



# **Collected Papers: Gregory H. Watson**

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GREGORY H. WATSON  
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**This collection of papers published in the *ASQ Journal of Quality & Participation* is dedicated to a person who inspired me to write and encouraged me to publish:**

**Deborah Lynn Hopen (1953-2020):  
She Shattered the Glass Ceiling**

ASQ Past President Deborah Lynn Hopen passed away quietly on Palm Sunday, April 5, 2020. Her life was a role model for the contribution of women to the field of quality management and provides a profound example of how one person can shape the future. Deb had been trained as an engineer, statistician, and psychologist and became an ASQ Certified Quality Engineer in 1991. She worked for industry as a quality executive at Weyerhaeuser and Xerox and managed her own consulting company for over 20 years. Deborah served as Editor of ASQ's *Journal of Quality & Participation* since 2000. Most importantly she was thoroughly professional in her work and provided an exceptional example for dedicated service to her profession. She dedicated her career to quality and was selfless in her devotion to the Society through her work at the section, region, division and national levels. Deb was the first woman to be elected as President of ASQ (1995) and she remained exceptionally active in the quarter century following her leadership term. In 2010 she was elected by ASQ as a Fellow and subsequently she was elected by the International Academy for Quality as an Academician. Perhaps some of the stories of her activities that have not been widely published would help people to understand the breadth and depth of her contributions to our community:



- In her 40 years of quality management experience she taught statistics, statistical process control, quality management, production management, and production costing at the university level.
- She held elective positions of responsibility at all levels of the ASQ organization from Section Chair to Division Chair to Chair of the national organization.
- From July 1995 through June 1997, she served as President and Chairman of the American Society for Quality. She also has served as President of the Washington State Quality Award Program and the International Standards Initiative. Deborah was also involved leading numerous Washington State cultural and charitable organizations.
- Upon the merger of the Association of Quality & Participation with ASQ in 2001, she served as the APQ-to-ASQ Transition Manager in wrapping up operations in Columbus, Ohio and transferring the work and intellectual property for inclusion within ASQ.
- An avid writer, journalist and 20-year editor of the ASQ ***Journal of Quality & Participation***, Deborah has accumulated over 200 written papers in various ASQ publications.
- Deborah remained active at the section, divisional and national level over the past 20 years working in her local sections, and several divisions (Healthcare, Human Development and Leadership, Lean Enterprise Division, Quality Management and Six Sigma Forum) in a variety of largely thankless tasks (newsletter editor, author of bylaws, policies and procedures, and treasurer were her most frequent activities). Her focus was dedicated to service in the quality community.



- Active in the leadership of the Education Division, Deborah served as both Treasurer and Committee Chair of the workforce development. She was the founding editor of the division's online journal ***Quality Approaches in Higher Education*** and also initiated the division's ***Workforce Development Brief***.

Although Deborah preferred to remain out of the limelight, she nevertheless received several accolades that her many friends supported. Among the honors and awards presented were:

- ASQ Distinguished Service Medal
- American Productivity and Quality Center's C. Jackson Grayson Quality Pioneer Medal
- IAQ Founders Medal
- IAQ Agnes Žaludová Woman of Quality
- Asia-Pacific Quality Organization Miflora M. Gatchalian Medal for Women in Quality Leadership
- American Society for Quality, Quality Management Division Roger Berger Spirit Award
- Frank M. Gryna Award for Excellence in a Written Article on Quality Management
- Simon Collier Quality Leadership Award

Needless to say, Deborah Lynn Hopen became the "First Lady of Quality" as ASQ's pioneering female president and exemplary role model of professionalism throughout her career. Not only can she be seen as a role model for women in quality, but she is a role model for all professionals for what dedicated service to her profession truly means. She will be missed greatly.

She always said we would write a book together. In retrospect, I guess we did. To my best editor, ever ....



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What are the components of strategic plan development and deployment? How does the strategic plan fit with the day-to-day work of the organization? This primer covers the basics of planning, creating alignment, and monitoring performance.

# Design and Execution of a Collaborative Business Strategy

Gregory H. Watson

## Introduction

Organizations that achieve their goals in the long term “plan their work and work their plan.” Realization of strategy—the long-term vision of an organization is achieved by a disciplined approach to setting direction and then executing that direction through the effective use of an organization’s resources—its processes, capital, and people.

In Japan this method is called policy deployment. Policy deployment is a strategic, direction-setting methodology used to identify business goals as well as formulate and execute major change management projects throughout an organization. It describes how strategy cascades from vision to execution

in the workplace through a collaborative engagement process that results in implementation of the plan through linkages to daily management methods such as performance self-assessment and management review.

This article describes how policy deployment relates to strategy development and the daily imperative to measure and manage operations—the linkage of the strategy, operations, and people processes of an organization. Policy deployment employs a system that aligns the actions of its people to produce collaborative action among the various business functions and processes to enhance the value an organization delivers to its customers.

## Historical Development of Policy Deployment

What were the circumstances under which policy deployment originated? Interest in strategy, market focus, and long-term planning were generated by visits of Dr. Peter F. Drucker to Japan in the early 1950s.<sup>1</sup> As a result of his teaching, “policy and planning” was added to the Deming Prize checklist in 1958. Bridgestone Tire Corporation developed the first iteration of a policy deployment system in 1965. In 1976, Dr. Yoji Akao and Dr. Shigeru Mizuno coached Yokagawa Hewlett-Packard (YHP) in implementing a more fully developed system as part of the company’s pursuit of the Deming Prize. By 1982 YHP had used this approach to manage a strategic change that, in just five years, had moved it from the least profitable HP division to the most profitable. In 1985 this methodology was introduced to the rest of the company as a lesson learned from the YHP Deming Prize journey.

From HP it was transferred to other leading companies including: Proctor & Gamble, Ford, Xerox and Florida Power & Light, involving several advisors and councilors of the Union of Japanese Scientists and Engineers (JUSE). The work of the GOAL/QPC research committee, directed by Bob King, also extended the exposure of policy deployment to some 40 member companies and was a key ingredient in introducing policy deployment across North America and, through multinational companies, into the world.<sup>2</sup> From Xerox Corporation the concepts of policy deployment were transferred to the United States government in a planning system developed under the Clinton administration. Called the Government Performance Results Act (GPRA) of 1993, the act currently governs planning at the executive level of cabinet-level departments in the United States federal government and cascades actions down to their distributed operating units.

## Key Concepts Within Policy Deployment

The fundamental premise of the policy deployment is that the best way to obtain the desired result for an organization is for all employees to understand the long-range direction and participate in designing the practical steps to achieve these results. This form of participative management evolved and was influenced by the Japanese refinement of Drucker’s management by objectives (MBO) concept through the emergence and maturing of the quality circle movement. In order

for workers to manage their workplace effectively, they must have measures of their processes and monitor these measures to assure that they are contributing to continuous improvement as well as closing the gap toward the strategic targets. Policy deployment became the tool that Japanese business leaders used to align the work of their front-line organizations to the strategic direction of their firms. When HP first implemented hoshin planning, many of its business leaders explained how it worked by calling it “turbo-MBO.”

Mizuno defined policy deployment as the process for “deploying and sharing the direction, goals, and approaches of corporate management from top management to employees, and for each unit of the organization to conduct work according to the plan.” This approach (or *kanri*, the Japanese word for a control system used to manage processes) integrates operational excellence in the daily management system with architectural design of its long-term future and contains two sub-systems of objectives that function at the strategic and operational levels of the organization:

- *Hoshin kanri*—the long-range planning objectives for strategic change that allow an organization to achieve its vision. This is a comprehensive, closed-loop management planning, objectives deployment, and operational review process that coordinates activities to achieve desired strategic objectives. The word “hoshin” refers to the long-range strategic direction-management process that anticipates and achieves business competitiveness.<sup>3</sup> Hoshin seeks breakthrough improvement in business processes by allocating strategic business resources (both financial and human resources) to projects that focus on sustaining successful performance into the long term.
- *Nichijo kanri*—the daily, routine management control objectives (of a daily management system) translate the strategic objectives into the tasks that people accomplish to fulfill the organization’s mission. This system provides an operational system for defining team and individual objectives. It does not encourage random business improvement projects, but focuses the organization on projects that move it toward its agreed strategic direction. This system reinforces hoshin by focusing daily management on *kaizen*—continuous improvement in pursuit of the long-term direction.

The blending of these two elements into a consensus management process to achieve a shared purpose is the key to success in the policy deployment process. In policy deployment, strategy is defined as persistence of a vision—policy is deployed across cycles of learning using coordinated improvement projects to move performance of the organization’s daily management system toward the direction of its desired progress.

Policy deployment links together breakthrough projects that deliver long-term strategic direction to achieve sustainable business strength while, at the same time, delivering an operating plan to achieve short-term performance. It helps to create the type of organization that William McKnight, former CEO of 3M, expressed as his desire: “an organization that would continually self-mutate from within, impelled forward by employees exercising their individual initiative.”<sup>4</sup> In short, an organization where creativity is managed through a combination of synergistic improvement projects with engaged teams that combine individual capabilities to achieve strategic improvements that make a difference on the larger organizational scale. How does this change-management process work at the front line where these strategic hoshin projects engage the routine work processes of the organization?

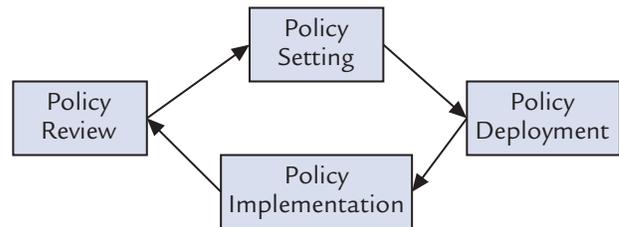
### Policy Deployment Aligns Operations With Strategy

Drucker commented, “Full effectiveness of all work needs to be integrated into a unified program for performance.”<sup>5</sup> The program for performance is designed by the top management team to provide a specific, effective course of action to achieve its desired results. To achieve these results, all dimensions of the business must be consistent with each other. This is the job of a policy deployment system.

A critical challenge for an organization is to align its strategic direction with daily work systems so that they work in concert to achieve the desired state. Alignment must include linking cultural practices, strategies, tactics, organization systems, structure, pay and incentive systems, building layout, accounting systems, job design, and measurement systems—everything. In short, alignment means that all elements work together much like an orchestra integrates the various instruments to conduct a coordinated symphony.

Organizations that are most mature in policy deployment do not put in place any random mechanisms or

Figure 1



processes, but they make careful, reasoned strategic choices that reinforce each other and achieve synergy. These organizations “obliterate misalignments.” If you evaluate your company’s systems, you can probably identify some specific items that are misaligned with its vision and that impede progress. These “inappropriate” practices were maintained over time and were not abandoned when they no longer aligned with the organizational purpose. “Does your incentive system reward behaviors inconsistent with your core values? Does the organization’s structure get in the way of progress? Do goals and strategies drive the company away from its basic purpose? Do corporate policies inhibit change and improvement? Does the office and building layout stifle progress? Attaining alignment is not just a process of adding new things; it is also a never-ending process of identifying and doggedly correcting misalignments that push a company away from its core ideology or impede progress.”<sup>6</sup>

This unified program for performance consists of kanri or control mechanisms that deploy business policy to execute management’s program for the business direction as developed during the strategic dialog. There are four steps, as shown in Figure 1, that energize an organization to achieve its strategic direction: policy setting (or establishment of hoshin projects), deployment (propagation of these projects throughout the organization), implementation (integration of the results of change into the daily management system), and review (assessment of the results achieved by the process).

### Policy Setting

Policy setting is the “catch ball” where top management conducts a strategic dialog with employees to collect ideas and opinions about chronic major problems and their aspirations regarding the business future. Then this information is processed in

conjunction with environmental data analysis and scenario analysis to formulate the annual business change objectives (hoshin or major change projects): strategic change projects (identified by both targets to achieve and means for achievement). Here organizations identify the most critical projects to accomplish in order to eliminate vulnerabilities or capture the benefits from potential change initiatives or newly emerging improvement opportunities.

A policy is a rule or operating principle that describes a management-approved approach to pursue objectives and manage risk. Policies consist of targets and means. Targets are the measurable results to achieve within a specific timeframe for performance. Targets have checkpoints. Means are the sequence of actions that are taken to implement a policy that is an outcome of the strategic direction. Means have control points.

How is this strategic policy formulated? Strategic direction is established using cross-functional dialog to build a common direction based on the consensus of organizational strengths and how to overcome organizational weaknesses in the face of critical business threats. Most organizations have just two kinds of strategic decisions: those that may be executed within the areas of their direct oversight of top management (e.g., personnel decisions, budgeting, merger, capital budgeting, etc.) and those that require cross-organizational collaboration for implementation. These cross-functional projects require special attention and project management in order to realize the objectives of the change initiative. Such change strategies that require mutual consent and collaboration are ideal for addressing with a policy deployment system. In addition to planned continuous improvement that is a result of problem solving, continuous improvement may also result from ad hoc process improvements as a process is enhanced over time.

This process is often called a catch ball because of its form as a dialog that tosses around ideas like a ball is tossed in a game. Two-way communication is both top-down in general direction and bottom-up in adaptation to the workplace using the existing hierarchical management structure and matrix process structure to engage all parts of the organization in the dialog. This dialog follows a negotiation process called *nemawashi*—prior consultation to achieve consensus. The goal of this process is to achieve “wa”

or harmony, consensus, and absence of conflict. Data is used in this process to assure that it is a fact-based process, not just a subjective negotiation process. Mutual consultation between levels tests the feasibility of plans using a progressive refinement process for conflict resolution with measurement as the basis for establishing agreement and aligning the way that people work as well as the foundation for conducting assessments of progress.

### *Policy Deployment*

In order to achieve “saturation” of policy and assure collaboration of all the affected work groups, the objectives cascade of an action plan for a particular improvement project must involve not only functional deployment of policy but also engage its cross-functional aspects. It is across the functional seams of an organization where most significant difficulties are encountered. These boundaries represent focus areas for management to assure continuous collaboration in the execution of change projects and consensus among the various functional organizations that engage all the decision-making managers in the areas where the change will have a direct effect.

To understand the difficulty that the boundary condition dynamics have, consider what happens as change is managed when organizations shift work activities from internal to external units (e.g., from internal manufacturing to an external contract manufacture). At such boundary conditions, conflicting objectives and political issues of the organizations often can interfere with performance improvement work and it is the job of the management team to eliminate any such barriers to the success of their project team. Policy deployment is a structured, systematic, and standardized process. This step has an ability to empower organizations for achieving strategic change. However, it also has the potential to drown managers in the mire of detail that results in overcontrol of the workers’ tasks.

Drucker quotes the Roman law to focus management on the things that are most important: “*De minimis non curat praetor*’ [The magistrate does not consider trifles].”<sup>7</sup> This warning to management against what has been called micromanagement is a reason for senior executives to focus on the vital few issues that are critical in the business that they manage. If they don’t take the time to manage these important things, then no one else will... If they choose to spend their

time focused at the detail level of project execution, then they will squander a more effective use of their time on those vital activities that engage the higher thinking levels of the organization that cannot be reasonably delegated to others for effective action.

Management must work the long term of the planning horizon in order to deliver sustained organizational strength. It must also review current actions to assure that short-term profitability is achieved. But, whenever management spends more time on the short term than it does on the long term, then it sacrifices the future strength in favor of current results—and displays to the entire organization its lack of trust in the ability of the organization to perform its daily work. This behavior signals to the entire organization that a crisis exists and reinforces stagnation as the workers wait for top management to intervene and make the decisions that they should more properly make. A very important benefit of an effective policy deployment system is delegation of appropriate decision rights to the proper place in the organization where the best information exists and where action will be taken to implement that decision.

### **Policy Implementation**

Policy implementation consists of the execution of the project plan—both the actions taken by the team involved in the change and the in-process management reviews. All change is implemented on a project-by-project basis according to the priorities established by management and the logical sequence for attacking each project. The project plan assigns clear responsibility for each improvement item in the implementation plan and records its progress in accomplishing the project tasks.

During policy implementation, management must publish information about the projects so that the entire organization is informed of the actions underway to improve performance. This communication can help the organization to align other activities with progress made on these strategically-focused change projects. As a guideline for communication, management should inform all involved parties of any changes to the change project team's mission, vision of the outcome, guiding principles, or objectives. If the management team communicates effectively and often, then it will translate the planning rhetoric into action realities. Drucker observed: "The most time consuming step in the process is not making the decision, but putting it into

effect. Unless a decision has degenerated into work it is not a decision; it is at best a good intention."<sup>8</sup> Former AlliedSignal CEO Larry Bossidy echoes this statement in defining execution as "the gap between what a company's leaders want to achieve and the ability of their organization to achieve it."<sup>9</sup>

### **Policy Review**

Policy review is done in two ways: through management self-assessment (by senior managers as well as by local managers evaluating their activities to determine where they have opportunities for improvement either performance enhancements or problem resolution) and through operating reviews of the results produced by the local organization where senior managers identify areas where results are not aligned with expectations for performance. Policy review applies two sub-processes to perform these duties: performance review and key indicator measurements.

The review process in policy deployment seeks to identify conformance to plans (e.g., Is there any short-fall or overachievement in targets?). Diagnosis of the performance of the policy planning process is conducted to drive improvements in planning systems. "Feedback has to be built into the decision to provide a continuous testing, against actual events, of the expectations that underlie a decision."<sup>10</sup> Once non-conformity is identified, then the root cause of the deviation is discerned to determine an appropriate response to the out-of-control type of condition. Both corrective actions and countermeasures are identified to realign the process and assure that process integrity and stability are achieved in the business control system.

Policy review facilitates organizational learning by examining problem areas and critical success factors to discover what directional shifts are needed to achieve the desired end state or vision of the business. Project reviews are conducted to assess achievement relative to the following planning elements:

- Change project objectives.
- Business planning objectives and corporate commitments.
- Business improvement plans.
- Economic plans and projections.
- Customer requirements and expectations.
- Competitive performance analysis.
- Business excellence self-assessment.

Organizations must ask if they really have engaged their front-line employees in actively formulating strategy. Nokia Mobile Phones developed a process called current state analysis for self-assessment of front-line operations and then rolls this data into its strategy-setting process. The company also created a strategic dialog that builds participation of mid-level managers in conversations about strategy based on structured dialogs that are lead by managers in intranet chat rooms. Other organizations open communication lines through e-mail forums and internal surveys.

### **Business Control and Management Responsibility**

The ultimate objective of policy deployment is to establish a reliable organization—one that creates predictable, consistently excellent results through the effective coordination of value-adding work that customers perceive as meeting their needs. In this environment, all employees are aware of their personal contribution to the objectives of the entire organization and are able to make local choices that are aligned with the strategic direction because they understand how the strategy affects their work and vice versa. To assure that these local decisions are aligned with strategic direction, it is the responsibility of the management team to develop a measurement system that provides employees with the visible line-of-sight from their work activities to its contribution to strategic direction.

Critical success factors for implementing a successful policy deployment program include ten imperatives to engage employees effectively in a strategic dialog that creates a collaborative environment in which to transition the strategy into reality. Organizations must change their style so they are:

- Assessing objectively.
- Questioning compulsively.
- Analyzing completely.
- Listening effectively.
- Visioning creatively.
- Adapting realistically.
- Acting persistently.
- Communicating obsessively.
- Reviewing regularly.
- Learning consistently.

### **Concluding Comments**

Policy deployment, when it is coupled with a statistically-based business measurement system, is proven to create a robust management process that engages an entire organization in the strategic planning process. It assures line-of-sight from the strategic goals of the organization to the operational tasks that workers perform at the front line as they do the work that produces the organization's goods or services. The nature of this process is described using the term "robustness"—a statistical state in which a process is able to accept variation in its inputs, without influencing the variation of its outputs. Such a process is capable of performing consistently—delivering consistent results according to its design intent. Since policy deployment engages the work force in achieving the common goal of sustained success, it is a strategic tool for assuring sustained competitive advantage over both current and potential business rivals.

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Selecting a planning process that helps your organization identify the key issues that are affecting its performance can ensure that you're prepared to deal with the future—no matter what it ultimately becomes.

# The Art and Process of Strategy Development and Deployment

In the article, "Introduction to Strategic Planning," Michael I. Policastro, vice president of The Travelers, provides the following insight. "Ask 10 people for a definition of strategic planning, and you will probably receive 10 different answers. Most agree that it is a way to identify long-term goals and to direct your company toward fulfilling those goals," he writes.

Indeed, people's concepts of the purpose of strategic planning vary dramatically and so do their reactions to the prospects of becoming involved in developing a plan or having their work guided by one. Some view strategic planning as a rare opportunity to step outside the doldrums of routine work, and others equate the process with fortune telling.

## **Strategic Planning Concepts**

John M. Bryson, professor of planning and public affairs at the University of Minnesota, defines strategic planning in his book, *Strategic Planning for Public and Nonprofit Organizations: A Guide to Strengthening and Sustaining Organizational Achievement*, as "A disciplined effort to produce fundamental decisions and actions that shape and guide what an organization is, what it does, and why it does it." For the purpose of this article, we'll define strategic planning as a process for assessing an organization's current and anticipated business environment and then identifying and implementing the best approaches for succeeding under those changing conditions. Several fundamental philosophies are inherent to this definition:

- The organization’s existing methods and the associated results are assumed as a baseline on which future performance can be built. You must assess them and the cause-and-effect relationships among them must be analyzed and hopefully understood to sustain and improve performance.
- The future is assumed different—often vastly different than the present; however, the exact nature and magnitude of the difference is unknown and presumed unknowable.
- It is presumed that the organization will need to change its approaches to succeed in the future. The ability to respond quickly when the environment around the organization changes is the most significant predictor of future success.
- Ultimately, strategic planning is about considering what changes the organization may face in the future and increasing its capability to deal with whatever actually may occur.

*One of the most compelling reasons to undertake the strategic planning process concerns alignment. Without a strategic plan to clarify direction and approaches, work processes and decisions actually may undermine progress, generating frustration and conflict.*

It is important to note that strategic planning is not about predicting the future or establishing a detailed recipe for daily work. One cannot forecast the future with enough accuracy to make it worthwhile for an organization to invest its time developing detailed transactional plans to address each anticipated event. Peter Schwartz wrote in *The Art of the Long View: Planning for the Future in an Uncertain World*, “Every year, every decade, we are surprised by social or technological upheavals that appear suddenly, surprisingly. How can people, businesses, and institutions plan for the future when they do not know what tomorrow will bring? A deep and realistic confidence is built on insight into the possible outcomes of our choices.”

Instead, planners focus on identifying the critical issues that are most likely to affect the organization in the future. Strategies are selected that will increase the organization’s ability to meet a wide range of potential futures. Leaders understand that the strategic plan is synonymous with change management, and they’re ready to adjust the plan as new information becomes

available during its implementation. The plan becomes a flexible, high-level document for guiding the change process.

Ultimately, the purpose of the strategic plan is to define the organization’s mission, vision, and values and translate them into tangible action by addressing its needs as follows:

- Increase understanding of the organization’s environment—its current and anticipated opportunities and challenges.
- Stimulate innovative responses to that changing environment.
- Provide a coordinated framework for modifying the organization’s products/services, processes, and capabilities to better meet future requirements.
- Identify new capabilities that the organization and its members must obtain to succeed in the future.
- Guide daily decision making by providing a long-term context to weigh against short-term pressures.

On the other hand, the process doesn’t stop with the development of that high-level document. It is deployed to functional workgroups, teams, programs, projects, and individuals so that their work is realigned to fit in with the organization’s overall direction. Inherent in the deployment process is an understanding that the daily work must change if the organization’s results are going to change, and the organization is prepared for the future.

One of the most compelling reasons to undertake the strategic planning process concerns alignment. Alignment involves ensuring that the organization’s work processes and decisions are congruent. The integration of aligned work processes and decisions leads to attainment of the organization’s required results—with the minimum expenditure of resources and the maximum customer and employee satisfaction. Without a strategic plan to clarify direction and approaches, work processes and decisions actually may undermine progress, generating frustration and conflict. Alignment can go far beyond the internal boundaries of the organization—once the strategic plan is developed, it’s useful for communicating and

building consensus with external stakeholders, such as customers, suppliers, and the community.

In a well-aligned organization, all efforts are traceable to the high-level goals. Employees at the point of action aren't told precisely what steps to follow (in other words, they're not controlled or micromanaged), but they do have a deep understanding of how their work contributes to achieving the overall plan. They are encouraged to evaluate their work processes, make changes that will increase their contributions, and are recognized for their achievements. They are willing to abandon work that no longer fits the strategic direction—even if it's "near and dear"—and to shift emphasis to work that promises better outcomes. They're vigilant, seeking ways to avoid repetition and redundant effort and to resolve conflicting endeavors, such as two teams taking actions that counteract each other's approaches.

Strategic planning is the only process that is designed specifically to accomplish the following steps:

- Assess the internal and external opportunities and challenges faced by the organization.
- Identify the diverse perspectives of the organization's leaders regarding those opportunities and challenges.
- Consolidate those varied leadership views into a shared vision, described by measurable goals.
- Articulate that shared vision clearly to all members of the organization.
- Determine how to refocus work efforts to attain the vision effectively and efficiently.
- Provide a disciplined approach for monitoring progress.

### Strategic Planning Processes

How do organizations develop their strategic plans? In this section, we'll present a standardized review of nine strategic planning approaches, using an analysis developed by Bryson in his book. After each method is introduced, a review of its key features and underlying assumptions will follow. Table 1 simultaneously compares the strengths and weaknesses of all the approaches. Primary references for each approach are included at the end of the article to assist readers who may want to investigate them in more detail. Note that these approaches fall into two broad categories: process- and content-oriented approaches.

### The Harvard Policy Model

This approach is an offshoot of the business policy courses taught at the Harvard Business School since the 1920s. Strategy is viewed as a pattern of purposes and policies defining the company and its business. Strategies are developed in response to an assessment of the strengths and weaknesses of the organization, as well as the external threats and opportunities faced by the organization (SWOT analysis) with an emphasis on competitive pressures. Strategies provide a mechanism for linking functional efforts together to respond to environmental forces. Kenneth R. Andrews and C. Roland Christensen are the principal authors associated with this approach.

Key features of this approach include the following:

- It focuses on identifying the strategies that best fit the organization's capabilities and environment.
- The values of senior management and the social obligations of the organization also are taken into consideration.
- It is applied primarily at the corporate or strategic business unit levels.

Assumptions associated with this approach are:

- Analyzing SWOT, senior management values, and social obligations will stimulate strategic thinking.
- To be effective, senior managers must reach consensus on the best strategies and have the authority to implement those strategies.

### Strategic Planning Systems

This approach views strategic planning as a system that makes it possible for managers to make, implement, and control decisions across the organization. Four questions are addressed by these systems, as follows:

- Where are we going? (mission)
- How do we get there? (strategies)
- What is our blueprint for action? (budgets)
- How do we know if we are on track? (control)

These systems vary in how they address the dimensions shown below:

- *Scope*—the span of decisions contained in the plan.
- *Structure*—the formality of the associated decision-making process.
- *Management*—the degree of control exercised over implementation of the decision.

**Table 1: Root-Cause Analysis—Level of Effort/Structure Versus Return**

Strategic Planning Approach	Strengths	Weaknesses
The Harvard Policy Model	<p>Based on a systematic analysis of internal and external factors that influence the organization’s outcomes.</p> <p>Can be coupled with other approaches to create aligned strategies at other levels of the organization.</p>	<p>Does not provide specific steps for determining what strategies will be most effective in addressing the issues identified in the analysis.</p> <p>Does not probe deeply into all potential stakeholder groups during the analysis.</p>
Strategic Planning Systems	<p>Provides a high degree of coordination across the organization.</p> <p>Can be coupled with other approaches to the most appropriate strategies, goals, and performance indicators.</p>	<p>May become too prescriptive, driving out innovation and undermining empowerment.</p> <p>Requires comprehensive information systems for determining strategies, goals, and performance indicators and monitoring performance. Can generate “information overload,” causing the organization to lose sight of its mission.</p>
Stakeholder Management	<p>Based on a systematic analysis of stakeholders who influence the organization’s outcomes and their needs.</p> <p>Takes into account that stakeholders’ requirements may be complementary in some cases and conflicting in other cases.</p> <p>Can be coupled with other approaches for the most appropriate strategies, goals, and performance indicators.</p>	<p>Does not provide specific steps for resolving competing requirements among stakeholder groups.</p>
Portfolio Methods	<p>Based on a systematic analysis of the organization’s current and potential performance, using measures that are considered strategically important.</p> <p>Can be coupled with other approaches to obtain a more comprehensive view of strategic issues and opportunities.</p>	<p>May not provide a comprehensive enough analysis if the analysis is limited to economic indicators.</p> <p>Can be difficult to expand to include social and political indicators because of an inability to reach consensus on which measures are strategically important.</p>
Competitive Analysis	<p>Based on a systematic analysis of six economic factors that influence an industry and an organization’s position within that industry.</p> <p>Provides relatively clear prescriptions for strategic action based on the analytical results.</p> <p>Can be joined with other approaches to obtain a more comprehensive view of strategic issues and opportunities.</p>	<p>May be difficult to clearly define the organization’s industry.</p> <p>May not provide a comprehensive enough analysis because the industry forces are based primarily on economic measures.</p> <p>Ignores the possibility that the best strategies for the organization might involve increasing collaboration rather than increasing competition.</p>
Strategic Issues Management	<p>Recognizes and analyzes critical issues quickly.</p> <p>Can be conducted as part of an annual or multi-year planning process or as an ongoing management review.</p> <p>Can be teamed with other approaches to determine factors affecting organizational success and to establish the most appropriate strategies, goals, and performance indicators.</p>	<p>Does not provide specific steps for determining and prioritizing the issues.</p>

**Table 1: Root-Cause Analysis—Level of Effort/Structure Versus Return continued**

Strategic Planning Approach	Strengths	Weaknesses
Strategic Negotiations	<p>Recognizes that influence and power are held by multiple individuals and groups so some compromise is necessary to establish common objectives.</p> <p>Can be coupled with other approaches to determine factors affecting organizational success.</p>	<p>Does not provide specific steps for analyzing the organization’s technical ability to implement the strategies.</p> <p>May undermine employees’ support for strategies that are perceived as too political.</p> <p>May not integrate individual strategies well to create a comprehensive plan for the organization.</p>
Logical Incrementalism	<p>Handles complex and changing strategies well.</p> <p>Addresses major and minor decisions effectively, tapping into the organization’s political realities and its formal and informal processes.</p> <p>Can be coupled with other approaches to determine factors affecting organizational success and to establish the most appropriate strategies.</p>	<p>May not achieve required results if incremental decisions do not combine effectively—the potential for redundancy and conflicting decisions is large.</p> <p>May make it difficult to track accountability.</p>
Framework for Innovation	<p>Balances centralized control of outcomes with decentralized innovation and entrepreneurship.</p> <p>Stimulates creativity and a willingness to embrace change.</p> <p>Can be paired with other approaches to determine factors affecting organizational success and to establish the most appropriate strategies, goals, and performance indicators.</p>	<p>Can generate costly mistakes as a by-product of poorly targeted or executed innovation.</p> <p>May make it difficult to track accountability.</p>

Peter Lorange is the principal author associated with this approach.

