and Mazzeo, J. M., September 1986. “Three Preachers, One Religion” (Quality, 25(9), 22-25)

strategic planning for quality. These three philosophies have been implemented over the years in various organizations in different countries. As philosophies, they go beyond the economic concerns of an organization and address an organization's employees as well. They give high priority to pride in workmanship, education, and the work environment as well as to team building, teamwork, cooperation, and participation, all essential to cultural change.²⁵

It is plain that our experts agree in general terms and in overall philosophy. When we read the specifics of their methods, however, we find significant differences.

Where the Gurus Disagree

There are a number of differences between the three approaches. Differences affecting use of measurement, goal setting, supplier relationships, leadership activities, and tolerance for defects are the predominant areas of disagreement.

Use of Measurement

Crosby, Deming, and Juran recognize measurement as important to quality improvement efforts, but they use it in different ways. Both Crosby and Juran view the cost of quality as the focus of measurement. Cost is measurable in terms of dollars, and, for them, money is the language of management. Success of quality efforts is ultimately measured by meeting customer requirements, but Crosby and Juran use the reduction in cost as an indicator of the effectiveness and efficiency of the process used to meet customer requirements. Juran considers that the cost of poor quality (CPQ) is a key factor because it represents how much the organization is losing and how much it is spending on scrap and rework. Nevertheless, he acknowledges the fact that there are other equally important factors to measure, such as how the organization compares with the competition and how customers perceive quality.

Deming does not use the cost of quality as a focus of measurement. He considers that the "unknown" costs, such as the impact of the loss of a customer, are far more important than "visible ones." To Deming, measuring and meeting customer needs and expectations about a product or service are paramount to implementing quality improvements. Deming gives greater emphasis than do his counterparts to quantitative methods and statistical methods as a means of analyzing and improving the production process. He uses measurements of process variation to determine whether processes are stable and capable.

Goal Setting

To Crosby, the ultimate goal should be defect-free products and services, but he stresses that intermediate goals should be set as well to help organizations focus their efforts on becoming defect-free. To him, a quality product or service results when the process has consistently produced something that falls within specification limits. Deming, on the other hand, considers that being within

²⁵ J. Gerald Suarez, July 1992. "Three Experts on Quality Management" (TQLO Publication No. 92-02, Published for the Dept. of the Navy by Office of the Under Secretary of the Navy)

specifications is just the first step to continuous process improvement. He advocates reducing process variation on a continuing basis to improve quality. Conforming to specifications is not enough, he says; worse, yet, it ensures the status quo.

Deming also opposes the use of numerical goals and quotas to manage work. He thinks that individual goals are necessary to help people in their personal and professional lives, but numerical goals imposed from top management can have negative effects on both quality of products and individual and team morale – a certainty if there is no plan to achieve the goals or tools by which to reach them.²⁶

Juran sees a need for written objectives for employees, with a plan for reaching them. He addresses quality-related goals and company-wide objectives, but more important to him is the deployment of goals throughout the organization. Strategic goals need to be deployed to all divisions and sections of the organization, and more specific goals need to be deployed to people so that they know what to do.

Supplier Relationships

The three advocates view the role of suppliers differently. Deming favors the practice of working with a single supplier, where feasible, to reduce variability of incoming materials, and states that this practice should be built on a long-term relationship of trust and understanding between supplier and purchaser. In this way, suppliers can produce materials that do a better job of fulfilling the needs of the organization. To maintain long-term contracts, suppliers will be more likely to improve their own processes to provide better products or services.

Crosby and Juran recognize some of the advantages of single suppliers, but they take a more conservative view and simply advocate reducing the number of suppliers. Crosby and Juran consider it important to have different suppliers for the same product when the product is a critical one. That way, the organization will not suffer because of strikes, accidents, or other problems beset by suppliers. Deming recognizes the possibilities of strikes, but admits that customers can receive products and services from alternative suppliers in such cases.²⁷

Leadership Commitment

Although Crosby, Deming, and Juran acknowledge and agree that top management support, involvement, and commitment are essential for carrying out any quality-focused efforts, each emphasizes leader participation differently. Crosby describes the "Zero Defects Day" as the time when management reaffirms its commitment to quality and communicates it to all employees. Similarly, Juran has a vehicle for involving top management. Juran's annual quality program is used by managers to communicate to all employees management's commitment to quality improvement. Managers decisions and actions must be oriented to establishing a quality council, deploying goals, providing resources, and serving on quality councils and quality improvement teams.

