



Fresh Thinking on Innovation and Quality

An ASQ White Paper



About ASQ

ASQ (American Society for Quality) is the world's leading authority on quality. With more than 85,000 individual and organizational members, the professional association advances learning, quality improvement, and knowledge exchange to improve business results and to create better workplaces and communities worldwide. As champion of the quality movement, ASQ offers technologies, concepts, tools, and training to quality professionals, quality practitioners, and everyday consumers, encouraging all to Make Good Great®. ASQ has been the sole administrator of the prestigious Malcolm Baldrige National Quality Award since 1991. Headquartered in Milwaukee, WI, ASQ is a founding sponsor of the American Customer Satisfaction Index (ACSI), a prominent quarterly economic indicator, and also produces the Quarterly Quality Report.

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The notion that innovation and quality are somehow mutually exclusive occurs with some regularity in reporting about current trends in business management. Pronouncements that activities designed to increase quality are bound to stifle innovation and creativity tend to reinforce the unwritten and unquestioned axiom that quality and innovation are incompatible.

This paper tests that assumption by examining the relationships between quality and innovation. It begins by defining what ASQ means by innovation. It looks at contemporary thinking on innovation and on the scope of quality today. It examines recent cases where quality methodologies have been applied in innovation-intensive environments such as commercial research and development, and it gathers insights from approaches of companies that are acknowledged leaders in both innovation and quality. The paper concludes by distilling some of this knowledge into some tips and recommendations for ways that organizations can strike a productive balance between creativity and innovation on the one hand and quality, efficiency, and control on the other.

ASQ believes that quality and innovation have much in common, and that the quality tools and approaches that transform both manufacturing and service businesses can play a key role in ensuring that the innovative capabilities of any organization can be harnessed for maximum value. ASQ's interest in innovation demonstrates its commitment to making a difference in the world by fully utilizing the transformative power of quality methods for making the world a better place.

Setting the Stage: A Lingering Perception

Controversy over the effects of quality disciplines on innovation and creativity was stoked by some highly visible reporting in the business press on an attempt to introduce Six Sigma methodologies within the R&D functions at 3M.

3M brought in a new CEO whose strategy called for a “relentless emphasis on efficiency.”¹ One element of his strategy was to implement Six Sigma methods across broad swaths of 3M—including the research and development areas.

“When these types of initiatives become ingrained in a company’s culture, as they did at 3M, creativity can easily get squelched,”² one article trumpeted. The article quoted former employees who felt stifled by the new ways of working.

These criticisms gained a veneer of academic respectability with supporting comments from academics to the effect that breakthrough, blue-sky innovation can take a back seat to incremental innovation when Six Sigma or other quality and process management techniques are employed.³ “The more you hardwire a company on total quality management, [the more] it is going to hurt breakthrough innovation,”⁴ according to a management professor at the Tuck School of Business at Dartmouth. “The mindset that is needed, the capabilities that are needed, the metrics that are needed, the whole culture that is needed for discontinuous innovation, are fundamentally different,” he said.

Reporting on this issue follows a familiar two-stage pattern that frequently emerges whenever criticisms are leveled against quality strategies, approaches, and methodologies.

First, the issue is presented in stark black-or-white terms—in this case as a choice between either

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process discipline or unbridled discovery, but not both. Or between uniformity or creativity, with little consideration given to the thought that perhaps an organization can successfully pursue both simultaneously, or even to the possibility that a measure of process discipline might actually enhance innovation.

Second, criticisms often focus on perceived shortcomings of one or more particular tools themselves, when the real problem may be a fault in the management approach to introducing change, adopting new tools and making certain they are applied only in appropriate situations.

“There is no reason why Six Sigma should hamper innovation—if used properly,” cautions Liz Keim, a past president of ASQ who coaches manufacturing and

service businesses on adoption of Six Sigma methods.⁵ She says these tools are not appropriate for all pieces of the job, so organizations must concentrate on those areas where the tools can be a benefit. Some of the appropriate application Keim mentions include: Doing

a better job of bringing in the voice of the customer, guided by Design for Six Sigma (DFSS) principles; providing a bit of structure to the development process to make the various pieces fit together; lessening the burden of the administrative aspects of the broad innovation process, leaving creative people more time and freedom to be creative. She also advises introducing Six Sigma and other new tools gradually so that people come to see their benefit over time—viewing it as a discovery they make rather than forcing new ways of work on them.

