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# There is More to Quality than Continuous Improvement: Listening to Plato

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*Quality programs that focus on continuous improvement are vital in providing incremental improvement of processes, products, and services in an existing technological paradigm. These programs view quality as being measurable in some quantitative way. Breakthrough improvement that leads to development of new paradigms requires thinking of quality in a different way. The transcendent view of quality is necessary for development of paradigm-shifting technologies. Plato's divided line represents four stages of awareness. The understanding stage is necessary for effective continuous improvement but inadequate for paradigm-shifting improvement. That requires Plato's insight stage of awareness. Drawing from Plato's divided line model, this article develops the approach to quality that is best suited for developing radical innovations.*

*The authors believe that organizations operating at Plato's level of understanding that focus almost exclusively on continuous improvement may be blind to breakthrough, paradigm-shifting innovations developed by organizations operating at Plato's level of insight. They see continuous improvement as essential but not sufficient for the long-term survival of an organization. Continuously improving a product that has been made technologically obsolete will not ensure the firm's survival. A firm in that position is forced to play catch up by developing its own version of the new technology. Operating at Plato's insight level becomes more critical to a firm's success as the level of technology increases and the length of the product life cycles decreases.*

*Key words: breakthrough improvement, paradigm shifting, transcendent quality*

## INTRODUCTION

*Quality* is a more complicated term than it appears. Dictionary definitions are usually inadequate in helping a quality professional understand the concept. It seems that every quality expert defines quality somewhat differently, and there are a variety of perspectives that can be taken in defining quality (for example, customer's perspective, specification-based perspective).

The purpose of this article is to discuss the transcendent approach to thinking about quality. The transcendent approach is the least understood and least utilized of the five approaches identified by Garvin (1984). At best, the transcendent approach is mentioned as being the realm of philosophers before discussion is quickly shifted to more "practical" approaches. Twice as many managers (62.4 percent vs. 33.3 percent) define quality in user-based terms (quality is realized when customer satisfaction is maximized because the product/service fits its intended use) as in transcendent-based terms (quality is innate excellence) (Tamimi and Sebastianelli 1996). This article will develop the concept of transcendent quality and provide an argument for its being the fundamentally most important approach to thinking about quality—particularly in the quality of design of breakthrough products and services.

## Historical Perspective

The debate over the nature of innate excellence is at least 2400 years old. Socrates, Plato, Aristotle, and other thinkers of ancient Greece were concerned with the true nature of things, and though they did not use the word

*quality*, one can see elements of quality in their discussions. So one would have to look at related notions such as goodness, excellence, and beauty to see how philosophers have thought about the *concept* of quality without using the *word*. According to Barfield: “The word *quality* is used by most educated people every day of their lives, yet in order that we should have this simple word Plato had to make the tremendous effort (it is one of the most exhausting which man is called on to exert) of turning a vague feeling into a clear thought. He invented a new word ‘poiotēs,’ ‘what-ness,’ as we might say, or ‘of-what-kind-ness,’ and Cicero translated it by the Latin ‘qualitas,’ from ‘qualis’” (Barfield [1953] 1988, 18-19).

From its invention by Plato, the word *quality* has been used with a variety of meanings, for example, the sense of a quality as simply one of the properties or characteristics of a thing. This variety of meanings can be accessed by consulting the Oxford English Dictionary (OED) (1989), and as part of the entry on quality, the earliest use of the word to mean *inherent excellence* that the OED reports is to be found in a 14th century work by Chaucer, *Troilus and Criseyde*.

Whatever the precise history of the word, the philosophical debate over the nature of quality in the sense of true excellence can be traced from the time of the Greeks through the ages in the writings of Augustine, Aquinas, Adam Smith, Jeremy Bentham, John Stuart Mill, and G.E. Moore, among others. But Walter Shewhart (1931) was the first modern-era quality expert to wrestle with the definition of quality. Shewhart suggested that quality has two aspects. The objective aspect, which refers to quality of a thing as “an objective reality independent of the existence of man,” and the subjective aspect, which refers to quality as “what we think, feel, or sense as a result of the objective reality.” According to Shewhart, although it is the objective aspect of quality that people usually try to measure, it is the subjective aspect of quality that is of commercial interest. Building on Shewhart’s (1931) work, Juran (1970) defined quality as “fitness for use” and Feigenbaum (1951) as “best for certain customer conditions.” These definitions form the basis for the modern definition of quality. Parasuraman, Zeithaml, and Berry (1988) and others

define quality as meeting or exceeding customer expectations, but in Deming’s (1993, 30) words: “Just to have the customer satisfied is not enough... You have to do better than that.” The authors contend that examining Plato’s philosophy will help “to do better than that.”