²⁶ Ibid, Suarez, 1992.

²⁷ M. Walton, 1986. "The Deming Management Method" (Dodd, Mead, New York, NY)

Although Deming acknowledges that top management commitment is imperative, he does not describe a program for accomplishing it. What works in one organization might not work in another. He affirms the need for management's commitment, but it is the responsibility of top management to show its commitment through leadership. Deming is specific, however, about the leaders' roles and responsibilities. As described by Deming, the aim of leadership is not to point fingers at individuals or to keep records of failures. To him, the leader's new job is to remove barriers and create a culture that values helping others to do a better job and to feel pride in workmanship.²⁸ Leaders must lead by example, not by cheerleading. They must be coaches who help to improve the system of which they and their employees are a part.

Zero Defects

One of the critical areas of disagreement lies between Crosby and Deming. Both have a 14-step, or 14-point program for implementing quality. In Crosby's program, the commitment to *Zero Defects* is not negotiable. Deming's 10th point, however, instructs companies to:

"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."²⁹

In my opinion, this is a contradiction that offers short-term benefits to the company at the expense of its customers. If your customers prefer defect-free products and services, are you jeopardizing your long-term competitiveness by internally accepting anything less than perfection?

In fact, many of Deming's principles are based on "touchy-feely" psychological approaches to employee motivation. While this has been shown to be effective in the Japanese workforce culture of the 1950s and '60s, American workers have counter-incentives in the form of labor unions and government regulations that often stand in the way of achieving quality and on-time delivery.

Unless top management can clearly express the precise requirements for each process, no amount of motivation or psychology will achieve the desired results. In my opinion, there is nothing clearer than Crosby's exhortation to meet the requirements without defects, especially combined with his emphasis on education and recognition.

²⁸ Ibid, Deming, 1986.

²⁹ Ibid, Deming, 1986.

Conclusion

In the context of quality management, can imperfect humans achieve perfect results? The answer is "Yes." By producing defect-free products and services that conform to the required specifications, employees can, and do. When corporate management commits unreservedly to the principles, and exemplifies the attitude of conformance to requirements, then the culture of quality in the enterprise will follow suit. When the entire company realizes that "It is always cheaper to do the job right the first time,"³⁰ then, and only then, will quality improvement happen.

³⁰ Ibid, Crosby, 1979, p. 232.

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Appendix A – Philip B. Crosby

[SOURCE: www.philipcrosby.com/pca/C.Articles/philsbio.htm]

Philip B. Crosby (1926-2001) was a business philosopher with more than 40 years of hands-on management experience.

Philip Crosby taught management how to cause their organizations, their employees, their suppliers, and themselves to be successful.

As an author Mr. Crosby published fourteen books, all of which have been best sellers. His first business book, *Quality Is Free*, has been credited with beginning the quality revolution in the United States and Europe. It has sold over 2.5 million copies in hard and soft cover and has been translated into 15 languages. His most recent book, *Quality & Me: Lessons of an Evolving Life*, was published in 1999.

Mr. Crosby was born in Wheeling, West Virginia on June 18, 1926. He started work as a quality professional in 1952 after serving in World War II and Korea, with a medical school in between.

Mr. Crosby's career began on an assembly line where he decided his goal would be to teach management that preventing problems was more profitable than being good at fixing them. He worked for *Crosley* from 1952–1955; *Martin-Marietta* from 1957–1965; and *ITT* from 1965–1979. As quality manager for Martin-Marietta, he created the *Zero Defects* concept. During his 14 years as corporate vice president for ITT, he worked with many industrial and service companies around the world, implementing his pragmatic philosophy, and found that it worked everywhere.

In 1979 he founded *Philip Crosby Associates, Inc.* (PCA), and over the next ten years grew it into a publicly traded organization with 300 employees around the world and \$100 million dollars in revenue. PCA taught management how to establish a preventive culture to get things done right the first time. *GM*, *Chrysler*, *Motorola*, *Xerox*, many hospitals, and hundreds of corporations worldwide came to PCA to understand quality management.

In 1991 he retired from PCA and founded *Career IV, Inc.*, a company that provided lectures and seminars aimed at helping current and prospective executives grow.

In 1997 he purchased the assets of PCA and established *Philip Crosby Associates II, Inc.* (PCA II). Now the *Quality College* operates in over 20 countries around the world.