Ron Atkinson believes that once companies understand Six Sigma, it aligns well with engineering practice. An ASQ past president whose experience is as a quality and engineering executive in the automotive industry, Atkinson says, “Six Sigma makes sure projects relate right back to the strategic plan of the company.”⁶ That allows the company to do things with more focus, avoiding dead ends and increasing the likelihood of success of new projects by making them less of a hit-or-miss proposition. Or, in other words, Six Sigma

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Tips for Balancing Quality and Innovation

- Keep things in perspective: Quality is broader than Six Sigma, and innovation is broader than breakthrough invention.
- Regardless of its potential, no tool will be effective if used inappropriately.
- Innovation occurs in social systems. Treat it like a team sport involving real-life interactions of multitudes of real people.
- Go outside the boundaries of your own organization for innovation insights. Collaborate with customers, suppliers, business partners, and academia.
- Think of innovation not as a series of unrelated eureka moments, but rather as a process—a change process that can be managed with familiar change management and quality management methods.
- Use process discipline to enhance innovation.
- Establish a widespread culture of innovation in your organization. And build innovation-enhancing capabilities throughout a customer-centered value stream.
- Develop innovation leaders in your organization.
- Challenge the common assumption that innovation is inversely related to structure. Common knowledge will give you only common results no different than what everyone else is doing.
- Encourage divergent thinking during ideation and convergent thinking during development.
- Take advantage of the capabilities of Six Sigma and other quality management methods to help manage the risks that are part of any new undertaking.

can help provide “a systematic process that takes the randomness out of concept generation and allows for a planned approach to product line management.”⁷

Faculty members at the Wharton school have joined experts at The Boston Consulting Group to proclaim that lean practices and innovation can complement each other. They say lean offers advantages such as bringing structure and predictability to the innovation process, helping empower researchers, reducing uncertainty in the innovation process, and focusing on the customer to reality-test innovations. As evidence that lean and innovation can coexist, they point to Pixar, the

Hollywood animation company, which has struck a successful balance between the structure that lean affords and the freedom required by creative professionals.⁸

How organizations manage change is therefore a critical factor for the successful introduction of lean, Six Sigma, or other quality methods in new environments.

And how innovation is defined is crucial to understanding whether and in what ways quality and innovation can be considered compatible.

Defining Innovation—ASQ’s Perspective

As a working definition, consider the following: Innovation means instituting significant change that adds value to the organization by developing new ideas that lead to new profit streams, while simultaneously increasing the efficiency of how work gets done, increasing the effectiveness of how work gets done, and reducing costs of doing business.

In essence, innovation is a change process. As such, it should be amenable to the effects of process management and change management techniques.

Innovation is also a social process—it takes place within modern organizational cultures and environments. In complex organizations, it requires collaboration. It is a team sport rather than the work of a lone genius.

The requirement that innovation should lead to new profit streams is what makes the innovation process complete. Without this condition, innovation is meaningless to the firm. Unless new ideas can be converted into products or services that people want to buy, and unless the conversion can be done efficiently and effectively enough so that the new idea leads to profit, there is no innovation. Great ideas count; originality counts; but in a business context—the context of commercial innovation at the firm level—usefulness trumps. Innovation is the route that invention takes to get to market.

Innovation must therefore be viewed as not mere invention, but as a disciplined and repeatable process that leads to value creation and enhanced business results. It is within this disciplined view of innovation where quality methods are applicable and, one can argue, necessary for success.

Current Thinking on the Meaning of Innovation—Some Basic Principles

Debunking myths

Myths about innovation persist, as do attitudes and innovation mindsets more suitable to conditions of the 20th century than the 21st century.

There is the romantic notion that innovation springs from the mind of the solitary genius. But an article in the *MIT Sloan Management Review* argues, “Most innovations are created through networks—groups of people working in concert.”⁹

In essence, innovation is a change process.

To lay the groundwork for this level of innovative activity, the authors say, organizations must make it easy for employees to talk to their peers, share ideas, and collaborate. Modern quality strategies rely heavily on the concept of people working in concert, through cross-functional teams that may also include people from outside the organization—suppliers, customers, and business partners.