Key features of this approach include the following:

- It focuses on formulating and deploying key decisions across the organization (all functions and all levels).
- Resources are allocated in accordance with the key decisions.
- The strategic plan attempts to guide all key decision areas, providing a framework to apply on a daily basis.

Assumptions associated with this approach are listed below:

- A set of integrated strategies can be developed and clear goals and performance indicators can be articulated and monitored in a timely and cost-effective manner.
- Centralized decision-making control is inherent to this approach.

### *Stakeholder Management*

This approach views the strategic plan as a bridge between the organization and its stakeholders. Stakeholders are individuals or groups who are affected by or could affect the future of the organization. These include customers, employees, suppliers, owners, governments, financial institutions, etc. Economic, political, and social concerns are considered during the development of strategies. R. Edward Freeman is the principal author associated with this approach.

Key features of this approach include the following:

- It focuses on identifying the organization’s key stakeholders and determining the criteria they use to evaluate the organization’s performance.
- Strategies are developed to address the needs of stakeholders, maintaining a sensible balance.

Assumptions associated with this approach are listed below:

- An organization can succeed only if it satisfies its key stakeholders.

- Analysis of stakeholders' concerns must go beyond economic considerations, taking social and political issues into account.

### **Portfolio Methods**

This approach focuses on analyzing the prevailing market conditions for the specific business category—the growth rate and the market share that the business commands. Businesses are categorized into four types, as follows:

- *High growth/high share*—These generate substantial cash flow but require large investments to maintain or increase market share.
- *Low growth/high share*—These generate substantial cash flow but require low investments.
- *Low growth/low share*—These generate little cash and are likely to improve with investments.
- *High growth/low share*—These generate little cash but might improve substantially with large investments.

Bruce D. Henderson is the principal author associated with this approach.

Key features of this approach include:

- It uses two economic dimensions—unit cost and volume—to analyze the organization's performance and suggest potential strategies.
- The organization's portfolio is balanced to ensure that financial goals can be achieved as its markets change.

Assumptions associated with this approach are listed below:

- An organization needs to balance its product/service portfolio in a way that generates cash flow and identifies appropriate investments.
- Financial measures are the best indicators of organizational performance and can be used exclusively to guide strategy development.
- For full effectiveness, this approach requires that senior managers can devise strategies that will change the market conditions, cost structure, or investment climate.

### **Competitive Analysis**

This approach focuses on analyzing the forces that shape an industry from a profitability perspective. Strategies can be tested to determine their likelihood of success within that environment. Six key forces are used to describe the industry, as follows:

- Relative power of customers.
- Relative power of suppliers.
- Threat of substitute products.
- Threat of new entrants.
- Level of competitive activity.
- In some cases, barriers that would prevent an organization from leaving the industry.

Michael E. Porter is the principal author associated with this approach.

Key features of this approach include:

- It uses six characteristics to analyze the organization's ability to affect its performance within the industry.
- Strategies are developed based on the ability to change the organization's impact on the overall industry.

Assumptions associated with this approach are listed below:

- It is more difficult for an organization in an industry where these forces are strong to attain acceptable profitability returns on their investments.
- Leaders can devise strategies to optimize the organization's performance relative to its industry competitors.

### **Strategic Issues Management**

This approach focuses attention on the recognition and resolution of strategic issues—"forthcoming developments, either inside or outside the organization, which are likely to have an important impact on the ability of the enterprise to meet its objectives." This approach was designed specifically to bridge between the analysis process and the strategy development process, providing a framework for strategy formulation. The environmental assessments can be based on SWOT, stakeholder, portfolio, competitive, or other analyses—this approach works independently from the analytical process. Igor Ansoff is the principal author associated with this strategic planning approach.

Key features of this approach include the following:

- This process is useful for short- or long-term planning to identify the issues that are most likely to affect the organization's performance.
- Once issues are identified and solutions determined, they are addressed through strategic initiatives or task forces responsible for immediate implementation.

Assumptions associated with this approach are listed below:

- The organization can identify its vital few issues after assessing its environment.
- Early issue identification is presumed to improve the organization's response, leading to enhanced performance.
- To work effectively, this approach requires that senior managers can reach consensus on the most critical issues and the best means for addressing them.

### *Strategic Negotiations*

This approach views strategy as the partial resolution of organizational issues through a highly political process. Strategy is considered as the flow of actions and values that exist within the organization's specific context. The organization's "power brokers" under the current and anticipated future environment are determined. Bargaining and negotiation are used to establish an acceptable strategic course for the organization. Graham T. Allison and A.M. Pettigrew are the principal authors associated with this approach.

Key features of this approach include the following:

- It focuses on identifying the individuals and/or groups who have the most influence or power over the organization.
- These individuals/groups actively participate in the strategy development process with the sponsoring organization facilitating negotiated settlements.

Assumptions associated with this approach are listed below:

- Individuals and/or groups with significant influence or power must be included in strategy development or the planning process will get derailed during implementation.
- Strategy must take into account the constant struggle among groups that compete for the organization's time, effort, and products/services.
- Differences among the "power brokers" will not be resolved totally, but it's possible to shape strategies to move the organization forward within the existing context.

### *Logical Incrementalism*

This approach focuses on appropriately balancing an overall direction for the organization with decentralized decision making. Leaders determine the

organization's purpose and objectives. Progress toward the organization's objectives is achieved in incremental changes that occur because appropriate decisions are made. Decisions are handled at the level of the organization that is closest to the information required for analysis. The main author associated with this approach is James Brian Quinn. Key features of the logical incrementalism approach include:

- It focuses on using broad organizational strategies to guide decision making, entrusting members of the organization who are familiar with the situation and have the necessary facts and data to make informed choices.
- Strategy formulation and implementation are linked in a continuous improvement cycle.

Assumptions associated with this approach are:

- Decisions can be grouped and analyzed to shape strategy and move the organization incrementally toward its objectives.
- Decentralized decision making is politically expedient and necessary.

### *Framework for Innovation*

This approach emphasizes the development of innovative strategies that promote creativity and entrepreneurship at the local level. Four considerations are stressed, as follows:

- Innovation as a strategy.
- Specific management practices to support innovation.
- Development of a "vision of success" that provides a common set of goals.
- Nurturing an entrepreneurial culture.

This approach was designed specifically to counteract the shortcomings of traditional strategic planning systems. The environmental assessments can be based on SWOT, stakeholder, portfolio, competitive, or other analyses; it works independently from the analytical process.

Key features of this approach include the following:

- It ensures that the strategies encourage innovation, providing the appropriate structure and resources.
- Many elements from other planning processes are used in conjunction with this one.

Assumptions associated with this approach are:

- The organization addresses environmental changes with innovation.

- For maximum effectiveness, this approach requires that senior managers can articulate the vision, including specific objectives, to guide decentralized decisions and activities.
- The organizational culture must foster innovation and appropriate risk-taking behaviors.

## Summary

There are nine basic approaches to strategic planning. Each has unique features, underlying assumptions, strengths, and weaknesses. Organizations are best served when they select one or a combination of these approaches based on their values and cultures. Regardless of the method selected, there's an art to strategic planning—the ability to step away from the current reality and into a consideration of what the future may hold. In the end, however, the process that is selected needs to identify the vital few strategies to address for the organization to meet whatever the future may hold.

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## **It's the People, Stupid, Not the Stupid People!**

*Gregory H. Watson*

Let's open the final thoughts of this edition of *The Journal for Quality and Participation* by considering the conceptual distinction revisited by Raj Parthasarathy between cognitive and emotional intelligence in his article. Since Frederick W. Taylor pointed out the need for "scientific" management, a debate continues between the cognitive, analytic school of management and the thinking characterized as a human relations approach about what is the best way to manage people. William Ouchi offered a resolution of this debate by creating a compromise pathway, which he called a "Theory Z" approach, an adaptation of Japanese management practices that blended the features of these opposing managerial styles (Ouchi, 1981).

If Japanese management methods are a panacea for improvement, however, then why is it that so few organizations can duplicate the strength of the Toyota system of management? The answer, according to Larry Bossidy, former chairman of Honeywell, lies in the inability of most organizations to effectively execute their people process, the core idea in the article by J. Bret Becton and Mike Schraeder.

The theme described in this issue, "Energizing Business Through People," prompted me to reflect on the question, "How did we lose sight of the importance of our people?" The news of the past years has been full of stories about governance and ethical issues, as well as greed-driven managerial decisions, which are not focused on the sharing of benefits with all stakeholders. Perhaps what is needed is a "back to the basics" book for dummies on how to manage people.

In the flat world described in Thomas Freidman's book, competition is no longer created by technology because all companies can buy the same hardware and software anywhere in the world. The creative element of today's modern organization comes from an effective people strategy, executed through enlightened leadership, which then becomes embedded into the organizational culture (Bossidy and Charan, 2002). This dynamic is multiplied by where the trivial many accumulate into a dominant force as

observed by Chris Anderson (Anderson, 2006). The competitive imperative in this evolving world is for organizations to manage what they know where what they know is embedded in the minds of their people (Davenport and Prusak, 1998).

Toyota has learned this, so has Ritz-Carlton Hotels. I'll now summarize what makes Toyota such an outstanding people culture and then compare those ideas with observations about The Ritz-Carlton in John C. Timmerman's print and online articles.

### **Smell the Roses, Don't Perfume the Pig**

Don't fall into the trap of doing things the same old way (perfuming the pig); instead, take the time to develop innovative ways to satisfy all of your stakeholders (smell the roses). The basic lesson is that the old tools used by "a boss" are no longer valid in today's world of Web 2.0. Replace command and control, micro-management, and root-blame analysis with collaboration, delegation, and innovative problem solving! The old must replace the new; this is Joseph Schumpeter's idea of innovation in action—the creative destruction of the past and planned abandonment of the old ways of working. The articles in this edition give us insight into how to abandon the old ways.

### **People Are Your Most Flexible Resource**

Parthasarathy asserts that self-awareness and social awareness are two ingredients of emotional intelligence that must be developed. Self-awareness includes the impact of personal emotions on decision making. Self-assessment identifies weaknesses within oneself and results in self-confidence from the knowledge of our own capabilities and self-esteem as we learn to appreciate the worth of our personal contribution. Social awareness comes from reinforcing our place in a group or collective setting. This is exactly what happens in the Toyota system. When a new leader is trained, he/she must learn the humbling lesson that the knowledge is in the workers' minds and that their job is not to tell workers what to do but to guide workers to self-discovery in a collective team setting (Spear, 2004).

Bossidy identified the people process as the key for translating the content of the strategy process (strategic intent and plans) into the operating process of the organization. This is the role that Becton and Schraeder describe as the evolving need for strategic human resources in their article. Perhaps a good example from a respected company can help to illustrate the pragmatic aspects of this linkage. Let's consider how the Toyota Motor Company makes better use of human capital than its competitors by summarizing the company's people-engaging processes below:

- Workers are responsible for the quality of their work.
- Workers share responsibility for the throughput rate of their processes.
- Workers are responsible for improving the quality of work.
- Workers are granted decision rights to stop production if the quality is not right.
- Workers are trained in their processes, provided tools to do the job right, and given achievable goals to deliver the throughput requirements of customers.
- Workers are encouraged to participate in improving their machine operations as well as routine maintenance and cross training of their co-workers.
- Workers are encouraged to experiment (under supervision of a coach) with process improvements that will decrease cost and defects, eliminate waste, improve cycle time, or enhance safety.

Why did Toyota develop this strategic human resource management focus? Perhaps it is because of the insight of its senior leaders. Toyota's long-term vice president of manufacturing, Taiichi Ohno, who is acknowledged as the architect of just-in-time (JIT) and the Toyota Production System (TPS), recognized that the most deadly waste in an organization is the waste of human intellect! When his workers presented him with a list of wastes, he observed that one was missing. This idea is captured in Timmerman's article about The Ritz-Carlton as he emphasizes that people are not just "hands" to hire, but they also are "heads" and "hearts" to engage and win.

### Human Capital Can Reduce the Need for Investment Capital

Some have observed that President-elect Barack Obama made an innovative use of Web 2.0 type of communication and gained votes and support through a long-tail phenomenon, where the mass

of small supporters overwhelms the massive contributions of the "vital few" (and therefore politically influential) large supporters. One clear lesson of this election is that the people are not a "trivial many!" If we challenge our people to more creatively apply the capital already invested in our businesses, then we can address the current financial crisis with a more positive attitude and discover innovative approaches; however, if we seek to cover our past mistakes and poor investments with just more money, then we will only exacerbate the situation and waste further resources. The solution to the problems of today is found in a more effective engagement of our people.

### Synergies and Idiosyncrasies Are Both Necessities

Recent Web debates discussing Albert Einstein raise a key question: Should we develop the individual genius or rely on "institutional" thinking and the power of the collective mind? We can focus synergies gained by bringing people together in one of two ways: developing standard work or developing innovative ways to do things (thereby creating new standards). For those who don't believe that the lessons learned in manufacturing can apply to their businesses, study how The Ritz-Carlton's respect for people and strong recognition of the value of people as a renewable resource can change the way an organization operates and gain the lasting favor of their customers. We can conclude that while genius is a necessary ingredient for success, it is not a sufficient one—unless we add the collective wisdom for innovative implementation of its ideas and creativity.

### Lessons Once Learned Should Not Be Forgotten

During the decade of the 1980s, Hewlett-Packard (HP) investigated many of these same issues related to the problem of managing people in teams and developed a process to help focus on the actions required to manage at all levels—a process of management (POM). HP created a five-step process that is applicable in many different organizations, no matter what the content of the process managed, because it focuses on enabling the people aspect of the process.

- *Establish a mutual purpose and direction*—Communicate with customers, study the environment, align with organizational objectives, be open to innovation, and analyze and integrate data.
- *Build a common vision*—Involve people in building the vision, define a collaborative way of working, communicate the vision, and maintain alignment.

- *Develop shared plans*—Use effective planning techniques, identify appropriate resources, and develop a spirit of shared responsibility.
- *Lead the course of action*—Facilitate the activities, review progress regularly, give and solicit feedback, support and develop people, lead by example, and recognize and reward contribution.
- *Evaluate results and process*—Determine customer and company satisfaction, review the process, identify opportunities for improvement, and celebrate successes.

### Sharing My Viewpoint as the Final Thought

I found the articles in this issue provocative. I don't believe that many people arrive at work seeking to fail; however, I do believe that we can condition people to ignore opportunities for improvement and to become insensitive to the potential for progress. These are issues about personal commitment and motivation, which are natural outcomes from the ideas expounded in this issue. We should consider three basic questions related to personal commitment and motivation as we seek to lead our organizations to innovate in these very troubled times:

- *If not this, then what?* Have we clearly established our priority for what must be accomplished so we are focusing on the vital few things that will engage the trivial many people (the ones who are sitting in the "long tail" of the distribution) to effectively accomplish our true imperatives?
- *If not me, then who?* Have we clearly accepted responsibility for what we must do? Are we effective stewards of what we must delegate and do we provide an approach for achieving the desired state?
- *If not now, then when?* Have we developed a realistic schedule for coordinating the use of our renewable "people" resource to efficiently and economically achieve the desired outcome of our coordinated activities?

I hope that you get as much stimulation for your thinking out of the articles in this issue as I did.

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## social RESPONSIBILITY

### Did You Know?

Suppose every American home replaced one incandescent light bulb with an energy-efficient fluorescent bulb? ENERGY STAR, a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy, reports that our country "would save enough energy to light more than 3 million homes for a year, more than \$600 million in annual energy costs, and prevent greenhouse gases equivalent to the emissions of more than 800,000 cars." Compact fluorescent lights (CFLs) use about 75 percent less energy, reducing electricity usage about \$30 over their lifetimes. They work most effectively in fixtures that remain lighted for long periods of each day, which makes them a great fit for offices. See [www.energystar.gov/index.cfm?c=cfls.pr\\_cfls](http://www.energystar.gov/index.cfm?c=cfls.pr_cfls) for more information.

This multi-part series of articles addresses the history of the quality movement and its role in attaining inclusive growth for organizations begins by establishing the importance of continual improvement as a key management function.

# A Comprehensive Approach to Quality Aims at Inclusive Growth

## Continual Improvement as a Management Imperative

Gregory H. Watson

Over the past century, the quality movement has focused on operational issues. Initially, Frederick W. Taylor systematically investigated productivity, seeking to achieve “maximum prosperity for the employer coupled with the maximum prosperity for each employee.”<sup>1</sup> He set out to develop the “one best way” to do work by determining how long work should take and how it could be accomplished in the most effective way. Since that time, organizations have emphasized generating effectiveness by focusing on efficiency and associated practices that eliminate waste while increasing quality

and throughput. These approaches have been applied to production operations and more recently, to services as well.

This foundation had led quality management professionals to concentrate their efforts somewhat myopically on improving the way people work. The main thesis that the four articles in this series will develop is the need to shift the focus from this traditional view to a broader perspective where management emphasizes achievement of quality results. This is a much more comprehensive approach, encompassing all disciplines and methods that are used to improve performance. Quality



becomes one of the primary outcomes that management must attain to achieve profitable growth and excellence in its work endeavors. These articles, therefore, will position “comprehensive quality” as a principal objective of “inclusive growth,” an outcome of the cooperative efforts within an organization.

### Total Quality Management

The historical focus on the concept of total quality management (TQM) might be considered sufficient for dealing with these same issues. TQM was initially described as Total Quality Control (TQC) by Armand V. (“Val”) Feigenbaum.<sup>2</sup> He presented quality as both the means and the result; management became the methodological process for applying those means and attaining the results.

Unfortunately, TQM never became part of the mainstream of the discipline of business management—despite the encouragement of many senior business leaders/influential quality gurus or approaches such as quality management systems, Lean Six Sigma methods, and performance excellence (e.g., the Malcolm Baldrige Award criteria). It was sidelined as a subset of production and operations management, as a technical issue for industrial engineers, applied statisticians, and Lean Six Sigma Black Belts, or as a standards compliance issue for quality assurance auditors.

If we are brutally honest, we must conclude that quality has fallen far short of universal acceptance as the critical ingredient in management thinking to stimulate growth. In fact, the best efforts of the quality community have tended to limit its integration into the domain of organizational management. Unwittingly, use of the term “quality management” has enabled executives to delegate responsibility to a few professionals rather than holding the entire organization accountable. Only by incorporating quality as a natural ingredient of management will it achieve fully the intended objective of benefitting both market- and ownership-based customers. This series of articles will describe an approach for “managing for quality” during the 21<sup>st</sup> century. This first installment explains the role of improvement in this comprehensive approach.

### The Improvement Imperative

In 1916, Henri Fayol, a French mining executive, advocated for “a constant search for improvements.”

He further emphasized “management’s need to have an unrelenting intention to effect improvement” as a cornerstone of business leadership.<sup>3</sup> These imperatives represent the first modern statements of the need to improve performance continuously and established this approach as a core obligation of management.

General Motors CEO Alfred P. Sloan Jr., subsequently emphasized organizational profitability, applying “the force of facts” for identifying constant improvement opportunities for “profitable growth.”<sup>4</sup> His ideas were interpreted as a requirement for business to demonstrate continual improvement of financial performance through increased quarterly and annual revenues and profits.

In the early 1980s, W. Edwards Deming repositioned the focus of continual improvement. Instead of management blindly pursuing growing profitability, Deming stressed that leaders must understand the roots of that growth. He stated that “quality must be built in at the design stage... downstream there will be continual reduction of waste and continual improvement of quality in every activity.”<sup>5</sup> He linked continual improvement of quality to the innovation process and to the daily management systems of organizations.

An ISO 9000-compliant quality management system aligns with this approach. The standard defines continual improvement as “recurring activity to increase the ability to fulfill requirements.”<sup>6</sup> This activity is addressed by monitoring audit findings, data analysis, management reviews, and other sources constantly in the search for improvement opportunities.

Both Deming and the ISO 9000 standard refer to continual improvement, but the term “continuous improvement” is used more commonly. This phrase is based on a widely-accepted translation of the Japanese word “kaizen.” What is the distinction between continual and continuous improvement?

Continuous and continual both are based on the Latin word “*continuus*.” Continual dates from the 14<sup>th</sup> century, but continuous ties directly to the French derivative *continère*, which means to hold together and came into usage in 1673.<sup>7</sup> Are these merely linguistic interpretations of the same source word, or is there a more profound difference?

It is possible to resolve this distinction by observing the subtleties of their usage, as described below:

- Continual implies a constant state of alertness—always being vigilant to determine if a possible change makes sense. Continual improvement, therefore, requires a rational review of opportunities in order to make strategic choices that will guide improvement. This review process is implied to be systematic and continuing indefinitely; it recurs regularly in a steady, rapid succession. Continual aligns with Fayol's concepts as well as the front-end analysis that supports Japanese Hoshin Kanri planning.
- In contrast, continuous implies an uninterrupted sequence of changes that occurs without the benefit of managerial review. This resembles the "white water" of a raging river that is flowing continuously from its headwaters down a vertical pathway and cascading through its channel to its ultimate destination.

Continual fits the concept of management better because it involves a systematic approach for controlling change through the iterative review and decision-making processes. Continuous is more reactionary and uncontrolled. The white water analogy brings an image of management steering a craft down the raging river, steering clear of the hidden boulders and other obstacles. This image leads me to prefer to use the term continual improvement because it is a more faithful representation of Fayol's original intention.

So, what conclusions can we make regarding continual improvement? It certainly does not involve a constant state of change merely for the sake of change. Instead, robust continual improvement must be embedded into a business strategy/plan that includes incremental, evolutionary change as well as discontinuous, breakthrough, revolutionary change. What we have learned impacts how we make decisions related to the need for change initiatives. A structured decision-making process is necessary for ensuring the most appropriate change option is selected. Organizational success in this arena, therefore, requires a management process that ensures changes drive growth in organizational performance.

Such improvement requires a never-ending stream of innovation, which emerges from systematic generation of creative ideas. Consideration

of all aspects of the organization's operations and impacts is necessary. Diverse ideas come from inclusive engagement of all stakeholders, and they lead to expanded perspective and increased decision-making quality. Continual improvement, therefore, begins with both a strategic organizational perspective and a democratic process for soliciting ideas and opportunities for improvement. On the other hand, it ends with an autocratic decision—a final choice from among the diverse options—and identifies the organization's future direction. This combination of an egalitarian front end and leader-driven back end works well. Ultimately, however, leaders interpret the ideas and define the vision and plans for moving the organization forward. It is management that establishes the overall process and is accountable for the final decisions; thus, continual improvement as described by Fayol and Deming becomes a function of management.

Since Fayol first established continual improvement as a fundamental concept of management, it has evolved into the global quality movement that has affected all types of enterprises and work disciplines. This total quality approach engages people from all functions and levels of the organization to achieve a common purpose. In an overarching sense, total quality not only improves organizational performance, but also increases the quality of life for all people through the organization's effect on society. We can conclude, therefore, that the total quality approach also is a function of management—one that reaches far beyond the organization's operations.

### Models for Continuous Innovation

Motivation for continuous innovation is a driver of sustainable success. Here the use of the word "continuous" is chosen to describe the effort management must place on innovation. In this case, the white-water analogy fits because a successful innovation process involves ceaseless search and rapid management interventions to steer the organization past obstacles that may hinder progress.

Organizational leaders are faced with the two simultaneous, opposing trends described below:

- Customers always want more performance, and their expectations rise as markets develop to maturity; therefore, increasing capability is required from organizations to succeed.

- Processes degrade in performance over time due to the natural effect of entropy; therefore, processes tend to decrease in capability to perform.

The capability to produce an outcome is evaluated by recipients of that outcome—the customers, clients, beneficiaries, etc. This assessment involves a comparative judgment of the organization’s effectiveness—the ratio of recipients’ expectations for results to the performance of the process the organization uses to produce those results. The gap between initial expectations and the achieved performance gives rise to the motivation and constant need to improve work in the organization through management processes.

Fayol described the process of management as a series of activities: planning, organizing, coordinating, commanding, and controlling.<sup>3</sup> He advocated that management foster a “constant search for improvements...that should be pursued unceasingly at all levels and throughout all parts of the business. The executive in charge should have an active, unrelenting intention to effect improvements.” He laid the foundation for the role of the modern executive just as Taylor<sup>1</sup> had established guidelines for the analytical understanding of work processes. Taylor proclaimed that “the system must be first.” In practice, however, Taylor worked only the bottom half of the system, and Fayol focused on the top-down perspective. Interestingly, the interplay between the daily work and the strategic direction is where many organizations fail in integrating their objectives. In the end, successful work requires an understanding of both of these theoretical approaches.

Russell L. Ackoff wrote “Successful problem solving requires finding the right solution to the right problem. We fail more often because we solve the wrong problem than we get the wrong solution to the right problem.”<sup>8</sup> Fayol established the need for looking at business using different perspectives, saying “forecasts are not prophecies: their function is simply to minimize the factors as much as possible.”<sup>3</sup>

Managers have attempted to build various models of organizations and structures without reaching consensus on what is really important. We would do well to heed the advice of the eminent statistician George E.P. Box, “All models are wrong, some models are useful. Every model is an approximation—it is the data that is real

(they actually happened!). Don’t fall in love with a model. The model is a hypothetical conjecture that might or might not summarize and or explain important features of the data.”<sup>9</sup>

From this discussion, we can draw two conclusions, as follows:

- The process of management must satisfy a requirement for continual improvement that engages the entire workforce (both directions are essential: That is, the improvements that begin at the top and filter down for execution as well as those that originate at the “front line” of the organization and rise to the top for validation and approval).
- Whatever model is developed to describe the way an organization operates must address work as a comprehensive system and be both simple enough to explain how work is done and profound enough to provide value. Such a model should begin with the process of management that engages the various organizational levels to produce its output.

Ultimately, describing the requirements needed for an organization to attain performance excellence and inclusive growth must include quality and innovation as key components of management and the role of executives.

## Future Articles

The next three articles in this series will focus on the role of quality and innovation as a stimulus for learning and building cooperation through a shared quality mindset. These all affect the process of management and provide the foundation for the more comprehensive “managing for quality” approach.

*Note:* The early thinking of Armand “Val” Feigenbaum can be traced using the migration of his publications during the initial 15 years of his career: “Quality Control as a Management Method,” American Institute of Electrical Engineers, 1946; *Quality Control: Principles, Practices, and Administration* (McGraw-Hill, 1951); “Total Quality Control,” Harvard Business Review, 1956, pp. 93-100; “Total Quality Control,” *Industrial Quality Control*, May 1957; and *Total Quality Control: Engineering and Management* (McGraw-Hill, 1961).

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## Gregory H. Watson

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## social RESPONSIBILITY

### Did You Know?

The Corporation for National and Community Service (CNCS), the U.S. Census Bureau, and the Bureau for Labor Statistics issue the annual *Volunteering in America* report. Data is collected from more than 60,000 households and 100,000 individuals. For the purpose of this study, "Volunteers are defined as individuals ages 16 and over who perform unpaid volunteer activities for or through an organization."

In the most recent edition researchers concluded, "Volunteers provide a powerful economic and social benefit to communities across the nation, with 62.8 million adults serving almost 8.1 billion hours through organizations in 2010..." (<http://www.volunteeringinamerica.gov/assets/resources/VIA2011NationalPressRelease080811FINAL.pdf>).

"Every day, volunteers of all ages are giving their time and talents to solve problems and make our country stronger," said Robert Velasco II, acting CEO of CNCS. "Americans are doing extraordinary things to improve the long-term health and vitality of the nation."

The median hours served per volunteer was 52, and the proportion who served at least 100 hours rose slightly to 33.8 percent. Volunteer efforts were valued at nearly \$173 billion. The report contains many facts that can be used for planning and tracking trends. As the report states, "Volunteers fill crucial voids in the community. Across the nation, organizations are serving our country's most vulnerable using fewer resources. In 2010, volunteers worked in a range of critical areas to bridge these gaps."

This is the second segment in a series of articles that addresses the history of the quality movement and its role in attaining inclusive growth for organizations.

# A Comprehensive Approach to Quality Aims at Inclusive Growth

## The Process of Quality Management

Gregory H. Watson

**I**n the first installment of this series, the importance of continual improvement as a key management function was established. Now we'll explore the process of management. As a foundation for this discussion, we'll look at a modern model of management developed in the mid-1980s at Hewlett-Packard (HP) and illustrated in Figure 1.

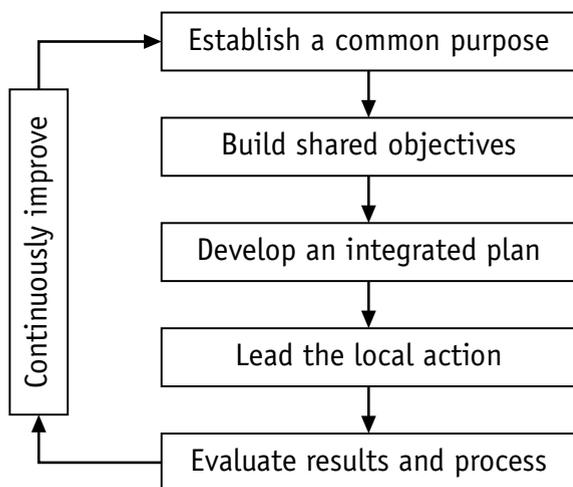
The HP model was developed using action research into the practices of the leading mid-level HP managers and is based on earlier work in Japan that developed the Plan, Do, Check, Act (PDCA) model, which often is called the Deming cycle (although the model

was actually developed by Shigeru Mizuno based on his interpretation of W. Edward Deming's early lectures in Japan). Perhaps the most innovative aspect of this HP model is its separation of a process of working (the process of management) from the content of this work (what flows through this generic process or the organization's daily management activities).

We can apply this model to the process for managing continual improvement in all areas of work. If this is an approach used for managing processes by quality (the means of a quality process), then how are the



**Figure 1: Model of Modern Process of Management (POM)**



quality content of products or services developed (the ends of a quality process)? To answer this question we must formally define the term quality and identify the boundary conditions for its scope or application.