## PLATO’S TRANSCENDENT APPROACH TO THINKING ABOUT QUALITY

In his dialogue *Greater Hippias*, Socrates, after criticizing parts of an exhibition speech by the sophist Hippias as not being fine, asks the question “What the fine is itself?” Cooper (1997), the editor of this translation of Plato, translates the Greek word *kalon* as fine. This word is widely applicable as a term “of highly favorable evaluation, covering our ‘beautiful,’ ‘noble,’ ‘admirable,’ ‘excellent,’ and the like.” “What Socrates is asking for, then, is a general explanation of what feature any object, action, person, or accomplishment of any kind has to have in order correctly to be characterized as highly valued or worth valuing in this broad way (that is, as being fine)” (p. 898).

In contrast to Plato and Socrates, during the early to mid-20th century, value judgments of any type tended to be written off under the influence of the epistemology of logical positivism. Value judgments were thought to be nothing more than the expression of subjective feelings (interestingly, this was the view of sophists like Hippias). To write of a “transcendent” concept of quality as the authors are doing is to use language that treats quality as something that exists apart from particular subjective reactions or feelings. Those are the sorts of things that are to be transcended.

After Shewhart (1931), David Garvin (1984, 25) was among the first to return to Plato’s “the fine” as the transcendent approach to understanding quality in his 1984 *SMR* paper. Here is what he says about it:

According to the transcendent view, quality is synonymous with “innate excellence.” 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. 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.

Following this, when Reeves and Bednar (1994) construct their survey of definitions of quality and give attention to the notion of quality as "excellence," they cite Garvin's discussion as a source. They provide Pirsig's (1992) definition of quality as excellence: "It is understood ahead of definition . . . as a direct experience independent of and prior to intellectual abstractions." In listing the strengths and weaknesses of the "quality is excellence" concept, they acknowledge the concept "provides strong marketing and human resource benefits" because it can be used to articulate an attractive-sounding vision for employees and customers. But they assert that the weakness of defining quality as excellence is that it "offers little practical guidance to managers." This is because "a definition of quality based on excellence makes it difficult, if not impossible, to measure and compare the impact of quality on performance and other variables of interest" (Reeves and Bednar 1994, 428).

It is the authors' thesis that Garvin's account of the transcendent idea of quality not only is wrong in historical detail, but, more important, they claim that ignoring Plato's actual views on the subject leads to a failure to adequately appreciate this important dimension of quality. Moreover, when this dimension is appreciated adequately, the weakness that Reeves and Bednar attribute to defining quality as excellence can be addressed.

First, there is a small matter of historical nit-picking. The explicit topic of Plato's dialogue, the *Symposium*,

is love not beauty, as Garvin says. The *Symposium* depicts a group of guests at a dinner party given by Agathon, a successful playwright. The guests include, among others, a medical doctor, the comic playwright Aristophanes, and Socrates. The wine flows freely, and the guests are to give speeches about love. When it is Socrates' turn to speak he tells a tale about a priestess named Diotima and what she told him about love. The point of mentioning all of this is to underscore the idea that Plato created dialogues that are pieces of dramatic writing. They contain characters who say all sorts of things, and it may not be straightforward to attribute to Plato himself anything the characters say. This is true even for the Socrates character.

To see a dialogue that does take beauty as its explicit focus one should read instead the *Greater Hippias*. In that dialogue, under the prompting of Socrates, the rather smugly self-satisfied sophist, Hippias, allows that what a beautiful woman, a beautiful picture, and a beautiful song all have in common is that "when seen or heard they produce pleasure" (Plato 1920, 399-407). It is that reaction that makes those things beautiful. Upon further questioning, however, Hippias and Socrates agree that producing pleasure cannot by itself be the essence of beauty, since other things such as tastes and smells also produce pleasure but are not beautiful. This dialogue ends, as many do, with an overly superficial definition having been rejected without settling on a final definition. Whether the subject is beauty, love, piety, or justice, it seems that Socrates is able to challenge a definition that is too limited and superficial without necessarily having a better definition ready to take its place. This is reflected in Socrates' famous assertion at his trial that he was the wisest of men, but this was only because he knew that he did not really know these important matters, in contrast to many others who complacently thought they did.