The idea that innovation must embrace both the blue sky and the practical is neither new nor radical, yet we cling to our fascination with the home run. Life-changing, transformative inventions, and the heroic stories of their inventors, are so much more interesting than incremental innovations that build upon existing products, methods, or technologies. Yet this exploitative, incremental form of innovation creates enormous value for companies and customers. Former Procter & Gamble chairman and CEO A.G. Lafley has stated that since World War II P&G has laid claim to just 17 disruptive innovations—major breakthroughs that created entirely new consumption and account for more than half of the company’s current revenues. In the same time, P&G has put out a steady stream of hundreds, if not thousands, of incremental innovations that sustain the company’s profitability. “While always actively seeking the next killer product, incremental innovation drives P&G’s sustainable growth model,” says Lafley. “There has to be a balance between disruptive and incremental innovation.”¹⁰

John Hagel, former McKinsey & Co. consultant, and John Seely Brown, former chief scientist at Xerox, say that innovation must be freed from “the tyranny of the

breakthrough mindset.” They criticize the tendency to focus narrowly on breakthrough technology, saying that, “while breakthrough innovations can generate significant value, sustaining that value requires a capacity for continual incremental innovations.”¹¹ They also point out that rapid and sustained waves of innovation can have the cumulative effect of leading to more radical change.

The nature of innovation varies among different industries, with some being more likely candidates than others for discontinuous innovation. Some, like telecommunications and consumer and medical electronics, are much more likely than others to experience the radical new product or concept, the great leap forward into totally unheard of new territory. For other industries, less radical innovation is more the order of the day.

In the packaged food industry, for example, Campbell’s Soup has achieved great success lately with product innovations such as soups packaged in microwaveable bowls, vegetable/fruit blends in its V8

Fusion line of beverages, and substituting natural sea salt for sodium chloride. Campbell’s no doubt would argue that these products represent genuine innovation.¹² And the company is happy to take to the bank the millions of dollars in new revenue these modified, repackaged, and reformulated products are contributing.

Innovation needn’t be inefficient

Although creativity and idea generation tend to be chaotic, nowhere is it written in stone that the innovation process must be inefficient. For one thing, innovation encompasses far more than the freewheeling idea generation phase, where creative individuals are given freedom to explore. To be complete, the innovation process must then cull out low-potential ideas early in the process before they soak up valuable resources, then turn the remaining high-potential ideas into marketable products.

Any methodologies and disciplines that allow the organization to carry out these functions with greater focus will increase the likelihood of success and help to avoid costly dead ends. They will also contribute to enhanced speed in product development. Speed to market has an increasing premium to companies as a means of differentiation from the competition, but speed alone is insufficient. Process discipline, combined with rapidly applied cycles of improvement and feedback, assures confidence in the speed of product development.

“Create a loose-tight process that loosens up the company and opens it to new ideas and concepts, but once you decide to go with a new product and fund and develop it, manage and control the process using disciplined process definitions and proven project management tools,”¹³ states author Bruce T. Barkley.

Opportunity abounds for increasing the efficiency of the new product development process. Robert G. Cooper, who conceptualized the stage-gate methodology for product development, observed that just one in four product development projects ever becomes a winner, and almost 50 percent of the resources that American firms devote to innovation are spent on products that are commercial failures.¹⁴

Spending more isn’t the answer

As a practical matter, no company today is content merely to throw money into R&D and hope that great ideas and stunning products will emerge. They expect results.

The Booz Allen Hamilton Global Innovation 1000 study—an examination of the 1,000 publicly held companies worldwide that spent the most on R&D in 2004—found that there is no relationship between R&D spending and the primary measures of corporate success, such as growth, enterprise profitability, and shareholder return. The study pointed instead to the quality of the innovation process as a determinant of superior results.¹⁵

Or, as Booz & Company partner Kevin Dehoff said: “We just could not find a direct relationship between spending and performance. . . . What we did find is that it’s much more important where you place your bets in terms of new products and technology, and how effectively and how efficiently you manage the R&D

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function itself. The companies that really stood out in the studies we have done are those that have been really focused on building capabilities across the entire innovation value stream—capabilities in areas like ideation, portfolio management, product development, and commercialization. It was much more about the capabilities that a company has and how efficiently and effectively they manage the R&D process, as opposed to how much they spend.”¹⁶

Innovation is serious business

In the United States, total research expenditures amount to about 2.6 percent of GDP, while the corresponding figure for the European Union countries is 1.8 percent and Japan 3.2

percent, based on 2006 European Commission data.

