

Quality



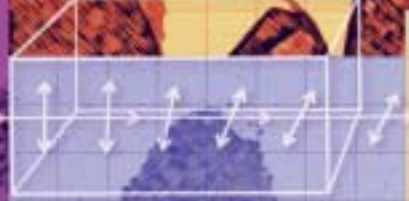
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Clockwise from upper left:
Genichi Taguchi, Philip B. Crosby,
Walter A. Shewhart, Joseph M.
Juran, Robert M. Pirsig, Armand
V. Feigenbaum, Kauru Ishikawa,
W. Edwards Deming

What Is Quality?

Learn how each of eight well-known gurus answers this question

by

R.W. Hoyer and Brooke B.Y. Hoyer

“IN 1908, HENRY M. LELAND astonished the members of the Royal Automobile Club (RAC) by having three of his Cadillac cars dismantled at Brooklands, and by having the component parts thoroughly mixed up.

His engineers set to work, taking any available part, and built the cars up again in front of the RAC members’ eyes. Then they drove the cars

off in triumph around the track.

Today, we take it for granted that the most intricate pieces of a car’s machinery can be replaced with an off-the-shelf duplicate. But in 1908, a car engine was still seen as an individually crafted organism, a handmade job. That was how most engines had to be made, since the engineering of their

parts was seldom consistent.

Few components arrived from the machine shop without the need for some extra filing or adjustment before they could be incorporated into an engine, and the secret of the phenomenal quantity and speed with which Henry Ford had produced first the Model N and then the Model T had been in the quality of Ford machining.”

SO WROTE ROBERT LACEY IN HIS excellent book *Ford: The Men and the Machine*.¹

If you walk through a manufacturing or assembly plant anywhere in the world today, you will see bins of parts that, except for very small manufacturing differences, are identical. The parts in a particular bin are identical in the sense that they are all designed for a specific function and are interchangeable with respect to that function.

To satisfy their specific purpose, parts must be of high quality. Although it was a simple matter to type the phrase “high quality” on this page—and although most of us use the term “quality” in a way we think makes sense

and is understandable to everyone else—we will soon discover a useful definition of quality is not easy to develop.

Background

Quality standards not substantially different from ours have been evident for centuries. The strategies and tools for assuring quality may have changed, but basic customer expectations have been fairly constant for a long time

Even though Henry Ford, for example, had no special training in quality assurance, he grew up in a culture in which excellent performance of products and services was taken for granted. Indeed, it was almost a century ago when he discovered he could gain a competitive advantage by focusing attention on quality.

Although the demand for quality has been part of human nature for a long time, the quantification of quality and establishment of formal quality standards are decidedly 20th century phenomena.

The inordinate attention to quality during the last two decades has created a global marketplace of consumers turned on to quality. They think they know what it means, they think they recognize it when they see it, and, just as important, they expect—even demand—quality in every product and service they purchase.

We will take a look at the writings of eight quality

gurus to see if we can get a sense of what they mean when they use the word “quality.” Don’t be surprised to learn that even though there may be a great deal of agreement among the gurus, they do not agree on a consensus definition. Although it is often convenient to use the phrase “quality sciences” to describe a broad assortment of analytical tools and quality issues, the study of quality is clearly not a science in the same sense that chemistry, for example, is.

The quality gurus

While admitting there is no general agreement about who is a quality guru and who is not, we have decided to examine the perspectives of the following:

- Philip B. Crosby.
- W. Edwards Deming.
- Armand V. Feigenbaum.
- Kaoru Ishikawa.
- Joseph M. Juran.
- Robert M. Pirsig.
- Walter A. Shewhart.
- Genichi Taguchi.

We are confident that if we conducted a poll to identify the 10 most important contributors to the advancement of quality in the 20th century, everyone on our list, with the almost certain exception of Pirsig, would be included. Acting on that prejudice, we are confident what we would learn about quality by examining the input of a larger group of individuals would be, at best, of marginal importance.