The authors' main contention is that by revisiting Plato's dialogues one can learn something useful about the idea of quality. The dialogue that they will focus on, the *Republic*, is one that is widely read today and is considered one of Plato's most significant. The explicit topic of the *Republic* is justice, but it covers a lot of ground, and in the dialogue there are many famous

**Figure 1** The divided line—Plato’s forms of awareness.

Objects of awareness	Forms of awareness
The “good” itself	Insight ( <i>noesis</i> )
Mathematical structures	Understanding ( <i>dianoia</i> )
Concrete things	Perceptual belief ( <i>pistis</i> )
Images	Imaging ( <i>eikasia</i> )

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ideas and images presented, such as the notion of the philosopher-king and the story of the prisoners in the cave. The authors will make use of one of those famous images, the divided line, and they will propose an interpretation of its significance that has implications for thinking about the concept of quality.

The divided line image is discussed at the end of Book VI of the *Republic*. Socrates is speaking with Plato’s brother Glaucon, and Socrates says: “. . . what gives truth to the things known and the power to know to the knower is the form of the good. And though it is the cause of knowledge and truth, it is also an object of knowledge” (Plato 1992, 182).

To clarify this assertion the image of a divided line is introduced (see Figure 1). The line is divided, first into two sections and then each of those parts is further divided into two sections. So the line has four sections in all, and each section, as it turns out, will represent jointly a form of awareness and the sorts of things that the form of awareness has as its objects. These forms of awareness are arranged in a hierarchy from weakest to strongest according to how real and unchanging are their objects. First, at the bottom of the hierarchy are images—representations of concrete things—and “imaging” (*eikasia*) as the corresponding form of awareness. Next, as one moves up the line are the concrete things themselves, with perceptual belief (*pistis*) as the corresponding form of awareness. The third segment of the line is where a form of awareness that can be called understanding (*dianoia*) is located, and the objects of understanding are “hypotheses.” What this means becomes clearer when Socrates asserts that geometers do not draw conclusions about the particular squares and diagonal lines that they

can draw, but rather about the “square itself” and the “diagonal itself.” So the third section of the line contains mathematically formulated general principles, which can be applied to understand particular concrete things while the principles are not limited by being only about those particular things. Finally, in the fourth and highest section of the line, the mind is alive with a form of awareness that can be called insight (*noesis*). This form of awareness uses the “hypotheses” of the geometers as “stepping stones to take off from, enabling it to reach the unhypothetical first principle of everything.” But having reached this unhypothetical first principle, it is important to note that the mind then returns to consider the geometers’ principles (Plato 1992, 185).

To save this from being merely an excursion into history, readers need to be able to see if they can identify these forms of awareness or this hierarchy of knowledge in their own situation. Take chemistry as an example. In the first, and lowest, stage there is a woman learning chemistry who becomes familiar with textbook representations of chemical phenomena. But even if she memorizes reams of textbook information, such knowledge is not as complete as that which the woman has who ascends to the second stage, the stage in which she has hands-on, personal experience in the laboratory. In the laboratory the woman sees for herself how things work. But if her experiences are to become more meaningful as knowledge, this in turn must lead to stage three. In stage three, the woman is not content simply to accumulate observations in the laboratory. She wants to understand the patterns that she observes, and this means that she will have to spend a great deal of time and effort learning and applying the laws and theories of chemistry, most of which are formulated in mathematical language. This is the part of the line where the developing chemist meets the “hypotheses” that Plato wrote about. But what if the woman’s attempts to know chemistry stop at this point? Then she is a highly trained, perhaps very capable, technician—not a genuine chemist. What is lacking? In a phrase, chemical insight, insight that enables her to identify and conceive *valuable* new chemical “hypotheses” that are worth being researched. Those who possess

chemical insight are capable of creativity and innovation in the field of chemistry, but those without insight are limited to repeating and applying what others have created. To speak in Plato's language, acquaintance with the good itself, as it is manifested through fruitful chemical insight, is necessary in order to have fully genuine knowledge in chemistry.

This same hierarchy of: a) familiarity with representations, b) personal experience, c) theoretical understandings, and d) creative insight can be identified in a number of fields. From this perspective one can understand why it can be misleading to talk about the awareness of the form of the good, that is, the grasp one has of genuine quality, is something "transcendent." That term can suggest that the good in itself exists somehow detached, separated from the things of one's experience. It does seem true on Plato's view that genuine quality, the good in itself, cannot be confined to or exhausted by the inevitably partial, limited understandings that our civilization has codified in its textbooks and manuals. Thus, the good in itself does, in that sense, transcend all specific definitions. But, at the same time, the good in itself is inherent in all of the truly valuable theoretical understandings, in authentic personal experiences, and in genuinely accurate representations. One can see what Plato means when he says that it gives to knowers the power to know.