### What is Quality?

Quality can be defined in many ways, including the following:

- The attribute (or set of attributes) that describes an actual entity (a product or service) delivered by an organization.
- The experience by which we judge that entity's utility, value, or relative worth, as well as the perceived level of service associated with its delivery, as determined by its recipient—a client, constituent, beneficiary, guest, customer, etc.
- The system for assuring that the attributes and experiences satisfy recipients' expectations.

Quality, therefore, involves a systems approach—one that includes both the ends (outcomes) and the means (the components of the system—philosophies, methods, and processes or procedures carried out through human effort and engagement), as portrayed in the management process model.

The following methods commonly are used as the means for assuring desired outcomes are delivered to recipients:

- Standards, such as the ISO 9000 series.

- Business excellence models and self-assessment to monitor the maturity of the quality development process.
- Quality design approaches for innovation, using a process such as Six Sigma DMADV.
- Strategic continual improvement project management, using processes such as Lean and Six Sigma DMAIC.

This latter method, continual improvement, includes both an emphasis on shorter-term change management as well as longer-term strategic change. When we define the scope of quality, it must address all the following types of change:

- Evolutionary or incremental improvement of work methods.
- Revolutionary or transformational breakthrough discoveries of totally new ways of working.
- Approaches designed to maintain performance gains in between improvement cycles.
- Review or monitoring processes for detecting losses in performance and correcting/preventing quality deviations/problems.

The outcomes of the quality system extend far beyond the product and service attributes or the recipients' experiences, however. They involve myriad impacts that are generated along the way, which may affect workers, organizations, and society. For instance, an effective quality system provides for workers' safety and security of the enterprise. As a broader perspective on the means and ends associated with the quality system takes hold, it naturally becomes more inclusive, involving people's minds and efforts more expansively into the work of achieving quality.

When this happens, quality not only helps individuals meet their fundamental needs but also provides an opportunity for them to experience self-actualizing fulfillment by contributing to the organization and society's innovations and results. An inclusive quality system is achieved through an integrated approach—people with a quality mindset that aligns with their personal and cultural values in a way that defines a common way of working. This could be described as people "doing quality" as they are "being quality." Quality systems become stronger when energetic individuals are encouraged to take more

active roles—in other words, when those systems become more inclusive. Continual improvement requires continuous learning, which, in turn, requires organizations to move from a “commitment to the principles of quality” to an “engagement in the practices of quality” to the “involvement in development of quality.”

### Why Does Quality Matter?

In a world of scarce resources, we must not squander their implicit value. We must pay attention to how we use our time—the length, scope, and degree of our involvement—as well as our finances—the money we invest to obtain value from objects and/or experiences. We cannot afford to lose quality either personally or on behalf of our organizations and society. Quality is an increasingly essential component of the human experience as mankind seeks to assure quality of life in all of its perceivable dimensions—an imperative to sustaining life as we know it. Without quality our world will suffer from entropy, and we will make poor use of its resources in the blind pursuit of economic development without creating appropriate value.

### How Do we Assess Quality?

What are the dimensions by which we formulate judgments about quality?<sup>1</sup> In 1987, Harvard professor David Garvin created a definition of quality that serves as a framework by describing eight distinct dimensions of quality, as listed below:

- Performance
- Features
- Reliability
- Conformance
- Durability
- Serviceability
- Aesthetics
- Perceived quality

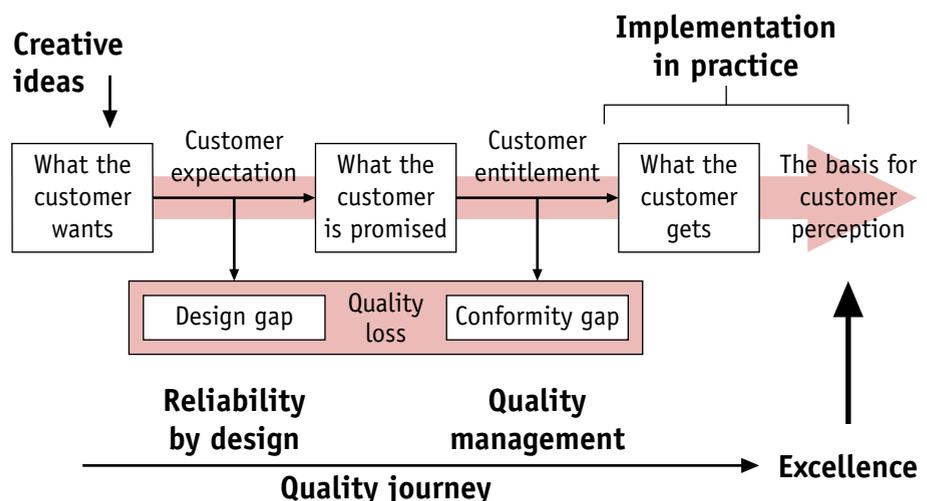
The interactions among these various quality attributes represent a spectrum of strategic opportunities for organizations to differentiate themselves

and their products/services from competing alternatives. Recipients, however, make their choices based upon the attractiveness of the relative quality propositions that are put forward by the competing organizations. In other words, quality judgments always reflect both a perceived need and alternatives for satisfying those needs. Strong cross-cultural considerations affect the determination of value.

Achieving quality outcomes often requires blending of several cross-disciplinary technologies, such as reliability engineering, auditing, statistical analysis, and measurement. The quality sciences, therefore, must be integrated into a well-designed system to achieve consistent outcomes on behalf of the recipients who make judgments regarding the adequacy of the products/services. Their opinions are based on the degree of attractive quality, as defined using the model of Noriaki Kano.<sup>2</sup> This model follows the process illustrated in Figure 2 for quality deployment in the process of management.

Here, quality is embedded expressly into the daily management of the organization by design of the actual entity (product) and/or the experience (service). It is a three-step process which delivers quality to the recipient, the evaluator of its value. As shown in this figure, the steps are to determine what the customer wants, promise the customer what outcome will be generated, and deliver that outcome, as summarized below:

**Figure 2: Quality Deployment in the Process of Management**



- *What the customer wants.* This process develops an imaginative understanding of the quality deliverable (either the actual entity and/or experience), based on an investigation of the attributes that will meet the customer's performance expectations. First, basic or foundational needs are identified and judged relative to a standard for performance. Then, potential alternatives are evaluated against competitive offerings to determine which attributes must be incorporated in the product/service design. Finally, quality attributes that provide unanticipated delight to the customer—the attractors—are introduced through innovation. Note that these attractors, however, provide a relatively short-term advantage because competitors quickly copy them. In determining what the customer wants, any gap in quality is a loss caused by the design and generally is addressed through reliability engineering. Furthermore, not all customer expectations must be met because the design must be balanced against the organization's commercial goals and its ability to engineer a product that will satisfy the critical requirements of its customers.
- *What the customer is promised.* The design process is followed by making a performance promise to customers that defines what product/service they should expect to receive. Additionally, the intention should be to fulfill the promise flawlessly.
- *What the customer gets.* People learn about quality by observing the entity and/or experience they receive. If customers perceive that the design is insufficient or that the product/service does not live up to its promise, they judge it to be lacking in quality. There are two new aspects of failure—poor execution of the design prior to delivery to the customer and poor design that generates problems with customer usage and/or service after delivery. In either case, these shortfalls from the promise will be perceived by the customer as a "lack of quality."

This management-based process ensures continual improvement of products and services as their value propositions become increasingly aligned with customers' expectations. The front

end of the process must develop imaginative ways of identifying customer application, described as "the job that needs to be done."<sup>3</sup> Creative ideas, therefore, drive the quality delivery process, and as cycles of improvement occur, it becomes a journey that delivers excellence—value that customers use and appreciate. Excellence is a milestone on the quality journey; it is the eventual result of having built an inclusive quality system that fully engages people. As customers intensify their requirements, setting higher expectations, the required level of excellence also increases.

### Learning About the Concept of Quality

The modern development of the concept of quality commenced a century ago after Frederick Taylor's work was published, as described in the first installment of this series. Since then, the focus on quality has changed. At first, assuring that already manufactured products met specifications was emphasized through standardization, measurement, acceptance testing, quality inspection, and quality control. As learning increased, the focus shifted to controlling processes during production so that outputs were acceptable through the discipline of quality engineering. Quality assurance came next when organizations recognized the need to align engineering specifications to contracted customer requirements. As an understanding of the value of including all employees in the process of continual improvement emerged, total quality management was born.

Today's emphasis on comprehensive quality recognizes the need to integrate quality across the entire business system, including extensions to the supply chain and distribution channels. Furthermore, it expands the scope of quality to a global system and incorporates reliability—quality that is enduring. Business leaders now must build a process of management that establishes reliable organizations—ones whose promises warrant customers' confidence in the organizations' ability to deliver on these commitments. Continuous innovation and reliable development both must be included in the modern version of continual improvement. Excellence is result of habitually doing the right things in the right way, which is the consequence of thinking and doing quality. Under these circumstances, quality matures into

a pervasive mindset that prevails in individuals, teams, and organizations. Quality thinking motivates action to apply principles, methods, and tools to deliver the right work outcomes as judged by customers.

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This is the third segment in a series of articles that addresses the history of the quality movement and its role in attaining inclusive growth for organizations.

# A Comprehensive Approach to Quality Aims at Inclusive Growth

## Integrating Innovation Into the Process of Management

Gregory H. Watson

In the first segment of this series, the importance of continual improvement as a key management function was established. The second segment explored the process of management. Now we will discuss how innovation fits into the overall quality system and improves the process of management.

Quality is generated by people working together in organizational processes that respect them as individuals and allow them to work with pride through personal contributions to a democratic process of continual improvement. This engagement forms an intersection between quality and

social responsibility through the broad application of organizational learning as a renewable process of innovation. Such organizational learning, as well as the process of innovation, is integrated within the management process through the quality delivery process. To understand what this means we must review some closely related concepts:

- *Creativity*: Generation of imaginative ideas without regard to practicality or ability and ease of implementation; success is measured only by the number of new ideas. Creativity refers to the act of producing new ideas, approaches, or actions. This is the

origin of the “white water at the headwaters of the innovation process.”

- *Invention*: The imaginative discovery of ideas that define a potentially practical new device, composition, gadget, or process that did not exist previously. Inventions may be derived from pre-existing works (in incremental improvements or variants of prior works), or they may be conceived independently (as radical breakthroughs).
- *Innovation*: Ideas applied in practice; the entire process by which an organization generates creative ideas and converts them into novel, useful, and viable commercial products, services, and business practices. Although creativity is the generation of novel ideas, which is a necessary step within the innovation process, innovation is the process of both generating and applying creative ideas in some specific context. Author Max McKeown commented that innovation is “a new way of doing something or new stuff that is made useful.”<sup>1</sup>
- *Engineering*: Designing and implementing useful features and functions at the lowest total cost (including the cost of failure).

Innovation, therefore, is part of continual improvement in both its incremental form (such as evolutionary improvement) and in its breakthrough form (revolutionary improvement). An organization uses innovation to ensure that the quality features of its products and services are developed into attractive quality where the perceived value exceeds that of alternative choices. Quality, therefore, incorporates innovation as part of its core delivery process, just as it is inclusive of problem solving and managing daily work. How can an organization consciously develop such an explicit approach to embedding quality? Organizations must learn to take positive action because

developing quality is not a natural act; it comes from having a quality mindset that is learned from experience. The process to create the best quality system for any organization is called “triple-loop learning” as shown in Figure 1.<sup>1</sup>

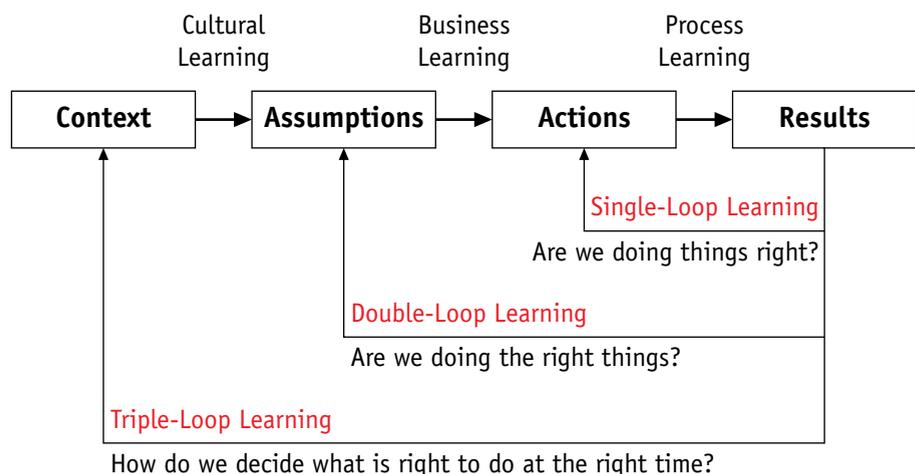
### The First Loop: Managing Continual Improvement

Harvard psychologist Chris Argyris<sup>2</sup> defined “single-loop learning” as the analysis of results to evaluate actions (or methods) and answer the question: Are we doing things right? This focus on the content or outcomes of process actions provides for “detection and correction of errors,” or solving the immediate problem, and seeks to learn how to do things consistently right. At this level we engage the daily work practices and operate the quality management system with the objective of obtaining a state of control over the work that is done to ensure a consistent outcome. Some aspects of single-loop learning are:

- Document the current standard work process.
- Instill discipline into work process measurement.
- Ensure quality review of work outcomes or products.
- Implement corrections to ensure standard results.
- Design preventive action to eliminate future problems.
- Change the standard work definition to ensure quality.

Single-loop learning applies to all process workers at all levels of an organization and it

**Figure 1: Triple-Loop Learning**



focuses on the execution of daily work process using work standardization, process improvement, and problem-solving methods. This type of learning devises an integrated system of work processes to eliminate waste and defects (commonly used quality methods include: ISO 9000, lean production methods, and the Lean Six Sigma DMAIC process). This first loop of learning is the realm of quality control, quality engineering, and quality assurance.

### **The Second Loop: Engineering the Quality Management System**

“Double-loop learning” occurs by questioning the system of learning resulting in correction of underlying principles, assumptions, theories, and policies of the organization or implementing insights for change that were identified in the detection and correction process. Quality management rules in this second loop of learning. This learning process focuses on the question: “Are we doing the right things?”

At this level we design the business system and engineer the quality management system to preserve a continual improvement process. Common tasks related to this cycle of learning include creating the methods that support single-loop learning activities such as:

- Developing a standard problem-solving process.
- Developing a standard process-mapping and analysis method.
- Developing a standard performance-measurement and reporting system.
- Developing a standard for risk and failure analysis method.
- Developing a standard process for change management.

Activities in this second learning loop are driven by the business process improvement and quality management staff and focus on cycles of learning to apply the first loop better by developing and improving standard ways of working through a structured review process (usually quarterly, bi-annually, or annually). This process gathers input that is distributed across the organization as well as from external partners (suppliers and distributors). It then centralizes

the understanding of what, where, and how to improve by reviewing lessons learned, best practices, and the results of failed project activities to increase the effectiveness of process and project performance.

### **The Third Loop: Transformation Management**

The third learning loop is a leadership rather than a management effort. It is directed at the adaptation of the organization to its changing context—the external environment in which it must operate to remain effective. At this level the organization is transformed by learning what needs to be different in its operating system: How does the organization decide to do what is right? Triple-loop learning focuses on what the organization needs to learn or learning how to learn differently. This provides the basis for permanent change in the way people work and is the realm of leadership that has the organizational power to mandate new directions and align resources to reshape the way an organization operates through evolution of its genetic code or DNA.

The executive management team typically handles the activities in the third learning loop. The focus is on developing an organizational process for change management as well as determining the context in which new content should be orchestrated into the management system. This process should be concentrated in a self-assessment of the organization’s maturity that is conducted annually as a prelude to strategic planning. The objective should be to identify strategic change projects that reshape the organization’s process capability to achieve its strategic intent. In the language of Six Sigma, this is called the “recognize” step, which generates either DMAIC or DMADV improvement projects. In a Japanese “Hoshin Kanri” system, this represents the culmination of the “catchball” process that specifies the Hoshin objectives to achieve by aligning the organization’s efforts.

In summary, single-loop learning occurs during problem solving of work processes while double-loop learning occurs during management review of improvement projects by integrating lessons into the organization. Triple-loop learning occurs through reflective review of change management efforts, scanning the organization’s

environment, and identifying what additional insights bring new knowledge for adaptation into the organization's culture. The triple-loop learning process, therefore, is a significant component of the management process and essential for driving continual improvements by quality innovations in the process of management.

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## Securing the Big Picture of Quality for Your Organization

Gregory H. Watson

The variety of topics addressed in this issue clearly reflects the broad range of issues related to quality and their effects on organizations. As a whole, they reinforce the reality that organizations are systems that must be managed in a way that not only generates sustainably high quality results but also that integrate quality approaches into every aspect of management.

The conclusion of my four-part article on a comprehensive approach to quality is based on systemic thinking as applied to organizations, a concept pioneered by the late Russell L. Ackoff. He identified organizations as purposeful systems that share at least one common purpose, make choices to accomplish that purpose, and possess at least one function to coordinate communication for feedback and control.<sup>1</sup>

Harvard psychologist Dorothy Leonard determined that organizations create structures and systems representing a range of behaviors from core rigidity to core flexibility.<sup>2</sup> Core rigidity is the result of a bureaucratic approach to compliance that is mindless and does not seek continual improvement. On the other hand, core flexibility is the hallmark of a purposeful organization that has the agility to adapt to changing external influences by transforming its operations and embracing risk, characteristic of a quality-centric business. Comprehensive quality stimulates an organization so that it may compete effectively by taking advantage of the following eight dimensions of attractive quality in the content of its products or services:<sup>3,4</sup>

- Utility: usefulness or suitability of design functions for the user's application.
- Capability: range of performance available for the design functions.
- Aesthetics: style and form of marketing features.
- Innovation: practical or technical originality or novelty in the design.
- Accessibility: ease of use and friendliness of human interfaces.
- Portability: ability to use in a wide variety of applications.
- Esteem: worth implied by recognition of a brand.

- Reliability: durability of performance capability in its intended environment.

A management system that delivers attractive quality will pursue a comprehensive approach to quality—developing sensitivity to changes in risk, creating profound systemic knowledge of how organizational processes interact to produce variation—and should be evaluated based on their ability to sustain high-performance outcomes.

In his article, "Risk and the Future of Quality," David Martin describes four elements in the process of risk management, and he presents a set of principles that elevate it from an operational concern to a strategic one. These principles, when rephrased, should sound familiar to many quality practitioners, as shown below:

- Understand the current state of performance outcomes.
- Question assumptions in your system and learn what is needed to develop competence.
- Determine your degree of risk acceptance.
- Increase the sharing of all performance-related information.
- Investigate all aspects of risk in internal business systems and external social systems.
- Maintain a continual monitor of factors with potential for process performance risk.
- Develop a never-ending effort to reinforce a culture of excellence.
- Reduce failure probability responsibly as an organization.
- Monitor performance outcomes continuously and learn from mistakes.

Martin believes that future developments in quality management must include risk management as contributors to the process. This extends the scope of quality, expanding it beyond that of poor quality to include the degradation of performance.

Richard N. Knowles invented The Process Enneagram® and recommends using it for organizational transformation. An enneagram is a nine-point diagram that depicts the relationships among the

interconnected components of a system. Knowles applies the enneagram structure to describe interactions among concepts in complex organizations.

Elements in the enneagram interact in patterns to describe the way that a system operates. Knowles identifies three dominant relationship patterns:

- One thought path moves around the circumference of the enneagram and results in the definition of a new identity for the organization.
- A second path describes the sequential method by which work is accomplished, occurring through an interconnected learning process.
- The third path forms a triangle that links identity with relationship and information to develop the process of self-organizing leadership.

The value of an enneagram is its ability to structure a discussion that permits organization-wide conversation about change. These imperatives must influence learning within organizations that engage effectively to generate dramatic change. Informal networks cut across functions and facilitate more rapid acceptance of new directions. This must become a characteristic of the new "management science" of "managing for quality results."

The desired result of such collaborative, cross-functional effort for continual improvement by managing for quality is the development of a high-performing organization. André de Waal's article suggests factors that are consistent with a need to generate a comprehensive approach to quality. He defines a high-performance organization as one that "achieves financial and nonfinancial results that are exceedingly better than those of its peer group over a period of time of five years or more by focusing in a disciplined way on that which really matters to the organization." Quality is important both as a precondition for achieving such performance and as an indicator of the sustainable performance achieved. De Waal recognizes five important factors as follows:

- Quality of management.
- Openness and action orientation.
- Long-term perspective.
- Continual improvement to ensure organizational renewal.
- Personal commitment to excellence and increasing the contribution to organizations through enhanced personal competence.

To achieve business sustainability, organizations must manage their systemic quality outcomes and

include not only defect-free performance, high reliability, and delivery consistent with promises to customers but also decreased risk, lower investments to achieve sustainable results, and a high return-on-invested capital. Quality outcomes require more than just quality in the products and services. The organization also must seek to win and deserve its customers by developing insight into their circumstances through an imaginative understanding of ways to address customer needs and ensuring organizational and personal competence in its capacity to deliver these needs consistently over the long-term. In such an organization, there is no place for short-term, nonsystemic thinking.

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It takes the proper blend of form and function to create innovative products for the marketplace, and balancing these factors requires more than just technical/engineering perspectives.

# Building Both Sides of the Brain

## Innovating by Blending Form and Function

Andrew D. Watson and Gregory H. Watson

Although the American science, technology, engineering, and mathematics (STEM) educational initiative focuses on developing the technical competence of students, holistic development to stimulate innovative problem solving will require introduction of artistic thinking by adding a creative component that goes beyond technical functionality and addresses form and human utility.

### How Should We Understand Innovation?

Modern thinking about innovation has been strongly influenced by the work of Austrian economist Joseph A. Schumpeter. His books, *Theory of Economic Development and Capitalism, Socialism, and Democracy*, define innovation as a systematic destruction of the old ways of doing things, which are replaced by a new way; a process he called “planned abandonment.” Schumpeter’s theory of creative

destruction has been incorporated into the European Union’s Lisbon Accord on Innovation. Although Schumpeter defined a concept about how innovation works, he did not specify the specific mechanism by which individuals innovate. This article examines three approaches to innovation, as follows:

- In the first model, creativity exists in a distinctly different context from logic (dualism or two-brain theory).
- In the second model, function is superior to form (science is superior to art or function dominates form).
- In the third model, form and function each require the other to achieve excellence in the resultant creation.

### Two Sides to the Brain: Two Different Worlds?

Mankind has often broken down thinking into simplistic, dualistic models—such as the division between good and bad or black and white.



These divisions create separate worlds that have no unifying principles and thus force creative choices into an either/or framework, which results in barriers that tend to separate people who have chosen a position on one side of the argument or the other. Such simplistic theories are sometimes used to describe creative thinking using a dualistic model.

- In *The Republic*, Plato described the two perspectives of reality as an imperfect shadow compared with the ideal form or type. (Carl Jung later described as an archetype or the original pattern from which copies are made. Jung's thinking about archetypes was influenced by Immanuel Kant's concept of forms and Arthur Schopenhauer's concept of prototypes, where an ideal is experienced only as a reduced copy that resembles or represents the unadulterated metaphysical pattern).
- In *The Two Cultures*, Charles P. Snow observed two traditions that mankind has embraced for interpreting reality—scientific and humanistic thinking.
- Roger W. Sperry, who received the Nobel Prize for his study of epilepsy, described a left-right schism in brain functionality where the left brain contributes logical, analytical thinking while the right brain initiates expressive, artistic abilities. In a 1974 paper, Sperry said that each brain hemisphere is "indeed a conscious system in its own right, perceiving, thinking, remembering, reasoning, willing, and emoting, all at a characteristically human level, and ... both the left and the right hemisphere may be conscious simultaneously in different, even in mutually conflicting, mental experiences that run along in parallel."<sup>1</sup> Clearly, the division of mental functionality is not as simplistic as a discrete choice between two alternative mental modes of operation.

The simplistic approach to decomposition of attributes is easy to comprehend, but the mental models that this style of thinking produces are inadequate descriptions of reality when they are examined closely. These theories require a deterministic model of reality in which things are clear cut (e.g., black and white) and where shades of gray are not permissible. David Hume wrote "all knowledge degenerates into probability."<sup>2</sup> Does this

imply that there is a dominance of the left-brain style of thinking over the right-brain style?

### Left Brain Dominance: Superiority of Function Over Form?

In *Form and Function: Remarks on Art, Design, and Architecture*, Horatio Greenough said, "It is the pervading law of all things organic and inorganic, of all things physical and metaphysical, of all things human and all things superhuman, of all true manifestations of the head, of the heart, of the soul, that the life is recognizable in its expression, that form ever follows function. This is the law."<sup>3</sup> This law was synopsised by architect Louis H. Sullivan, who is best known as the instructor of Frank Lloyd Wright and the designer of the first steel-framed building: "form follows function"—that the purpose of a structure should determine the form in which it is constructed.<sup>4</sup> This rule is so engrained in the thinking of architects and civil engineers that it has been espoused by such engineering thinkers as Henry Petroski who said, "past experience warns us against valuing form over function."<sup>5</sup>



*Tacoma Narrows Bridge collapses in 1940 due to issues with form over function.*

(Used with permission of the Tacoma Public Library.)

Proponents of an engineering-first approach to design often cite the catastrophe that occurred with the Tacoma Narrows Bridge—a classic failure of engineers to properly consider functional requirements as a priority over aesthetic considerations. Even during construction, the bridge was subject to vertical motion in light winds and became nicknamed "Galloping Gertie." In this case, the design flaws were confounded by lack of

funding and a desire to build a slim and elegant structure. Unfortunately, the design was subject to resonance during even light winds, and the bridge collapsed due to structural vibration that occurred when the wind was only 42 knots; it was supposed to survive 120 knot winds.<sup>6</sup>



*Apple's iPhone 4 was aesthetically pleasing but design flaws associated with the antenna negatively affected its performance.*

A similar problem occurred with the design of Apple's iPhone 4 and the basic functionality of its antenna performance. Richard Gaywood, a wireless telecommunications expert, concluded, "The iPhone 4 is a fantastic device, but a lousy phone." In this case, the problem occurred due to an error in judgment in the antenna design—a notoriously classic problem that Apple overlooked in order to achieve aesthetic appreciation for the appearance of the interior of the product (which the typical user never views). Gaywood's report cited, "obvious lapse in Apple's engineering judgment. The fact that Apple didn't have the foresight to coat the stainless steel antenna band with even a fraction of an ounce worth of non-conductive material either tells us that Apple doesn't care or it simply doesn't test thoroughly enough."<sup>7, 8</sup> In this case, form should not have been trumped by function in the design, as the result was a decrease in customer satisfaction.

These examples make it clear why many engineers believe that functionality comes first and form, or the aesthetic principles of design, should take secondary priority. There are equally available high-technology examples where engineering

functionality is trumped by aesthetic form, however. Consider how rapidly Apple's iPhone replaced the BlackBerry® and Nokia phones. Market share of the iPhone rapidly replaced the RIM and Nokia products, gaining 26 percent of the U.S. market within six months following its release in 2007—despite the fact that the Nokia antenna designs were superior or that RIM had better capability in data compression, message management, and encryption. The commercial advantage that was derived by Apple's engineering on the delivery of attractive quality far exceeded the concentrated engineering focus of RIM and Nokia on flawless functionality for technical performance. Surprisingly, this means that the market did not play the technical trump card against Apple's iPhone, despite its poor technical design!

### **Holistic Approach to Innovation: Inclusive Thinking as a Creative Mode**

Just as brain physiologists and neurologists have come to emphasize holistic brain dynamics instead of the split brain model, those who describe human creativity and innovation are now turning to a more integrative approach to the development of innovation in human activity. In a human brain, the frontal lobe serves as the coordination center for intellectual activity, which engages all components to provide the comprehensive functionality to define human rationale and the thinking process. The way that people think is based on a mental network that dynamically connects the various physiological components of the brain. Similarly, the creation of a product with mass market appeal requires a dynamic and collaborative team that applies a broad spectrum of decision criteria.

There has been a long-standing tension that occurs at the front end of new product development. The industrial designers prefer to create exciting forms, and the hardware engineers seek reliable functionality. When one perspective takes precedence over the other, the result is an unbalanced design that may fail. This tension may be addressed by considering some of the methods used by applying design engineering techniques used by Japanese companies to increase the alignment of their innovations with consumer interests.

## Quality Function Deployment (QFD)

Shigero Mizuno and Yoji Akao developed a method to merge conceptual requirements of customers with the technical requirements of designers in their QFD methodology. In this method, conflicts are made visible, ensuring open communication as the conceptual form is translated into a functional engineering design.<sup>9</sup>

## Kansei Engineering

Mitsuo Namaguchi created the concept of *kansei*, or affective engineering, to increase the intimacy between the consumer interaction and the product. *Kansei* engineering is the engineering of the senses or user experience whereby an instantaneous emotional feeling is experienced in the interaction of the user with the thing that is used (e.g., the Apple iPhone user's experience as they caress their mobile phone).<sup>10</sup>

## Theory of Attractive Quality

Noriaki Kano created his theory of attractive quality with its mental model to explain the relationship between the excellence of design and the satisfaction of customers.<sup>11</sup> The Kano model is especially important for understanding how to achieve a merger of form and function within the product design.

This model, shown in Figure 1, illustrates three functions that describe considerations made by teams as they set requirements during conceptualization based on customer perception regarding the degree of their satisfaction with product design. The vertical axis depicts the degree that the consumer is satisfied with the design of the product (typically considered one feature at a time) on a continuous scale from completely dissatisfied to ecstatically delighted. The horizontal scale depicts the excellence in design of the feature from barely functional to exceptionally capable. The three curves that are plotted on these two axes represent the trends in customer perception across the two scales and identify unique design strategies for creating engineering functions that deliver marketing features.

- *Must be quality*. Product features that occupy this strategy never deliver satisfaction despite the degree of engineering excellence with which they are designed. There can only be a limited amount

Figure 1: Kano Model: Theory of Attractive Quality



Original source: Noriaki Kano, Nobuhiko Seraku, Fumio Takahaashi, and Shinichi Tsuji<sup>11</sup>  
Modified by: Gregory H. Watson

of reliability in a product before it becomes over-designed—and potentially too costly.

- *One-dimensional quality*. Competitive product features are compared among the alternative market offerings. Consumers' purchase decisions favor the proposition (typically a price-performance ratio) that offers exceptional value.
- *Attractive quality*. Features that deliver attractive quality are perceived by customers as having exceptional, yet unanticipated, value. They are delivered in a way that indicates the engineers possess an imaginative understanding of the customers' true needs. Features that deliver attractive quality tend to define the "wow" product or the "killer application," disrupting the market where it is introduced.