In general, the experts’ definitions of quality fall into two categories:

- Level one quality is a simple matter of producing products or delivering services whose measurable characteristics satisfy a fixed set of specifications that are usually numerically defined.
- Independent of any of their measurable characteristics, level two quality products and services are simply those that satisfy customer expectations for their use or consumption.

In short, level one quality means get it in the specs, and level two means satisfy the customer.

Crosby defines quality

The essence of Phil Crosby’s definition of quality is laid out in his own words in the sidebar at left. Notice his definition is strictly a level one formulation in which the quality of a product or service is equivalent to being sure all measurable—or, to be more accurate, all measured—characteristics of the product or service satisfy the characteristics’ specification criteria.

The essential points of his definition are:

- It is necessary to define quality; otherwise, we cannot know enough about what we are doing to manage it.



Crosby's

DEFINITION OF QUALITY

The first erroneous assumption is that quality means goodness, or luxury, or shininess, or weight. The word “quality” is used to signify the relative worth of things in such phrases as “good quality,” “bad quality” and that brave new statement “quality of life.” “Quality of life” is a cliché because each listener assumes that the speaker means exactly what he or she, the listener, means by the phrase. That is precisely the reason we must define quality as “conformance to requirements” if we are to manage it. ...

In business the same is true. Requirements must be clearly stated so they cannot be misunderstood. Measurements are then taken continually to determine conformance to those requirements. The nonconformance detected is the absence of quality. Quality problems become nonconformance problems, and quality becomes definable.

PHILIP B. CROSBY

From Philip B. Crosby, *Quality is Free* (New York: McGraw-Hill Book Co., 1979), p. 7.

- Somehow, someone must know what the requirements are and be able to translate those requirements into measurable product or service characteristics.
- With requirements stated in terms of numerical specifications, we can measure the characteristics of a product (diameter of a hole) or service (customer service response time) to see if it is of high quality.

It is not at all clear from Crosby's definition whether there are many different levels of quality or merely two levels—acceptable and unacceptable. Is it the case, for example, that all product or service units that conform to the requirements are of equal quality? Crosby does not address this issue, but one gets the impression that his answer to this question is “yes.”

Deming defines quality

A great many people have waded through Deming's book *Out of the Crisis* with the expectation that somewhere in those pages they will find a formula for achieving quality. Most are disappointed.

It is important to understand that the book—like much of the content of Deming's workshops, seminars, speeches and consulting—is about management. In fact, in the book's preface Deming writes, “The aim of this book is transformation of the style of American management.” Perhaps a more accurate statement would have been, “The content of this book is a discussion of optimal management strategies for organizations whose operational practices are based upon a quality paradigm.”

In *Out of the Crisis*, Deming does not get around to discussing quality until the sixth chapter. Even then, his discourse is essentially a long discussion with at least one example or quotation on practically every page. It is not possible to pin Deming down long enough to get a clear, concise, practical definition of quality. Perhaps it was his opinion that such a definition is impossible—or, if possible, unnecessary. He simply does not address the issue.

In any event, Deming's perspective (see the sidebar at right) is clearly consistent with a level two definition. In fact, the title of his chapter on quality is “Quality and the Consumer,” indicating the extent to which he equates high quality and customer satisfaction.

Deming's essential arguments are:

- Quality must be defined in terms of customer satisfaction.
- Quality is multidimensional. It is virtually impossible to define the quality of a product or service in terms of a single characteristic or agent.
- There are definitely different degrees of quality. Because quality is essentially equated with customer



Deming's

DEFINITION OF QUALITY

The problems inherent in attempts to define the quality of a product, almost any product, were stated by the master, Walter A. Shewhart. 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. This is not easy, and as soon as one feels fairly successful in the endeavor, he finds that the needs of the consumer have changed, competitors have moved in, there are new materials to work with, some better than the old ones, some worse; some cheaper than the old ones, some dearer ...