PCA II serves clients ranging from multinational conglomerates to small manufacturing and service companies assisting them with the implementation of their quality improvement process.

Appendix B – W. Edwards Deming

[SOURCE: www.deming.org/theman/biography.html]

William Edwards Deming (1900-1993) was born in Sioux City, Iowa. Deming's parents, Pluma Irene and William Albert Deming, were well-educated and emphasized the importance of education to their children. Pluma had studied in San Francisco and was a musician. William Albert had studied mathematics and law.

In 1917, he enrolled in the University of Wyoming at Laramie, graduating in 1921 with a B.S. in electrical engineering. In 1925, he received an M.S. from the University of Colorado and in 1928, a Ph.D. from Yale University. Both graduate degrees were in mathematics and mathematical physics. Dr. Ed Deming (he chose to go by his middle name) also studied music theory, played several instruments and composed masses, canticles and other music.

Throughout his career, Dr. Deming received many awards and honors, as well as 18 honorary doctorate degrees and other accolades, including:

- Taylor Key award, American Management Association, 1983
- The Deming prize was instituted by the Union of Japanese Scientists and Engineers and is awarded each year in Japan to a statistician for contributions to statistical theory. The Deming prize for application is awarded to a company for improved use of statistical theory in organization, consumer research, design of product and production.
- Recipient of the Second Order Medal of the Sacred Treasure, from the Emperor of Japan, 1960, for improvement of quality and of Japanese economy, through the statistical control of quality.
- Recipient of the Shewhart Medal for 1955, from the American Society for Quality Control.
- Elected in 1972 most distinguished graduate from the University of Wyoming.
- Elected in 1983 to the National Academy of Engineering.
- Inducted into the Science and Technology Hall of Fame, Dayton, 1986.
- In 1980, the Metropolitan section of the American Society for Quality Control established the annual Deming Medal for the improvement of quality and productivity.
- Recipient of the Samuel S. Wilks Award from the American Statistical Association in 1983.
- Recipient of the Distinguished Career in Science award from the National Academy of Sciences in 1988.
- Recipient of the National Medal of Technology from President Reagan in 1987.

Appendix C – Joseph M. Juran

[SOURCE: www.juran.com/drjuran/bio_jmj.html]

Both the life and influence of Joseph M. Juran (1904-) are characterized by a remarkable span and an extraordinary intensity. Born in Romania, Juran has been active for the bulk of the century, and influential for nearly half that period. Juran's major contribution has been in the field of management, particularly quality management. Juran has been called the "father" of quality, a quality "guru" and the man who "taught quality to the Japanese." Perhaps most important, he is recognized as the person who added the human dimension to quality - broadening it from its statistical origins to what we now call Total Quality Management.

In 1937, Juran conceptualized the *Pareto* principle, which millions of managers rely on to help separate the "vital few" from the "useful many" in their activities. He wrote the standard reference work on quality control, the *Quality Control Handbook*, first published in 1951 and now in its fourth edition. In 1954, he delivered a series of lectures to Japanese managers, which helped set them on the path to quality. The classic book, *Managerial Breakthrough*, first published in 1964, presented a more general theory of quality management, comprising quality control and quality improvement. It was the first book to describe a step-by-step sequence for breakthrough improvement, a process that has become the basis for quality initiatives worldwide. In 1979, Juran founded the *Juran Institute* to create new tools and techniques for promulgating his ideas. The first was *Juran on Quality Improvement*, a pioneering series of video training programs.

The Quality Trilogy, published in 1986, identified a third aspect to quality management-quality planning. In addition to these accomplishments, there is Juran's seminal role as a teacher and lecturer, both at New York University and with the American Management Association. He also worked as a consultant to businesses and organizations in forty countries, and has made many other contributions to the literature - in more than twenty books and hundreds of published papers (translated into a total of seventeen languages) as well as dozens of video training programs.

In 1987, Dr. Juran relinquished his leadership of *Juran Institute, Inc.* After a triumphant series of lectures in 1993-94, "The Last Word" tour, he ceased all public appearances in order to devote his time to writing projects and family obligations. Juran has established *The Juran Foundation* to explore the "impact of quality on society" and make his contributions in the field - and those of others - available to serve society in a positive way. "My job of contributing to the welfare of my fellow man," writes Juran, "is the great unfinished business."