A significant learning associated with application of the Kano model is recognition of the need to foster dynamic capabilities within new product development groups. Then, design teams can be flexible when responding to external forces through innovation that anticipates the needs of consumers. Failure to understand and apply this lesson reduces the competitiveness of development teams' outputs. Attractive quality must deliver both form and performance. At the same time, degradation of "must be" quality considerations may undermine even an exceptional design. When describing product design in areas of new technology, Steve Jobs said, "The customer

doesn't know what they want."<sup>12</sup> Engineers must become imagineers, but they also must get the technology right!

### STEAM: Educating Engineers for Excellence in Design

Engineers and designers who have been taught to think like each other and value the contributions that come from collaboration will be more likely to form productive design teams that can deliver attractive quality in the features and form of the product without compromising its technical functionality. American educators have been in the process of redirecting engineering education over the past decade in recognition of this fact.

The STEM educational initiative focuses on developing students' technical competence. Holistic development to stimulate innovative problem solving will require introduction of artistic thinking, however (thereby adding an "A" to the STEM acronym to create STEAM).<sup>13</sup> In doing so, this approach integrates a creative component that goes beyond technical functionality and addresses form and human utility.

The logic of adding artistic thinking as a core component to STEM to form STEAM can be illustrated through the design of a guitar. Such design requires integrated thinking, an understanding of the resonance properties of materials, the acoustic effects of harmonics in space, the physics of sound, and the biological configuration of the hands of the player. Because the guitar is a highly personal instrument, it also must attract the individual player. The guitar delivers an experience that the guitarist associates with his/her own physical attributes. The guitarist, therefore, comes to identify the instrument as an anthropomorphic entity, instead of a structured thing.

This proposed logic of synergy between art and engineering follows the ideas of Jim Collins where he distinguished between the reductionist perspective of "either/or" logic and the systemic perspective of "both/and" logic.<sup>14</sup> Instead of requiring the separation or prioritization of form and function in a design, STEAM requires their merger in a participative design team effort. Participative design has been recognized as important since the emergence of concurrent engineering principles in the late 1980s.

The continuing force to reduce cycle time in the new product development process has encouraged stronger collaboration among the various engineering disciplines to ensure that time to market is minimized and that new products are available when their window of opportunity opens. The principle of participative design requires transition from a "me-focus" to a "we-focus," where collaboration and cooperation are the hallmarks. Engineers and designers need to work together and know enough about each other's fields to communicate in a productive way. They need to balance the form and function of their products.



STEAM supports participative design by fostering a lifelong, integrative approach to cross-disciplinary innovation. STEAM adds three ingredients to STEM:

- Integration of the disciplines through human experience
- Addition of a creative component through artistic thinking
- Transition from a discipline-centric team approach to a fully participative and integrative cross-disciplinary way of working—the fusion of form and function into a coherent whole

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## More Online

For more information on how to transform engineering education from STEM to STEAM, see the supplemental article at [www.asq.org/pub/jqp](http://www.asq.org/pub/jqp).



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# Transitioning STEM to STEAM: Reformation of Engineering Education

Andrew D. Watson and Gregory H. Watson

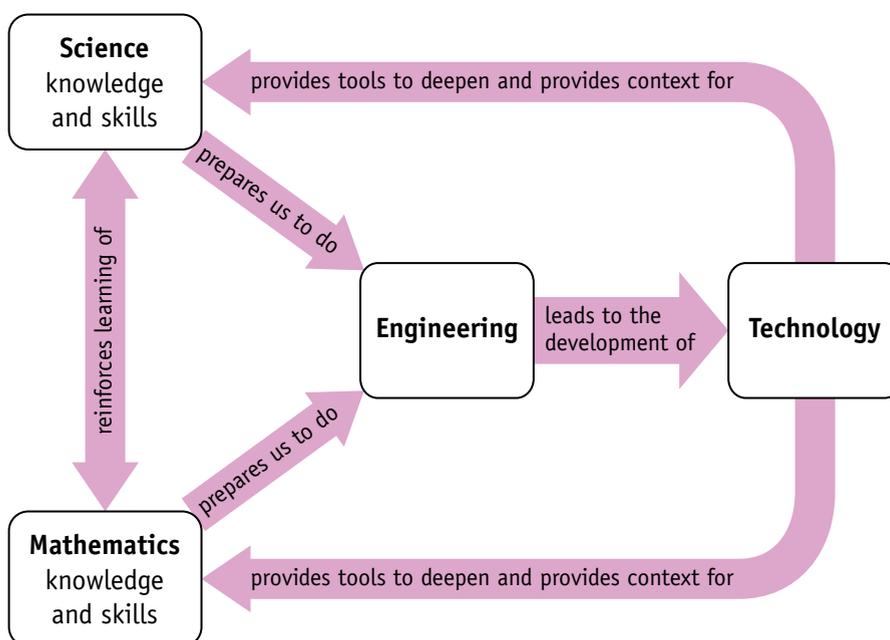
The acronym STEM was coined in 2001 by Judith A. Ramaley of the National Science Foundation. STEM now is used as a brand name to describe the integration of science, technology, engineering, and mathematics in educational curricula. Ramaley defined STEM as an educational inquiry where learning was placed in context and students solved real-world problems through creation of opportunities—a pursuit of innovation. Her concept provided an answer to the relatively poor performance of American students in standardized exams for mathematics and science as well as the need to bolster the declining enrollments in universities in the academic STEM fields. Emphasis has been placed on programs that stimulate these disciplines with half of the funding provided for K–12 educational programs and the other half for basic and advanced studies in colleges and universities.<sup>1</sup> To make sense of the integration of these fields into the STEM initiative, the Minneapolis Public School district uses a graphical interpretation of their relationship as shown in Figure 1.<sup>2, 3, 4</sup>

The need for a strong national program for development of STEM-related disciplines was generated by a series of studies by the National Science and Technology Council, National Science Foundation, the National Science Board, and the National Academies of Science and Engineering as well as the Institute of Medicine.<sup>5</sup> The educational programs promoted by STEM are innovative. STEM breaks the educational mold by incorporating the disciplines together in project-focused learning. For example, students may learn algebra and physics to build robots or geometry, physics, and biology to build a working greenhouse. These projects, however, tend to take a purely functional approach to the task. On occasion, however, the projects may incorporate design elements to combine function and form. This is where the necessity for considering “art” as a component of STEM occurs.

## Transition From STEM to STEAM

In his 1959 Rede Lecture, Charles P. Snow identified the split of Western society into two fundamental cultures—the scientific and the humanistic. This schism is seen clearly in the early focus of STEM into a set of scientific-only disciplines.<sup>6</sup> Some very prominent scientists have long recognized the value of art and imagination in the process of generating scientific knowledge, however. Nobel laureate Jacobus Henricus van’t Hoff said he believed true scientific imagination is correlated with and supported by creative activity outside science.<sup>7</sup> Albert Einstein

**Figure 1: Relationship Model of the STEM Initiative**



agreed with this viewpoint, “I am enough of an artist to draw freely upon my imagination. After a certain high level of technical skill is achieved, science and art tend to coalesce in esthetics, plasticity, and form. The greatest scientists are artists as well.”<sup>8</sup>

The STEM disciplines require artistic thinking to ensure that the final design appeals to the aesthetic sense of consumers in the products created for the commercial market. The American Association for the Advancement of Science has defined engineering as “the use of creativity and logic, based in mathematics and science, utilizing technology as a linking agent to create contributions to the world.”<sup>9</sup> Engineers apply a spectrum of activities in developing new products by conversion of imaginative concepts into dependable reality. These activities differ in the degree of rigor used when managing the work of the design team.

New products move from conceptual design to functional engineering, where the focus is on delivering consistent quality. The following sequential taxonomy, which recognizes the decreasing degree of coupling associated with free-form creative thinking, provides one way of characterizing these activities:

- *Creating.* This activity involves the act of producing new ideas, approaches, or actions without regard to practicality or implementation. Success is measured by the number of new ideas.
- *Inventing.* Here, the ideas that define a potentially practical, new device, composition, gadget, or process that did not exist previously are explored imaginatively. Inventions may be either derived from pre-existing works (evolutionary), or they may be conceived independently (revolutionary or radical breakthrough).
- *Innovating.* Ideas are applied in practice. This involves the process of both generating and applying creative ideas in some specific context—a new way of doing or producing something that is useful.
- *Engineering.* Designing and implementing useful features and functions at the lowest total cost (including the cost of failure) occurs during this activity.
- *Controlling.* The output of the process is managed in a way that produces consistent

products, ensuring the process operates reliably and predictably throughout its life cycle.

## STEAM: More Than the Addition of Art and Design

The foundation of STEAM can be traced to the Platonic dialogs where Socrates argued about the way beauty is related to goodness. STEAM concepts also were included in recommendations made by educator and philosopher John Dewey more than 100 years ago when he suggested integrating education across subjects and engaging students with real-world applications in order to increase their pragmatic knowledge. STEAM is a practical and holistic model that is rooted in economic need, ensuring more relevance with consumers’ experiences. Inclusion of artistic thinking in the education of scientists and engineers improves their ability to create relevant products and services. The resulting paradigm shift disrupts the structured, logical flow of the thinking processes that are encouraged by the traditional STEM disciplines. The need to extend the mental model of STEM to integrate the fields of art and design was addressed in a paper by Georgette Yakman who described STEAM as “science and technology interpreted through engineering and the arts, all based in mathematical elements.”<sup>10</sup>

In the commercial world, there are many fields where the line between art and engineering has been blurred for years. For instance, both architecture and industrial design require the knowledge of an engineer but are driven by aesthetics. With the onset of digital media, the commercial publishing and advertising worlds now require engineers to have art skills and artists to have engineering skills. This blending of engineering and the arts had been adopted by companies such as Apple and Disney (where design engineers are titled “imagineers”).<sup>11</sup> The term “imagineering” was popularized by Alcoa and then adopted by Disney to describe the skills required to design and build its theme parks.<sup>12</sup>

In the STEAM paradigm, the arts—especially the visual arts—reinforce engineering. Although, these two fields set out to make things for different reasons, they both apply many of the same techniques, strategies, and tools. In many arts classes, the STEM disciplines already are being taught as a means to attain professionalism

in the use of media. For instance, the physics of light, basic chemistry, and fundamentals of trigonometry are key learning areas in photography. In teaching computer graphics or game design, it is necessary to provide a foundation in mathematical thinking, geometry, and software programming. The inclusion of the arts in teaching STEM, therefore, does not minimize any aspect of the STEM disciplines; it makes them stronger, more engaging, and relevant to students.

The arts contribute to STEM education by exposing students to a different way of seeing the world. Students learn through different pedagogical modalities engaging their other interests. By applying the STEM disciplines, combined with real-world experience, students become more comfortable in both worlds. The integration of these disciplines is particularly apparent when designing new products.

### Moving Forward—The Growing Need for Integrated Thinking

The recent emphasis in engineering education advocating use of the STEAM model has its foundations in the modern thinking of many prominent academics. The sidebar contains a list of recommended books to enhance understanding of the STEAM concept.

The STEM initiative was not adopted rapidly, and problems were noted with its development during governmental reviews.<sup>13, 14</sup> Its momentum seems to be increasing, however. For instance, in 2005 a technology-driven informal “do-it-yourself” community arose, driven by newly released technology such as 3-D printing. Furthermore, the self-styled Maker Movement has merged with such mainstream engineering institutions as MIT’s Design Lab, Media Lab, and Hobby Shop, as well as the Stanford D-School.<sup>15, 16</sup> Since 2008, the Rhode Island School of Design has sponsored an effort to stimulate the transition of STEM to STEAM by the addition of “Art + Design.”<sup>17</sup>

Other organizations also have become involved in supporting a more cross-disciplinary approach to education improvement by embracing the STEAM concept, as shown by the examples below:

- Sesame Street is focusing its curriculum on STEAM, using creative arts to make STEM concepts more relevant to young children and fostering scientific and innovative thinking.<sup>18</sup>

### Recommended Books to Enhance Understanding of STEAM

1. James L. Adams, *The Care and Feeding of Ideas: A Guide to Encouraging Creativity*, Da Capo Press, 1986.
2. Henry Petroski, *To Engineer is Human: The Role of Failure in Successful Design*, Vintage Books, 1992.
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- A collaboration between Discovery Education and the i.am.angel Foundation recently launched an learning program, called “i.am.STEAM,” to encourage education in all of the STEAM disciplines.<sup>19</sup>
- EDUTOPIA is a foundation created by George Lucas to improve “the K–12 learning process by documenting, disseminating, and advocating innovative, replicable, and evidence-based strategies that prepare students to thrive in their future education, careers, and adult lives.”<sup>20</sup> This organization is increasing its efforts to advance a broader concept of design.

## Conclusion

The great gulf that once existed between engineering and art is becoming blurred to a thin line. Perhaps someday the distinction will become almost meaningless. To achieve this, the concept of STEAM must move from industry and higher education into the K–12 school system. Teachers must be trained in project-based learning and encouraged to collaborate across disciplines. Students need exposure to real-world problems and encouragement to apply their knowledge to explore multiple solutions. Industry needs to encourage and support these changes in schools’ curriculum. Otherwise, like so many past innovative educational programs, the STEAM emphasis may fail.

The original Ramaley concept for STEM education pursued innovation, but it fell short because artistic thinking was not included. STEAM doesn’t merely add art to STEM, it changes STEM’s focus from better test scores in the core STEM academic disciplines to better quality of inclusive thinking and from focus on the development of a larger, technically competent workforce to one that is also more innovative.

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# Transitioning STEM to STEAM: Reformation of Engineering Education

Andrew D. Watson and Gregory H. Watson

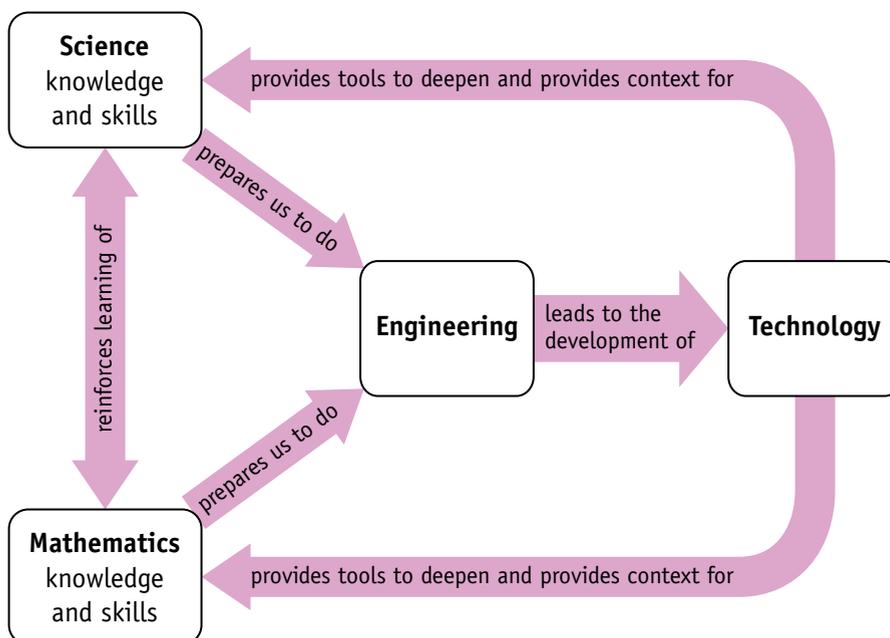
The acronym STEM was coined in 2001 by Judith A. Ramaley of the National Science Foundation. STEM now is used as a brand name to describe the integration of science, technology, engineering, and mathematics in educational curricula. Ramaley defined STEM as an educational inquiry where learning was placed in context and students solved real-world problems through creation of opportunities—a pursuit of innovation. Her concept provided an answer to the relatively poor performance of American students in standardized exams for mathematics and science as well as the need to bolster the declining enrollments in universities in the academic STEM fields. Emphasis has been placed on programs that stimulate these disciplines with half of the funding provided for K–12 educational programs and the other half for basic and advanced studies in colleges and universities.<sup>1</sup> To make sense of the integration of these fields into the STEM initiative, the Minneapolis Public School district uses a graphical interpretation of their relationship as shown in Figure 1.<sup>2, 3, 4</sup>

The need for a strong national program for development of STEM-related disciplines was generated by a series of studies by the National Science and Technology Council, National Science Foundation, the National Science Board, and the National Academies of Science and Engineering as well as the Institute of Medicine.<sup>5</sup> The educational programs promoted by STEM are innovative. STEM breaks the educational mold by incorporating the disciplines together in project-focused learning. For example, students may learn algebra and physics to build robots or geometry, physics, and biology to build a working greenhouse. These projects, however, tend to take a purely functional approach to the task. On occasion, however, the projects may incorporate design elements to combine function and form. This is where the necessity for considering “art” as a component of STEM occurs.

## Transition From STEM to STEAM

In his 1959 Rede Lecture, Charles P. Snow identified the split of Western society into two fundamental cultures—the scientific and the humanistic. This schism is seen clearly in the early focus of STEM into a set of scientific-only disciplines.<sup>6</sup> Some very prominent scientists have long recognized the value of art and imagination in the process of generating scientific knowledge, however. Nobel laureate Jacobus Henricus van’t Hoff said he believed true scientific imagination is correlated with and supported by creative activity outside science.<sup>7</sup> Albert Einstein

**Figure 1: Relationship Model of the STEM Initiative**



agreed with this viewpoint, “I am enough of an artist to draw freely upon my imagination. After a certain high level of technical skill is achieved, science and art tend to coalesce in esthetics, plasticity, and form. The greatest scientists are artists as well.”<sup>8</sup>

The STEM disciplines require artistic thinking to ensure that the final design appeals to the aesthetic sense of consumers in the products created for the commercial market. The American Association for the Advancement of Science has defined engineering as “the use of creativity and logic, based in mathematics and science, utilizing technology as a linking agent to create contributions to the world.”<sup>9</sup> Engineers apply a spectrum of activities in developing new products by conversion of imaginative concepts into dependable reality. These activities differ in the degree of rigor used when managing the work of the design team.

New products move from conceptual design to functional engineering, where the focus is on delivering consistent quality. The following sequential taxonomy, which recognizes the decreasing degree of coupling associated with free-form creative thinking, provides one way of characterizing these activities:

- *Creating.* This activity involves the act of producing new ideas, approaches, or actions without regard to practicality or implementation. Success is measured by the number of new ideas.
- *Inventing.* Here, the ideas that define a potentially practical, new device, composition, gadget, or process that did not exist previously are explored imaginatively. Inventions may be either derived from pre-existing works (evolutionary), or they may be conceived independently (revolutionary or radical breakthrough).
- *Innovating.* Ideas are applied in practice. This involves the process of both generating and applying creative ideas in some specific context—a new way of doing or producing something that is useful.
- *Engineering.* Designing and implementing useful features and functions at the lowest total cost (including the cost of failure) occurs during this activity.
- *Controlling.* The output of the process is managed in a way that produces consistent

products, ensuring the process operates reliably and predictably throughout its life cycle.

## STEAM: More Than the Addition of Art and Design

The foundation of STEAM can be traced to the Platonic dialogs where Socrates argued about the way beauty is related to goodness. STEAM concepts also were included in recommendations made by educator and philosopher John Dewey more than 100 years ago when he suggested integrating education across subjects and engaging students with real-world applications in order to increase their pragmatic knowledge. STEAM is a practical and holistic model that is rooted in economic need, ensuring more relevance with consumers’ experiences. Inclusion of artistic thinking in the education of scientists and engineers improves their ability to create relevant products and services. The resulting paradigm shift disrupts the structured, logical flow of the thinking processes that are encouraged by the traditional STEM disciplines. The need to extend the mental model of STEM to integrate the fields of art and design was addressed in a paper by Georgette Yakman who described STEAM as “science and technology interpreted through engineering and the arts, all based in mathematical elements.”<sup>10</sup>

In the commercial world, there are many fields where the line between art and engineering has been blurred for years. For instance, both architecture and industrial design require the knowledge of an engineer but are driven by aesthetics. With the onset of digital media, the commercial publishing and advertising worlds now require engineers to have art skills and artists to have engineering skills. This blending of engineering and the arts had been adopted by companies such as Apple and Disney (where design engineers are titled “imagineers”).<sup>11</sup> The term “imagineering” was popularized by Alcoa and then adopted by Disney to describe the skills required to design and build its theme parks.<sup>12</sup>

In the STEAM paradigm, the arts—especially the visual arts—reinforce engineering. Although, these two fields set out to make things for different reasons, they both apply many of the same techniques, strategies, and tools. In many arts classes, the STEM disciplines already are being taught as a means to attain professionalism

in the use of media. For instance, the physics of light, basic chemistry, and fundamentals of trigonometry are key learning areas in photography. In teaching computer graphics or game design, it is necessary to provide a foundation in mathematical thinking, geometry, and software programming. The inclusion of the arts in teaching STEM, therefore, does not minimize any aspect of the STEM disciplines; it makes them stronger, more engaging, and relevant to students.

The arts contribute to STEM education by exposing students to a different way of seeing the world. Students learn through different pedagogical modalities engaging their other interests. By applying the STEM disciplines, combined with real-world experience, students become more comfortable in both worlds. The integration of these disciplines is particularly apparent when designing new products.

### Moving Forward—The Growing Need for Integrated Thinking

The recent emphasis in engineering education advocating use of the STEAM model has its foundations in the modern thinking of many prominent academics. The sidebar contains a list of recommended books to enhance understanding of the STEAM concept.

The STEM initiative was not adopted rapidly, and problems were noted with its development during governmental reviews.<sup>13, 14</sup> Its momentum seems to be increasing, however. For instance, in 2005 a technology-driven informal “do-it-yourself” community arose, driven by newly released technology such as 3-D printing. Furthermore, the self-styled Maker Movement has merged with such mainstream engineering institutions as MIT’s Design Lab, Media Lab, and Hobby Shop, as well as the Stanford D-School.<sup>15, 16</sup> Since 2008, the Rhode Island School of Design has sponsored an effort to stimulate the transition of STEM to STEAM by the addition of “Art + Design.”<sup>17</sup>

Other organizations also have become involved in supporting a more cross-disciplinary approach to education improvement by embracing the STEAM concept, as shown by the examples below:

- Sesame Street is focusing its curriculum on STEAM, using creative arts to make STEM concepts more relevant to young children and fostering scientific and innovative thinking.<sup>18</sup>

### Recommended Books to Enhance Understanding of STEAM

1. James L. Adams, *The Care and Feeding of Ideas: A Guide to Encouraging Creativity*, Da Capo Press, 1986.
2. Henry Petroski, *To Engineer is Human: The Role of Failure in Successful Design*, Vintage Books, 1992.
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11. John Maeda, *The Laws of Simplicity: Design, Technology, Business, Life*, MIT Press, 2006.
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- A collaboration between Discovery Education and the i.am.angel Foundation recently launched an learning program, called “i.am.STEAM,” to encourage education in all of the STEAM disciplines.<sup>19</sup>
- EDUTOPIA is a foundation created by George Lucas to improve “the K–12 learning process by documenting, disseminating, and advocating innovative, replicable, and evidence-based strategies that prepare students to thrive in their future education, careers, and adult lives.”<sup>20</sup> This organization is increasing its efforts to advance a broader concept of design.

## Conclusion

The great gulf that once existed between engineering and art is becoming blurred to a thin line. Perhaps someday the distinction will become almost meaningless. To achieve this, the concept of STEAM must move from industry and higher education into the K–12 school system. Teachers must be trained in project-based learning and encouraged to collaborate across disciplines. Students need exposure to real-world problems and encouragement to apply their knowledge to explore multiple solutions. Industry needs to encourage and support these changes in schools’ curriculum. Otherwise, like so many past innovative educational programs, the STEAM emphasis may fail.

The original Ramaley concept for STEM education pursued innovation, but it fell short because artistic thinking was not included. STEAM doesn’t merely add art to STEM, it changes STEM’s focus from better test scores in the core STEM academic disciplines to better quality of inclusive thinking and from focus on the development of a larger, technically competent workforce to one that is also more innovative.

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As the definition of quality expands, the challenges faced by designers—with their inherent human capabilities and foibles—become more complex, requiring new strategic direction for the design process.

# The Strategic Importance of Sustainable Quality

## The Role of Human Endeavor Through Effective Design

Gregory H. Watson

Quality is not the outcome of accidental occurrence; it is the result of purposeful design. Quality must be incorporated into every aspect of the design of products or services to guarantee that market and customer needs are attained. Furthermore, the natural law of entropy predicts that initial designs will degrade over time, generating decreased performance and capability. So not only do systems need to be designed with intentional quality built into them, but they also must be maintained in their excellent condition to ensure their continuing capability. Inattention to these two parameters—design and maintenance of intentional quality—can create lost economic value and social waste. These latter two additional parameters have become associated with the modern concept of sustainable quality, moving quality from a tactical methodology associated with

specific products or services to a strategic approach that connects the impacts of those deliverables to society with the overall good of mankind both immediately and in the future.

### Changing Definition of Sustainable Quality

The meaning of the term quality can be elusive—particularly when it relates to every aspect of a product or service's acceptability as judged by customers. James L. Adams notes that "We evaluate the overall quality of a product with a mixture of logical thinking and emotional response."<sup>1</sup> In this broadest sense, quality not only includes the functionality of the design but also customers' experiences as they interact with it. The definition of quality, therefore, goes beyond the physical characteristics and incorporates the emotional and



psychological aspects of the customers' experiences as they interact with a product or service.

At its roots, therefore, quality includes those delivered characteristics that are intended to provide a conscientious transformation of customers' expectations into reality. The transformation process occurs when humans purposefully design quality into a product or service and ensure that the design is delivered correctly so customers receive the intended benefits and readily recognize its value. Furthermore, the original design capability that uniquely addresses customers' requirements must be maintained throughout repeated application by the supplier. This concept of quality, which has been the basis of the profession for many decades, emphasizes the fitness for use and ability to provide customers with a satisfying experience, which is inherent in the product or service design.

Quality, however, is not a static concept, and over time its definition has expanded to take on more strategic considerations for organizations and society at large. One driver of these changes is the linkage between quality and other concepts. For instance, quality is inextricably linked to the concept of value, which also has experienced changes in its definition over time. Originally, value reflected how well a product or service fulfilled its intended use. Now, perceptions of value include an economic or monetary component associated with a product or service's ability to provide customers with personal prosperity. Under these conditions, enduring quality is comingled with the accumulation of wealth, rather than focusing strictly on fitness for use, and this broader definition results in a far more strategic outcome.

As might be expected, however, this shift has not been accepted universally and has led to debate and the emergence of other considerations. Most recently, the definition of quality has taken on an even broader strategic framework, counterbalancing the emphasis on fitness for use and economic reward with the ability of quality systems to create a more harmonious and equitably sustainable society system or community. To attain the greatest common good, quality systems now also must incorporate the efficient, nonwasteful consumption of mankind's resources.

Clearly, the concept of sustainable quality changes as people's views of the world change. An understanding of the connectivity among the design and effective delivery of products and

services that meet specific customers' requirements, the economic component of value, and the need to have a more socially responsible long-term view have led to a greatly expanded view of the important role of quality.

### **Human Influence on the Attainment of Sustainable Quality**

One constant factor throughout the evolution of the development of quality, however, has been the role of humans in the process of designing for and delivering quality. Mankind always has had an internal compulsion to build and create products and services that fit customers' perceived needs. This endeavor uses available resources in a planned way to alter the environment and generate new, beneficial offerings.

Customers' perceived needs continually expand and become more complex, requiring greater variety and increasing the challenges faced by human designers. Fortunately, the natural ability of humans to be inventive makes it possible for product and service designs to deliver features that meet or exceed ever-changing market and customer demands. Despite the fact that quality now not only addresses the suitability of specific consumer deliverables but also their impacts of those on current and future results, it is important to recognize that the interaction between human creativity and design are still the keys to successfully attaining sustainable quality.

What exactly are the challenges currently faced by human designers in their pursuit of quality? As the role of quality has expanded to include bettering the current lives of people and the future promise to society, so has the complexity of issues that must be addressed in the development of sustainable quality systems. The likelihood of many interacting problems—disruptions in the effective and efficient provision of products/services that meet these broader requirements—increases. Resources are diverted when these complex problems occur, undermining the strategic pursuit of sustainable quality and creating a loss for society.

Russell Ackoff called these complex problems "messes" and wrote, "In an ideal state, as I conceive it, man would not be problem-free, but he would be capable of solving a continual flow of increasingly challenging problems."<sup>2</sup> Joseph A. Schumpeter recommended that accomplishing this objective rely on a "creative destruction" process, where an

innovative solution replaces the original process activities by implementing a redesign whose value is judged by the quality of its output and the results that it delivers to society.<sup>3</sup> This approach clearly relies on the ingenuity of humans to tackle and solve increasingly challenging messes in a way that addresses both current and future impacts.

That human ingenuity must be channeled properly by integrating it into work systems by designing “dynamic capabilities,” as described by David J. Teece.<sup>4</sup> Dynamic capabilities allow organizations to survive messes by redesigning work and coordinating resources into new directions that meet evolving challenges. Collaboration among workers from varied disciplines ensures achievement of solutions that meet or exceed the strategic sustainable quality goals. Establishing a work environment where dynamic capabilities can flourish not only requires a commitment by the executive level of the organization but also the presence of a well-executed project management system that oversees application of project resources and controls the scope of work to achieve the required performance schedule.

### Effect of Waste on Design for Sustainable Quality

Implicit in a product or service development system to generate dynamic capabilities needed to solve modern-day sustainable quality messes is the need to execute the design process in a way that minimizes waste. Waste is defined as any activity that adds cost or time but does not add value as judged from the customers’ perspective or any activity that increases risk to employees through imposition of hazardous working conditions. Japanese quality uses three terms to identify different forms of waste, as described below:<sup>5</sup>

- *Muri* arises from poor decision making in the design process. For example, *muri* occurs when poor decisions are made related to inappropriate application of technology, unfavorable contract terms, or establishment of specifications that cannot be achieved.
- *Mura* occurs when the sequence of work activities is integrated poorly. A common situation involves work load that has an unbalanced flow across a supply chain. The work activities of all participants are not streamlined, and interruptions occur that disturb scheduled activities and cause schedule delays.

- *Muda* arises from poorly implemented operations (e.g., waiting time, bad quality parts, etc.). This type of waste occurs when quality problems arise or tasks are not performed efficiently.