What is quality? Quality can be defined only in terms of the agent. Who is the judge of quality?

In the mind of the production worker, he produces quality if he can take pride in his work. Poor quality, to him, means loss of business and perhaps of his job. Good quality, he thinks, will keep the company in business. All this is true in the service industries as it is in manufacturing.

Quality to the plant manager means to get the numbers out and to meet specifications. His job is also, whether he knows it or not, continual improvement of processes and continual improvement of leadership.

W. EDWARDS DEMING

From W. Edwards Deming, *Out of the Crisis* (Cambridge, MA: Massachusetts Institute of Technology, Center for Advanced Engineering Study, 1988).



Feigenbaum's

DEFINITION OF QUALITY

Quality is a customer determination, not an engineer's determination, not a marketing determination, [n]or a general management determination. It is based upon the customer's actual experience with the product or service, measured against his or her requirements—stated or unstated, conscious or merely sensed, technically operational or entirely subjective—and always representing a moving target in a competitive market.

Product and service quality can be defined as: The total composite product and service characteristics of marketing, engineering, manufacture and maintenance through which the product and service in use will meet the expectations of the customer.

ARMAND V. FEIGENBAUM

From A.V. Feigenbaum, *Total Quality Control*, third edition (New York: McGraw-Hill Book Co., 1983).

satisfaction, the quality of product A is greater than the quality of product B with respect to a specific customer if A satisfies that customer's needs and expectations to a greater degree than B does.

Feigenbaum defines quality

Feigenbaum's definition of quality (see the sidebar above) is unmistakably a level two definition. In fact, both the definition and the accompanying commentary are remarkable for their consistency about satisfying the needs and expectations of customers.

Feigenbaum's essential points are:

- Quality must be defined in terms of customer satisfaction.

faction.

- Quality is multidimensional. It must be defined comprehensively.
- Because customers have changing needs and expectations, quality is dynamic. In that regard, Feigenbaum writes, "A crucial quality role of top management is to recognize this evolution in the customer's definition of quality at different stages of product growth."

If quality assessment is up to the customer and we need a surrogate for quality while the product is being manufactured, then we must be able to translate customer satisfaction into product characteristics. Feigenbaum observes that marketing evaluates the level of quality customers want and are willing to pay for, and engineering reduces this marketing evaluation to exact specifications.

This need to determine what customers are willing to pay to obtain an approximation of their ideal product (or service) and then translate that information into specifications for a variety of product (or service) characteristics is the nightmare that challenges every total quality management expert.

Feigenbaum's discourse seems fairly weak on the subject of translating customer expectations into product or service characteristics. On the other hand, it is difficult to find a better outline of the basic components and issues of a modern quality focused organization than the one presented in Feigenbaum's book *Total Quality Control*. The book is well-organized, comprehensive and concise. A well-worn copy should be on the desk of everyone who has special responsibility for assuring quality.

Ishikawa defines quality

Ishikawa's definition of quality is a level two definition (see the sidebar at right). He is very insightful, has a great deal to say about the principles of quality control and is clearly interested in quality assurance at the in-plant, practical level. He does not, however, have much to say about how manufacturing procedures can be designed to assure the satisfaction of customer needs and expectations.

On the other hand, Ishikawa makes it clear the proof of high quality is the satisfaction of ever changing consumer expectations.

Ishikawa's essential points are:

- Quality is equivalent to consumer satisfaction.
- Quality must be defined comprehensively. It is not enough to say the product is of high quality; we must focus attention on the quality of every facet of the organization.
- Consumers' needs and requirements change. Therefore, the definition of quality is ever changing.

- The price of a product or service is an important part of its quality. Ishikawa writes that no matter how high the quality, if the product is overpriced, it cannot gain customer satisfaction. In other words, one cannot define quality without considering price.

Juran defines quality

Juran's definition (see the sidebar on p. 58) simultaneously attempts to be a level one and level two definition.