## PLATO'S HIERARCHY AND QUALITY

Plato's hierarchy provides a philosophical basis for understanding the various approaches to defining quality. Understanding Plato's hierarchy leads to the unavoidable realization that radical improvements (Juran's (1970) "breakthroughs," Barker's (1990) "paradigm shifts," Khalil's (2000) "radical innovations,") only derive from insight—the highest level of Plato's hierarchy—which is most closely related to transcendent quality. Far from being an impractical approach to defining quality and of interest only to philosophers, the transcendent approach is the most practical approach when breakthroughs in quality are important.

Consider the case of consumer products. Most customers are rather naïve about the technology involved in the products they purchase and use every day. They know quality when they see it, but they generally know little of the technologies involved in laser pointers, CD-ROMs, and personal computers. Customers are usually at the images level of Plato's hierarchy. Marketing and quality professionals who obtain inputs from customers about products and then translate them into specific product-based attributes are at the perceptual belief level. Engineers and scientists who create prototypes and test these attributes and their interactions with each other, and on the basis of these tests establish product specifications, are at the understanding level. When scientists and engineers in the research department use creativity combined with detailed knowledge of the science involved and the fundamental needs of the customer to create entirely new products, they are at the insight level. An example of this would be where customers describe their need for greater ease of operation for the personal computer (images-level). Insightful researchers use creativity to get beyond the keyboard/DOS programming paradigm (which leads to the DOS shell—understanding-level) to the mouse/graphical user interface paradigm (insight-level).

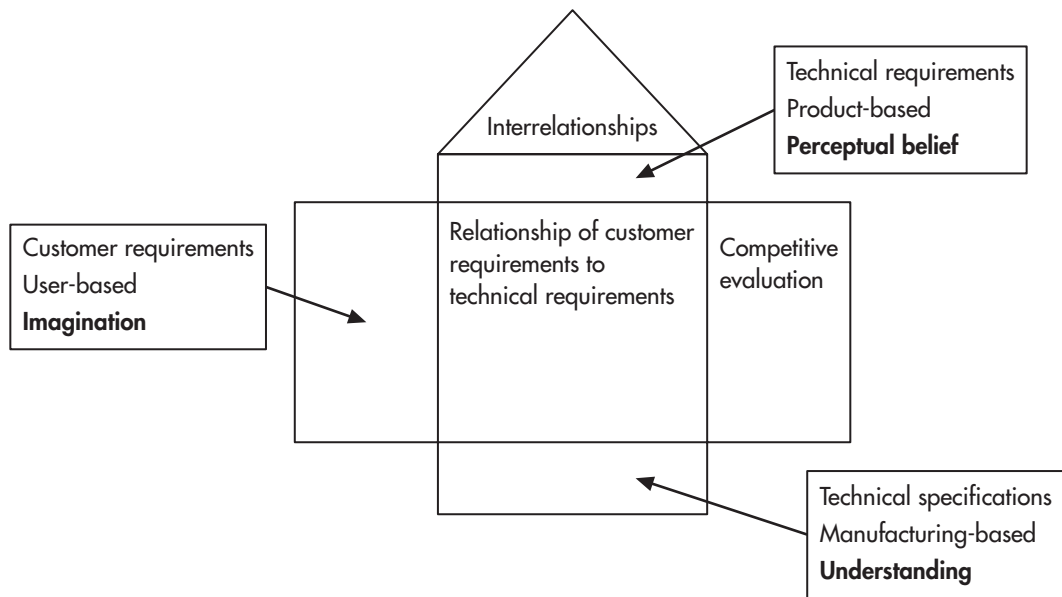
## INTEGRATING TOOLS

There are tools used within the modern quality community that can be viewed as integrating tools. They provide a means of integrating the different approaches to defining quality, as well as integrating these approaches with Plato's hierarchy. As the authors discuss these integrating tools, they will show how they relate to Plato's forms of awareness.

## Quality Function Deployment

Quality function deployment (QFD) (Akao 1990) is one of these integrating tools. QFD is defined as "a structured method in which customer requirements are translated into appropriate technical requirements for each stage of product development and production" (Bemowski 1992, 26) and is one of the matrix diagrams included in the seven management tools (Evans

Figure 2 QFD as integrating tool.



and Dean, 2000, 107). The customer requirement-planning matrix, also known as the house of quality, “provides the basis for the QFD concept” (Evans and Lindsay 2005, 569; Comstock and Dooley 1998, 35). The QFD process begins in the “west wing” of the house of quality, as shown in Figure 2. Customers provide input for this matrix. Most consumers are fairly naïve about the technology of products they use (this is often not as true for commercial customers), therefore, their inputs tend to be couched in nontechnical terms. The customers are at Plato’s images level. An example of a customer input would be, “I want the product to fit my hand well.”