The business sector funds the lion’s share of total R&D spending—64 percent in the United States,

55 percent in the EU, and 76 percent in Japan.¹⁷ Among the world’s 1000 largest corporate R&D spenders, R&D outlays amounted to US\$532 billion in 2008, a 5.7 percent gain over the previous year even as the world was gripped by recession.¹⁸

Clearly, innovation is serious business. With that level of expenditure, corporations will take measures to ensure the money is well spent. So it makes sense to manage innovation activities with the same management tools and approaches that are used in other major sectors of the business. Organizations are taking steps to fully integrate the innovation-generating functions of R&D and product development with the regular management structures and practices in place elsewhere in the organization, rather than maintaining a separate, hands-off management structure.

Manage the innovation process

The need to integrate innovation and management discipline is cited by both management experts and innovation thinkers.

Quality management expert A.V. Feigenbaum believes that there must be simultaneous management

innovation in order for product and service innovation to be realized. He says:

“One of the primary characteristics of the new twenty-first-century management model is its meaning and emphasis concerning innovation. This is characterized by the institutionalization of—and the infrastructure, e-frastructure, and integration for—constant management innovation. The reason for this is that today an important characteristic of a successful business innovation is that it also positions a company for the next innovation: It is not only an end in itself. In every industry, from silicon and steel to optics and genetics, it is also a necessary condition for connecting systematic product R&D throughout the entire company—not only focusing it on a central research laboratory—and enhancing the assurance of its timing and success.”¹⁹

John Seely Brown, former chief scientist at Xerox Palo Alto Research Center and a widely quoted authority on innovation, echoes that position when he says, “A successful innovation often demands an innovative business model at least as much as it involves an innovative product offering.”²⁰ He thinks large corporate research departments don’t easily grasp this concept, and as a result many promising innovations never make it out of the lab.

Author Alexis Goncalves has an organic interpretation of the many relationships and cultural factors involved in managing an innovation process: “Innovation is inherently a highly cross-functional activity that, when it works well, creates a constructive tension between competing objectives of development cost, product value, performance, quality, and time to market..... the ability to consistently and continually bring an innovation to market involves: (a) hardwiring all the cross-functional activities in an effective way and (b) hardwiring several organizational factors—factors that, to use a biological metaphor, are embedded in a company’s organizational DNA.”²¹

Innovation doesn’t happen on an island

As more organizations acknowledge that innovation involves more than just the R&D function, the imperative to integrate innovation processes with mainstream management practice has expanded to encompass processes, logistics, strategy, operations,

Speed to market has an increasing premium to companies as a means of differentiation from the competition.

and multiple functions in the organization and also outside the organization. Business partners, suppliers, and customers, wherever in the world they might be, are playing an expanded role in corporate innovation strategies. There is a trend toward developing extensive innovation networks engaging in distributed innovation initiatives. These initiatives, based on methods for collaborating with partners to solve business problems in innovative ways, go by names such as open innovation and crowdsourcing.

The shift from tech push innovation strategies to market pull strategies is one factor in the expanded need to include the voice of the customer in product development. Whereas companies once were content to

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develop an interesting new technology and then try to find or construct a market around the new invention, today companies are much more likely to start with a perceived need and try to find new technologies that will fill that need for customers. In this new environment, where the market dictates the

search for new technology, management integration, process management, and quality management methods play an expanded role in the successful commercialization of innovative ideas.

Wanted: leadership for innovation

The key to effective innovation strategy is therefore deft management of the innovation process itself and all the interrelated processes and functions both inside and outside the firm. It becomes a leadership issue for the organization that needs to be addressed against the background of senior management's track record of fickleness with both innovation and quality. Today's innovation leader skillfully balances all the competing demands of innovation change initiatives: determining how much or how little structure is needed in any particular situation or with which group of employees; knowing what tools to use in each situation, and understanding the consequences of applying various tools and strategies in different situations; knowing where to reach a proper balance between the blue-sky

and the practical and the necessary mix of disruptive innovation and incremental innovation.

Company Experiences and Examples

There are as many unique approaches to innovation as there are unique organizations. While they may share some similarities in their deployment of various combinations of the principles mentioned above, many carry out their search for innovation in ways particularly suited to their own organization culture. Here are some examples illustrating the approaches of organizations widely regarded as successful, serial innovators.