Juran's essential points are:

- A practical definition of quality is probably not possible.
- Even though we would like to use the word "quality" in terms of satisfying customers and specifications, it will be very difficult to do so. By defining quality as fitness for use, we can avoid the difficulty. Use is apparently associated with customers' requirements, and fitness suggests conformance to measurable product characteristics. One gets the impression that Juran would like to

define quality in terms of customer satisfaction. To do so, however, he must deal with the relationship between customer satisfaction (for which there appear to be no comprehensive measurement strategies) and the conformance of product characteristics to product specifications (which can be accomplished fairly well in the workplace).

Because he is not satisfied with efforts to integrate customer satisfaction with product characteristics, he first attempts to define quality in two different—and possibly inconsistent—ways. When that appears not to work, he defines quality ambiguously as fitness for use. In any event, we do not find his definition of quality useful. What measures of fitness for use do we have that would enable us to assess the quality of a product or service?

Pirsig defines quality

In our opinion, you must go all the way back to Shewhart's pronouncements about quality to find an

In short, level one quality means get it in the specs, and level two means satisfy the customer.



Ishikawa's

DEFINITION OF QUALITY

We engage in quality control in order to manufacture products with the quality which can satisfy the requirements of consumers. The mere fact of meeting national standards or specifications is not the answer. It is simply insufficient.

Japanese Industrial Standards (JIS) or international standards established by the International Organization for Standardization or the International Electrotechnical Commission are not perfect. They contain many shortcomings. Consumers may not be satisfied with a product which does meet JIS. We must also keep in mind that consumer requirements change from year to year. Generally even when industrial standards are modified, they cannot keep pace with consumer requirements.

We must emphasize consumer orientation. Heretofore, it has been acceptable for manufacturers to think that they are doing consumers a favor by selling their products to them. Let us call this a "product out" type of operation.

What I propose is a system of "market in," in which consumer requirements are to be of the utmost concern. In practical terms, I propose that manufacturers study the opinions and requirements of consumers and take them into account when they design, produce and sell their products. When developing a new product, a manufacturer must anticipate consumers' requirements and needs.

How one interprets the term "quality" is important. ... Narrowly interpreted, quality means quality of product. Broadly interpreted, quality means quality of work, quality of service, quality of information, quality of process, quality of division, quality of people, including workers, engineers, managers and executives, quality of system, quality of company, quality of objectives, etc.

KAORU ISHIKAWA

From Kaoru Ishikawa, *What is Total Quality Control? The Japanese Way* (Englewood Cliffs, NJ: Prentice-Hall Inc., 1985), pp. 44-45.



DEFINITION OF QUALITY

The word quality has multiple meanings. Two of those meanings dominate the use of the word:

1. Quality consists of those product features which meet the needs of customers and thereby provide product satisfaction.
2. Quality consists of freedom from deficiencies.

It would be most convenient to have some short phrase which is universally accepted as a comprehensive definition of quality; i.e., so that it includes the product features which lead to product satisfaction and in addition includes freedom from deficiencies. Various such phrases have been proposed by practitioners but none has achieved universal acceptance.

Nevertheless, in a handbook such as this [*Juran's Quality Control Handbook*, fourth edition] it is most convenient to standardize on a short definition of the word "quality" ... as "fitness for use."

JOSEPH M. JURAN

From *Juran's Quality Control Handbook*, fourth edition. J.M. Juran, editor-in-chief, Frank M. Gryna, associate editor (New York: McGraw-Hill Book Co., 1988), pp. 2.2, 2.8.

intellectually defensible, practically important discussion of the concept. But if we were asked to recommend one or two books about quality that have been written since Shewhart's early writing, our choices would be David Garvin's *Managing Quality*² and Pirsig's *Zen and the Art of Motorcycle Maintenance*.³

Pirsig's book is not for every reader. It is probably more interesting—and more meaningful—to acade-

mics. On the other hand, we believe Pirsig's (and Garvin's) discussion of quality is more comprehensive, careful and interesting than that of any of the quality gurus whose work we are examining—with the exception of Shewhart's.