From an organization-wide perspective, these three forms of waste are interconnected and combine to make the messes addressed by human designers even more complex. Executive *muri* (waste associated with irrational decisions at the highest levels of the organization) creates systemic *mura* (waste in the flow of processes and systems) which, in turn, generates *muda* (waste in workplace activities). Workers cannot eliminate these complexities in the course of normal operations or by using simplistic problem-solving methodologies. More thorough and robust approaches are required to eliminate this type of complex *muda* waste.

As the broader implications of these sources of waste are considered, it becomes obvious that they can take a toll on every aspect of sustainable quality—not just the acceptability of a product or service’s ability to meet customers’ expectations but also the system’s ability to use resources effectively in generating the consumer deliverable without negative consequences. This scope exceeds traditional considerations of waste, clarifying that waste at any level ultimately affects society at large. Clearly then, the reduction of waste of all kinds must become an explicit consideration in the definition of quality for the design process—a requirement that ensures this expanded definition of sustainable quality is fulfilled.

This expectancy of the design process constitutes an enormous challenge because it intrinsically requires that the original design not only be capable of meeting current requirements with the nonwasteful utilization of resources, but it also assumes that the design will have forward flexibility—capabilities that will respond dynamically to an uncertain future. The demands on human designers, therefore, increase substantially under these circumstances.

Upon deeper consideration of these requirements a dichotomy arises. On the one hand, by its very nature, the provision of products and services requires the consumption of resources, which reduce the wealth of society over the long term. Genichi Taguchi observed that “just because products pass inspection does not mean that they are good.” Sustainable quality is “... fundamentally based on the perspective that all waste creates a loss

to society of its scarce resources—either materially or a loss of energy and enthusiasm of workers.”<sup>6</sup>

At the same time, however, demands for new products and services increases, and their creation generates benefits for society on a day-to-day basis. How then can the human designer satisfy these seemingly conflicting goals?



### Human Dynamics of Successful Design

Some interesting—and unexpected—issues emerge as human designers set out to address these issues in their work. Addressing these issues requires an introspective understanding of the designers’ role in both creating and solving these positive and negative outcomes. Furthermore, the approach used to bridge that gap successfully can require a very different mindset than is traditional.

### Personnel Accountability

To minimize the creation of waste and reduce the associated resource losses to society, a design team must evaluate the sources of waste and identify their root causes. All too often these investigations lead to the unpleasant recognition that assigning responsibility for the causes points back to the designers who now are trying to improve the process. The biggest problem is not in finding the waste; the challenge is to assign responsibility for the propagation of the waste, which must be done to establish causality and to implement corrective actions that will reduce impacts on subsequent results. This means that elimination of the mess—waste—is inherent in the original design.

In a world where assignment of blame carefully is avoided in root cause analysis, there can be great reluctance regarding acceptance of accountability for designing an original process that inherently generates waste. The differentiation between assigning blame and ownership of the designer’s role in promulgating a wasteful process can become blurry. In some circumstances, where the organizational culture deals harshly with perceived failures—it even can be risky.

Chris Argyris and Donald A. Schön comment, “The practitioner performs under stress; he must meet deadlines; he is constrained by time and money; and he faces a finite risk of failure that depends on the complexity of the situation and how far it departs from normal routine. To perform in these situations while aware of these [limiting] factors is to perform responsibly.”<sup>7</sup> This analysis differentiates between recognizing that the constraints surrounding the design process may undermine its ability to minimize social waste effectively and the acknowledgement that the designers need to accept their accountability—and be willing to undertake concerted efforts to find better ways to achieve sustainable quality.

### Importance of Failure

Humans naturally seek success, and that certainly is the case for design teams. When evaluating the relative merit of success and failure on the elimination of social waste and sustainable quality, however, these thoughts of Henry Petroski bear additional consideration. “Failures appear to be inevitable in the wake of prolonged success, which encourages lower margins of safety ... Failures, in turn, lead to greater safety margins and, hence new periods of success.” Petroski continues by observing that: “No one wants to learn by mistakes, but we cannot learn enough from successes to go beyond the state of the art.”<sup>8</sup> To rephrase Petroski’s observations—the recognition and study of failures breeds greater attention to finding better ways to achieve design quality.

### Pragmatic Application of Sustainable Quality

To achieve holistic performance in design requires a process that ensures achieving fitness for use from both the practical and experiential customer perspectives, contributing to the economic value equation, and minimizing negative impacts on society. Furthermore, these lofty objectives must be achieved in a way that maximizes the use of

human ingenuity while minimizing social waste—not just for the current time but for the largely unpredictable future. This outcome requires that leadership institute a strategic approach to sustainable quality that is based on new mindsets from the boardroom to the shop floor. Only if both the organization and its individual members accept this broader definition of quality and come to understand the ramifications of quality not just on markets and customers but also on society at large, can this challenge be met successfully.

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## What Does Quality Actually Mean?

Gregory H. Watson

The idea of quality is as old as civilization, and it has been one of the most consistent themes in the maturing of humanity's thinking processes. Fundamentally, quality is a term used to compare two conditions or situations—the actual current state and the desired state or a vision of what it ought to be. This certainly serves as the foundation for much of the work carried out through quality management systems and tools that are applied for the betterment of products and services.

As shown in the sidebar, however, quality has many definitions. It can be used as a noun to represent a particular attribute or as an adjective to describe another noun. Some of its uses are fairly absolute, but others are much more obscure and challenging to describe. Although comparisons are associated with all of these uses of the word quality, what is compared is not always obvious, and it may not be perceived uniformly among different observers making the comparisons.

### A Metaphysical Perspective of Quality

For instance, people can say that they “believe in quality.” In this case, quality can be viewed as an abstract or metaphysical entity where goodness represents a sense of what they believe ought to be present. Of course, what people mean when they make this claim is likely to vary substantially from person to person and be challenging to summarize into concrete characterizations. It seems reasonable to wonder if using the word quality in this way helps or hinders the

applicant of quality principles and practices, so let's explore this issue more deeply.

The value of metaphysical constructs often has been discounted. For instance, William K. Clifford, the noted mathematician and philosopher, contended that “it is wrong always, everywhere, and for anyone, to believe anything upon insufficient evidence.”<sup>2</sup> He opposed the concept of blind faith, the belief in things in spite of the lack of evidence for them. This assumption supports empiricism, the requirement that knowledge be obtained from

observable events and the principles of science, which require verification of tentative research hypotheses through objective observation.

William James countered this position when he argued for acceptance of beliefs without prior evidence. He claimed that the evidence of truth may be forthcoming through subsequent inquiry; in other words, reasonable premises can be accepted and validated later. Stating that “Wherever the option between losing truth and gaining it is not momentous, we can throw the chance of gaining truth away, and at any rate save ourselves from any chance of believing falsehood, by not making up our minds at all till objective evidence has come.”<sup>3</sup>

It is, therefore, the obligation of an investigator to avoid falsehood. The knowledge of truth occurs only after an inquiry into the nature of the matter; that investigation must be conducted in a way that avoids prejudice or

### Definitions of Quality

#### Noun

1. “An essential or distinctive characteristic, property, or attribute: the chemical qualities of alcohol.
2. “Character or nature, as belonging to or distinguishing a thing: the quality of a sound.
3. “Character with respect to fineness or grade of excellence: food of poor quality; silks of fine quality.
4. “High grade; superiority; excellence: wood grain of quality.
5. “A personality or character trait: kindness is one of her many good qualities.
6. “Native excellence or superiority.
7. “An accomplishment or attainment.

#### Adjective

8. “Of or having superior quality: quality paper.
9. “Producing or providing products or services of high quality or merit: a quality publisher.
10. “Of or occupying high social status: a quality family.
11. “Marked by a concentrated expenditure of involvement, concern, or commitment: Counselors are urging that working parents try to spend more quality time with their children.”<sup>1</sup>

preconditions. This approach allows the exploration of science to begin in wonder, stemming from a metaphysical perspective to proven discovery only following investigation; however, the belief that an inquiry is worthy of pursuit is sufficient to provide a working concept while validation is underway. This “will to believe” is the starting point for all scientific hypotheses.

### Justifying Beliefs

All people have personal moral codes or sets of beliefs that guide their thinking and behaviors. This “gestalt” or “world view” combines the many unique perspectives that are a product of their personal life journeys: tribal cultures, religious experiences, educations, and personal development. This complexity of mental and emotional stimulants establishes a framework that they use to make judgments about the truthfulness of propositions that are the subject of inquiry or consideration.

The essays of Clifford and James form boundary conditions that have been used to identify a spectrum of arguments which are described as “justified true belief.” This approach expresses three levels or alternative ways in which people validate their beliefs.

- *Belief*. This level reflects the primitive thinking processes of humanity, which often is referred to as blind faith. Individuals hold beliefs without any rational or objective justification that can represent any type of hypothesis, ranging from a strictly personal view to a research hypothesis that serves as the basis for scientifically based inquiry. When beliefs at this level affect system performance, they should be subjected to validation before being operationalized in the real world. These beliefs frequently are justified by storytelling and the use of anecdotes; however, one must remember that the plural of anecdote is not data; anecdotes are insufficient for making any claims to establish universal truth. I refer to this level as “Theory O,” the theory opinion.
- *Justified belief*. This level of belief was proposed originally by Aristotle in his essays on logic. His argument provided the intellectual foundation for all subsequent scientific belief and defined a system for conducting human inquiry, which for many centuries was considered as a complete and comprehensive definition of logic<sup>4</sup> until Francis Bacon challenged those assumptions after observing changes in scientific discovery.

“Although Aristotle provided specific axioms for every scientific discipline, what Bacon found lacking in the Greek philosopher’s work was a master principle or general theory of science, which could be applied to all branches of natural history and philosophy.”<sup>5</sup> Justified belief is based on rationally defined premises or logical arguments. They are not required to align with any external reality as long as their logic meets tests of consistency and completeness. All arguments proposed for validity by justified belief, however, are subject to physical confirmation through the observation of what Alfred North Whitehead called “actual entities” in the physical world.<sup>5</sup>

- *Justified true belief*. When logical premises or hypotheses have been investigated in the physical world through empirical observations, this level is attained, becoming the foundation for scientific knowledge. Confirmation subsequently establishes the level of probability to which theory is validated by practice and real-world experiments. Up to this point, beliefs are propositional but not scientific. When the preponderance of the evidence points to the factual nature of a belief at a sufficiently high probability level that demonstrates the investigation findings did not occur by random chance, then the hypothesis can be accepted as scientific knowledge. Settled science is achieved when these findings can be independently verified by replications of the experimental observations by multiple investigators who arrive at the same conclusion.

### Applications of These Thoughts

How then does this discussion on the difference between metaphysical definitions and scientific knowledge lead to the journey to achieve quality? I believe that it generates three very specific approaches to consider, as follows:

- For those who are swayed by the passionate expression of idealistic descriptions of quality, which are quite effective in generating a compelling rationale for adoption and change, it reminds people that inspiration is not sufficient for supporting process changes that involve risk to customers, the organization, community, or other stakeholders. Their inspiration, however, should be used to drive subsequent inquiry and formal investigation.

- On the other hand, for those who are shackled to the need for absolute proof before change can occur, it suggests that a more adaptive approach may be worthwhile. By leveraging the beliefs of people, much can be accomplished on the road to validation. People become more engaged in the organization's success when they see that their beliefs are accepted as reasonable and that an impartial effort is being made to evaluate and potentially substantiate their premises. This can provide a valuable foundation for managing change.
- Finally, it provides a process for encouraging new thinking and moving toward operational improvements. There is much discussion these days about innovation and creativity. Although clearly important, they only can be employed effectively and without excess risk when they are transformed from premises to scientific knowledge.

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## How Do Beliefs Become Profound Knowledge?

Gregory H. Watson

In the January issue, the definition of quality was discussed from a metaphysical or abstract perspective, based on people’s beliefs of goodness and how that approach affects the application of quality principles and practices. People substantiate their beliefs by using a three-level approach which begins with beliefs that have no objective justifications, proceeds to justified belief that is based on logical arguments, and ultimately are verified as justified true belief through physical confirmation of observations taken under a full range of uncontrolled situations. This issue explores the transformation of beliefs to proven constructs that provide profound knowledge.

### Beliefs and Statistics

Interestingly, probability theory, as proposed by Leonard J. Savage, identified statistical approaches for interpreting those three levels of belief in making judgments.<sup>1</sup> Absolute truth is identified as a scientific law that is subject to confirmation by objective verification. Even then, however, beliefs classified as absolute truth actually never can be considered absolute because there is the potential that they will be disproven in the future. They can, however, be accepted as “settled knowledge” or “profound knowledge,” indicating validation at very high levels of probability based on a set of reasonable assumptions and the ability to observe the events upon which their conclusions were confirmed.

Perception in judgment, therefore, is always a matter of the degree to which a belief aligns with our personal criteria for goodness and to the probability associated with observations and confirmation of the facts. Savage proposed the following three levels of probability that work in parallel to the three levels of belief and are related to the quality of observation:<sup>1</sup>

- *Personal probability*—This level can be described as truth that is referenced relative-to-me, the individual who is formulating the judgment. Such subjective estimates of a proposition’s truthfulness are based simply upon the believer’s feelings. Based on this criterion, blind faith

would indicate 100 percent certainty in a proposition’s veracity, supporting the decision that no alternative proposition would be considered as appropriate for an inquiry. This is the state of belief Eric Hoffer described as that of a “fanatic” who is consumed by a mass movement.<sup>2</sup> This basis for a probabilistic judgment corresponds to the belief level described in the January installment of “Quality Thoughts: What Does Quality Actually Mean?” as shown in Table 1.

**Table 1: Comparison of Belief- and Probability-Based Systems**

Savage’s Probability-Based System	Clifford and James’ Justified True Belief System
Personal probability	Belief
Objective probability	Justified belief
Scientific probability	Justified true belief

- *Objective probability*—Logical calculations based on frequency distributions derived from observed events serve as the foundation for this level. Truth is established by the preponderance of the evidence based on counts from the frequency distribution. At this level, truth will be only as valid as the ability to notice, observe, and measure supporting objective evidence. This approach requires the ability to identify and separate the rational subgroups that distinguish the distinct categories used to classify the actual entity observed. Operational definitions must be accepted by all observers and measurements calibrated to ensure that subjective judgment does not enter into the process of detection and observation. This level of Savage’s system aligns with the justified belief level.
- *Scientific probability*—Deterministic analyses serve as the basis for this level. They use the principles of scientific experiments to establish causality through carefully controlled trials and investigations that verify and validate experimental results. In his seminal book Nobel Laureate Percy W. Bridgeman claimed “A situation like this merely

means that those details which determine the future in terms of the past may be so deep in the structure that at present we have no immediate experimental knowledge of them, and we may for the present be compelled to give a treatment from the statistical point of view based on considerations of probability."<sup>3</sup> Justified true belief can be associated with this probability level.

### Beliefs and Control

Bridgeman's quote is also used in Walter A. Shewhart's foundational book that set the stage for many of the process control methods in use today. Although the book's title focused on the economic control of quality in manufactured product, it is clear to me that it goes well beyond that topic, presenting a thorough consideration regarding the theory of control. Shewhart said, "The relationship which the theory of control bears to exact science ..." has "... six stages in the development of better ways and means of making use of past experience."<sup>4</sup>

The first three stages that Shewhart associated with control correspond directly with the three levels in belief- and probability-based systems. The final three stages, however, extend this thinking into a mature theory that is scientifically useful. These six stages are listed below, and they indicate a clear progression that aligns well with the other two systems, as shown in Table 2:

- Belief that the future cannot be predicted in terms of the past.
- Belief that the future is pre-ordained.
- Insufficient use of past experience in the sense that experiences are not systematized into laws.
- Control within probability limits.
- Maximum control.
- Knowledge of all laws of nature (exact science).<sup>4</sup>

Shewhart developed the statistical quality control chart to enable the fourth stage of control. Later, engineers created automated data capture and analysis programs with adaptive feedback loops for process control to enable the fifth stage. Pursuit of profound knowledge is accomplished when the sixth stage of control has been demonstrated.

### Beliefs and Profound Knowledge

So, what is profound knowledge? W. Edwards Deming devoted much of his career to developing a system of profound knowledge that used statistical knowledge about process performance as the basis for critical thinking and decision making. He proposed the following four dimensions as the essential components of this system:<sup>5</sup>

- *Appreciation for a system*—Understanding the system in which work is done and decisions are made (process management).
- *Knowledge about variation*—Knowledge of system operation comes from a study of performance variation; improvement requires control of the sources of variation (statistical thinking).
- *Theory of knowledge*—Knowledge comes by observing work, defining a theory, testing, and confirming it (measurement system).
- *Psychology*—Human behavior must be understood, motivated, and coordinated to achieve results (collaborative culture).<sup>5</sup>

The connection between Shewhart and Deming's work is apparent, but the research and concepts of other noteworthy contributors to the quality field have also influenced the discussion of profound knowledge. This subject and its influence on leadership and strategy development will be considered in the next issue.

*(Continued on page 38)*

**Table 2: Comparison of Belief-, Probability-, and Control-Based Systems**

Shewhart's Control-Based System	Savage's Probability-Based System	Clifford and James' Justified True Belief System
Belief that the future cannot be predicted in terms of the past	Personal probability	Belief
Belief that the future is pre-ordained		
Insufficient use of past experience in the sense that experiences are not systematized into laws		
Control within probability limits	Objective probability	Justified belief
Maximum control	Scientific probability	Justified true belief
Exact science		

(Continued from page 33)

### Applications of These Thoughts

How then does this discussion on profound knowledge help achieve quality? I believe that it generates three questions to consider before making a decision that will affect customer or employee satisfaction and loyalty, process operation, and/or organizational success, as follows:

- What is the basis for the alternatives under consideration for this decision? Personal experiences and associated beliefs? Conclusions based on observations? Analysis of historical data? Designed experiments that investigate potential variables affecting the process?
- How should risk analysis be incorporated into the process of determining how to make decisions (what level of probability/control is necessary)? Cost-benefit analysis? Time pressures? Human factors?
- How can these levels be used to assess the efficacy of existing processes and determine the need for improvement?

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## The Impact of Profound Knowledge on Leadership and Strategy

Gregory H. Watson

In the last two issues, the definition of quality has been explored, beginning with its abstract perspective, based on people's beliefs of goodness. From that initial individual perspective, objective justifications reflecting probability theory are used for confirmation, considering a full range of uncontrolled situations to ensure their robust applicability. This foundation connects to Shewhart's six progressive stages for process control. The final stage, "knowledge of all laws of nature (exact science)"<sup>1</sup> supports the pursuit of profound knowledge, which Deming advocated as using statistical knowledge about process performance as the basis for critical thinking and decision making.<sup>2</sup>

Deming identified four dimensions as the essential components in a system of profound knowledge, which is summarized below:

- *Appreciation for a system*—Understanding the system in which work is done and decisions are made (process management).
- *Knowledge about variation*—Knowledge of system operation comes from a study of performance variation; improvement requires control of the sources of variation (statistical thinking).
- *Theory of knowledge*—Knowledge comes by observing work, defining a theory, testing, and confirming it (measurement system).
- *Psychology*—Human behavior must be understood, motivated and coordinated to achieve results (collaborative culture).

Since Shewhart and Deming began this discussion, many other researchers have explored these concepts and their influence not only on the quality field but also on leadership and strategy development. Let's delve more deeply into how profound knowledge affects modern organizations.

### Continual Improvement vs. Breakthrough

In order to understand the linkages among the dimensions of profound knowledge, leadership, and strategy development, we first must differentiate

between continuous and breakthrough change. In the former case, incremental improvements impact the associated customers, process owners and operators, and key stakeholders. The scope of these changes is relatively small, and the number of people affected by the improvements tends to be quite limited, too. Although change management efforts are required, the approaches used are generally straightforward and can be implemented quickly.

From a problem-solving and statistical basis, the efforts connected to incremental change address the variation associated with special or assignable causes. The root causes of these are identified and appropriate solutions for eliminating (or at least dramatically reducing) them are implemented. The process's overall variation decreases, and its outputs become more stable and better able to meet customer expectations regularly.

On the other hand, breakthrough tends to involve a far greater magnitude of change, impact more people, and require more complex change management approaches. It is associated with innovation and improvements that have a larger scope and significantly greater results. They often involve the commitment of resources (investments in infrastructure, equipment, or software, as well as the development of people). Breakthrough, therefore, often affects the social structure and/or culture of the organization, which can necessitate changing organizational values, interpersonal and leadership styles, and other aspects of work life that are more challenging to describe concretely.

Breakthrough requires a noticeably different improvement process. Instead of concentrating on special causes, the focus shifts to the inherent causes of common variation. These usually involve design shortcomings that have been accepted as unavoidable or too complex to resolve. Deming observed: "once you reach statistical process control" (removal of all special cause variation so that only common causes of variation remain in the process) then "the difficult problem commences—improve the system."<sup>3</sup>

Dorian Shainin called these latent variables “red Xs.” He noted that their impact on process performance is not discernable by traditional statistical analysis and estimation. This type of variation is confounded with the noise in the system and the residual effects that are not explained by the statistical analytical model; therefore, the associated source is not identifiable using the same problem-solving approaches.<sup>4</sup> These unknown factors are determined by examining the premises that were adopted during the system’s design phase and challenging those assumptions through testing of innovative solutions that transcend the accepted beliefs.

Clearly, this type of transformative improvement shifts the platform that leaders use for critical thinking and decision making. For an organization to be sustainable, it must not only adopt continual improvement practices but also develop strategies that require breakthrough change. Historical perspectives must be set aside as no longer valid, and they must be replaced with a deeper understanding of the new direction that needs to be followed. So, profound knowledge is a prerequisite for transformative change.

Figure 1 illustrates how the limitations of continual improvement of results for a system require development of profound knowledge to structure an innovation project that can push performance beyond the system’s inherent limitations once it has stabilized.<sup>5</sup> Continual improvement makes incremental change by fixing one problem or resolving one performance issue at a time. This approach is able to increase performance to the level of design

limitations and maximize to the point that further gains require changes in the infrastructure or design of the process itself. In other words, after the process has maximized the gains in its current configuration to achieve a state of control, a breakthrough is required to drive performance beyond this limit.<sup>6</sup> Breakthrough performance is achieved based on gaining profound knowledge about the drivers of common cause variation, which transforms the system to achieve higher levels of capability.

### Profane vs. Profound Knowledge

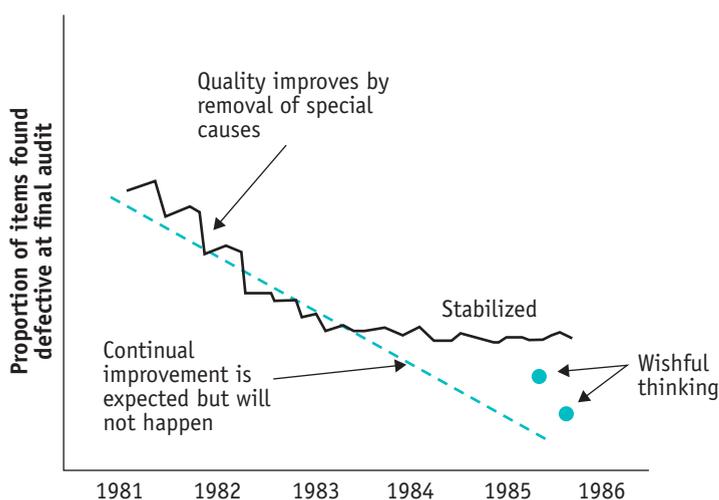
Let’s consider the typical design methodology that generates inherent or common cause variation. With the best of intentions, the designers set out to develop a product/service and process for providing it that will meet customers’ expectations. Along the way, some factors that increase the variation of the output are ignored—either intentionally because they are presumed to be uncontrollable or unwillingly because they are not recognized. Ultimately, the unclarified effects of these factors are incorporated into the system’s inherent variation. They are perceived as unchangeable and/or unmanageable.

Herbert I. Weisberg describes this willful ignorance as a “mismeasure of uncertainty,” which is based on what will happen “on the average” and is a qualifying characteristic of the state of learning that will be identified here as “profane knowledge” in juxtaposition to Deming’s concept of profound knowledge.<sup>7</sup> The individual in this state either exhibits a condition of unconscious incompetence or conscious incompetence, according to Martin M.

Broadwell.<sup>8</sup> This mental model regarding the system’s operation is accepted widely and often serves as the basis for decision making. Daniel Kahneman compares such emotionally driven thinking to logically driven thinking.<sup>9</sup> In the course of time, the premises based on profane knowledge develop a life of their own—with the anecdotal tales of their merit and managerial excuses describing why they cannot or should not be challenged taking the place of its opposite form of logically based critical thinking.

Profound knowledge contrasts with this approach by establishing its understanding of the system on a different

**Figure 1: Limitations of the Continual Improvement Approach**



kind of knowledge—factually proven characteristics of the system as determined by scientific evaluation. This is the essential nature of profound knowledge. If the leaders devote time and effort to reviewing factor analyses, they become consciously competent, or if prior learnings have been incorporated into the system's standard operations, the leaders may have integrated the relationships so thoroughly that a state of unconscious competence exists—an automatic, rational mindset for decision making. Conscious competence and unconscious competence are the other two components of Broadwell's framework.<sup>8</sup>

### Summary

When leaders rely on profound knowledge, rather than profane knowledge, their initial, emotionally driven responses are brought into alignment with verified, rational logic.<sup>8</sup> This improves their ability to lead transformational change and foster innovation. Whereas Deming's original thinking regarding profound knowledge was focused primarily on eliminating special or assignable cause variation, the leaders of modern organizations are faced with the need to ensure that inherent or common cause variation at the system level also is improved. In the next issue, we will show how this broader view provides a more effective and sustainable approach.

### Applications of These Thoughts

How then does this discussion help achieve quality? The following questions can be used to evaluate your current personal and organizational approaches:

- What improvement approaches are used regularly in your organization? What is the ratio of continual improvement to breakthrough projects? How successful has your organization been at investing the time, effort, and other resources necessary to reduce inherent variation? What is your organization doing to ensure that new process/systems are designed in the way that explores the sources of inherent or common cause variation and reduces it before the process/system is implemented?
- How can a leader determine if he/she is relying on profane or profound knowledge when making decisions? What approaches can be implemented across an organization—and particularly at the leadership level—to ensure that decisions are based primarily on profound knowledge and scientific, rational verification of critical factors that affect the outputs and outcomes?

- What actions can leaders take to identify the systems that are undermined by excessive inherent or common cause variation? How can quality professionals show the value of these more intensive improvement efforts to leaders and gain their support? How can leaders build commitment for tackling the changes necessary to address this type of variation and set aside long-perceived notions (profane knowledge)?

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## The Challenge in Organizing Business as a System

Gregory H. Watson

One of the principles in managing for quality is to distinguish between the Big Q and little q aspects of the quality management system (QMS). This is important because many executives do not feel that they have any responsibility for quality as it deals with the gemba or workplace as opposed to their role as executive suite members, future shapers, and decision makers. The reality of contemporary work life, however, is that there are, in fact, two distinct gemba—one that reflects the working world of the little q QMS while the other gemba addresses the quality aspects of the Big Q work environment. For simplicity I will refer to them as Gemba 1 for the working world that defines the little q system and Gemba 2 for the working world that defines the Big Q system. Let's consider the challenges that management confronts with each of these two gemba and how cooperation across these gemba should be facilitated.

In Gemba 1, the workforce is engaged in its responsibility for disciplined work that is capable of delivering valuable outcomes for customers of the business system. In this gemba, we observe the tools and methods of lean management used to eliminate waste, loss, and inefficiency. There is a need for crisp and clear communication with suppliers—particularly regarding customers' quality issues that have been raised and the organization's approach to corrective and preventive action. Team-based problem solving focuses on fixing issues in the daily management system and making statistically sound investigations to identify opportunities for improvement. Gemba 1 often is documented in an ISO 9000 QMS that operates in a tangible world—the physical world of production processes and service engagements. It is important because this gemba delivers value-adding work, and it manages the flows of the organization that produce results. It is Gemba 1 that most often is associated with a traditional QMS. This gemba emphasizes the need for defect elimination and process mistake proofing to prevent defects associated with product

or service design flaws from infecting the customer with poor performance or a degraded experience.

On the other hand, a Gemba 2 quality system operates totally differently. While Gemba 1 focuses on measurements such as cycle time and defect elimination from products and services, the Gemba 2 system uses financial measurement to focus the organization on delivering value to shareholders and organizational owners. This system seeks to manage the resource flow of the organization and prohibit spending or investing too much in the business. It is intended to generate the maximum return on the invested (ROI) capital. In Gemba 2, improvement is measured in terms of financial return, and strategic decisions are made to identify projects that will increase return; resources are allocated to those projects that will generate the highest ROI by increasing the capability and capacity of the productive system that defines the Gemba 1 work environment. Ultimately, the purpose of Gemba 2 is to generate improvement in the common-cause dimension of the Gemba 1 work system.

How does this work in the real world? Strategic planning establishes a set of projects that will enhance the value of the organization's Gemba 1 working system. The Gemba 2 strategy process focuses improvement efforts and resources on driving change in the daily management system so that the ROI can be maximized.

To perform this work effectively, there must be collaboration between the two gemba, which requires aligned measurement systems. The time-based and quality-focused measures of Gemba 1 must be transformed into the financially structured measurement system of Gemba 2. The more down-to-earth workers involved with Gemba 1 monitor the tangible work and become concerned if its flow is diminished or if customers are not satisfied with the product/service they purchased. For Gemba 2, concerns are raised if the economic expectation of the owners is not met. The operation of these two gemba may be simplified into the characteristics shown in Table 1.

**Table 1: Quality Characteristics Associated With Gemba 1 and Gemba 2 Systems**

Quality Characteristic	Gemba 1 (Process Worker)	Gemba 2 (Process Owner)
Type of work	Tangible work	Intangible work
Measurement scale	Temporal	Monetary
Work emphasis	Physical	Financial
Work focus	Internal operations	External deliverables
Working style	Operational function	Executive function

Gemba 1 produces value through the operation of the daily management system; its QMS designs and develops procedures that ensure repetitive tasks deliver highly prized value to customers. Gemba 2 addresses financial management, and its QMS ensures that returns on capital (e.g., operating profit) are optimized.

If you want to test the reality of a Gemba 2-related QMS, just watch the intense expression on the face of the CEO when he/she is questioned about the quality of the organization’s financial indicators! Although executives may believe that the work of a Gemba 1 QMS should not be their duty, they cannot dodge the responsibility for operation of the finance-focused quality system, which reports on the output of the Gemba 1 fundamental QMS. The Gemba 1 system creates efficiency by improving the

workflow’s throughput and reducing transactional cost. The Gemba 2 system increases cooperation across the organization’s functional elements, ensuring that investments are minimized.

