What Does "Product Quality" Really Mean?

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In this article, the author reviews and synthesizes the varying definitions of product quality arising from philosophy, economics, marketing, and operations management. He then goes on to build an eight-dimensional framework to elaborate on these definitions. Using this framework, he addresses the empirical relationships between quality and variables such as price, advertising, market share, cost, and profitability. *Ed.*

Product quality is rapidly becoming an important competitive issue. The superior reliability of many Japanese products has sparked considerable soul-searching among American managers.[1] In addition, several surveys have voiced consumers' dissatisfaction with the existing levels of quality and service of the products they buy.[2] In a recent study of the business units of major North American companies, managers ranked "producing to high quality standards" as their chief current concern.[3]

Despite the interest of managers, the academic literature on quality has not been reviewed extensively. The problem is one of coverage: scholars in four disciplines — philosophy, economics, marketing, and operations management — have considered the subject, but each group has viewed it from a different vantage point. *Philosophy* has focused on definitional issues; *economics*, on profit maximization and market equilibrium; *marketing*, on the determinants of buying behavior and customer satisfaction; and *operations management*, on engineering practices and manufacturing control. The result has been a host of competing perspectives, each based on a different analytical framework and each employing its own terminology.

At the same time, a number of common themes are apparent. All of them have important management implications. On the conceptual front, each discipline has wrestled with the following questions: Is quality objective or subjective? Is it timeless or socially determined? Empirically, interest has focused on the correlates of quality. What, for example, is the connection between quality and price? Between quality and advertising? Between quality and cost? Between quality and market share? More generally, do quality improvements lead to higher or lower profits?

Five Approaches to Defining Quality

Five major approaches to the definition of quality can be identified: (1) the *transcendent* approach of philosophy; (2) the *product-based* approach of economics; (3) the *user-based* approach of economics, marketing, and operations management; and (4) the *manufacturing-based* and (5) *value-based* approaches of operations management. Table 1 presents representative examples of each approach.

1. The Transcendent Approach

According to the transcendent view, quality is synonymous with "innate excellence."[4] It is both absolute and universally recognizable, a mark of uncompromising standards and high achievement. Nevertheless, proponents of this view claim that quality cannot be defined precisely; rather, it is a simple, unanalyzable property that we learn to recognize only through experience. This definition borrows heavily from Plato's discussion of beauty.[5] In the *Symposium*, he argues that beauty is one of the "platonic forms," and, therefore, a term that cannot be defined. Like other such terms that philosophers consider to be "logically primitive," beauty (and perhaps quality as well) can be understood only after one is exposed to a succession of objects that display its characteristics.

2. The Product-based Approach

Product-based definitions are quite different; they view quality as a precise and measurable variable. According to this view, differences in quality reflect differences in the

Table 1 Five Definitions of Quality

I. Transcendent Definition:

— "Quality is neither mind nor matter, but a third entity independent of the two . . . even though Quality cannot be defined, you know what it is." (R. M. Pirsig, *Zen and the Art of Motorcycle Maintenance*, pp. 185, 213)

— ". . . a condition of excellence implying fine quality as distinct from poor quality. . . . Quality is achieving or reaching for the highest standard as against being satisfied with the sloppy or fraudulent." (B. W. Tuchman, "The Decline of Quality," *New York Times Magazine*, 2 November 1980, p. 38)

II. Product-based Definition:

— "Differences in quality amount to differences in the quantity of some desired ingredient or attribute." (L. Abbott, *Quality and Competition*, pp. 126–127)

— "Quality refers to the amounts of the unpriced attributes contained in each unit of the priced attribute." (K. B. Leffler, "Ambiguous Changes in Product Quality," *American Economic Review*, December 1982, p. 956)

III. User-based Definition:

— "Quality consists of the capacity to satisfy wants . . ." (C. D. Edwards, "The Meaning of Quality," *Quality Progress*, October 1968, p. 37)

— "Quality is the degree to which a specific product satisfies the wants of a specific consumer." (H. L. Gilmore, "Product Conformance Cost," *Quality Progress*, June 1974, p. 16)

— "Quality is any aspect of a product, including the services included in the contract of sales, which influences the demand curve." (R. Dorfman and P. O. Steiner, "Optimal Advertising and Optimal Quality," *American Economic Review*, December 1954, p. 831)

— "In the final analysis of the marketplace, the quality of a product depends on how well it fits patterns of consumer preferences." (A. A. Kuehn and R. L. Day, "Strategy of Product Quality," *Harvard Business Review*, November–December 1962, p. 101)

— "Quality consists of the extent to which a specimen [a product-brand-model-seller combination] possesses the service characteristics you desire." (E. S. Maynes, "The Concept and Measurement of Product Quality," in *Household Production and Consumption*, p. 542)

— "Quality is fitness for use." (J. M. Juran, ed., *Quality Control Handbook*, p. 2–2)

IV. Manufacturing-based Definition:

— "Quality [means] conformance to requirements." (P. B. Crosby, *Quality Is Free*, p. 15)

— "Quality is the degree to which a specific product conforms to a design or specification." (Gilmore, June 1974, p. 16)

V. Value-based Definition:

— "Quality is the degree of excellence at an acceptable price and the control of variability at an acceptable cost." (R. A. Broh, *Managing Quality for Higher Profits*, 1982, p. 3)

— "Quality means best for certain customer conditions. These conditions are (a) the actual use and (b) the selling price of the product." (A. V. Feigenbaum, *Total Quality Control*, p. 1)

quantity of some ingredient or attribute possessed by a product.[6] For example, high-quality ice cream has a high butterfat content, just as fine rugs have a large number of knots per square inch. This approach lends a vertical or hierarchical dimension to quality, for goods can be ranked according to the amount of the desired attribute that they possess. However, an unambiguous ranking is possible only if the attributes in question are considered preferable by virtually all buyers.[7]

Product-based definitions of quality first appeared in the economics literature, where they were quickly incorporated into theoretical models. In fact, the early economic research on quality focused almost exclusively on durability, simply because it was so easily translated into the above framework.[8] Since durable goods provide a stream of services over time, increased durability implies a longer stream of services — in effect, more of the good. Quality differences could, therefore, be treated as differences in quantity,

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considerably simplifying the mathematics.