Pirsig's "definition" of quality (see the sidebar at right) is neither a level one nor a level two definition. This is not surprising because, at the point in his book where he defines quality, he admits that his response to the difficulty of formulating a definition entails both sloppy thinking and intellectual dishonesty.

Pirsig's essential points are:

- It is not possible to define quality; in other words, we are "stupid about quality."
- If you cannot define a concept accurately, it is impossible for you to know that it exists.
- Quality is like modern art. We may not be able to define great modern art; but we frequently (almost always) recognize it when we see it.
- There is a great deal of intellectual dishonesty in discussions that involve technical terms that have not been adequately defined (and whose meanings have not been accurately determined).

If you think Pirsig's discussion is filled with contradictions, you are correct. That is precisely his point. These contradictions are practical challenges that must be addressed by anyone who cares about quality.

Later, Pirsig writes, "The quality that he [Phaedrus, the first name of the principal character in Pirsig's book] and the students had been seeing in the classroom was completely different from the qualities of color or heat or hardness observed in the laboratory. Those physical properties were all measurable with instruments. His quality—'excellence, worth, goodness'—was not a physical property and was not measurable."

On the other hand, excellence, worth and goodness are precisely the characteristics of products, services and processes that satisfy customer needs and expectations.

Shewhart defines quality

Although Shewhart has a healthy concern for being able to determine measurable characteristics of high quality products and services, the focus of his definition of quality (see the sidebar on p. 60) is consistent with a level two specification.

Shewhart's essential points are:

- There are two sides to quality: subjective (what the customer wants) and objective (properties of the product, independent of what the customer wants).
- An important dimension of quality is value received for the price paid.
- Quality standards must be expressed in terms of



Pirsig's

DEFINITION OF QUALITY

A few days later he [Phaedrus, the central character in Pirsig's novel] worked up a definition of his own and put it on the blackboard to be copied for posterity. The definition was: "Quality is a characteristic of thought and statement that is recognized by a nonthinking process. Because definitions are a product of rigid, formal thinking, quality cannot be defined."

The fact that this "definition" was actually a refusal to define did not draw comment. The students had no formal training that would have told them his statement was, in a formal sense, completely irrational. If you can't define something you have no formal rational way of knowing that it exists. Neither can you really tell anyone else what it is. There is, in fact, no formal difference between inability to define and stupidity. When I say, "Quality cannot be defined," I'm really saying formally, "I'm stupid about quality."

Fortunately the students didn't know this. If they'd come up with these objections he wouldn't have been able to answer them at the time.

But then, below the definition on the blackboard, he wrote, "But even though quality cannot be defined, you know what quality is!," and the storm started all over again.

"Oh, no we don't!"

"Oh, yes you do."

"Oh, no we don't!"

"Oh, yes you do!" he said, and he had some material ready to demonstrate it to them.

He had selected two samples of student composition. The first was a rambling, disconnected thing with interesting ideas that never built into anything. The second was a magnificent piece by a student who was mystified himself about why it had come out so well. Phaedrus read both, then asked for a show of hands on who thought the first was best. Two hands went up. He asked how many liked the second better. Twenty-eight hands went up.

"Whatever it is," he said, "that caused the overwhelming majority to raise their hands for the second one is what I mean by quality. So you know what it is!"

There was a long reflective silence after this, and he just let it last.

This was just intellectually outrageous, and he knew it. He wasn't teaching anymore, he was indoctrinating.

ROBERT M. PIRSIG

From Robert M. Pirsig, *Zen and the Art of Motorcycle Maintenance* (New York: William Morrow & Co., 1974), pp. 206-207.

physical, quantitatively measurable product characteristics.