In the second floor of the house of quality, customer inputs are translated into technical requirements. This process requires that the organization have individuals at Plato’s perceptual belief level—that is, they are aware of the technologies that relate to the customer inputs. In this stage, the customer requirement “fits my hand well” is translated into the technical requirement “product width.” The main floor of the house of quality is used to show the relationships between the technical requirements and the customer inputs.

In the basement of the house of quality the technical requirements are translated into technical specifications. This requires an understanding of the

technologies that can be used to meet the technical requirements—Plato’s understanding level. In this stage, the technical requirement of “product width” is translated into “width specification =  $4 \pm 0.5$  inches.”

Using QFD ensures that meeting the specifications will enable the product to meet the customer requirements. Effective use of the QFD process blurs the distinction between user-based, product-based, and manufacturing-based definitions of quality, because all three approaches are internally consistent. If done properly, the processes of translating customer requirements to technical requirements to technical specifications moves the organization toward Plato’s level of understanding. An organization can go beyond the minimum required for QFD and incorporate creativity and innovation based on knowledge both within and without the organization. Ways to do this would be to incorporate some of the creativity tools (Jayaram, Handfield, and Ghosh 1997), such as brainstorming and nominal group techniques, with the modeling tool, QFD. When this is accomplished the organization is at Plato’s level of insight. Unfortunately, the study indicated that the creativity tools were relatively underutilized compared with the other classes of quality tools.

## The Seven Management Tools

The seven management tools (Okes and Westcott 2001; Sower, Savoie, and Renick 1999; Evans and Dean 2000) are another integrating mechanism. The tools are:

- Affinity diagram: provides a means for arranging customer input into categories
- Tree diagram: assists in planning actions to implement ideas and objectives emerging from the affinity diagram
- Process decision program chart (PDPC): provides a framework for developing contingency plans for dealing with unexpected outcomes
- Matrix diagrams/matrix data analysis: allow planners to analyze the relationship between objectives and actions to achieve those objectives
- Interrelationship digraph: depicts causal relationships among the categories in an affinity diagram
- Prioritization matrix: allows for the weighting of the categories and comparison using both quantitative and qualitative information
- Activity network diagram: provides a means for planning and controlling the improvement project

Effective use of the seven management tools, like QFD, will help assure the internal consistency of the user-based, product-based, and manufacturing-based definitions of quality, but they will not lead to genuine breakthroughs.

## Design for Six Sigma

Design for Six Sigma (DFSS) was developed by General Electric to help close the gap between the focus of Six Sigma on prevention of customer dissatisfaction and the desired focus on product and service innovation (Finster 2001). According to Finster (2001, 24), Six Sigma is an example of defensive quality, while DFSS is an example of offensive quality. "Offensive quality approaches produce customer value by creating what customers do like, in contrast with defensive quality approaches that eliminate what customers do not like (variation from target)." DFSS incorporates QFD as one of its approaches to

offensive quality. But a focus on offensive quality is nonetheless likely to be concerned with giving customers more of what they currently value.

Tools such as QFD, the seven management tools, and DFSS provide integrating mechanisms to move to the third level of Plato's hierarchy, understanding. Understanding is generally sufficient to support continuous quality improvement for existing products, processes, and services and to provide for improvement in product and service design within the existing paradigm. This type of improvement is referred to as routine innovation by Nord and Tucker (1987) and incremental or evolutionary innovation by Khalil (2000).

## GETTING BEYOND UNDERSTANDING TO INSIGHT

Understanding is sufficient for continuous improvement, but insight is required for breakthrough improvement. To move to the fourth level of Plato's hierarchy, the level of insight, requires more than just the QFD process or application of the seven management tools. These must be combined with creativity and innovation in order to develop paradigm-shifting products and services. This type of improvement is referred to as radical or revolutionary innovation by Khalil (2000). The focus on customer needs that works so well for incremental improvement is less successful for radical innovations (Allen 2003). That customer input often is less useful in developing products based on disruptive technologies, as illustrated by Phillip Quigley (2000): "If we were to go back in time 100 years and ask a farmer what he'd like if he could have anything, he'd probably tell us he wanted a horse that was twice as strong and ate half as many oats. He would not tell us he wanted a tractor. Technology changes things so fast that many people aren't sure what the best solutions to their problems might be."