There are two obvious corollaries to this approach. First, higher quality can only be obtained at higher cost. Because quality reflects the quantity of attributes that a product contains, and because attributes are considered to be costly to produce, higher-quality goods will be more expensive. Second, quality is viewed as an inherent characteristic of goods, rather than as something ascribed to them. Because quality reflects the presence or absence of measurable product attributes, it can be assessed objectively, and is based on more than preferences alone.

3. The User-based Approach

User-based definitions start from the opposite premise that quality "lies in the eyes of the beholder." Individual consumers are assumed to have different wants or needs, and those goods that best satisfy their preferences are those that they regard as having the highest quality.[9] This is an idiosyncratic and personal view of quality, and one that is highly subjective. In the marketing literature, it has led to the notion of "ideal points": precise combinations of product attributes that provide the greatest satisfaction to a specified consumer;[10] in the economics literature, to the view that quality differences are captured by shifts in a product's demand curve;[11] and in the operations management literature, to the concept of "fitness for use."[12] Each of these concepts, however, faces two problems. The first is practical — how to aggregate widely varying individual preferences so that they lead to meaningful definitions of quality at the market level. The second is more fundamental — how to distinguish those product attributes that connote quality from those that simply maximize consumer satisfaction.

The aggregation problem is usually resolved by assuming that high-quality products are those that best meet the needs of a majority of consumers. A consensus of views is implied, with virtually all users agreeing on the desirability of certain product attributes. Unfortunately, this approach ignores the different weights that individuals normally attach to quality characteristics, and the difficulty of devising an unbiased statistical procedure for aggregating such widely varying preferences.[13] For the most part, these problems have been ignored by theorists. Economists, for example, have typically specified models in which the market demand curve responds to quality changes without explaining how that curve, which represents the summation of individual preferences, was derived in the first place.[14]

A more basic problem with the user-based approach is its equation of quality with maximum satisfaction. While the two are related, they are by no means identical. A product that maximizes satisfaction is certainly *preferable* to one that meets fewer needs, but is it necessarily *better* as well? The implied equivalence often breaks down in practice. A consumer may enjoy a particular brand because of its unusual taste or features, yet may still regard some other brand as being of higher quality. In the latter assessment, the product's objective characteristics are also being considered.

Even perfectly objective characteristics, however, are open to varying interpretations. Today, durability is regarded as an important element of quality. Long-lived products are generally preferred to those that wear out more quickly. This was not always true: until the late nineteenth century, durable goods were primarily possessions of the poor, for only wealthy individuals could afford delicate products that required frequent replacement or repair.[15] The result was a long-standing association between durability and inferior quality, a view that changed only with the mass production of luxury items made possible by the Industrial Revolution.

4. The Manufacturing-based Approach

User-based definitions of quality incorporate subjective elements, for they are rooted in consumer preferences — the determinants of demand. In contrast, manufacturing-based definitions focus on the supply side of the equation, and are primarily concerned with engineering and manufacturing practice.

Virtually all manufacturing-based definitions identify quality as "conformance to requirements."[16] Once a design or a specification has been established, any deviation implies a reduction in quality. Excellence is equated with meeting specifications, and with "making it right the first time." In these terms, a well-made Mercedes is a high-quality automobile, as is a well-made Chevette.

While this approach recognizes the consumer's interest in quality — a product that deviates from specifications is likely to be poorly made and unreliable, providing less satisfaction than one that is properly constructed — its primary focus is internal. Quality is defined in a manner that simplifies engineering and production control. On the design side, this has led to an emphasis on reliability engineering;[17] and on the manufacturing side, to an emphasis on statistical quality control.[18] Both techniques are designed to weed out deviations early: the former, by analyzing a product's basic components, identifying possible failure modes, and then proposing alternative designs to enhance reliability; the latter, by employing statistical techniques to discover when a production process is performing outside acceptable limits.

Each of these techniques is focused on the same end: cost reduction. According to the manufacturing-based approach, improvements in quality (which are equivalent to reductions in the number of deviations) lead to lower costs, for preventing defects is viewed as less expensive than repairing or reworking them.[19] Firms are, therefore, assumed to be performing suboptimally: were they only to increase their expenditures on prevention and inspection — testing prototypes more carefully or weeding out a larger number of defective components before they become part of fully assembled units — they would find their rework, scrap, and warranty expenses falling by an even greater amount.[20]

5. The Value-based Approach

Value-based definitions take this idea one step further. They actually define quality in terms of costs and prices. According to this view, a quality product is one that provides performance at an acceptable price or conformance at an acceptable cost.[21] Under this approach, a $500 running shoe, no matter how well constructed, could not be a quality product, for it would find few buyers.

A recent survey of consumer perceptions of quality in twenty-eight product categories suggests that the value-based view is becoming more prevalent.[22] While ingredients and materials were seen as the key quality indicators in such categories as food, clothing, personal care, and beauty products — reflecting a product-based approach to the subject — the study's overall conclusion was that "quality is increasingly apt to be discussed and perceived in relationship to price."