- Statistics must be used to take information about the individual product or service wants of a great many potential consumers and translate it into measurable characteristics of a specific product or service that will satisfy societal (marketplace) wants.

It is sometimes difficult to remember that Shewhart wrote this definition in the 1920s, particularly since we believe it to be far superior to the definitions of the gurus who followed him.

Taguchi defines quality

While it may be difficult for the reader to imagine that quality is loss, it is actually easy to create some simple graphical displays that demonstrate what Taguchi has in mind. Our explanation begins with the display in Figure 1 (p. 61).

It is important to note Figure 1 is a model of a societal decision function in relation to a product or service whose measurable characteristic of interest is

represented on the horizontal axis.

Taguchi is, unfortunately, careless about how a societal quality (or loss) function can be derived from the quality functions of individual customers who make up a given marketplace and how you can go about the business of determining loss to society if the model's input information is a collection of quality profiles of individual customers.

In Figure 1:

1. The horizontal axis represents a scale for a measurable characteristic society believes to be important.
2. The preferred point is society's preferred value of the quality characteristic (it is precisely what the overall market wants).
3. The vertical axis is a scale for the quality experienced by society over the entire domain of the quality characteristic.
4. The quality function is usually assumed to be a quadratic function that relates values of the quality characteristic to the quality that society will experience, subject to the location of both its preferred



Shewhart's

DEFINITION OF QUALITY

If we are to talk intelligently about the quality of a thing or the quality of a product, we must have in mind a clear picture of what we mean by quality. Enough has been said to indicate that there are two common aspects of quality. One of these has to do with the consideration of the quality of a thing as an objective reality independent of the existence of man. The other has to do with what we think, feel or sense as a result of the objective reality.

In other words, there is a subjective side of quality. For example, we are dealing with the subjective concept of quality when we attempt to measure the goodness of a thing, for it is impossible to think of a thing as having goodness independent of some human want. In fact, this subjective concept of quality is closely tied up with the utility or value of the objective physical properties of the thing itself.

For the most part, we may think of the objective quality characteristics of a thing as being constant and measurable in the sense that physical laws are quantitatively expressible and independent in time.

When we consider quality from a subjective viewpoint, comparatively serious difficulties arise. To begin with, there are various aspects of the concept of value. We may differentiate between the following four kinds of value:

1. Use.
2. Cost
3. Esteem
4. Exchange.

From the viewpoint of control of quality in manufacture, it is necessary to establish standards of quality in a quantitative manner. For this reason we are forced at the present time to express such standards, insofar as possible, in terms of quantitatively measurable physical properties. This does not mean, however, that the subjective measure of quality is not of interest. On the contrary, it is the subjective measure that is of commercial interest ...

Looked at broadly, there are, at a given time, certain human wants to be fulfilled through the fabrication of raw materials into finished products of different kinds. These wants are statistical in nature in that the quality of a finished product in terms of the physical characteristics wanted by one individual is not the same for all individuals.

The first step of the engineer in trying to satisfy these wants is, therefore, that of translating as nearly as possible these wants into physical characteristics of the thing manufactured to satisfy these wants. In taking this step, intuition and judgment play an important role as well as the broad knowledge of the human element involved in the wants of individuals. The second step of the engineer is to set up ways and means of obtaining a product which will differ from the arbitrarily set standards for these quality characteristics by no more than may be left to chance.

WALTER A. SHEWHART

From W.A. Shewhart, *Economic Control of Quality of Manufactured Product* (New York: D. Van Nostrand Co., 1931), pp. 53-54.

point and what it actually gets.

Note that two specific values of the quality characteristic have been identified as A and B on the horizontal axis. To find the quality that society associates with A, for example, merely trace a vertical line from A down to the societal quality curve; then trace a horizontal line from that point over to the quality axis. The point on the vertical axis is the quality society will experience for wanting its preferred point, but having to settle for A.