For an organization to operate holistically as an integrated system, the two gemba must function synergistically. The Gemba 1 world of productive systems must be integrated with the Gemba 2 world of finance. This enables a predictive capability for understanding the financial implications of the work improvement efforts. Strategic change management projects that are commissioned by Gemba 2 actually may deliver many times the value of the regular process work of Gemba 1.



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Challenges to well-being and success are affecting individuals, organizations, and society on a daily basis. By expanding the role of the quality professional, even seemingly insurmountable problems can be addressed more effectively and efficiently.

## QUALITY CONFRONTS GLOBAL CHALLENGES OF THE

# Coming Century

**Gregory H. Watson, Lars Sörqvist, Elizabeth M. Keim,  
and Narayanan (Ram) Ramanathan**

**I**n the early 1960s, the musical, “Stop the World! I Want to Get Off,” by Leslie Bricusse and Anthony Newley premiered. It told the thought-provoking story of an everyman character, Littlechap, and his journey through life in a circus-like world, as he faced and dealt with many challenges. Quality practitioners now are living in tumultuous times, and they

may be sharing a wish to escape from the current realities that are making it increasingly difficult to increase customer satisfaction and enhance customer experience through improved processes, products, services, and other outcomes. Throughout the past three decades, ASQ has conducted studies to investigate how global megatrends might impact the attainment of quality and improvement, as well as how people/organizations, nations, and even society might be positively affected by the application of quality principles and tools. Although many differing factors have emerged in association with that research, one thing has been consistently clear—change is inevitable, and the pace and breadth of change are increasing rapidly.

This article presents the perspectives of global quality thought leaders from North America, Europe, and Asia regarding the current state related to four of these megatrends and the challenges that they create for the quality community. Four trends are spotlighted, focusing on issues that warrant the attention of quality professionals across the world—digital diversity, business barriers, democratic dualism, and environmental explosion.

### **Digital Diversity**

One obvious megatrend involves the pace of technological change, which has exceeded our capacity to adapt to new options that are generated constantly. Although younger generations deal with technological change based on emotional and intuitive assessments, older generations tend to address it differently, relying on rational and reflective evaluations. This latter approach may appear to be “sloth-like” to younger people, and it may impede the ability to cope quickly with lifestyle shifts that are stimulated

by global connectivity and social media. People’s lives are becoming saturated with technoshifts, and this reality can create yearning for stability and freedom from the imperative to adapt or become fossilized. In the song “Digital Man” by the rock group Rush, there is a line that sums up this human situation—“He’s adept at adaptation because ... constant change is here to stay.”

In the quality field, continual improvement is essential for managing the challenges associated with process and performance degradation that are natural consequences of entropy. What can quality professionals do to ensure that they are coping effectively with digitization and technological change? How can they manage the diversity of constantly occurring technoshifts more efficiently?

During the 20<sup>th</sup> century, individuals and organizations experienced the inventions of radios, television, and computers, as well as the beginning of the “Age of the Internet.” Digital transformation expanded and technology now rules the workplace and everyday life. For instance, the use of sensors as well as dependence on data and computations are ubiquitous. These days, data can be gathered by satellite, camera, and a wide variety of other mechanisms, making it easy to almost instantaneously share data globally. Younger generations are comfortable communicating in many different environments, including social networks that foster real-time idea exchange. Digital information is transferred seamlessly from laptop to mobile phone to television to gaming platform, providing incredibly diverse ways of accessing and interacting with data.

What seemed to be the creative notions of science fiction writers 50 years ago, are now realities that have changed the landscape of quality

and how its concepts and tools can be applied. Reliance on technology and digitalization not only is accepted but also has become a necessity. These days a “killer app” or some “breakthrough technology” is much more likely to gain attention than a historical novel or a live debate. News reports are delivered in segments that last less than two minutes because attention spans have declined substantially due to constant digital stimulation. Quality of life is subtly shifting from a measurement standard that is based on human experience to one associated with technological engagement. The human aspect of quality needs to be returned to a dominant position in the measurement of what constitutes a successful life. Restoring this element to its rightful focus will require quality professionals to emphasize cooperative engagement, involvement, and participation in order to foster human collaboration and generate social breakthroughs that lead to an equitable society for humanity. Technology must serve mankind, not the other way around.

In the digital age, quality professionals must seek digital diversity. This should not involve proliferation of emerging technologies, but instead, focus on the integration of technology into the human sphere where quality of life is assured for all through enriched consumer experiences that support pursuit of successful and enjoyable lives.

### **Business Barriers**

Individual responsibilities can be quite disparate depending on the size of the organization; smaller organizations often expect workers to handle a broader scope of assignments and tackle more projects than their peers in larger organizations. This reality is highlighted in the lyrics to the theme song from the recent revival of the Broadway musical, “How to Succeed in Business Without Really Trying,” based on the book by Shepherd Mead. It humorously suggests, “How to choose the right company before applying for a job? Make sure you have chosen the right company. It is essential that the company be a big one. It should be at least big enough so that nobody knows exactly what anyone else is doing.”

There were 125 million micro, small, and medium enterprises (MSME) in the 132 international economies that were tracked in a country indicators study published in 2010, and 89 million of them were located in emerging economies. Those organizations employed more than one-third of the global labor force.<sup>1</sup> MSMEs face

barriers to development and growth that do not exist for their larger counterparts, multinational corporations (MNC). This challenge arises primarily due to the comparatively smaller scale of their enterprises. It is as if the world is divided into a dualistic competitive business environment, where MSMEs are contrasted with MNCs. In the commercial world, the advantage goes to the MNCs, which have the resources and political astuteness to set the global agendas and/or rules by which competition generally occurs.

Essentially, smaller organizations are powerless to overcome this existing construct, so they must find ways to comply with it. For instance, to compete in international trade, the MSMEs often must follow procurement rules set by the MNCs. These established systems favor big business by creating generally insurmountable barriers for the MSMEs. This, in turn, limits the ability of the smaller organizations to trade freely and remain sustainably profitable.

With this issue so prevalent in the global marketplace, it is not surprising that quality requirements often also are formulated in a way that impedes MSMEs’ abilities to fulfill them. Some of these barriers occur because requirements related to independent product testing are too costly. Furthermore, complex certifications for assuring quality and safety may require resources beyond the means of MSMEs. In addition to globally mandated compliance standards, large multinational corporations often also levy their own specific rules to constrain the supply chain. Smaller organizations may not be capable of integrating these requirements into a holistic quality system for managing their processes and providing products/services.

Of course, continual improvement is essential for organizations of all sizes. The costs of poor quality are usually very substantial. Much waste exists in the processes of most organizations, and there are many improvement opportunities available for delivering higher value to customers. Clearly, improvement initiatives can enhance business results and competitiveness for smaller organizations and can help the global quality community shift control of the current inequities to a more even-handed approach that fosters success in organizations of all sizes.

### **Democratic Dualism**

“Warning lights are flashing down at quality control” according to the Dire Straits song “Industrial Disease.” Some people blame management for the

disease, and others insist the fault lies with employees, but everyone agrees the disease is endemic. Indeed, it seems that dualism always emerges when a conflict occurs that separates winners from losers and results in a zero-sum game.

This reality is obvious in all aspects of society and organizations. Conflicts disintegrate into dualistic democracies that generate the mental boundaries “us vs. them” (e.g., north vs. south, east vs. west, rich vs. poor, elites vs. masses, nationality vs. nationality, gender vs. gender, etc.). Introduced in Robert Axelrod’s book, *The Evolution of Cooperation*, a zero-sum game describes a situation where there is no common interest between the parties, so a game begins that divides into winners and losers. If there is a common interest, win-win or lose-lose, results can be achieved depending on the type of challenge that exists.<sup>2</sup> The quality challenge that the world faces in the future can be described by the questions, “How can a more harmonious world be built where all parties gain an improved quality of life? How can the work of quality professionals ensure that there are sufficient social benefits for all mankind and not a logistically unbalanced distribution of them?”

At first it may seem that there never will be enough resources available to meet this lofty goal, but seemingly unattainable things can happen if creativity, innovation, and human ingenuity are applied to the challenges. This has been proven many times throughout history, where imaginative ideas later came to fruition. Indeed, quality practitioners routinely lead teams to solve problems that have plagued their organizations for decades and were believed to be unsolvable. Although the quality field traditionally has been assumed to focus strictly on organizational process, products, and services, and to rely on mathematical and engineering approaches, in recent years quality has incorporated innovation techniques into its tool kit and expanded its applications to much broader social issues.

For example, the healthcare sector is faced with a shortage of affordable and accessible care, and quality of not only patient safety and health outcomes but also operations have become increasingly important. Elimination of waste and errors in healthcare could be instrumental in addressing the inequities that currently exist across the world. The notion of building in quality and doing things

right the first time fits healthcare just as it does manufacturing and service organizations. Using improvement methods such as lean and Six Sigma to reduce waste and errors, simultaneously decreasing costs and increasing availability of professional services to diagnose and treat more people—particularly underserved populations—could be possible.

Certainly, there are also issues about the general availability of healthcare in specific areas of the world. Improvements in technology that provide greater functionality and accessibility are being used to reach patients in distant locations that cannot support traditional clinics, hospitals, and other facilities. For instance, healthcare professionals now use technology to conduct virtual consultations, robotic surgery driven from a distance, and 3-D printers to make medications and medical devices that can be available anywhere quickly and inexpensively. New technology also makes it possible for healthcare professionals who have different levels of training and experience to handle more complex issues; technology provides information and tools that increase their professional competencies.

Clearly, the combination of quality improvement methodologies and technology could have a profound effect on the challenge of democratic dualism in healthcare, but there are many other circumstances where those approaches could be used to achieve similar results, too. Here are a few examples.

- Education has similar issues with accessibility. Many qualified candidates for higher education and advanced workforce development are denied the opportunities because affordable options are not accessible to them locally or are too costly.
- Studies have indicated that a sufficient amount of food to feed all people a nutritiously suitable diet is attainable, but issues related to distribution systems stand in the way of meeting this basic human need.
- The need for clean drinking water exists across the globe, but a variety of issues make this resource a precious commodity that is unavailable to all people in all locations.
- Safe and affordable housing also are denied to many people. Homelessness rates are increasing—even in seemingly well-to-do regions.

Although quality practitioners generally focus their attention on the processes, products, and



services offered by their organizations, the time has come for the principles and techniques used in those situations to be applied more broadly to benefit society and mankind as a whole. Quality professionals are able to aid in changing the landscape of issues such as democratic dualism by applying their unique knowledge and skills.

### Environmental Explosion

Environmental change has emerged as a global issue recently, and there is increased recognition that quality approaches can help solve problems and establish reliable processes for ensuring a safe environment for future generations. Environmental activism is prevalent across the globe, and many songs lament the losses that have occurred in the past. For instance, Marvin Gaye wrote and sang, "... Mercy mercy me; ah things ain't what they used to be ...," and described a variety of harmful environmental impacts that exist today and need to be addressed.

Environmental issues now are important to organizations not only because of increasing governmental regulations and customer/stakeholder attention, but also because there is a greater understanding of how the environment is affected by

and affects the well-being of individuals, organizations, and society at large. Neglectful behaviors generate enormous risks in both the short and long terms; therefore, the knowledge and skills of quality practitioners need to include this critical issue in their efforts.

The concept of "causing no harm" is embedded in the definition of quality. It is inherent to the quality being measured by fitness for use, and Genichi Taguchi defined quality in terms of loss caused to society,<sup>3</sup> which clearly encompasses all aspects of life, including the environment. It seems, however, that almost every day there are news agencies reporting another incident of environmental abuse or devastation. Despite the increased emphasis on reducing organizations' environmental footprints, new products/services are introduced that cause environmental harm by wasting energy generated from precious fossil fuels, incorporating harmful ingredients, producing byproducts that can't be recycled or that damage land and/or water, and many other ill effects that can last for several generations into the future. These are societal problems that should be incorporated into quality efforts, not slotted into separate categories that receive far too little attention.

Clearly, the accepted definition of quality needs to be expanded so that leaders and all people understand that this field not only fulfills the needs of customers but also society. Quality professionals should steer discussions away from the question, “Who is to blame for this environmental issue?” Instead they should ask, “What is the root cause of this problem and how can it be eliminated?”

For example, consider the environmental issues related to global climatic warming. As with most complex or “wicked” problems, there is an ongoing debate regarding whether or not this is even a valid issue. On one side of the debate is a preponderance of supporting facts and data developed by the scientific community. On the other side are anecdotal—and often emotional claims—that debate the validity of the scientific research. The debate misdirects attention and impedes the use of quality principles and tools for solving the many root causes of the problem. This quandary poses a significant challenge for quality professionals, who could be leading initiatives to face this challenge in a positive manner.

The gift of quality is to determine problems, symptoms, and causes systematically—however shadowy they might be. Furthermore, the application of quality approaches increases the ability to design processes and products/services more effectively and efficiently with society being considered as the customer in this case. The paradigms associated with the quality field are characterized by a long-term orientation; respect for humanity; emphasis on a purpose that goes beyond self-interest; and regard for facts, data, and variation. The methods used by quality practitioners identify the most appropriate metrics and targets, involving all stakeholders at each stage of process development and implementation. Additionally, reduction of waste and undesirable byproducts are key considerations, and quality management approaches focus on getting all members of an organization to cooperate in the initiatives established to achieve objectives.

Quality management systems once were used to transform organizations in Japan and then the rest of the world. Now, they can help preserve the planet and improve the quality of life for all of society.

## Conclusion

The desire to return to a more nostalgic and carefree life is shared by many people in these hectic days that are filled with change and a largely ambiguous future. As Mary Hopkin sang, “Those were the days my friend. We thought they’d never end.”

Unfortunately, a wistful return to the past may not be possible in the modern world. The role of quality professionals must encompass new dimensions that include preserving the Earth and improving the everyday existence of humanity. Quality professionals have an obligation to apply what they have learned about the technical and human factors associated with this field in support of the continuing betterment of society at large.

In the 1937 precepts of Toyota Motor Company, the emphasis on employee service was not limited to the organization, but it also focused on the country.<sup>4</sup> Similarly, Kaoru Ishikawa reminded practitioners of their higher purpose—actively propagating quality knowledge (theory) and spreading activities (practice), writing “... that quality all over the world be improved, that cost be lowered, that productivity be increased, that raw materials and energy be saved, that peoples all over the world be happy, and that the world prosper and be peaceful.”<sup>5</sup>

Understanding of the mechanisms of quality improvement and management cannot stagnate, but they instead must advance into a higher state of profound knowledge, stimulated by technical advances and addressing the evolving global challenges of organizations, politics, and the environment. The key question is “Are members of the quality field accepting Ishikawa’s challenge so they can contribute to solving the problems that occur as the world changes?”

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## What Is the Theory of Profound Knowledge?

Gregory H. Watson

The first three installments of this series discussed how the principles and practices associated with quality are affected by the beliefs and thinking of individuals, organizations, and society. These articles are summarized below, and the original articles can be accessed through the link provided in the “More Online” section of this edition.

- “What Does Quality Actually Mean?”—The metaphysical or abstract definition of quality was explored, based on individuals’ perceptions of goodness. In other words, quality is equated with the degree of goodness or the absence of badness—a definition that has been in existence for thousands of years. Beliefs regarding the presence or absence of quality initially are founded on opinion, rather than objective justifications. Personal life journeys, tribal cultures, religious experiences, educations, and personal development shape these beliefs, which are stimulated by complex mental and emotional experiences that establish a framework each person uses to make judgments about the truthfulness of his/her accepted beliefs. Through time, however, that belief system is substantiated by the development of logical arguments and later to verified true belief through physical confirmation of observations taken under a full range of uncontrolled situations.
- “How Do Beliefs Become Profound Knowledge?”—The connection between this belief-based approach and probability theory demonstrated how statistical approaches can be used to interpret those three levels of belief in making judgments. Shewhart’s six progressive stages for process control also were addressed. The final stage, “knowledge of all laws of nature (exact science)”<sup>1</sup> supports the pursuit of profound knowledge, which Deming advocated as using statistical knowledge about process performance as the basis for critical thinking and decision making.<sup>2</sup>
- “What Is the Impact of Profound Knowledge on Leadership and Strategy?”—From those historical foundations, the four dimensions identified by Deming as being the essential components in a system of profound knowledge were

introduced—appreciation for a system, knowledge about variation, theory of knowledge, and psychology. In order to understand the linkages among the dimensions of profound knowledge, leadership, and strategy development, the third column differentiated between continual and breakthrough improvement. It also contrasted profane knowledge, which accepts common cause variation as being uncontrollable or unworthy of improvement efforts, with profound knowledge, which establishes an understanding of the system based on its factually proven characteristics that have been determined by scientific evaluation.

The last article concludes, “When leaders rely on profound knowledge, rather than profane knowledge, their initial emotionally driven responses are brought into alignment with verified, rational logic.<sup>3</sup> This improves their ability to lead transformational change and foster innovation. Whereas Deming’s original thinking regarding profound knowledge was focused primarily on the elimination of special or assignable cause variation, the leaders of modern organizations are faced with the need to ensure that inherent or common cause variation at the system level also is improved.”

### Purposeful Transformation

Now let’s explore how this broader view provides a more effective and sustainable approach. It extends the foundation presented in Deming’s “System of Profound Knowledge” to formulate a comprehensive scientific approach called the “Theory of Profound Knowledge.” The ultimate purpose of this approach is to facilitate strategic organizational change—the conscious restructuring of an organization’s purpose, policies, processes, infrastructure, and core competence to achieve either a desired future state or an increased level of operational control over its performance outcomes. This theory presumes that managers will make the appropriate decisions regarding organizational resources so that a common, systemic goal can be achieved through coordinated, shared actions. These purposefully planned decisions are intended to deliver increased capabilities that extend the organization’s resource

effectiveness and efficiency, which mutually benefits all stakeholders. In other words, applying the elements associated with the Theory of Profound Knowledge can be expected to attain far more transformative results for the organization than those associated with studies related to the variation of specific processes, as described in Deming's work. Essentially, this expanded theory encompasses the organization's overall performance, rather than focusing on its individual processes. This article discusses the elements that separate these approaches.

Deming's work clearly moved the effects associated with decisions based on profane knowledge to a broader platform, which challenged managers to accept that common cause variation in processes could be investigated and improved. So, the original beliefs associated with profane knowledge, which were based on supposition without verification, began to reflect statistical thinking that enhanced process capability. With the advent of this new Theory of Profound Knowledge, however, Deming's model now has become the platform for profane knowledge and is being replaced by the broader scope of system-based statistical thinking, the new description of profound knowledge. This shift does

not invalidate Deming's work; there still is much to learn from eliminating or substantially reducing the impact of special causes on specific processes. On the other hand, in this increasingly competitive, global marketplace, only managers who make decisions based on this new definition of profound knowledge can ensure organizations have the ability to attain sustainable success.

Table 1 compares the current states of profane and profound knowledge, based on 12 differentiating characteristics, as follows:

- *Degree of knowledge*—Although Deming's System of Profound Knowledge challenged that common cause process variation was inherent and not worthy of improvement efforts, the deeper investigations it stimulated considered only one process at a time. From a systems perspective, this represents a naïve understanding, which can be enhanced only through an enlightened approach that seeks to improve the overall system.
- *Explicitness of function*—Process-oriented improvements focus on changing the performance of specific outputs/outcomes, so their results are readily apparent. At the system level, however, the likelihood of concealed outputs/outcomes, such

**Table 1: Comparison of Current Characteristics of Profane and Profound Knowledge**

Characteristic category	Profane knowledge	Profound knowledge
Degree of knowledge	Provides only surface knowledge (naïve understanding)	Provides deep knowledge (enlightenment)
Explicitness of function	Describes manifest functionality of the organization	Describes latent functionality
Discovery mechanism	Determines conclusions through explicit discovery	Determines conclusions through tacit discovery
Predictive function	Bases predictions of future behavior on past behavior and the status quo	Bases predictions of future behavior on the assumption that change will continue to occur dynamically
Analytical model	Focuses on averages	Focuses on variation
Human considerations	Does not take human factors into account	Takes human nature into account
Data approach	Uses enumerative data as its basis	Uses analysis of factors as its basis
Propositional agreement	Promotes convergent thinking	Promotes divergent thinking
Methodological validation	Supported by tribal lore and relatively simplistic evaluations	Supported by comprehensive theories and evaluations that use robust statistical analyses
Decision criteria	Is based on common sense	Is based on uncommon logic
Decision mindset	Involves decisions based on subjective reflection and introspection	Involves decisions based on objective reflection and mindfulness
Speed of decision making	Relies on reactive/rapid decisions	Relies on logical, deliberate decisions

as interactions, becomes far more probable—and the potential benefit of those learnings far greater.

- *Discovery mechanism*—Traditional problem-solving methods that use statistical evaluations to verify root causes and test the efficacy of improvements involve very specific steps that move from identification of the issue that needs to be resolved through a structured analysis. Because of the complexity associated with the system level, this approach is not possible, so inferences must be made based on broader theories and then proven using more robust statistical methods.
- *Predictive function*—In this characterization, profane knowledge predicts future performance by assuming it will continue to involve similar factors behaving in similar ways—the status quo. On the other hand, profound knowledge assumes that the future is changing dynamically, so predictions of the future must take the probability of change into account.
- *Analytical model*—Although traditional process-improvement methodologies incorporate concerns regarding excessive variation, particularly through consideration of process capability into their protocols, their focus most often is aligned with analyzing and shifting averages. The overall impact of variation associated with different factors or interactions among factors, which can accumulate to have a serious impact on system performance, rarely are addressed.
- *Human considerations*—The improvement approaches that were developed based on Deming’s work are driven by technical considerations, largely ignoring human factors. Although the System of Profound Knowledge does include “psychology” as one of its dimensions, the challenge of quantifying human factors has long caused them to be set aside in most improvement projects—or at least treated superficially. The new theory, however, recognizes that these are essential drivers of system performance and accepts that more complex behavioral models are necessary in order to incorporate these areas into the improvement process.
- *Data approach*—The difference between enumerative and analytical studies is very important. It originally was described by Deming in a 1975 paper, where he defined an enumerative study as an analysis where action is based on a descriptive analysis of a population and an analytic study as an analysis where action is based on the causal system operating in a process during the

timeframe of the study.<sup>4</sup> Enumerative studies are weaker than analytic studies because they do not provide a basis for predicting future performance, and scientific problems are analytic in nature.

- *Propositional agreement*—When managers make decisions, their critical thinking skills become a key factor in determining the probability that a specific decision will succeed. Convergent thinking pulls diverse inputs together to find the least common denominator that unifies them. Divergent decisions incorporate the broad range of differing inputs into a unifying decision that adequately describes the comprehensive set; therefore, convergent decisions are not as robust as divergent decisions.
- *Methodological validation*—As described throughout this article, Deming definitely encouraged the use of statistics to determine process improvements. Many commonly practiced problem-solving methods, however, rely on tribal knowledge to define the boundaries for those investigations. This means that some factors may not be included in the studies. The new approach associated with the Theory of Profound Knowledge sets out to identify all potential factors and to incorporate them into the analytical protocol.
- *Decision criteria*—When the statistical analyses associated with typical problem-solving methods generate findings, managers mentally judge them based on personal experiences, observations, and other potentially biased and limiting views. This is not the case with profound knowledge where managers recognize that new understandings will emerge from the analyses and new ways of thinking about the system will be necessary.
- *Decision mindset*—This characteristic links to the previous discussion. Generally, managers use their judgment, which may be based on a flawed mindset, to determine the efficacy of proposed changes. When the Theory of Profound Knowledge is adopted, however, managers must open up their minds to accept new concepts that make future horizons attainable.
- *Speed of decision making*—It is obvious that the time required to make a decision is impacted by these two approaches. When the foundation for a decision is commonly accepted assumptions, it can be made quickly. Far more time for deliberation and collaborative debate is required to make a decision that will address the system’s performance successfully in changing conditions and be accepted by stakeholders.

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## Summary

Fundamentally, the Theory of Profound Knowledge addresses the scope of the results that are obtained from investigations, which expand substantially when a systems perspective is adopted. Of course, with that expanded scope also comes increased value to the organization. In the next issue, we will explore two systems-based approaches to decision making and how they relate to profane and profound knowledge.

## Applications of These Thoughts

How then does this discussion help the achievement of quality? The following questions can be used to evaluate your current personal and organizational approaches:

- Is your organization currently focusing on improving the performance of individual processes? How does it deal with competitive and environmental changes that impact the overall system?
- Does your organization develop strategic initiatives to address future requirements? Are those initiatives based on an extrapolation of existing premises? Are they based on statistically verified predictions? Do they appear to reflect leaders' existing mindsets and personal creativity more than robust models that take all the system factors into account?
- What can you do to foster adoption of the Theory of Profound Knowledge in your organization?

## More Online

To review the three previously published articles in this series, see their compiled editions at [www.asq.org/pub/jqp/](http://www.asq.org/pub/jqp/).

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## How Is Decision Making Affected by Organizational Roles?

Gregory H. Watson

In the April issue, we explored how the more broadly defined “Theory of Profound Knowledge” extends the foundation presented in Deming’s “System of Profound Knowledge” and provides an effective and sustainable approach for facilitating strategic organizational change—the conscious restructuring of an organization’s purpose, policies, processes, infrastructure, and core competence in order to achieve either a desired future state or an increased level of operational control over its performance outcomes.

This new theory presumes that managers will make the appropriate decisions regarding organizational resources so that a common, systemic goal can be achieved through coordinated, shared actions. These purposefully planned decisions are intended to deliver increased capabilities that extend the organization’s resource effectiveness and efficiency, which mutually benefits all stakeholders. In other words, applying the elements associated with the Theory of Profound Knowledge can be expected to attain far more transformative results for the organization than those associated with studies related to the variation of specific processes, as described in Deming’s work. Essentially, this expanded theory encompasses the organization’s overall performance, rather than focusing on its individual processes. The previous article included descriptions of 12 elements that separate these two approaches.

Fundamentally, the Theory of Profound Knowledge addresses the scope of the results obtained from investigations, which expand substantially when a systems perspective is adopted. Of course, with that expanded scope also comes increased value to the organization. In this issue, we explore two systems-based approaches to decision making and how they relate to profane and profound knowledge.

### Driving Organization-Wide Transformative Change

If an organization aspires to operate as “a system of systems,”<sup>1</sup> then all of its components must

be designed with their interactions in mind, not just the desired performance criteria of their individual system components. Emphasis related to future organizational design needs to focus on factors of interoperability, cross-functionality, portability, extendibility, reuse, and commonality, as is required in the development of software methods. Rapidly growing organizations need to develop future capability by reusing validated and verified existing systems that were previously optimized. This approach generates reliable future applications that effectively and efficiently address emerging technological advancements.

The key component of the future design of organizations for improved operability, therefore, evolves from a statistical understanding of performance. Transformative decisions that impact overall organizational performance are driven by understanding the interactions that occur when different considerations are combined to create a holistic perspective regarding strategic change initiatives. In other words, the organization’s overall performance can be changed substantially only when decisions are made that go well beyond the study and improvement of individual processes; they require a deep understanding of how all of the organization’s processes interact to generate a combined set of system-wide results. When that profound knowledge about the organization has been obtained, decisions can be made with greater insight and increased effectiveness and efficiency.

### Two Decision-Making Approaches

Recently, the Japanese word “gemba” has been used liberally to refer to the shop floor of an organization, where value is produced, and waste and losses are accumulated. Although there is not enough space available in this article to describe the etymology of this word, it is important to know that its actual usage infers a much deeper meaning. At this point, gemba can be considered a place where value can be created or destroyed; it is where

problems are visible and improvement ideas can be generated naturally. From an organizational perspective, gemba not only describes the place where an organization's process operators work, but it also summarizes any action or process for which the executive function is responsible.

The concept of gemba encourages leaders to investigate personally and see more clearly how to improve the resource effectiveness, efficiency, and economics of their organizations by focusing on the work done at the front line where value is produced. This makes it possible for leaders to understand the real issues that exist in their workplaces and provide proper assistance for streamlining work flows and eliminating the waste that exists while meeting customer needs. Most importantly, this description emphasizes what should be a routine action/expectation of the executive function in organizations. These skills make it possible for leaders to cast off over-reliance on summary data and filtered information that distorts the observations of the gemba, which migrate to them through the process of upward reporting. These leaders also gain profound knowledge regarding the way that processes actually work in their organizations. The unique value of an engaged executive in the gemba emerges from his/her ability to apply resources to affect the improvement of operational work flows, which is a responsibility that exceeds roles of frontline workers. In this way, an executive can cut through the dirty data that describes the messy processes and obtain enlightenment about what must be changed to improve results.

Ultimately, there are actually two distinct gemba situations operating in an organization. The first involves the workplace, and it is a tangible gemba that delivers value to customers through the productive work output of the organization's process activities in an operational sense. The second is associated with the executive function, and it represents an intangible gemba that delivers monetary value to shareholders through the way that effective, efficient, and economic processes create value from the work performed.

Gemba 1 manages the physical work an organization performs; it is the gemba of action. Gemba 2 manages the reflective work of the organization—the planning and organizing of work and improvement in the physical workplace. This is

the gemba of thought where action is planned and opportunities for improvement are identified and resourced. In fact, most organizations possess both types of gemba, which focus on two distinctly different customers. Gemba 1 is where the actual entity (whether a product or a service) is designed and delivered to the external customer in fulfillment of a proffered value proposition for the marketplace. Gemba 2 is where plans for the execution and improvement of Gemba 1 are conceived and outcomes are delivered as indicated by return on resource investments by stakeholders, such as financial investors and government authorities.

This division of organizational perspectives creates a two-sided way of observing the actual work conducted by an organization. The Gemba 2 perspective is top down, viewed through the lens of an external financial perspective and translated into monetary language. On the other hand, the Gemba 1 perspective is initiated at the bottom of the organization and moves upward, starting with the actual work performed to produce the value offered as a product or service, which is viewed through the physical lens of human activity.

### Summary

Fundamentally, sustainable organizations require that decisions are driven by consideration of both the Gemba 1 and Gemba 2 situations. The organization's daily management system needs to assess and appropriately improve the work processes that provide products/services to customers; however, transformative improvement of the organization as a whole can be achieved only when the myriad processes that exist are assessed and improved systemically. This is the role of executive decision makers who must gain a deep understanding of the interactions among the processes and adopt strategic initiatives based on a much broader view of the organization and its impact on stakeholders who influence its long-term viability.