The difficulty in employing this approach lies in its blending of two related but distinct concepts. Quality, which is a measure of excellence, is being equated with value, which is a measure of worth. The result is a hybrid — "affordable excellence" — that lacks well-defined limits and is difficult to apply in practice.

The Implications of Multiple Definitions

Most existing definitions of quality fall into one of the categories listed above. The coexistence of these differing approaches has several important implications. First, it helps to explain the often competing views of quality held by members of the marketing and manufacturing departments. Marketing people typically take a user-based or product-based approach to the subject; for them, higher quality means better performance, enhanced features, and other improvements that increase cost. Because they see the customer as the arbiter of quality, they view what happens in the factory as much less important than what happens in the field.

Manufacturing people normally take a different approach. For them, quality means conformance to specifications and an emphasis on "doing it right the first time." Because they associate poor quality with high levels of rework and scrap, manufacturing people usually expect quality improvements to result in cost reductions.

The Potential for Conflict. These two views are obviously in conflict, and can cause serious breakdowns in communications. Remedial efforts may become paralyzed if the coexistence of these competing perspectives is not openly acknowledged. For example, a large division of a major consumer goods company recently reviewed its quality management practices. The firm was especially interested in assessing its new-product introduction process, for new products were regarded as the key to competitive success. Two divergent views emerged. One group felt that the process had been quite successful: new products appeared regularly, customer complaints were few, and defective items had not been shipped to the trade in any large number. Another group felt that the process had to be revamped because quality was so poor: new product releases were frequently delayed while designs were reconfigured to adapt to manufacturing requirements, and material and labor variances of several hundred thousand dollars had been incurred because of unanticipated expenditures on rework and scrap. Because of these disagreements, the project quickly stalled. Further progress requires the recognition that one group is employing a user-based definition of quality while the other is employing a manufacturing-based approach. Only then are the two groups likely to agree on the nature of the problems they face.

The Need for Different Definitions. Despite the potential for conflict, companies need to cultivate such differing perspectives, for they are essential to the successful introduction of high-quality products. Reliance on a single definition of quality is a frequent source of problems. For example, a Japanese paper manufacturer recently discovered that its newsprint rolls failed to satisfy customers even though they met the Japanese Industrial Standard. Conformance was excellent, reflecting a manufacturing-based approach to quality, but acceptance was poor. Other rolls of newsprint, however, generated no customer complaints even though they failed to meet the standard.[23] A leading U.S. manufacturer of room air conditioners faced the opposite problem. Its products were well received by customers and highly rated by *Consumer Reports*. Reject, scrap, and warranty costs were so high, however, that large losses were incurred. While the product's design matched customers' needs, the failure to follow through with tight conformance in manufacturing cost the company dearly.

These examples suggest the need to actively shift one's approach to quality as products move from design to market. The characteristics that connote quality must first be identified through market research (a user-based approach to quality); these characteristics must then be translated into identifiable product attributes (a product-based approach to quality); and the manufacturing process must then be organized to ensure that products are made precisely to these specifications (a manufacturing-based approach to quality). A process that ignores any one of these steps will not result in a quality product. All three views are necessary and must be consciously cultivated.

Nevertheless, each of the major approaches to quality shares a common problem. Each is vague and imprecise when it comes to describing the basic elements of product quality. Relatively few analysts, with the exceptions of Juran[24] and Maynes,[25] have shown an interest in these details. That oversight is unfortunate, for much can be learned by treating quality in a less homogeneous fashion.

Eight Dimensions of Quality

Eight dimensions can be identified as a framework for thinking about the basic elements of product quality:

1. Performance,
2. Features,

3. Reliability,
4. Conformance,
5. Durability,
6. Serviceability,
7. Aesthetics,
8. Perceived Quality.

Each is self-contained and distinct, for a product can be ranked high on one dimension while being low on another.

1. Performance

First on the list is performance, which refers to the primary operating characteristics of a product. For an automobile, these would be traits like acceleration, handling, cruising speed, and comfort; for a television set, they would include sound and picture clarity, color, and ability to receive distant stations.

This dimension of quality combines elements of both the product and user-based approaches. Measurable product attributes are involved, and brands can usually be ranked objectively on at least one dimension of performance. The connection between performance and quality, however, is more ambiguous. Whether performance differences are perceived as quality differences normally depends on individual preferences. Users typically have a wide range of interests and needs; each is likely to equate quality with high performance in his or her area of immediate interest. The connection between performance and quality is also affected by semantics. Among the words that describe product performance are terms that are frequently associated with quality as well as terms that fail to carry the association. For example, a 100-watt light bulb provides greater candlepower (performance) than a 60-watt bulb, yet few consumers would regard this difference as a measure of quality. The products simply belong to different performance classes. The smoothness and quietness of an automobile's ride, however, is typically viewed as a direct reflection of its quality. Quietness is therefore a performance dimension that readily translates into quality, while candlepower is not. These differences appear to reflect the conventions of the English language as much as they do personal preferences.

There is a clear analogy here to Lancaster's theory of consumer demand.[26] The theory is based on two propositions:[27]

> All goods possess objective characteristics relevant to the choices which people make among different collections of goods. The relationship between . . . a good . . . and the characteristics which it possesses is essentially a technical relationship, depending on the objective characteristics of the good. . . .
>
> Individuals differ in their *reaction* to different characteristics, rather than in their assessments of the characteristics. . . . It is these *characteristics* in which consumers are interested . . . the various characteristics can be viewed . . . as each helping to satisfy some kind of "want."

In these terms, the performance of a product would correspond to its objective characteristics, while the relationship between performance and quality would reflect individual reactions.