Customers are rarely able to articulate a need for a paradigm-shifting product or service. In fact, most disruptive technologies face an uphill battle with customers. In markets characterized by technological

turbulence, conventional marketing and planning are “useless for identifying desirable product features” (Cole 2001, 13). Kano’s (1987) offensive quality (focusing on providing products customers like rather than focusing on defensive quality—approaches to eliminating things customers do not like) “often involves areas of value that customers themselves do not understand, cannot articulate, or are unable to recognize” (Leonard and Swap 1999). The automobile and airplane were viewed as novelties rather than practical transportation media for years after their discovery. When Thomas Watson, Jr. (1990, 136) first viewed the ENIAC (one of the first digital computers), he thought that computers were “an interesting experiment way off on the sidelines that couldn’t possibly affect (IBM). Fortunately, this myopia was only temporary.” The Xerox machine was declared to be a product concept without a market (Mort 1989). More than 20 potential customers rejected Xerox technology believing carbon paper provided the same result (Khalil 2000). Given that customers often do not recognize that they need the paradigm-shifting technology, a user-based definition of quality is of limited usefulness.

Organizations with significant commitments to existing paradigms are often blind to new paradigms—even those that they discover. The Swiss watchmakers discovered the quartz movement watch, but were so committed to their mechanical movement watch paradigm they gave the idea away (Barker 1990). A quartz watch is much more accurate than a mechanical watch, but the Swiss could not recognize the higher quality of this paradigm-shifting technology. The insightful individuals who were the recipients of the freely given Swiss technology for the quartz watch recognized the transcendent quality of the new technology and developed it into the new paradigm for keeping time. Kodak developed the first digital camera in 1975 (Arner and Tiplady 2004) but is currently laying off employees and frantically trying to develop its place in the digital photography market because they underestimated the impact of this new technology and the pace at which it would replace film photography (Gordon 2004).

Developers of paradigm-shifting technologies recognize the transcendent nature of quality. Initially, the quality of a new unproven product or service cannot be based on user, product, manufacturing, or value-based definitions of quality. Indeed, as Reeves and Bednar (1994, 428) state “. . . a definition of quality based on excellence makes it difficult, if not impossible, to measure and compare the impact of quality on performance and other variables of interest.” And Kiella and Golhar (1997, 191) contend, “Performance standards for the innovative new product are without history (making SPC and QC difficult to apply) and are evolving relative to the characteristics of the product and its customers.” By extension, making breakthrough products and services subject to traditional quality control based on definitions of quality not based on the transcendent approach may stifle innovation. “. . . early measurement strategies could be erroneous and might allow incorrect conclusions to be drawn.” (Kiella and Golhar (1997, 191). For this reason, Robinson and Stern (1997) suggest a period of “unofficial activity” is necessary for creative projects to develop before being subjected to traditional measurement strategies. Only certain aspects of traditional quality control are applicable in research and development (R&D) organizations where development of paradigm-shifting products and services often occurs (Anderson and Tushman 1990).

Quality programs such as Six Sigma, continuous quality improvement (CQI), zero defects (Crosby 1979), and total quality management (TQM) focus on continuous incremental improvement of quality as defined by the customer. They contribute little to breakthrough quality and, in fact, may stifle creativity by subjecting breakthrough products and services to detailed quantitative scrutiny too early (Plsek 1998). This can be illustrated by the following story:

Imagine being part of the R&D staff at a leading manufacturer of slide rules during the late 1960s. A discussion is under way on ways to improve the quality of the company’s slide rule. Customers say they want more accuracy. Providing more accuracy means making longer slide rules. Customers do not want slide

rules that are too long. The dilemma is resolved when someone observes that the circumference of a circle is more than three times the diameter. This means that a circular slide rule with a diameter of only 10 inches will have a circumference (effective length) of more than 30 inches.

Another participant observes that much has been happening in the world of microelectronics as a result of the replacement of vacuum tubes with transistors. Radios are now portable and fit in one's pocket. What if the company could develop a portable electronic device programmed to do all that a slide rule can do?

Subject both suggestions to analysis and I suspect that the circular slide rule would get the nod. The investment would be much less, leading to a higher return on investment (ROI); it is responsive to customer input for a more accurate slide rule (did any customer even mention a pocket size calculator?); the development lead time would be less; and the company already possesses command of the required technologies. However, in perfect hindsight, which approach would have prepared the company to compete in the scientific calculating marketing of the 1970s? It is instructive to note that the only place where slide rules are sold today is in antiques markets while almost everyone owns a pocket calculator.