Obviously, the maximum quality experienced by society occurs when society gets exactly what it wants (its preferred point). The larger the distance between what society actually gets and the location of its preferred point, the less quality society will experience. In Figure 1, A is closer to what society wants than B is. Therefore, society will experience greater quality if it gets A than if it is forced to settle for B—in other words $Q(A) > Q(B)$.

Although there is considerable merit in the concep-

FIGURE 1 Societal Quality Function

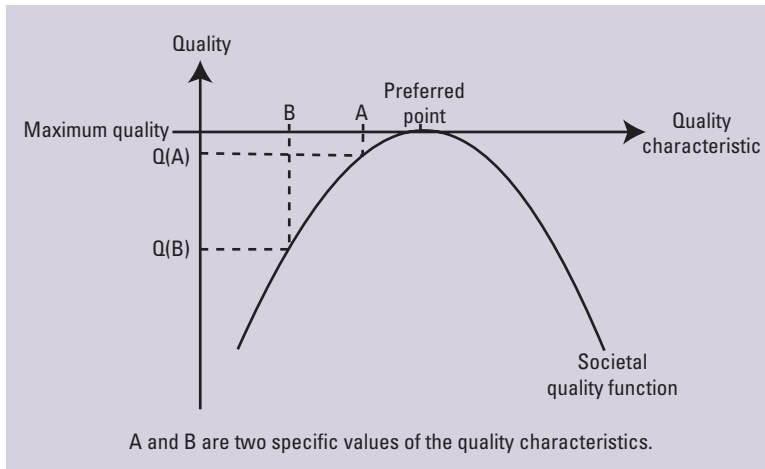
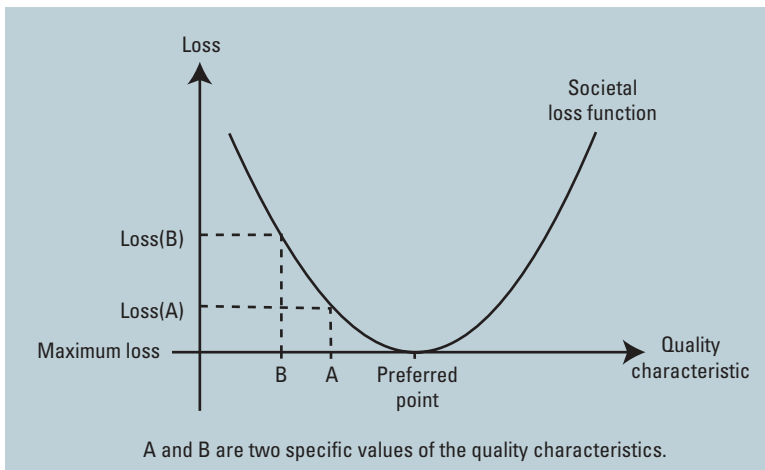


FIGURE 2 Taguchi Societal Loss Function



tual model depicted in Figure 1, the model is usually characterized in terms of loss, not quality. It is a simple matter to change the orientation from quality to loss. Simply take the display in Figure 1 and flip it upside down (see Figure 2). Instead of experiencing a decrease in quality as the supplier's product or service position moves away from the societal preferred point, society experiences an increase in loss when that occurs.

In truth, we are troubled by this model for societal loss. If you replace "societal loss function" in Figure 2 with "customer loss function," the illustration is a

superb conceptual model for the way an individual customer actually thinks about the quality of alternatives, given his or her quality profile. By "quality profile," we mean an ordered pair consisting of the customer's preferred point and loss function. That is an excellent characterization of an individual customer.

But how do you aggregate the individual quality profiles of customers to produce a logically defensible and practically usable societal quality profile? Taguchi has no answer to that question. In fact, it is not clear that he ever entertains that thought.

Taguchi says "Quality is the loss a product causes to society after being shipped." (See the sidebar on p. 62). If we are correct in suggesting each potential customer in a marketplace has a quality profile that looks much like the model in Figure 2, then the challenge is to determine loss to society by somehow aggregating the quality profiles of individuals to obtain a societal quality profile.