2. Features

The same approach can be applied to product features, a second dimension of quality. Features are the "bells and whistles" of products, those secondary characteristics that supplement the product's basic functioning. Examples include free drinks on a plane flight, permanent press as well as cotton cycles on a washing machine, and automatic tuners on a color television set. In many cases, the line separating primary product characteristics (performance) from secondary characteristics (features) is difficult to draw. Features, like product performance, involve objective and measurable attributes; their translation into quality differences is equally affected by individual preferences. The distinction between the two is primarily one of centrality or degree of importance to the user.

3. Reliability

Reliability is a third dimension of quality. It reflects the probability of a product's failing within a specified period of time. Among the most common measures of reliability are the mean time to first failure (MTFF), the mean time between failures (MTBF), and the failure rate per unit time.[28] Because these measures require a product to be in use for some period, they are more relevant to durable goods than they are to products and services that are consumed instantly. Japanese manufacturers typically pay great attention to this dimension of quality, and have used it to gain a competitive edge in the automotive, consumer electronics, semiconductor, and copying machine industries.

4. Conformance

A related dimension of quality is conformance, or the degree to which a product's design and operating characteristics match preestablished standards. Both internal and external elements are involved. Within the factory, conformance is commonly measured by the incidence of defects: the proportion of all units that fail to meet specifications, and so require rework or repair. In the field, data on conformance are often difficult to obtain, and proxies are frequently used. Two common measures are the incidence of service calls for a product and the frequency of repairs under warranty. These measures, while suggestive, neglect other deviations from standard, such as misspelled labels or shoddy construction, that do not lead to service or repair. More comprehensive measures of conformance are required if these items are to be counted.

Both reliability and conformance are closely tied to the manufacturing-based approach to quality. Improvements in both measures are normally viewed as translating directly into quality gains because defects and field failures are regarded as undesirable by virtually all consumers. They are, therefore, relatively objective measures of quality, and are less likely to reflect individual preferences than are rankings based on performance or features.

5. Durability

Durability, a measure of product life, has both economic and technical dimensions. Technically, durability can be defined as the amount of use one gets from a product before it physically deteriorates. A light bulb provides the perfect example: after so many hours of use, the filament burns up and the bulb must be replaced. Repair is impossible. Economists call such products "one-hoss shays," and have used them extensively in modeling the production and consumption of capital goods.[29]

Durability becomes more difficult to interpret when repair is possible. Then the concept takes on an added dimension, for product life will vary with changing economic conditions. Durability becomes the amount of use one gets from a product before it breaks down and replacement is regarded as preferable to continued repair. Consumers are faced with a series of choices: each time a product fails, they must weigh the expected cost, in both dollars and personal inconvenience, of future repairs against the investment and operating expenses of a newer, more reliable model. In these circumstances, a product's life is determined by repair costs, personal valuations of time and inconvenience, losses due to downtime, relative prices, and other economic variables, as much as it is by the quality of components or materials.

This approach to durability has two important implications. First, it suggests that durability and reliability are closely linked. A product that fails frequently is likely to be scrapped earlier than one that is more reliable; repair costs will be correspondingly higher, and the purchase of a new model will look that much more desirable. Second, this approach suggests that durability figures should be interpreted with care. An increase in product life may not be due to technical improvements or to the use of longer-lived materials; the underlying economic environment may simply have changed. For example, the expected life of an automobile has risen steadily over the last decade, and now averages fourteen years.[30] Older automobiles are held for longer periods and have become a greater percentage of all cars in use.[31] Among the factors thought to be responsible for these changes are rising gasoline prices and a weak economy, which have reduced the average number of miles driven per year, and federal regulations governing gas mileage, which have resulted in a reduction in the size of new models and an increase in the attractiveness to many consumers of retaining older cars. In this case, environmental changes have been responsible for much of the reported increase in durability.

6. Serviceability

A sixth dimension of quality is serviceability, or the speed, courtesy, and competence of repair. Consumers are concerned not only about a product breaking down, but also about the elapsed time before service is restored, the timeliness with which service appointments are kept, the nature of their dealings with service personnel, and the frequency with which service calls or repairs fail to resolve outstanding problems. Some of these variables can be measured quite objectively; others reflect differing personal standards of what constitutes acceptable service. For example, a recent study of consumer satisfaction with professional services found the major complaints to be that "the service was provided in a careless, unprofessional manner" and that "I feel I was treated as an object rather than as an individual."[32] These comments clearly reflect subjective views of what constitutes acceptable professional behavior. Other aspects of service can be assessed more objectively. Responsiveness is typically measured by the mean time to repair (MTTR), while technical competence is reflected in the incidence of multiple service calls required to correct a single problem. Because most consumers equate more rapid repair and reduced downtime with higher quality, these elements of serviceability are less subject to personal interpretation than are those involving evaluations of courtesy or standards of professional behavior. A number of companies have begun emphasizing this dimension of quality. Caterpillar Tractor's promise that it will deliver repair parts anywhere in the world within forty-eight hours and Mercedes' guarantee of twenty-four-hour (overnight) service in California and Arizona show that even top-of-the-line producers believe that this approach has value.

7. Aesthetics

The final two dimensions of quality are the most subjective. Both aesthetics and perceived quality are closely related to the user-based approach. Aesthetics — how a product looks, feels, sounds, tastes, or smells — is clearly matters of personal judgment, and reflections of individual preferences. In fact, the marketing concept of "ideal points" — those combinations of product attributes that best match the preferences of a specified consumer — was originally developed to capture just this dimension of quality.[33]

8. Perceived Quality

Perceptions of quality can be as subjective as assessments of aesthetics. Because consumers do not always possess complete information about a product's attributes, they must frequently rely on indirect measures when comparing brands.[34] In these circumstances, products will be evaluated less on their objective characteristics than on their images, advertising, or brand names. These forces even affect scholarly judgments. When professors around the country were asked to rank the departments in their fields by quality, their rankings were only partially explained by such objective measures as the number of articles published in leading journals by members of the department. Both reputation — the historical strength of the department — and affiliation — the quality of the university to which a department was attached — were equally important in explaining the rankings.[35]

Together, the eight major dimensions of quality cover a broad range of concepts. Several of the dimensions involve measurable product attributes; others reflect individual preferences. Some are objective and timeless, while others shift with changing fashions. Some are inherent characteristics of goods, while others are ascribed characteristics.