Programs such as business process reengineering (BPR) (Hammer and Champy 1993) and Hoshin Kanri (Tennant and Roberts 2000) are used to achieve dramatic improvements in performance, quality, and costs through radical redesign of processes and improved long-range planning. Strategic quality planning (Rakich 2000) integrates continuous quality improvement (CQI), BPR, and the Shewhart plan-do-check-act cycle (PDCA) for process and quality improvement. These programs, however, are not designed to drive the development of paradigm-shifting technologies. They are designed to provide improved competitive position beyond what could be attained using CQI alone but generally within existing paradigms. Indeed, some researchers claim

that continuous improvement programs actually may stifle creativity. Provost and Sproul (1996) suggest that creative thinking is an essential supplement to the critical thinking associated with the tools of continuous improvement. They suggest that early positive results obtained from the application of the traditional approaches to continuous improvement may lead the organization to forsake its creative efforts. They conclude, "Continuous improvement efforts that do not actively integrate creativity stand to reap only limited benefits. Further, they might even suppress any previously existing creativity in the organization, thus losing out on the associated benefits" (p. 102).

Robinson and Stern (1997) also discuss the importance of serendipity and sagacity in the creative process associated with paradigm-shifting discoveries. To illustrate their point they use the discovery of Teflon. DuPont discovered Teflon in 1938 when researchers working on new refrigerants found some white powder in a tank supposed to contain tetrafluoroethylene gas. This was the serendipitous part—the fortunate accident. Sagacity enters when the researchers are curious about the powder, analyze it, and find it to be a polymer, polytetrafluoroethylene, trademarked as Teflon in 1944. They went on to determine its properties: It is impervious to most solvents, acids, and other corrosives, it doesn't melt or burn, and it won't stick to anything. Next they discovered the conditions under which the powder formed. At this point they recognized that they had discovered a "quality" material. Quality in this case was not adequately defined by customer needs, or comparison to other similar materials, or potential applications. This polymer did not dissolve or stick to anything—a detriment when compared to other polymers like polyurethanes used in paints and coatings. Teflon would not melt—a detriment when compared to other polymers like polystyrene used in injection molding. This polymer was rigid and could be machined—a detriment when compared to polyurethanes used for pillow stuffing. Their insight, however, prepared them to recognize the quality of what they had discovered. Their curiosity led them to follow up on their fortunate accident by characterizing its properties and methods of preparation. Others

developed wondrous applications for the product, among them nonstick cookwear, rainproof garments, chemically resistant gaskets, and inert lubricants.

Sagacity, derived from the Latin noun *sagacitas* (“keenness of perception”), means “gifted with acuteness of mental discernment” (OED, quoted in Robinson and Stern 1997, 179) and is an attribute of insight. Serendipity without sagacity—without insight—does not lead to paradigm-shifting discovery. Accidents are simply accidents without the insight necessary to turn them into fortunate accidents. Robinson and Stern (1997, 192) suggest that serendipity can be increased by creating a “bias for action” within the organization that will promote fortunate accidents. Sagacity can be increased by “expanding the company’s human potential beyond its immediate needs.” This is diametrically opposed to current trends to downsize—particularly in overhead (including R&D) positions. If an organization wishes to receive the benefits that derive from achieving Plato’s insight level, it must provide the resources. There must be individuals and groups within the organization charged with asking Barker’s (1990) fundamental question: “What is it that is impossible today, that if it were possible, would fundamentally change the way we do business.” These people must have the sagacity—indeed the insight—to recognize the value of the answers to that question.

Plsek (1998) identifies successfully fostering creativity and innovation as a differentiating factor between successful and less successful firms. He identifies three dilemmas facing organizations that serve as barriers to creativity. Many leaders believe they lack the creative gift. “Research from the field of cognitive science indicates that this is simply not true” (p. 22). Robinson and Stern (1997) believe that the need for creativity is as powerful as the need for food in all individuals. Another dilemma is the idea that many creative approaches appear to be frivolous. Leaders are afraid to ask for the creative ideas they need for “fear of being seen as making light of the situation” (Plsek 1998, 22). The third problem is that many leaders are unaware of the numerous tools available to help generate creative ideas. These tools are designed to move one out of mental ruts and to

think in new patterns. These tools include concept fan, morphological analysis, word play, analogies, cinematics, and reversals.

It is important to understand that continuous improvement and radical innovation are not mutually exclusive (Hamel 2001). In fact, both are necessary. Xerox CEO Joe Wilson and vice president of Research and Development John Dessauer are the insightful pioneers of xerography who commercialized Chester Carlson’s invention and established Xerox as a household name. In later years Xerox was insightful enough to redefine its market as documents rather than imaging. But in the difficult times of the 1970s and 1980s, the company was “rescued by the understanding level of quality as promoted by CEO David Kerns” manifest in their TQM effort known as “leadership through quality” (Shotmiller 2004).