### Applications of These Thoughts

How then does this discussion help the achievement of quality? The following questions can be used to evaluate personal and organizational approaches:

- Is your organization currently focusing primarily on improving the performance of individual processes? How are decisions made at this Gemba 1 level?

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- How often do your organization's executive leaders rely on compiled data from a variety of processes to establish their view of the organization-wide system?
- Do the executive leaders of your organization invest the time and effort required to go beyond summarized process data to probe deeply into and understand the interactions among processes that can provide a platform for transformative change?

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Investigating the thinking behind contemporary perspectives associated with quality

## How Can Thought and Action Be Combined to Improve Quality?

Gregory H. Watson

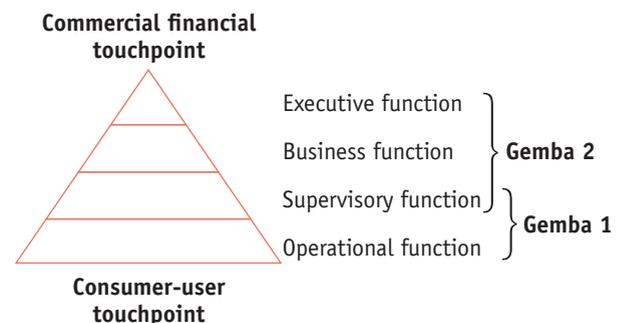
In previous issues, we considered how the concept of quality has moved from a metaphysical sense of goodness to a more structured and broader foundation based on justified beliefs and Deming's "System of Profound Knowledge," which stemmed from the writings and thoughts of Walter Shewhart. In current times, however, a more robust framework that integrates organization-wide strategic decisions with the daily management system that focuses on products, services, and processes is required to ensure sustainable success. In the July issue, the new "Theory of Profound Knowledge" was introduced. It facilitates the conscious restructuring of an organization's purpose, policies, processes, infrastructure, and core competence in order to achieve either a desired future state or an increased level of operational control over organizational performance outcomes. Two decision-making approaches, called Gemba 1 and Gemba 2, address workplace operations and executive functions, respectively. In this issue, Gemba 2, the additional facet of quality management incorporated into the new "Theory of Profound Knowledge, will be explored more deeply—particularly how it impacts Gemba 1.

### An Overview of Gemba 2

Gemba 2 delivers monetary value to shareholders by ensuring effective, efficient, and economic processes create value from the work that is performed. This is intangible when compared to Gemba 1, which focuses on shop-floor operations that produce value through the provision of products and services but also generate waste and losses that organizations need to address with structured improvement initiatives. On the other hand, Gemba 2 encourages leaders to think at a higher level, focusing on actions associated with planning and determining what opportunities for improvement will favor organizational results best. Gemba 2 generates cycles of improvement that change the Gemba 1 operations and increase return on resource investments for stakeholders. It is driven by an external financial perspective and its

results are reported in monetary language. This is a top-down approach that establishes transformational goals for the entire organization. Figure 1 illustrates how Gemba 1 and Gemba 2 are integrated, clearly showing that Gemba 2 provides the platform that supports all Gemba 1 activities, and Table 1 compares their quality characteristics. The information conveyed in this figure and table help to differentiate the two gemba and clarify why it is so important to understand how the executive decision-making process associated with Gemba 2 is so essential to organizational success.

Figure 1: The Two-Sided Gemba of Organizations



### The Reality of Gemba 2

Organization leaders are the process owners for Gemba 2 and are responsible for allocating resources and determining what improvement initiatives will be supported. Transformation occurs when projects that shift process performance or increase the capability of those processes are launched and supported to generate both continual improvement and innovation that lead to breakthrough results.

Note that there has been much debate concerning the terms continuous improvement and continual improvement, and they often are used interchangeably, which is not appropriate. Strictly speaking, continuous improvement represents activities that are unceasing or occur without interruption; activities of that type never stop, pause, or hesitate unless a crisis or notable interruption happens. In contrast, activities that occur intermittently—even if frequently—are



**Table 2: Characteristics of Organizational Operating Layers**

Characteristics	Operational Function–Gemba 1	Executive Function–Gemba 2
Value proposition	Appreciated by customers	Appreciated by investors
Improvement effort	Task-related activities	Supervisory activities
Primary measures	Time, defects, cost	Productivity, financial
Planning horizon	Daily, weekly, monthly	Quarterly, annually
Dominant entity	Tangible-concrete	Intangible-abstract
Improvement approach	Continuous improvement	Continual improvement
Method transparency	Visible to third party	Invisible to third party
Inquiry approach	Rational-empirical	Rational-phenomenological
Constructive focus	Internalities of process	Externalities in market
Solution approach	Factual inquiry	Policy advocacy
Quality concept	Quality strategy	Quality as strategy
Causal emphasis	Special cause	Common cause
Principal focus	Control	Breakthrough
Process emphasis	Do-Act	Plan-Check
Dominant waste	Muda-Mura	Muri-Mura
Decision initiative	Worker decisions	Manager decisions
Learning mode	Kinesthetic and oral	Oral and written

Gemba 1 and Gemba 2 processes are integrated into a single system flow that combines common sense derived from accepted precepts and experience with the uncommon sense of scientific inquiry. Both share responsibility for effective, efficient handoffs between the two layers, and their joint efforts transform organizational performance and capability, which generates better current results and the adaptability that is necessary to survive and succeed in a constantly changing world.

**Applications of These Thoughts**

How then does this discussion help the achievement of quality? The following questions can be used to evaluate personal and organizational approaches:

- How do the leaders of your organization make decisions at the Gemba 2 level? Do they solicit input from key stakeholders? Do they consider facts, data, and analysis when making decisions

related to quality strategies and goals? Do they determine the impacts their decisions make on the Gemba 1 level?

- Does your organization have a comprehensive quality strategy? Does it set out to build organization-wide capability and performance that will lead to sustainable success?
- How often do your organization’s executive leaders scan the environmental factors—both external and internal—that might indicate the need for revising the corporate quality strategy? Are those changes communicated in a way that shifts the organization’s focus systematically and rapidly while avoiding knee-jerk reactions and creation of resistance?

*Editor’s note: All figures and tables, as well as the concepts, presented in this article appeared in “The Theory and Practice of Profound Knowledge: An Inquiry Into Quality and Strategy Management” by Gregory H. Watson, which currently is in the process of being published by Oklahoma State University.*



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Investigating the thinking behind contemporary perspectives associated with quality

## How Does Scientific Inquiry Transform Historical Knowledge?

Gregory H. Watson

In previous issues, we considered how the concept of quality has progressed from a values-oriented definition to a more scientific approach. Deming's "System of Profound Knowledge," which stemmed from the writings and thoughts of Walter Shewhart, has been explored, along with some of the opportunities to make it more robust and up to date. In the past two issues, a framework which integrates organization-wide strategic decisions with the daily management system that focus on products, services, and processes has been described in detail, using the newly developed Gemba 1 and Gemba 2 construct. It's now time to consider how executive decisions are made and the way historical and current factors are considered when making those decisions.

### The Bayesian Moment

Bayes Theorem is the conceptual basis for considering conditional probability. It provides a framework for thinking about probability that transitions from historical performance to proposed beliefs. It is described mathematically as the "Probability of A (a future state) given the Probability of B (a prior state)."<sup>1</sup>

The Bayesian Moment or point of decision is a recently developed concept that can be used to describe the executive decision-making process that leads to strategic quality transformation. This mental model applies the scientific method to observations generated from previous data analyses that are illuminated by the system of profound knowledge. This approach produces insights that can be shaped into choices which describe potential future states and provide a foundation for transformational decisions.

### Application of the Bayesian Moment

The insight component is represented in the conditional future state that decision makers are considering. It recognizes the decision maker's psychological perspective and judgment. These conditional choices provide the potential for organizational transformation, and the Bayesian Moment clearly compares the status quo (the historical

performance) to the desired future state performance. The strategic decision then goes through a structured change-management process, and the organization realizes the opportunity to achieve its potential. It is important to note that this model considers customer experience and requires the decision maker to have a deep understanding of the many psychological factors that should be used to shape the conditional proposal.

During this Bayesian Moment the condition of profound knowledge is produced. This is driven by what the economist Frederick A. Hayek observed—knowledge is dynamic and is influenced by the social interactions among individuals and organizations.<sup>2</sup> Knowledge is built not only based on human relations in social situations, but it also is context-specific. The integrity and veracity of knowledge is based on its particular location in time and space, which defines its historical boundary. If the context is missing, then the data can only be informational (e.g., an answer to a question), but it does not represent enduring knowledge because it may be subject to revision based on a deeper understanding of its contextual meaning.<sup>3</sup> The profound knowledge used to construct the proposed future state decision-making option should represent predictions of future events or outcomes and should involve more than just a place or location. It needs to have a dynamic with respect to time. Fundamentally, general wisdom is more permanent than profound knowledge because it describes specific behavioral patterns of people, organizations, materials, etc. As knowledge increases in probability and veracity, however, it transitions to profound knowledge, incrementally increasing to higher levels of predictive capability and becoming more valuable for determining future plans and making decisions.

The executive decision-making process occurs within the Bayesian Moment. A scientific inquiry is conducted to transform historical knowledge of past performance into strategic decisions. Those decisions identify and initiate change projects and deliver predicted expectations for future

performance. The Bayesian Moment stimulates change that creates a future way of working, and that new approach possesses a high probability of success. It is very important, therefore, to understand clearly what generated the insights that led to profound knowledge. Understanding the decision maker's perspective of the organization and the factors that affect its performance is pre-requisite for accepting the transformational change associated with the Bayesian Moment.

## **An Example of the Bayesian Moment**

### **Current Situation**

Suppose that a mid-sized organization manufactured its products in the United States. Through the years, it has worked solely with suppliers from the United States and Canada. Its reputation and the high customer-satisfaction levels have generated a growing market share and increased revenue and profitability.

### **Observations and Insights**

On the surface, the business is performing at a high level, but its CEO and other executives recently observed some trends that have led to questions and concerns. A few of them are listed below:

- Many of the firm's loyal customers have expanded their operations globally. As these expansions have occurred, suppliers in other countries have been introduced. Despite the fact that these suppliers' products are adequate, they do not meet the same standards as the U.S. company. Unfortunately, however, shipping U.S.-made supplies to these other countries is prohibitive.
- The company has a long-standing U.S.-centric culture that is supported by policies which limit interactions with non-U.S. businesses. This culture not only is widely accepted by the workforce, but there is also a prevailing sense of negative sentiment when the U.S. government opens up trade opportunities for foreign businesses.
- The leaders feel that the company's daily management system is working quite well. Internal and external audits have verified the performance of the firm's ISO 9001-based quality management system. The leaders are confident that issues are identified and resolved effectively using proven continual improvement approaches, including the Lean Six Sigma methodology. There is a strong belief that the existing containment of the company's operations would be undermined if facilities were built outside of the United States,

non-U.S. suppliers were introduced, and/or foreign contractors were used.

### **Proposed Changes**

After a discussion with the board of directors, the CEO gathered the executive team to review his proposed transformation changes. Before sharing those plans, he explained the rationales for each recommendation and made it abundantly clear that detailed change management plans would be required to communicate the new strategic direction and to involve the workforce in establishing robust processes to create a smooth transition and produce sustainably improved results.

- After examining data for the global locations of current customers, global marketplaces that offered significant opportunities for new business based on their current competitors' performance, and a diverse set of business metrics, he proposed that the company open a new manufacturing plant in India within the next three years. The CEO used facts, data, and analysis supported with appropriate charts and graphs to demonstrate how he had moved from the current state through a disparate set of data to profound knowledge to his transformational proposal.
- The CEO also recommended that the company begin an intensive initiative to change the workforce's cultural perceptions and become more open to global operations. He had decided that this effort should begin immediately and that third-party experts who were experienced in this type of cultural change be hired to conduct preliminary assessments; provide a detailed change plan; and to work with internal leaders to develop the communications, education, training, and application opportunities to achieve the required future state that would be supported and adjusted based on monitoring of key cultural factors. His goal was to have the organization's culture become more accepting of the proposed strategy within the next 18 months.
- Finally, he intended to create a new team to manage the supplier-qualification and performance-auditing processes. He intended to begin this transition immediately and planned to hire a specialist to lead that team. The current quality engineer who oversaw these duties would be a member of that team, but would be asked to continue with other current duties so the existing well-functioning quality management system

would not be affected by the change. Other team members would include representatives from finance, purchasing, and shipping, whose processes also would need to change to accommodate the new approach.

Obviously, this is a high-level summary of the deliberations that led to acceptance of the transformation changes, but it demonstrates how three executive decisions related to the company's operational location, culture, and supplier management were structured so that a Bayesian Moment could occur.

### Applications of These Thoughts

How then does this discussion help the achievement of quality? The following questions can be used to evaluate personal and organizational approaches:

- How do the leaders of your organization identify and explore issues that might affect sustainable performance?
- Does your organization have a process for creating profound knowledge based on facts, data, and analyses? Is that process used regularly to generate the opportunity for transformational changes? If not, what can you do to improve your organization's decision-making process?

*Editor's Note: The concepts presented in this article appeared in "The Theory and Practice of Profound Knowledge: An Inquiry Into Quality and Strategy Management" by Gregory H. Watson, which Oklahoma State University is currently in the process of publishing.*

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How do American and Japanese quality approaches vary? As the analogy used in this article points out, the intention of achieving quality may be similar, but the approaches reflect important cultural differences.

# American Versus Japanese Quality

## Let the Noodle be the Noodle

Gregory H. Watson

Often the subtle meanings of significant concepts are hidden by cultural differences. It was in 1991 that I first heard Dr. Noriaki Kano describe the differences between “A” and “J” quality—where A stood for the American approach and J for the Japanese approach—American verses Japanese quality.<sup>1</sup> I have heard him speak about this difference on several occasions since that time, but recently I finally understood what he meant. It only took this student 28 years to learn this lesson from his master teacher!

Let me try to explain the difference so others don't need to wait so long to gain understanding of this profound concept. When Kano spoke about cultural differences, he compared how the Eastern world uses two pieces of wood to hold the food, while the Western world uses a spoon. Although this may seem to be a trivial cultural difference, there is a deep implication from its underlying meaning. We need to dig deeper into these two cultures and perceive the implications of their actions from different angles to understand how this comparison provides a foundation for understanding the two quality approaches.

Let's start by considering the haiku, “Do not seek to follow in the footsteps of the old masters, seek instead what these masters sought,” Matsuo Bashō.<sup>2</sup> This profound message provides a philosophical foundation for Kano's thought process.

When I tried to use my interpretation of the footsteps which Kano described, I became lost in the surface analogies and missed what was at the core of his distinctions. So, let's take a moment to set aside the difference in the utensils and focus instead on the eating processes. Let us consider the A verses J difference using the analogy of eating food but thinking about the process of eating rather than focusing on the implements that are the objects or tools for eating. As with any type of investigation into processes, we can gain greater understanding how a product evolves as the process transforms inputs to generate it. We can illustrate the distinction between the two cultures by evaluating the process of eating noodles, a food that is common in both cultures. Specifically, I'll use spaghetti bolognese as the example for the American process and udon soup for the Japanese culture.



What does the spoon contribute to eating the spaghetti? The spoon helps to control the process, maintaining order and avoiding chaos. The diner is able to master the art of eating the spaghetti without dropping the noodle covered with tomato sauce. The spoon needs a resource—the fork. The fork pierces the spaghetti and is twirled tightly within the shallow bowl of the spoon. The spaghetti is embraced by the tines of the fork. Then the fork is lifted to the mouth for consumption. Of course, some sauce is errant and must be wiped from the mouth of the diner to preserve good etiquette. What happens in this circumstance? The process of eating and the design of the food have been constructed to accommodate an underlying cultural attitude about eating—the diner must control the situation. So, the noodle must be cooked into a pliable form for wrapping around the fork as guided by the spoon. The sauce must be thick enough to help the noodles adhere to each other and facilitate the noodle-wrapping activity so that excess noodles can drop harmlessly into the bowl and do not soil the diner’s clothing while he/she sits in a straight vertical position maintaining control over the entire process. The spoon is a guide for facilitating the noodle distribution process.

So how is the Japanese process for eating noodles different and what rationale supports that difference? The udon noodle is very thick compared to a spaghetti noodle, and it can be picked up by the chopsticks which serve as pincers. It takes time, however, for the diner to grab each noodle individually and transfer it to his/her mouth. The Japanese, therefore, devised a more efficient system; it involves bringing the bowl close to the mouth and using the chopsticks to guide the noodles into the mouth along with the broth. Culturally, this is very distinct from the American approach to eating noodles, and it typically would be considered an impolite method in America. In Japan, this method is accepted (and now is generally accepted in all cultures) as a normal practice for eating udon, and the chopsticks are used as a guide to facilitate the noodle distribution process.

Let’s now consider how the distinct processes for eating noodles provide insights regarding the two cultures’ underlying principles regarding quality. First, we’ll analyze the American way of eating noodles with a spoon, which is driven by the diner’s attempt to control the noodles. This process places the bowl of food in a subservient position

with respect to the diner, who is positioned as being more important than the bowl. The eating process must avoid any actions that would diminish the relative standing of the diner to the bowl, such as bringing his/her head closer to the bowl of spaghetti. The diner dominates the noodle, which becomes an object, rather than an individual contributor to the process.

On the other hand, the Japanese process is much more egalitarian, and there is greater harmony between the noodle and the diner. The diner does not consider him/herself to be superior to the noodle, but he/she eats using a mutually supportive system and shows respect for the noodle by bowing his/her head to the bowl and applying energy to the process. In this case, the noodle is not controlled, and it has an equal opportunity to escape the chopsticks and momentarily avoid consumption. This ability to choose the time of consumption must give great peace to the noodles as they are not forced by the tines of a fork into a controlled delivery process! The Japanese process lets the noodle be the noodle—self-sufficient in its own right and free from the manipulative control of an external master—the fork.

How does this analogy apply to managing a process or creating improvement? The American process has a strong “do-act” bias with respect to the noodle, which is mandated to participate to act only when the fork exercises control. This process is executed in a linear way—a step-by-step process where the fork loads the food, and the diner then consumes the spaghetti in repetitive cycles. This is a familiar approach to American quality management that relies on linear, step-by-step processes that are executed by one operator at a time to attain the desired output. The Japanese approach also may appear to be linear, but its meaning is very subtle and hidden by its unique cultural context. The seemingly linear pattern is actually a dynamic set of events.

### **How are These Cultural Differences Evidenced in 5S Processes?**

For example, consider the linear way that Americans implement the 5S approach. Each step is taken individually in order to institute a sound housekeeping system for daily management.<sup>3,4</sup> Although the 5S process that originated in Japan also seems to be linear, a deeper exploration of its design intentions, based on the original kanji

**Table 1: 5S Terminology and Meaning**

Japanese Term	English Equivalent	Meaning of the Step
Seiri (整理)	Sort	Remove the unnecessary
Seiton (整頓)	Systematize	Place work into order
Seisou (清掃)	Sanitize	Clean the work station
Seiketsu (清潔)	Standardize	Develop standardized work
Shitsuke (躰)	Sustain	Maintain the standard

pictograms (viewed by many Americans as mysterious brush strokes), rather their interpretive romaji text, can add substantial insights regarding the cultural differences associated with implementation of 5S in America and Japan (see Table 1).

At first, everything seems aligned and in order (the American way); however, examining the original Japanese characters gives a subtle hint that this observation is incorrect. Although the first four terms in this flow all begin with the romaji word “sei,” kanji uses two different characters for the same term—整 and 清. What does the original Japanese 5S step really mean and how is it different than the American approach? The logical interpretation of the romaji is clear and actionable for Americans. Unfortunately, it doesn’t help us understand the true original intentions of this Japanese method, and that can undermine our attempts to emulate the process. The Japanese approach follows the advice of Miyamoto Musashi, “Step-by-step walk the 1,000-mile road.”<sup>5</sup> So, let’s review these terms and their underlying cultural meanings.

- **Seiri (整理)**—The first term, “sei” (整), means to bring chaos into order while the second term, “ri” (理), describes the method applied—a thinking process of setting logical categories and making decisions about what to do with them—rationalization or streamlining of the work, so the process operates in its most straightforward state or condition. Typically, American culture reduces this concept to sorting and removing unnecessary things associated with the process, which is far more limited.
- **Seiton (整頓)**—In this step, the “sei” term is the same as in “Seiri,” but, the second term has changed to “ton” (頓), which has a medical connotation, referring to medicine that takes effect immediately. When combined, this means that work should be organized so that necessary things can be accessed immediately. Typically,

Americans reduce this idea to “organize,” “set in order,” or some similarly simplistic term.

- **Seisou (清掃)**—The character representing “sei” in the romaji term “seisou” is different (清 instead of 整), and it implies the idea of purity or spotlessness. It is combined with “sou” (掃), which means to sweep, exterminate, or clear away. Americans typically call this “sweep,” “sanitize,” or “clean and inspect,” but that misses the real meaning. When cleaning a house, there typically are two levels of performance—rough-cut cleaning or sweeping out the major dirt (e.g., what children bring inside on a muddy day), which is the level implied in *seisou*.
- **Seiketsu (清潔)**—Here the character for “sei” again relates to the state of being pure, but it is combined with “ketsu” (潔), which also means cleaning but in a deeper and more hygienic sense—sanitary, virtuous, immaculate. It also has a medical implication as in the sanitization and sealing of medical instruments, so they are packaged and ready for an operation. Interestingly, Americans seem to miss the mark on this term when they translate this step to “standardize” and seek to force the development of a work standard—a form of control. Actually, this should involve a deeper form of cleaning—the spring-cleaning that occurs after a long winter and is used to air out old odors and make a home feel fresh. Interpreting this term as “standardize” is somewhat monolithic and may be associated with standards such as those set by the International Organization for Standardization and published to foster global compliance. In the Japanese culture, standards are developed over time—beginning with easy and simple ideas that gradually become more defined as they are proven in practice.<sup>6</sup>
- **Shitsuke (躰)**—The final “S” in the system is “shitsuke” (躰), which means discipline, training,

or teaching manners. Americans describe this as “sustain,” implying that it is the state of consistently performing and improving. Again, this misses the mark; the Japanese culture, where kaizen is not limited to one step but is a dynamic cycle that integrates the standardize-do-check-act process of daily management with the plan-do-check-act (PDCA) change management process.

How do the 5-S steps actually operate in Japan? Most importantly, their combined effect is not linear. For example, when an elementary school teacher in Japan wants students to deal with their messy desks, he/she would say: “seiri-seiton,” combining the two terms for organizing chaos into a shared activity rather than a linear, sequential flow. Likewise, the third and fourth steps of the 5-S process share the same kanji word for “sei” meaning “pure” and represent two types of cleaning. The first gets a work area into suitable condition for daily use, while the second returns the equipment to its standard operating condition (making it like new)—an activity associated with eliminating the root cause(s) of the equipment failure by applying total productive maintenance.<sup>6</sup>

These cultural observations raise important questions. Who does what, when, where, and why in the Japanese approach? Can we define this 5-S concept more thoroughly, so it is operationally consistent and coherent within the American framework for process management? Just as the Japanese teacher admonishes the students “seiri-seisou,” the Japanese supervisor encourages the workers as evidenced by the requirement that some observation or study takes place prior to initiation of the 5-S process. Taiichi Ohno recommended that PDCA begin with “check” because insight needs to be gained from reflection before starting the cycle.<sup>6</sup>

Taiichi Ohno commented: “Within common sense there are things that we think are correct because of our misconceptions.”<sup>6</sup> It is time that the Americans learn to interpret the meaning behind the Japanese cultural contributions to quality in order to gain the profound knowledge that the

masters offer. Just as noodles should be allowed to be noodles, people should be encouraged to work together in a coherent system, guided by their leader without being mandated to perform in a way that ignores the benefits of leveraging all system of resources.

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Understanding and applying the Kano Model properly can change the way organizational leaders develop and deploy strategies that ensure products and services will drive customers' purchasing decisions and loyalty, ensuring long-term business sustainability.

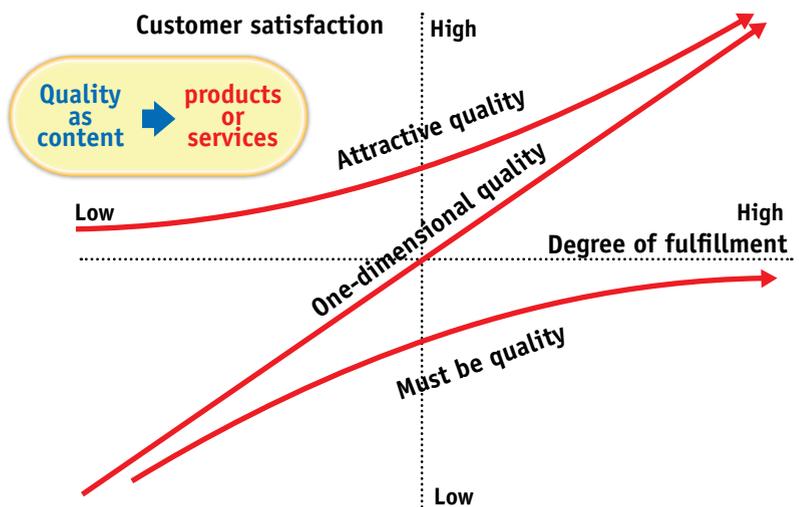
# Using the Kano Model as a Basis for Strategic Thinking

Gregory Watson

In 1984, Noriaki Kano and his colleagues published an explanation of an entirely new process they developed to better describe customer requirements, preferences, and satisfaction.<sup>1,2</sup> This breakthrough approach was accepted very quickly across the globe, and the framework on which it is built now is known as the Kano Model or the Theory of Attractive Quality. This model describes five dimensions that differentiate customers' perceptions of product/service features. In particular, they identified three quality levels in products and services—attractive, must-be, and one-dimensional quality. Attractive quality anticipates the needs of customers, must-be quality describes customers' basic

requirements, and one-dimensional quality indicates the product/service characteristics that matches competitive offerings and are virtually unnoticed by customers (see Figure 1). This article also focuses on those three dimensions, and it connects the model's information to the strategic-thinking approaches that drive business performance.

Figure 1: Kano Model for the Theory of Attractive Quality



Kano shared two essential criteria regarding this process. “Quality activity can only begin if top management is conscious of the critical need for organization-wide commitment to quality and its own responsibility for introducing such activity.”<sup>3</sup> and “Improving all attributes of quality will not lead to satisfied customers as not all attributes are equal in their eyes. Some quality attributes will increase the value to customers because they are attractive and do not detract even when their physical fulfillment is not strong.”<sup>3</sup>

### **Forward- and Backward-Looking at Quality**

To begin to understand the Kano Model and how it can have a profound impact on strategic thinking, it is first important to realize that quality can be considered from two very different perspectives. Forward-looking quality focuses on creating positive value by enhancing features that lead customers to believe that the resultant products/services are superior to other options available in the marketplace. Clearly, this approach attempts to identify features that will create differential customer satisfaction and increase customers’ purchases and loyalty.

On the other hand, backward-looking quality aims to resolve product/service issues that have occurred in the past. These include defects that have been observed by customers, issues related to failure of the product/service to meet customers’ expectations, and/or feedback associated with complaints. All of these are associated with the potential loss of customers’ sales, and they tend to receive a high level of attention from most organizations, but this approach is a stopgap measure that focuses on eliminating customer dissatisfaction without increasing the perceived value of the product/service.

Obviously, backward-looking quality efforts are essential, but they are far from sufficient. They have little or no effect on the organization’s ability to sustain long-term acceptable performance. If a business limits or over-emphasizes the backward-looking approach, it can expect to lose ground to its competitors—the ones who are ensuring that current products/services satisfy customers’ expectations and simultaneously are constantly looking for and finding ways to offer unique solutions that separate their products/services from the pack.

### **Definitions of Quality**

Kano and his colleagues had a rich supply of quality concepts regarding the meaning of quality

available to them when they were developing the new model. Although there have been many published definitions of this term from academics and professionals across the globe, the work of organizations, such as the Union of Japanese Scientists and Engineers, has provided a well-accepted source for distinguishing among the multiple dimensions of quality. Understanding two concepts of quality that exist in Japanese literature is particularly important because they provide the framework for the Kano Model.<sup>4</sup>

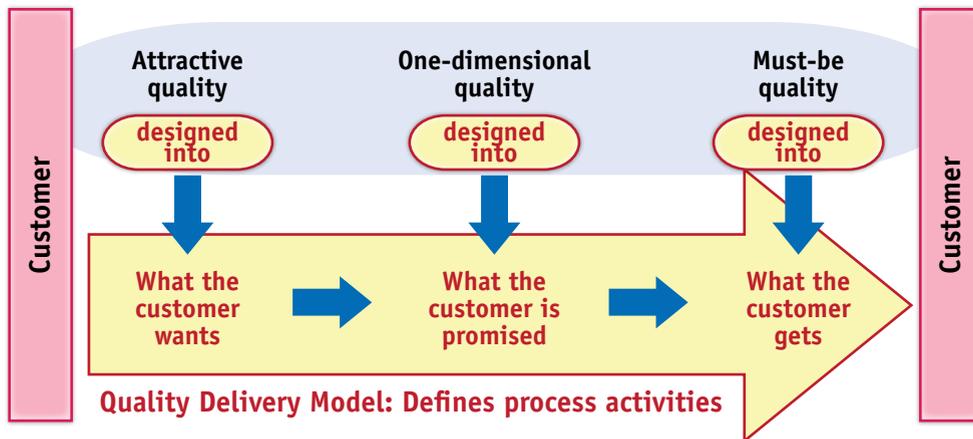
- Atarimae Hinshitsu (当たり前品質) is used to describe a product/service that is fit for function and is capable of doing or performing its intended purpose (e.g., a pen will apply ink to a substrate without smearing or other defects). This dimension is described primarily as must-be quality in the Kano Model; however, characteristics which exist in competitive offerings that are associated with one-dimensional quality are likely also to be noticed, and hopefully addressed, in conjunction with backward-looking quality initiatives.
- Miryokuteki Hinshitsu (魅力的品質) refers to the “charm of quality,” and it is associated with the measurement characteristics such as appearance, sound, and touch, which customers perceive as giving “personality” to the product/service. This dimension satisfies customers’ concepts of features that are fascinating and are “worthy of attraction” or “fit for love.”

This understanding of quality has broadened management’s attention beyond the currently produced offerings to include features that generate distinctive aesthetic qualities (e.g., such as a pen that is pleasing to the writer during its use and to the reader as its output is observed). This dimension is described as attractive quality in the Kano Model.