The diversity of these concepts helps to explain the differences among the five traditional approaches to quality. Each of the approaches focuses implicitly on a different dimension of quality: the product-based approach focuses on performance, features, and durability; the user-based approach focuses on aesthetics and perceived quality; and the manufacturing-based approach focuses on conformance and reliability. Conflicts among the five approaches are inevitable because each defines quality from a different point of view. Once the concept is unbundled, however, and each dimension is considered separately, the sources of disagreement become clear.

The Strategic Importance of Quality Dimensions

A recognition of these eight dimensions is also important for strategic purposes. A firm that chooses to compete on the basis of quality can do so in several ways; it need not pursue all eight dimensions at once. Instead, a segmentation strategy can be followed, with a few dimensions singled out for special attention. For example, Japanese manufacturers have traditionally entered U.S. markets by emphasizing the reliability and conformance of their products while downplaying the other dimensions of quality. The superior "fits and finishes" and low repair rates of Japanese automobiles are well known; what are less frequently recognized are their poor safety records (performance) and low corrosion resistance (durability). Despite these drawbacks, Japanese automobiles have come to symbolize the very best in quality for many American consumers.

This example suggests that firms can successfully pursue a relatively narrow quality niche. In fact, they may have no other choice if competitors have already established broad reputations for excellence. In these circumstances, new entrants may only be able to secure a defensible position if they focus on an as yet untapped dimension of quality.

This pattern clearly fits the piano industry. For many years, Steinway & Sons has been the quality leader; its instruments are known for their even voicing (the evenness of character and timbre of each of the eighty-eight notes on the keyboard), the sweetness of their registers (the roundness and softness of tone throughout the piano's entire range), the duration of their tone, their long lives, and their finely polished woodwork.[36] Each piano is handcrafted, and each is unique in sound and style. Despite these advantages, Steinway has recently been challenged by Yamaha, a Japanese manufacturer that has developed a strong reputation for quality in a relatively short time. Yamaha has done so by emphasizing reliability and conformance, two dimensions of quality that are low on Steinway's list, rather than artistry and uniqueness. In fact, one of Yamaha's major selling points is that all of its pianos sound exactly the same. Both companies enjoy high profits, despite their widely varying approaches to quality.

This example suggests the importance of carefully targeting one's quality niche. The selection of a defensible niche, however, is only a first step. Operational requirements must also be met, for each dimension of quality imposes its own demands on the firm. High performance requires careful attention to design and a strong design staff; superior durability requires the use of long-lived or "derated" components and close cooperation between the engineering and purchasing departments; superior conformance requires attention to written specifications and precision in assembly; and exceptional serviceability requires a strong customer service department and active field representatives. In each case, a different function enjoys the lead role, and different tasks are required for success. The managerial implications of this analysis should be obvious: after selecting the dimensions of quality on which it hopes to compete, a firm must tailor its organization and operations to meet these specific needs. Otherwise, the wrong departments may be elevated in status, or the wrong tasks pursued. Disaggregating the concept of quality allows companies to pinpoint these operating requirements as carefully as they target untapped markets.

Correlates of Quality

Managers are interested in quality primarily because of its marketing and financial implications. Many believe that a product's price, advertising, market share, costs, and profitability are connected in some way to product quality. The following section of the article explores the theory and evidence in each of these areas.

Quality and Price

The theoretical argument about the relationship between quality and price runs in both directions. On the one hand, quality and price are assumed to be positively correlated. If higher quality can only be produced at higher cost, and if costs and prices are, as economic theory suggests, positively related, then quality and price will move together.[37] This assumes, however, that consumers possess sufficient information to evaluate product quality. If they do not, they will rely on other cues when making that assessment, including comparative prices.[38] As Riesz points out, once managers observe this behavior, they may then respond by readjusting prices:

> If managers believe that perceptions and perhaps consumer purchase decisions are positively correlated with price, they may set higher prices in order to imply higher product quality. Price, therefore, may become a means of differentiating a product . . . . Such pricing strategies . . . would likely result in a deterioration of the price-quality relationship within a product category.[39]

The theory, then, is equivocal. Quality and price may or may not be positively correlated, depending on the amount of information available to consumers. The empirical results are equally mixed. A number of studies have found a positive correlation between the two variables.[40] These studies, however, were based primarily on experimental evidence rather than on market data. When market data were used, the results differed by product category. Nondurables generally displayed a weak or negative correlation between price and quality (with quality measured by *Consumer Report* rankings, which typically focus on product performance), while durables showed a significant positive correlation.[41] The findings for durables are broadly consistent with research on the purchase decision for major home appliances. Westbrook *et al.* found that 86 percent of recent purchasers and 75 percent of prospective buyers felt that they had no difficulty judging the quality or reliability of competing brands.[42] A similar study, "The Buying Consumer: Room Air Conditioners," found that 85 percent of all buyers rated the product information available to them as adequate or more than adequate.[43] Where information of this kind is available, a positive correlation between price and quality is to be expected.