Then by minimizing loss to society (which is Taguchi's objective), we maximize quality. In a real sense, this is the challenge that confronts the market research and design and development departments of every company.

The essential points made by Taguchi are:

- Quality is loss to society.
- Loss caused by the product's or service's intrinsic function does not count toward the loss to society. For example, an intervention program designed to get young girls to use computers may be a very high quality program (the girls' parents are

extremely satisfied with their daughters' increased interest in computers), even though the program's intrinsic function causes certain losses to society (because some of the girls, when using the Internet, come into contact with unsavory adults whose intentions are far from honorable).

Is Taguchi's definition level one or level two? Although it is not easy to tell from the discussion presented here, Taguchi's definition is level one.

At first blush, you might think his definition is the epitome of level two, but a second look will reveal that the strategy designed to maximize quality (min-



Taguchi's

DEFINITION OF QUALITY

Quality is the loss a product causes to society after being shipped ... other than any losses caused by its intrinsic function.

GENICHI TAGUCHI

From Genichi Taguchi and Yu-in Wu, *Introduction to Offline Quality Control* (Negaya, Japan: Central Japan Quality Control Association, 1979), p. 2.

cut and dried as it seems. Suppose, for example, the product in question is a steel bar, and the tier two supplier has only two customers—both tier one companies whose needs and expectations for this product are almost identical.

If this is, indeed, how the two customers perceive the quality of their supplier's product, then they are equally satisfied with steel bars with diameters at B and C, and they are completely dissatisfied with a bar whose diameter is at A.

If bars whose diameters are between lower specification limit and upper specification limit are equally satisfactory to the customers and if the tier two company ships only bars with those diameters, then it is providing products whose quality is, for all intents and purposes, level two.

Preferred definition

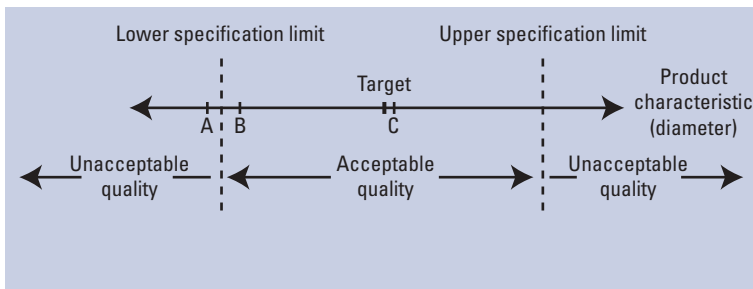
In our view, there is no question Shewhart provides the best definition of quality of any of the eight gurus. That is certainly true from an intellectual perspective, and it is probably true from a practical perspective as well—assuming that “practical” is interpreted comprehensively.

We are enthusiastic about the conceptual model implied by but not acted on by Taguchi. His focus on a societal perspective puts him behind a practical and methodological eight ball that simply makes his definition much less interesting than those of the other seven gurus.

REFERENCES

1. Robert Lacey, *Ford: The Men and the Machine* (New York: Ballantine Books, 1991), pp. 113-114.
2. David A. Garvin, *Managing Quality* (New York: The Free Press, 1988).
3. Robert M. Pirsig, *Zen and the Art of Motorcycle Maintenance* (New York: William Morrow & Co., 1974), pp. 206-207.

FIGURE 3 Two-Sided Specification Limits



imize loss to society) may be one that leaves a fairly large number (even a majority) of individual customers out in the cold.

For example, if we are concerned with providing police department services, perhaps our strategy for minimizing loss to society (maximizing quality according to Taguchi) for a particular service is one in which we significantly curtail services for the poor and invest all our resources in protecting the wealthy.

Figure 3, which is sometimes called the “goal posts model,” is often presented as the illustration of the level one definition of quality. Even that is not as

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