### **Learning What Really Matters to Customers**

So quality is both the content of a product/service that is provided to customers and a process for identifying and developing new or substantially improved characteristics which increase the value proposition for customers and improve their overall experience. The three components of the Kano Model—must-be, one-dimensional, and attractive quality—not only capture immediate customer needs but also drive the innovation that ensures future success. The process steps associated with designing and delivering quality, therefore, must

Figure 2: The Process of Managing for Quality



include tasks for learning what the customer wants, discovering what the customer believes has been promised, and evaluating the customer's perception of what they actually received. Of course, the work of gathering this critical information needs to involve the targeted customers so that improvements and innovations can have a definitive impact on business results. Figure 2 demonstrates these relationships.

Just how do the must-be, one-dimensional, and attractive-quality dimensions of the Kano Model connect specifically with customer behaviors? Frederick Herzberg's Motivator-Hygiene Theory provided insights that Kano considered when formulating this model (see the article, "A Comprehensive Refresher on the Kano Model," which also appears in this issue). Fundamentally, the Kano Model recognizes that there is more than one potential reaction of customers to each specific product/service characteristic. Some features generate customer satisfaction, others increase customer dissatisfaction, and some have a neutral effect (not affecting satisfaction). Prior to introduction of the Kano Model, organizations generally considered the inclusion of new features as automatically increasing satisfaction and adding value in the minds of customers. The fiascos associated with product/service changes that were presumed to be value-added improvements by the producers but that failed in the marketplace were considered to be anomalies rather than the result of poor decision making. They were written off as one-time issues instead of being recognized as failures in

the processes related to strategic thinking, market research, product/service development, etc. The Kano Model's publication basically revolutionized the way organizations came to understand customers' behaviors, including purchasing choices and brand loyalty.

Before product/service features can be categorized into one of the five dimensions addressed in the Kano Model, customers' requirements need to be identified and described clearly. Unfortunately, obtaining that information is frequently more complicated than might be anticipated. In some cases, customers can express their expectations clearly, but, in other cases, customers are either unable to describe their requirements, or they lack the knowledge or communication ability to specify features that they want or would appreciate having included in the design. They also may perceive that a particular feature is so obviously needed that they don't think it's worth mentioning when they provide input. Furthermore, customers may not even be aware of potential options that might enhance the product/service and their experiences substantially. This reality definitely complicates the process of identifying and evaluating design options, so they can be categorized properly according to the Kano Model.

Of course, organizations that lead their markets and consistently present customers with highly valued innovations have processes in place that overcome the inherent issues of determining customers' needs and addressing those requirements in differentiating ways. In other words, they have

mastered the ability to provide attractive quality. The approaches listed below are built into the most successful processes:

- Understanding what it takes for the product/service to be suitable for the customer’s usage.
- Having the capability to provide the full range of functionality necessary for the product/service to perform as required.
- Going beyond functionality to incorporate aesthetics (style and form) that delight customers.
- Being able to think creatively and generate innovations that make the product/service unique (often by leveraging technology in new ways).
- Improving accessibility and ease of use of the product/service, making it more user-friendly and enhancing the way humans interface with it.
- Making it possible for the product/service to be used in a wider variety of applications.
- Ensuring that the product/service is durable and will perform reliably in all its intended environments.
- Bringing esteem to the customers who use the product/service because it is a recognized and respected brand.

### Strategies That Change the Organizational Profile

Successful organizations have clearly defined purposes that are fulfilled by their daily management

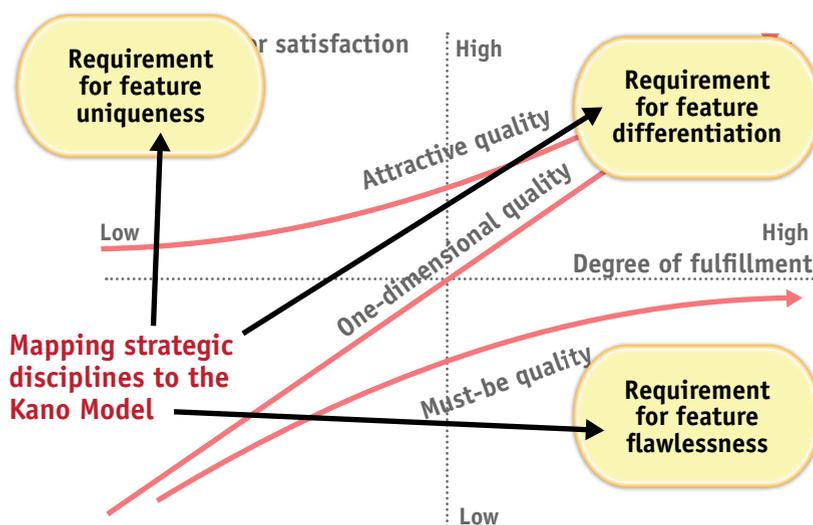
systems—the systems they have in place to ensure provision of value to customers. They create core competence that support attainment of the value proposition consistently, and they emphasize the three following strategic disciplines (see Figure 3) to maintain that capability even though surrounding environmental factors keep changing.<sup>5</sup>

- *Product/service leadership*—Delivering innovative product/service features that exploit new technological innovations, transforming research results into applications that facilitate customers’ usage and enhance their positive perceptions.
- *Customer intimacy*—Adjusting products/services to ensure they fulfill all of the customers’ requirements better. This discipline focuses on building agility in the marketplace so that the adjustments can reposition offerings in ways that simultaneously increase satisfaction and generate business performance gains.
- *Operations excellence*—Being able to provide consistent low-cost and highly effective and efficient provision of goods and services that have no perceivable flaws. This discipline applies methods that reduce costs by eliminating all forms of waste throughout the product/service’s life cycle. This typically leads to having a competitive pricing as well as flawless execution of work.

The quality approaches used to address the three dimensions of the Kano Model discussed in detail in this article are not all identical. Each of the dimensions requires specific considerations to ensure the product/service features will meet the appropriate customer requirements, as described below:

- Must-be quality is achieved when the product/service complies with customers’ essential requirement levels. A compliance-based quality approach does not drive customers’ purchasing decisions directly; it merely ensures that the offering meets the minimum threshold which

Figure 3: Alignment of Strategic Disciplines to the Kano Model



makes the customer willing to purchase it. When the must-be quality dimension is fulfilled, actual purchasing decisions actually are driven by price.

- Improvement efforts are used to maintain one-dimensional quality (competitive quality in the figure), which positions the product/service as being competitive within its particular market. Customers see the offering as equivalent to competitors' options. This generates head-to-head comparisons and results in purchasing decisions that are based on a more comprehensive evaluation of all the features.
- Attractive quality only can be attained when the organization seeks excellence, going beyond current requirements and competitive products/services. Imaginative designs that appeal to customers previously unrecognized or unconsidered features separate these products/services from the pack and establish a whole new standard for comparison. It is represented by the "differentiated quality" track in this adaptation of the model.

Organizational competence is the result of the synergistic combination of individual staff members' skills and experiences as they pursue the business's purpose. Encouraging and developing individuals' application of knowledge and skills that support collaboration, improve interactions, and increase personal and organizational capabilities is instrumental to being able to design features properly within the Kano Model's framework.

Being able to perceive emerging requirements of targeted customers and anticipate new directions for development pleads to enduring competitive advantage. Obtaining an intimate understanding of customers' uses of the product/service builds critical relationships and captures customers' insights that can drive designs.

The ability to innovate is too important to be left to chance. Management must stimulate new ideas and encourage experiments that apply appreciative inquiry to understand the "hidden knowledge" that is not yet known but might be exploited to improve customers' experiences when using the product/service in order to enhance the value proposition.

Sustainable excellence, however, occurs only when the organization's processes are able to meet the required quality level reliably on a continuing basis, ensuring competitive advantage is maintained despite the effects of unavoidable variation. Achievement of a state of control requires

management to support appropriate adjustments to processes that reflect changing customer expectations. In other words, true process control occurs when this strategic approach to quality management and product/service leadership is recognized as being dynamic. They need to support changes that are associated with process externalities and natural process variation. This results in a sustainably positive experience for customers that enhances brand recognition. When management develops a system to provide attractive quality persistently, there must be components that assure reliable control over process variables (both controllable and uncontrollable) and simultaneously maintains consistent, robust quality of deliverables despite changes in the process variables.

It's important to reiterate that for the organization to continue to meet its purpose in a dynamically changing environment involves successful development and deployment of two systems—strategic planning and the daily management system, which must operate in tandem with proper direction and coordination, as mentioned earlier in this article. The application of various quality approaches differs between these two systems and the objectives that are present. Highly successful organizations that have been studied have been found to have a clear understanding of how to integrate these two systems to create agile performance that stays abreast with newly recognized opportunities and issues. Their senior managers make conscious decisions related to both systems and the integration of those systems.

The two descriptions below are intended to clarify the objectives of each of these systems:

- The strategic quality management system is intended to deliver breakthrough transformation by conducting projects that either will advance the process performance capability of the daily management system significantly or will provide a substantial leap in the capability of product/service performance. The projects that identify the changes necessary to achieve these breakthroughs require revolutionary thinking, including innovative insight into the customer's application. Notice, however, that realization of the findings of these critical projects actually occurs through the processes associated with the daily management system.
- On the other hand, the objective of a daily management system is to maintain a discipline

for controlling the performance of routine work so that the standard work outcomes achieve continual improvement. This system generates improvements by conducting planned sequences of small experiments that increase the reliability of process performance or quality, or reduce costs through evolutionary change.

The organizations that gather and appropriately categorize customer insights by using the approach associated with the Kano Model actually are seeking another type of quality that can be called “transcendental”. They persistently pursue goodness while carefully avoiding badness.<sup>6</sup> These two opposing outcomes are achieved by tightly managing the strategic quality and daily management systems in a way that identifies opportunities and risks thoroughly and making well-considered decisions.

This transcendental quality approach impacts the organization’s changing products/services in three ways. First, the operational processes are designed and executed in a reliable way that ensures the customers’ requirements are being met properly. The operational processes, however, also address other elements that impact customers’ experiences when they are working with the organization’s support services and/or using its products/services. Finally, transcendental quality connects these first two customer-focused requirements directly with the internal processes that are conducted to provide all deliverables that customers receive. Transcendental quality is not attained by following a generically applicable framework. Instead, each organization identifies and manages its own unique processes after determining how their processes interact to fulfill customers’ expectations.<sup>7,8</sup>

The components of the productive system that combine human elements with technical and process elements to deliver the organization’s outputs to its customers also must be in place for organizations to succeed in these efforts. There are three key components in this system. The technical area

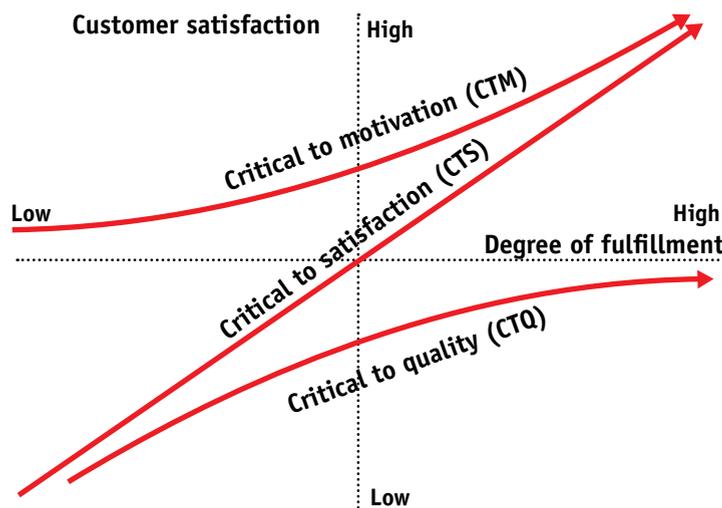
includes hardware, software, and support. Process flow, data, and analytics are associated with the system component, and the human factors include philosophy, psychology, and methods. The following three quality approaches drive this system:

- Quality as content—The outputs provided to organizational customers.
- Quality as experience—The experiences of customers with the quality outputs.

Quality as methods—The tools and techniques applied to create quality. Ultimately, quality drives the methods that drive actual achievements, as shown by the “ingredients” in Figure 4.

- *Critical to quality (CTQ)*—In order to understand the requirements of the must-be quality dimension with its requirements for delivering a disciplined approach to feature and function characteristic compliance, an organization must pay particular attention to the drivers of both product/service quality as well as the process by which its deliverables are created. Failure to meet expectations and requirements described in the CTQs undermines customer confidence in the deliverables and results in loss of business over the long term.
- *Critical to satisfaction (CTS)*—These requirements provide a competitive edge to the features and functions of the organization’s products/

**Figure 4: Critical Ingredients That Drive Quality**



services. A CTS quality characteristic should take advantage of the intimate customer insights and improve performance relative to competitive market offerings. Their performance requirements are clearly superior to alternatives and will create higher perceivable value to customers.

- *Critical to motivation (CTM)*—These create the “charm of a product” through differentiated innovation that triggers emotional responses to latent customer desires and, thereby, creates customer delight that results in a “killer product/service” or “hot application” that disrupts the marketplace.

Of course, organizations cannot design and deploy these worthwhile systems overnight. Instead, those businesses that see the value of this integrated approach increase the maturity of their systems over time. Diligent leadership attention and appropriate support, including allocation of necessary resources, is essential for progressing from initial efforts to implementation and continual improvement of comprehensive, high-performing systems.

### Summary

The most common application of the Kano Model is for analysis of customer requirements; however, a strategic application can be made by understanding the dynamics inherent in the model. Features degrade throughout time. What was attractive yesterday becomes competitive the next day, and it may ultimately revert to being a must-be feature. Additionally, the amount of quality designed into a feature that is characterized by any of the paths shown in the model for those three dimensions may vary on a relative quality scale from good-to-bad as interpreted by customers. If an organization intends to sustain its market and continue to develop its business, it needs to apply the Kano Model findings in a disciplined manner that integrates customer insights with the overall business strategy. This approach relies on the application of quality principles to develop and maintain the associated competitive advantage that occurs.

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## Gregory H. Watson

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*In My View...*

# Profane Knowledge Seeks Easy Executive Decisions

Gregory H. Watson

**T**here is a cartoon that I enjoy which depicts a man presenting his improvement project to his boss. The boss responds, “What I need is a cheap, long-term quick fix!” Although the point is obvious, there is also more than a grain of truth in his comment. W. Edwards Deming proposed that executive decision making (EDM) be based on a “system of profound knowledge,” an approach to management based on systems thinking, statistical inquiry, and psychological insights that are founded on a deep knowledge of how to deliver penetrating insights to achieve the “desired state,” as well as those actions that are required to stimulate organizational transformation.<sup>1</sup> Deming, however, never described the “current state” that prevails in most organizations. If executives are not making decisions based on profound knowledge, then it is logical that they are relying on profane knowledge, the alternative,

which depends on subjective, opinion-based decisions. This article describes why profane knowledge is not an advisable basis for strategic decision making. Ultimately, if the strategic culture of an organization is based on profane knowledge, it is unlikely that a leadership position in a competitive industry can be attained.

## What are the Origins of Executive Decision Making?

Executive decision making was first highlighted during the 20<sup>th</sup> century when several pioneers proposed theories on a new way of thinking regarding how executives should direct enterprises. For instance, Henri Fayol believed that executives must execute a “constant search for improvements that can be introduced into every sphere of activity. The search for improvement should

be pursued unceasingly at all levels and throughout all parts of the business. The executive in charge should have an active and unrelenting intention to effect improvements."<sup>2</sup> With this focus, executives must make decisions to act for the sake of improvement, so that the future performance of the organization becomes stronger over time.

EDM was defined using negative terms by Chester I. Barnard: "The fine art of executive decision consists in not deciding questions that are not now pertinent, in not deciding prematurely, in not making decisions that cannot be made effective, and in not making decisions that others should make."<sup>3</sup> In other words, EDM should focus on what is relevant, imperative, and limited in scope to addressing only essential matters. Peter F. Drucker later summarized Barnard by saying, "The job of the executive is to execute," which means "to get the right things done right."<sup>4</sup> Executives, therefore, decide what must be done and then follow through with a sound plan to accomplish it.

### **What are the Constraints of Executive Decision Making?**

Herbert A. Simon proposed a set of constraints, which he called "bounded rationality," to define the limits of an executive's ability to make effective decisions. He identified three areas of concentration for improving EDM—integrity of the data used for decision making, competence of the decision maker with respect to the content of the decision, and the sense of urgency with which a decision is required. As data continues to expand in volume and becomes more accessible, the urgency of developing meaning that can be derived from it will increase. Data integrity can be improved through technology and statistical methods. This means that the competence of the decision maker probably will become the most critical systemic opportunity for improvement and that profound knowledge must be sought actively to improve decisions.<sup>5</sup>

### **What is Executive Decision Making?**

The concept of EDM evolved from these roots. Most importantly, EDM must be understood as a cognitive process involving management of psychological considerations. It is based on the mental state of a decision maker who must remain flexible. That person must be able to respond effectively to external shifts that are instigated by situational dynamics from sources in the organization's environment. Exceptional performance requires insight into these situations and the ability to make sense out of the various signals they provide, which become inputs to the future potential state of performance that are necessary for fulfilling the organization's evolving purpose, the ultimate goal. Development of exceptional EDM competence requires applying a cross-disciplinary approach to support strategic choices regarding the organization's future direction.

This EDM process must consider all issues raised by a multitude of disciplines that are systematically and inclusively

engaged in providing "data streams" to support the decision-making process and potential alternatives. EDM must not be confined to a singular, myopic perspective that is purely technological but must integrate administrative behavior, social psychology, and behavioral economics. Throughout the past half century, new concepts have influenced the psychological conditions that should be incorporated into Deming's system of profound knowledge. Because these ideas were not available during Deming's lifetime, he focused on psychology as the means for motivating and managing the work environment, rather than the decision environment.

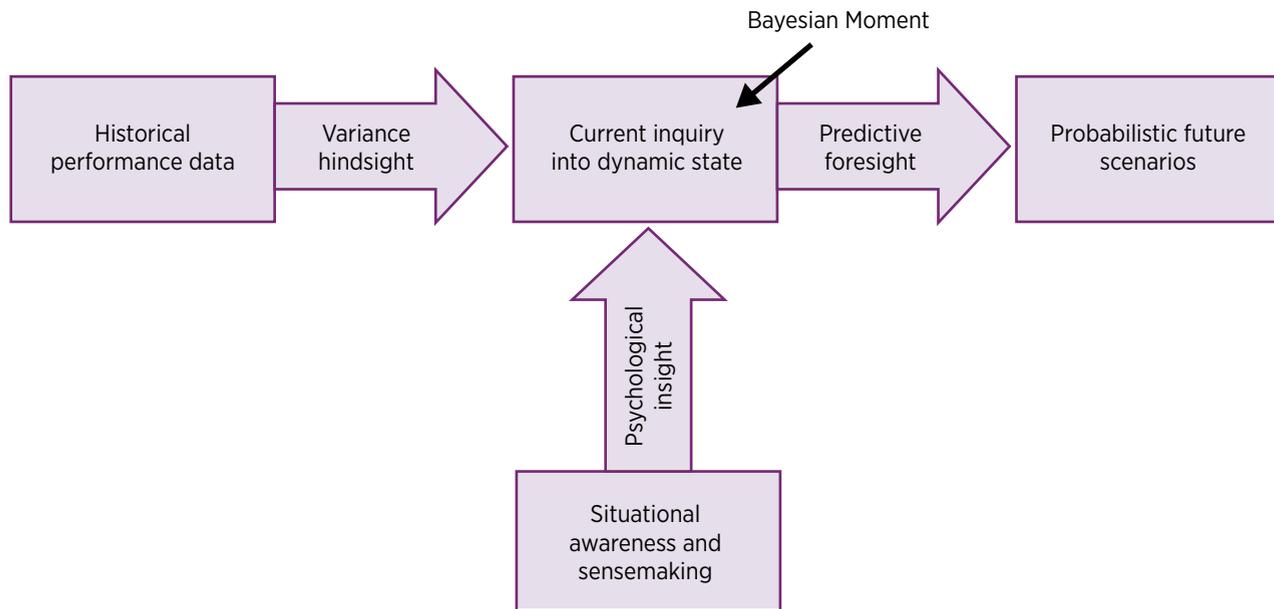
Karl E. Weick described sensemaking, which begins with a developing awareness of emerging situations—the act of noticing shifts in those environmental conditions that will influence the future directions of the firm. Upon noticing a phenomenon, the decision maker's observation must be recognized as an important influencing factor and be recorded for future investigation and inquiry, making it an important part of the EDM process for determining strategic direction.<sup>6</sup> This is a contributor to creating information integrity and delivering sound data.

Dynamic capability, proposed by David J. Teece, represents "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments."<sup>7</sup> Responding to the emerging environments associated with shifting situations requires sensemaking and EDM to guide the response that builds appropriate strategic capabilities, allowing the organization to secure its future in the face of a dynamically shifting external environment filled with social, technical, economic, and political disruptions. This increases managerial decision agility and provides flexibility in the choice of salient decision options.

Daniel Kahneman's pragmatic system of decision making, called behavioral economics, expanded the work of Simon. Kahneman postulated two types of decision making, which he labeled Systems 1 and 2. System 1 is the process of thinking emotionally—what Barnard called "illogical thinking," and System 2 is generated by creating a statistical understanding of the real world, what Barnard called "logical thinking." System 2 logic can be used to establish a "rules-based" approach to bound rationality in a System 1 type of decision.<sup>8</sup>

Decisions are made in a moment during the transition between considering the past and making predictions about the future. This is a time for insight generation which can be called the "Bayesian moment," that is named after Reverend Thomas Bayes, who originated the concept of conditional probability (see Figure 1). The Bayesian moment occurs when historical scientific inquiry is conducted to transform the knowledge of past performance to shape strategic decisions that create the future capabilities of an organization—a future that is capable of withstanding its dynamic environment. EDM decisions that identify and initiate change projects and deliver predicted expectations for future performance generate transformation. EDM, therefore,

**Figure 1: Executive Decision Making in the Bayesian Moment**



can be defined as “a unilateral decision made by a person who possesses both executive decision rights and the authority to allocate sufficient resources to implement the decision.”<sup>9</sup>

### ***How do Profane and Profound Knowledge Apply to EDM?***

Deming’s theory did not include an operational definition for profound knowledge, which is required to understand how it differs from profane knowledge. Profound knowledge is the insightful knowledge of phenomena that can be characterized with probabilistic interpretation by understanding their associated process performance outcomes. This knowledge is gained objectively by using statistical methods to investigate past performance. The resultant understanding of the real-world process behavior permits future states of performance to be predicted with some probability, following Deming’s system of profound knowledge.

On the other hand, profane knowledge is that superficial or ordinary knowledge that is based on intuitive interpretation and understanding of potential process results that were obtained subjectively, which also has been called “Theory Opinion” or “Theory O.”<sup>10</sup> Profane knowledge assesses the apparent state of reality by observing and applying common sense to derive a theory of reality that is based on opinions rather than objective data analysis. In its purest form, it represents emotional decisions based on personal mental models that are not supported by analytical methods. Table 1 compares the characteristics of the qualities of profane and profound knowledge.<sup>11</sup> Clearly, when executives base their thinking on profane knowledge, the risk of an incorrect decision increases.

### **What Decisions are Typically Made by Applying Profane Knowledge?**

There is a saying applied to prioritization in decision making—the “squeaky wheel gets the grease,” and another adage defines the “golden rule” as “he who has the gold makes the rules!” Both of these represent common-sense EDM. The executive responds to those who apply the most pressure on issues of personal concern, such as salaries, bonuses, and job security. In other words, executives tend to be most sensitive to the needs of the capital markets, stock analysts, owners, and shareholders who judge their performance based on short-term, quarterly performance. These forces have their own common-sense criteria of decision making that influence what an executive should do to create impact, driving decisions that will produce rapid performance change and are relatively easy to implement.

Profane knowledge seeks easy solutions that follow a legacy rulebook that is filled with long-standing, seemingly safe executive improvement decisions that have been passed down as tribal logic. This tradition produces a set of accepted decision alternatives that executives follow almost blindly. Table 2 describes these so-called strategies, using the decision filters of speed of implementation and degree of difficulty. This set of decisions supports a capitalist’s need for rapid financial returns; however, it does not always support workers’ human needs for economic safety and long-term security. Executives tend to focus on applying profane knowledge in order to attain profitable knowledge that responds to their most dominant customers—the financially oriented stakeholders who evaluate management performance and hold the executives accountable.

**Table 1: Comparison of the Quality Characteristics of Profane and Profound Knowledge**

Quality Characteristic	Profane Knowledge	Profound Knowledge
Depth of knowledge	Provides only surface knowledge (naïve understanding)	Develops deep knowledge (enlightenment)
Explicitness of function	Describes manifest functionality of the organization	Describes latent functionality
Discovery mechanism	Determines conclusions through explicit discovery	Determines conclusions through tacit discovery
Systems approach	Sub-optimistic myopia	Holistic, inclusive focus
Predictive function	Bases predictions of future behavior on past behavior and the status quo	Bases predictions of future behavior on the assumption dynamic change will persist
Analytical model	Focuses on averages	Focuses on variation
Human considerations	Does not take human factors into account	Takes human factors into account
Data approach	Uses enumerative data for all executive decisions	Uses analysis of factors as its basis
Propositional agreement	Promotes convergent thinking	Promotes divergent thinking
Methodological validation	Supported by tribal lore and relatively simplistic evaluations	Supported by comprehensive theories and evaluations that relying on robust statistics
Decision criteria	Based on common sense (e.g., System 1 thinking)	Based on uncommon logic (e.g., System 2 thinking)
Decision mindset	Decisions based on subjective reflection and introspection	Decisions based on objective reflection and mindfulness
Speed of decision making	Reactive/rapid decision making	Relies on logical, deliberate decisions

**How does Profane EDM Apply the Taylor Perspective of Prosperity?**

This decision bias was incorporated into scientific management based on assumptions made by Frederick W. Taylor in his propositions for the founding principles in applying science to management. He premised that organizations should deliver the greatest prosperity for all—both workers who provide the labor resources and for the capitalists who provide the financial resources that enable this economic system. Taylor recommended implementing his “laws for least waste” and then sharing the derived benefits between labor and the capitalist class; however, this was only an ideal. In retrospect; it was not a reality.<sup>12</sup> In Taylor’s system, he advocated for paying workers more, but he didn’t want them to be overpaid because he believed that would result in wasteful spending that was not beneficial to society or increasing the quality of life for the workers. Taylor’s engineered work-improvement practices were classified as “innovations,” rather than “inventions” by Joseph A. Schumpeter.<sup>13</sup> Innovation is defined as “creative destruction” of past practices because it requires creating an economic shift by the “planned abandonment” of legacy ways of working.<sup>14</sup> Such transformations require an economic decision—the output of EDM to make a choice, direct resources, and manage an effective transition as executed in the operational environment where work is accomplished.

Although Taylor may not have applied the right economic context for allocating benefits of improvement, his analytical approaches for process improvement were based on accepted scientific principles of situational observation followed by

structured analysis of the details for the work methods. Taylor’s innovative approach to improvement can create scientifically efficient systems; however, the motivation for improvement is not congruent with the beneficial welfare of society. EDM that follows the profane knowledge approach shares the motivation with Taylor’s system, but it lacks the benefit of applying an analytical system to generate its decision rules.

**What can be Done to Improve the Quality of EDM?**

Deming was concerned about the motivation of executives driving transformation. He commented that his system of profound knowledge was the true core of his contribution and proposed that his 14 points on management be interpreted in the light of this system. Transformational management along with its ability to ascertain the best alternatives is derived from management’s capacity for executing sound decisions, and this is only achievable with constancy of purpose when profound knowledge supports EDM.

According to the late physicist Stephen W. Hawking, “The cost of bad data is the illusion of knowledge,”<sup>15</sup> which is a poor basis for making a profound decision for shaping the future of an organization. Peter F. Drucker recommended that the starting point in EDM should be to ensure that the data upon which recommendations are made has integrity and is reported clearly so that the decision alternatives are thoroughly understood and any recommendations made are supported by sound analysis.<sup>16</sup> This addresses the first two of Simon’s points in his criteria for ensuring bounded rationality. After this, the decision

**Table 2: Classic Executive Decisions Based on Ease of Implementation and Time to Implement**

		Speed of Implementation		
		Fast (1 year or less)	Medium (2–3 years)	Slow (more than 3 years)
Difficulty to Implement	Easier	<ul style="list-style-type: none"> <li>Start a sales campaign</li> <li>Change pricing</li> <li>Discontinue products or services offered</li> <li>Change incentives</li> <li>Reduce budgets</li> <li>Replace management</li> <li>Downsize organization</li> <li>Close facilities</li> <li>Squeeze suppliers on pricing or discounts</li> <li>Increase/reduce debt</li> </ul>	<ul style="list-style-type: none"> <li>Consolidate operations</li> <li>Divest business unit</li> <li>Buy back shares</li> <li>Merge companies</li> <li>Acquire business</li> <li>Consolidate suppliers</li> <li>Outsource functions</li> <li>Extend patent term</li> <li>Change accounting methods or periods</li> <li>Extend the current product families</li> </ul>	<ul style="list-style-type: none"> <li>Develop new core competence and/or process capabilities</li> <li>Digitize data collection</li> <li>Influence the content of applicable third-party standards</li> <li>Lobby to assure more favorable laws and tax regulations</li> <li>Develop brand image and reputation</li> </ul>
	More Difficult	<ul style="list-style-type: none"> <li>Divest inventory, assets, or resources</li> <li>Automate production</li> <li>Inventory liquidation</li> <li>Modify old products or services</li> </ul>	<ul style="list-style-type: none"> <li>Relocate to reduce tax or reduce regulations</li> <li>Change IT systems</li> <li>Develop new products</li> <li>Execute an inversion (shift corporate HQ)</li> </ul>	<ul style="list-style-type: none"> <li>Develop new markets</li> <li>Introduce advanced technology</li> <li>Change work culture</li> <li>Design an innovative business model</li> </ul>

is up to the managerial judgment of the leader. Kahneman noted that 70 percent of executive decisions apply System 1 thinking; however, the quality of these decisions is improved when System 2 rules constrain the scope of System 1 decision applications. Ultimately, the responsibility for the bad decision rests upon the business leader. If the executive’s staff has done all it can to provide complete and accurate data, coupled with clear explanations and viable risk-assessed alternatives, then the decision maker must be held accountable for making the final judgments. The job of a quality professional is to set the scene for these decisions by conducting the work necessary to ensure that decisions are based on data which has integrity and sound data analytics. ■

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