This relationship breaks down, however, in the more sophisticated experimental studies. Where multiple cues are present for inferring quality — brand name, store image, product features, or country of manufacture, in addition to price — the strong price-quality association of the earlier bivariate research weakens or disappears.[44] In these circumstances, quality assessment is guided less by price than by the other variables present.

Quality and Advertising

The theoretical argument for a positive association between quality and advertising was initially developed by Phillip Nelson.[45] A more formal modeling was later pursued by Richard Schmalensee.[46] Nelson first introduced the distinction between "search" and "experience" goods. The attributes of the former can be determined prior to purchase, while those of the latter can only be learned after the product has been purchased and used. The cut and fit of an article of clothing are examples of product characteristics that can be learned through search; the reliability and durability of a major home appliance are examples of traits that can be learned only through experience. Nelson then argued that for experience goods, higher levels of advertising would be associated with higher quality products. Schmalensee has summarized this argument succinctly:

> High-quality brands will obtain more repeat purchases, *ceteris paribus*, than low-quality brands. Thus, . . . sellers of high-quality brands will spend more to persuade consumers to try their wares, since *ceteris paribus* again, the present value of a trial purchase is larger. Nelson contends that this force causes better brands to advertise more in equilibrium as long as consumers respond to advertising at all; the level of advertising for experience goods is thus positively correlated with quality, regardless of what individual ads actually claim. Quality information is provided by the level of advertising, not the claims it makes.[47]

The evidence on this point is inconclusive. Analysts using both American and British data have found some evidence of a positive relationship between advertising and product quality (with quality again measured by *Consumer Reports* or *Consumers' Bulletin* rankings), but these results have been undercut by other studies. Rotfeld and Rozell, after reviewing the research on this topic, concluded that: "Advertised products are apparently of better quality than nonadvertised goods for some products, when rated by certain criteria, in some years . . . . But no broad generalizations can be made."[48]

Gilligan and Holmes, who expanded on the earlier studies by using a variety of different measures of both advertising expenditures and brand quality, reached a similar conclusion: "A heavily advertised product is just as likely to be poor quality as any other."[49] While these studies have involved both search and experience goods, the same conclusions apply if the analysis is limited to goods in the latter category. Nelson's claim that heavy advertising implies superior quality is, therefore, not supported by the available evidence. In fact, in a recent survey of consumer attitudes the majority of respondents felt that advertised products were no more likely to be dependable than were products without advertising.[50]

Quality and Market Share

The relationship between quality and market share is likely to depend on how quality is defined. If a high-quality product is one with superior performance or a large number of features, it will generally be more expensive, and will sell in smaller volumes. But if quality is defined as fitness for use, superior aesthetics, or improved conformance, high quality need not be accompanied by premium prices. In that case, quality and market share are likely to be positively correlated.

Virtually all empirical work on this topic has employed the Profit Impact of Marketing Strategies (PIMS) data base.[51] All studies have, therefore, used the same, highly aggregated measure of quality. Each company in the PIMS survey was first asked the following questions: What was the percentage of sales of products or services from each business in each year which were superior to those of competitors? What was the percentage of equivalent products? What was the percentage of inferior products? Quality indexes were then compiled for each firm by subtracting its percentage "inferior" from its percentage "superior."

Using these indexes, analysts have found a strong positive association between quality and market share. Those businesses in the PIMS study that improved in quality during the 1970s increased their market share five or six times faster than those that declined in quality, and three times as rapidly as those whose relative quality remained unchanged.[52] Cross-sectional studies using both bivariate[53] and multivariate methods[54] have confirmed the positive association between quality and market share.

Quality and Cost

Theoretical discussions of the relationship between quality and cost fall into three distinct categories. One group, following the product-based approach, argues that quality and direct cost are positively related. The implicit assumption here is that quality differences reflect variations in performance, features, durability, or other product attributes that require more expensive components or materials, additional labor hours in construction, or other commitments of tangible resources. This view dominates much

American thinking on the subject. A second view, which draws on the operations management literature, sees quality and cost as inversely related because the costs of improving quality are thought to be less than the resulting savings in rework, scrap, and warranty expenses. According to this view, which is widely held among Japanese manufacturers and explains much of their dedication to the goal of "continuous improvement," quality is synonymous with the absence of defects, and the costs in question are quality costs.[55]

Quality costs are defined as any expenditure on manufacturing or service in excess of that which would have been incurred if the product had been built exactly right the first time.[56] In their most comprehensive form, these costs would include such hidden elements as the expense of carrying excess raw materials and work-in-process inventory to insure that defective items do not shut down the production process, as well as the cost of owning and operating excess capacity in order to compensate for machine clogging and downtime. In practice, less inclusive measures are usually employed. Total quality costs typically include expenditures in the following four categories:[57] prevention (e.g., quality planning, worker training, and supplier education); appraisal (e.g., product inspection and testing); internal failures (e.g., rework and scrap); and external failures (e.g., warranty and product liability).