Often the new technologies that transform industries come from outside the industry itself. Intense scanning of the technological environment beyond the boundaries of the organization’s current technologies is required to prevent being blindsided by a paradigm shift from outside the industry. The slide rule manufacturers of the 1960s failed to detect the technological breakthroughs in the electronics industry that put them out of business. The carbon paper and photographic imaging companies of the 1930s and 1940s rejected Carlson’s xerography technology, which came from outside their industry. They defined their technological environment too narrowly. What potentially paradigm-shifting technologies are emerging today? Nanocrystals, such as quantum dots, may have applications in areas as diverse as medical diagnostics and household lighting (Sidawi 2003). Terahertz (THz) technologies may have applications in medical imaging and chemical analysis (Mallozzi 2003). Magnetic field nanosensors may revolutionize computer data storage (Solin 2004). These are examples of technologies that make yesterday’s impossibilities tomorrow’s mainstream technologies. Lack of awareness of developing technologies such as these could render today’s market-leading companies tomorrow’s has-beens. Insight is required to develop applications for the key emerging technologies that potentially can disrupt the existing paradigm upon which one’s business depends.

## CONCLUDING REMARKS

So how is this concept of quality, of the good in itself grasped by creative insight, useful to managers? First, one can and does in some sense measure creativity by recognizing its creation. Whether it is in Hollywood on Oscar night, in Stockholm for the Nobel Prize ceremony, or on Madison Avenue for the Clios, people celebrate creative insight. More formally, people attempt to measure creativity in organizations using models such as the Creativity Awareness Program (Frijling and Mostert 2000). Hence, the achievements of Bell Labs and Xerox's Palo Alto Research Center in their heydays become the stuff of legends because of the number of significant innovations those organizations produced. Second, in an increasingly dynamic competitive environment, organizations are subject to the familiar imperative: innovate or die. The "transcendent approach" to the concept of quality reminds people that truly valuable innovation involves a commitment to seeking the good in itself, to continuing to seek genuine quality, and not resting content with the "tried and the true."

According to Matthew Bent, president and CEO of Syntelic Design (2003):

We all recognize that quality (is) made up of just "product quality" that involves the three levels of awareness up through understanding. This is the side of quality that we focus on (and measure with traditional tools and techniques) day-in and day-out. But quality is also composed of (the sometimes less tangible? I don't know) "solution quality" which reflects how any one-product solution stacks up against the infinite set of other product solutions (known and unknown; achievable and unachievable). A true measurement of quality must include both components.

There are notable examples of organizations operating at the insight level and there are commonalities in their approaches. Companies such as Xerox, Hewlett-Packard, and Microsoft have established creativity and innovation as top priorities, and have provided well-equipped facilities staffed with

top research talent given the freedom to pursue their ideas. In addition, 3M sets stretch targets based on its goal of achieving at least 30 percent of its sales from products that have been around no longer than four years (Kanter, Kao, and Wiersema 1997). A key aspect of creativity and innovation at 3M is its 15 percent rule. The rule states that 15 percent of an employee's time must be spent on pursuit of individual creative ideas. According to Mayer (2003), while "the rule is more heavily aimed at our technical employees... the rule applies to any of our employees who have a project they want to pursue to improve business and make 3M Company better." This policy is consistent with Robinson and Stern's (1997) idea that anyone can be creative and also the guiding principles, beliefs, and assumptions of Jassawalla and Sashittal's (2002) innovation-supportive organizational culture—a key aspect of which is involving all participants in the creative product development process. All of the insight-level companies are risk-tolerant, as Michael Dell said when asked for the secret of Dell Computer's success: "Taking risk and staying one step ahead of your competitors" (Jain 2003, 27). "One way to do this is to introduce new products continuously and vigorously." Microsoft's TechFest—where its researcher division displays its innovations to the rest of the company—believes that within-company communication, one of Robinson and Stern's (1997) elements of corporate creativity, is one way of avoiding what they perceive as the "inability of Xerox's... PARC to capitalize on computer science innovations" (Stix 2004).

Understanding is sufficient for continuous improvement. Insight is required for breakthrough improvement. Listening to Plato and following the transcendent approach to quality enables one to advance to the insight level of awareness and develop the breakthrough products and technologies of the 21st century. This is the basis for technological leadership and quality leadership as well.

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