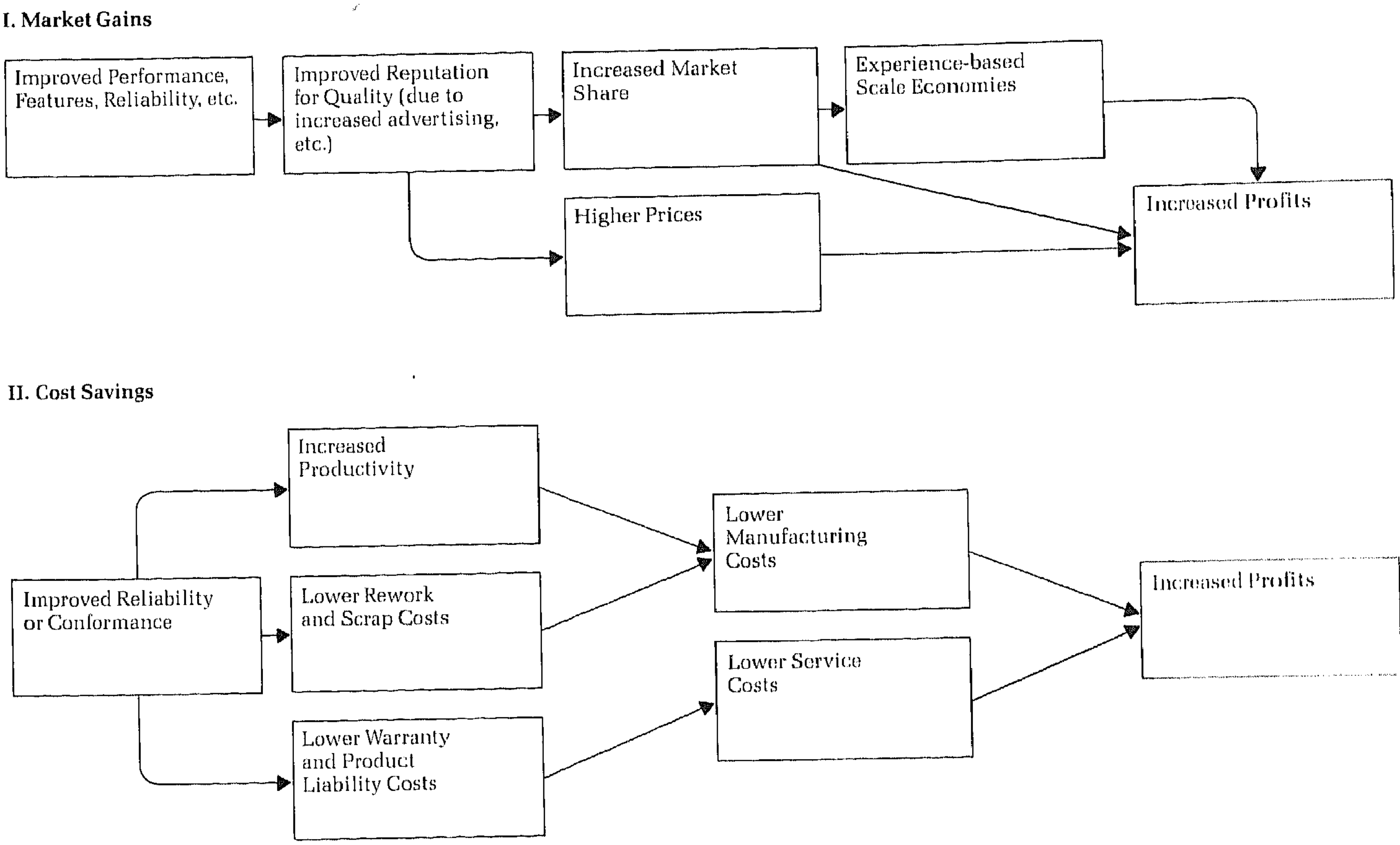
A number of analysts have extended this argument, claiming that improved conformance should eventually lead to a reduction in long-term manufacturing costs.[58] One justification for this claim has been the expected link between quality improvement and productivity gains. For example, simplified and easy-to-assemble designs should require fewer workers at the same time that they reduce defects. Investments in machinery and equipment should result in more consistent production as well as improvements in worker productivity. Quality improvements are also expected to lead to further savings, in the form of experience-based scale economies, through their impact on market share and (cumulative) production levels.[59]

While the evidence is limited, most empirical work suggests that superior conformance and total quality costs are inversely related. Garvin, for example, in a study of the room air conditioning industry, found that Japanese manufacturers, with defect and field failure rates between fifteen and seventy times lower than U.S. competitors, averaged total costs of quality that were 1.3 percent of sales.[60] The best American companies averaged rework, scrap, and warranty costs that alone were 2.8 percent of sales. At the U.S. firms with the poorest quality, these costs exceeded 5.8 percent of sales. Garvin also found that quality and productivity were positively related, even though firms employed similar technologies and showed few differences in capital intensity. In this industry, U.S. companies with the highest quality were five times as productive, when measured by units produced per man-hour of assembly-line direct labor, as companies with the poorest quality.

Several surveys have collected more comprehensive data on the costs of quality; these provide additional support for the above relationships. A 1977 survey, for example, found that companies with formal systems for assessing quality costs — which most analysts associate with superior quality management and low failure rates[61] — had lower total costs of quality than companies without such systems. Companies in the former group averaged quality costs that were 5.8 percent of sales; those in the latter, rework, scrap, and warranty costs that alone were 7.8 percent of sales.[62]

Moreover, the amount that companies are spending to prevent quality problems — and, therefore, to insure lower failure rates — may very well be suboptimal. Gilmore found that at least one-quarter of the companies he surveyed were spending less than 5 percent of their quality costs on prevention; approximately one-half were spending less than 10 percent.[63] His conclusion was that greater expenditures on prevention would result in improved conformance and

Figure 1 **Quality and Profitability**



fewer defects; these, in turn, were likely to produce an overall reduction in the total costs of quality because of significant savings in rework, scrap, and warranty.

The PIMS data base has generally been used to examine the relationship between quality and direct cost. The results have varied considerably by industry. In one study, quality and direct cost were positively related for differentiated-product businesses but negatively related for homogeneous products.[64] In another study, the two were positively related in capital goods businesses but negatively related in components and supplies businesses.[65] However, the experience curve effect, with high quality leading to high market share, increases in cumulative production, and eventually, experience-based reductions in costs, were found in all types of businesses.[66]

The varying results of these studies may reflect differences in the definitions of quality used by firms in different industries. The PIMS quality index is highly aggregated; no distinction is made among performance, features, reliability, or the other dimensions of quality discussed earlier. As a result, different industries could be employing different definitions when assessing the quality of their products. This, in turn, would determine whether the relationship between quality and direct cost was positive or negative. For example, among homogeneous product businesses (e.g., chemicals), quality is often defined as "meeting specifications."[67] Such a conformance-based view of quality is likely to result in an inverse relationship between quality and direct cost. Among differentiated and capital goods businesses, however, quality is likely to be equated with performance or features, suggesting a positive association between quality and direct cost. While these inferences are consistent with the PIMS findings, they require further research in order to be verified.

Quality and Profitability

Figure 1 shows two ways in which improved quality might lead to higher profitability. The first route is through the market: improvements in performance, features, or other dimensions of quality lead to increased sales and larger market shares, or alternatively, to less elastic demand and higher prices. If the cost of achieving these gains is outweighed by the increases in contribution received by the firm, higher profits will result.[68]

Quality improvements may also affect profitability through the cost side. Fewer defects or field failures result in lower manufacturing and service costs; as long as these gains exceed any increase in expenditures by the firm on defect prevention, profitability will improve.

Empirical studies using the PIMS data base confirm the strong positive association between quality and profitability.[69] High quality produces a higher return on investment (ROI) for any given market share: among businesses with less than 12 percent of the market, for example, those with inferior product quality averaged an ROI of 4.5 percent, those with average product quality an ROI of 10.4 percent, and those with superior product quality an ROI of 17.4 percent.[70] Quality improvements, by increasing share, also lead to experience-based cost savings and further gains in profitability.[71] The market-based link between quality and profitability is, therefore, well supported by the evidence. The second linkage described in Figure 1 is less firmly established. As an earlier discussion has shown, the relationship between quality and cost depends on how the terms are defined. Those studies that have equated quality with conformance, and cost with total quality cost, have found an inverse relationship between the two. They have not, however, carried the analysis a step further to find if profitability was similarly affected. Nor have the studies focusing on the connection between quality and direct cost taken into account differences in investment levels or capital costs, which would clearly affect the relationship between quality and ROI.

The empirical research on quality, then, has produced mixed results, with few clear directions for managers. The relationship between quality and such variables as price, advertising, and direct cost is both complex and difficult to predict. Few unambiguous results are found in the literature. Even where the expected relationships have emerged, further work is required because of the highly aggregated nature of the quality measures that have been employed. This is especially true of the studies relating quality to market share and profitability, for they have all employed the PIMS data base. These findings suggest a number of directions for future research.

Directions for Future Research

There is a clear need for more precise measures of product quality. Few studies have recognized the multiple dimensions of quality, and still fewer, the possibility that quality may have different meanings in different industries. Much of the empirical research on the correlates of quality needs to be replicated with these distinctions in mind. Similarly, analysts need to determine if the various dimensions of quality move together or separately, for otherwise, managers will be unable to position their companies to exploit particular quality niches.

These questions suggest two possible avenues of research. The first would focus on the determinants of consumer satisfaction, consumer perceptions of quality, and the relative importance of the various dimensions of quality in shaping buyer behavior. Andreasen, for example, has found that indexes of consumer satisfaction based on voiced complaints, objective measures of product nonperformance, satisfaction immediately after purchase, and satisfaction after initial problems have been resolved are not well correlated.[72] Each apparently measures a slightly different aspect of consumer satisfaction. Similar research is necessary to understand the precise connection between consumer satisfaction and the various dimensions of quality discussed in this article. As Takeuchi and Quelch point out, for many consumers "quality is more than [simply] making a good product."[73]

A second possible line of research would focus on manufacturing tradeoffs. Traditionally, analysts have argued that manufacturing operations could only be effective if they pursued a limited set of objectives.[74] Low cost, high quality, rapid delivery, flexibility to volume changes, and flexibility to new product introductions were thought to be mutually incompatible. Tradeoffs were unavoidable, and any one goal could only be achieved at the expense of others.

Japanese manufacturers, however, have succeeded in producing products that meet the twin objectives of high quality (conformance and reliability) and low cost. Their ability to do so has forced analysts to reconsider the concept of manufacturing tradeoffs, for many traditional assumptions no longer apply.[75] This area clearly warrants further research. Tradeoffs among the various dimensions of quality and between these dimensions and the objectives of cost, flexibility, and delivery must be better understood. Do the different dimensions of quality require different forms of expertise, or are firms likely to succeed on several dimensions at once? Durability, for example, often requires the use of sturdy and oversized components; does it also guarantee superior reliability, or is that more a reflection of how the assembly process is managed? More generally, which of the dimensions of quality are primarily a reflection of manufacturing skills, and which reflect design and engineering expertise? These questions must be answered if companies are to devise and execute effective strategies for competing on the basis of product or service quality.

Conclusion

Quality is a complex and multifaceted concept. It is also the source of great confusion: managers — particularly those in different functions — frequently fail to communicate precisely what they mean by the term. The result is often endless debate, and an inability to show real progress on the quality front.

This article has identified several different perspectives on quality, and has emphasized a number of critical dimensions. These distinctions are more than just theoretical niceties: they are the key to using quality as a competitive weapon. Managers must learn to think carefully about how their approach to quality changes as a product moves from design to market, and must devise ways to cultivate these multiple perspectives. Attention must be focused on the separate dimensions of quality; markets must be closely examined for any untapped quality niches, and the organization must be tailored to support the desired focus. Once these approaches have been adopted, cost savings, market share gains, and profitability improvements can hardly be far behind.

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