Procter & Gamble: Structuring the Organization for Integrated Innovation

It takes a lot to grow a company when you're starting from a multi-billion dollar sales base. Procter & Gamble realized that in order to meet growth objectives, it would have to innovate. "We had to become a more consistent operator and a much more consistent and reliable innovator," according to former chairman and CEO A.G. Lafley.²²

P&G began around 2000 to structure itself in a way that would empower innovation, open up the company to new ideas from outside its walls, and make the innovation culture an integral part of its business model. The company began by determining that it should be possible to manage its innovation activity in much the same structured, disciplined way that it would operate a factory.

P&G maintains that a major driver of its innovation is the mix of systems the company has created to enable innovation throughout the company. These systems provide structure to the innovation drive. "More than any other factor, systems are the way we avoid dependence on 'eureka!' approaches to innovation," says Robert McDonald, chairman, president, and CEO. "We manage innovation with considerable rigor. We select innovation projects, allocate resources, and ultimately bring the best innovations to market with highly disciplined processes and systems."²³

Two major, innovative structural elements of P&G's innovation model are its Corporate Innovation Fund and FutureWorks.

The Corporate Innovation Fund focuses on high-risk, high-reward ideas. “It’s essentially an in-house venture capital firm that does initial concept, design, engineering, and qualification work and then hands over successful ideas to the appropriate business units,” states McDonald.²⁴

Future Works is an organization of multidisciplinary teams whose objective is to seek out innovation opportunities outside of existing business units. This new-business incubator is separate from the business units, but it has a business unit sponsor for each of its projects to provide practical, upfront guidance and eventually to take over responsibility for commercialization. The Mister Clean Car Wash outlets that P&G opened this year are a product of Future Works.²⁵

The company looks for payoff from innovation by integrating it into how the business is run. “It is integrated with the mainstream of managerial decision making, particularly choices of where to play, specific time-based goals, and key performance indicators. Innovation is also linked with budgetary revenue growth and cost targets, resource allocation and reallocation, people development and promotions, and performance appraisals and rewards,”²⁶ says Lafley.

DuPont: Balancing discipline and creative freedom, managing risk

DuPont positions itself as a market-driven science company, adept at moving useful, customer-valued ideas through its development pipeline. The company accomplishes that through the discipline of a stage-gate product development process that is supported by extensive use of Six Sigma methodologies.

Training in various Six Sigma methodologies is heavily focused on individuals the company identifies as innovation process champions. These are future innovation leaders drawn from both the marketing side and the technology side of the organization.

“We consider the innovation space to really be the intersection between these two, where we have marketing excellence and technology excellence as the most fruitful ground for innovation,”²⁷ states Kymm Hockman, DuPont senior consultant. She is a Six Sigma Master Black Belt and Innovation Process Champion who mentors people working on Six Sigma development projects.

The innovation process champions from marketing and R&D not only train together, they work together.

“These folks are doing terrific high-level projects that enable their organizations to push the improvement and innovation along the pipeline,”²⁸ says DuPont principal consultant Steve Bailey, who leads DuPont’s Master Black Belt Network. Bailey is also a past president of ASQ and past chair of its Statistics Division.

DuPont defines innovation broadly and breaks the innovation process into three broad phases: ideation, project selection and resourcing, and execution. At each phase, different disciplines and tools apply. In ideation, tools for managing and facilitating the idea-generation process using diagnostics and screens will come into play. Whereas during the selection and resource phase portfolio management techniques will be used to decide when to continue or kill

a project. Early on in an innovation effort DuPont might run a rapid market assessment or a rapid technology assessment, which would be carried out as a Black Belt project. Actual development work would be done as a Black Belt project or projects.

An innovation and choices database differentiates between initiatives, programs, and projects. An initiative is a broad area of work. Programs are one step down from that—specific efforts undertaken within the initiative. Projects are very concrete beginning-and-end efforts with specific objectives. Six Sigma efforts are employed at the project level. A program might cover the entire innovation process and have several Six Sigma Black Belt projects associated with it. So Six Sigma is used across the board.

DuPont uses two different classes of Six Sigma methodologies to execute projects, depending on the nature of the task. Incremental improvement projects, in which the objective is to improve an existing process, employ the DMAIC methodology.²⁹ In clean-sheet development, where everything is new—new product manufactured using new processes for new

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customers or new market segments—the methodology of choice is DMADV.³⁰ And sometimes hybrids of the two methods are appropriate. In either case, the Six Sigma discipline entails some similar basic steps: define the problem, identify performance requirements, understand possible solutions and choose the best one, then implement and verify.

Hockman explains that Six Sigma provides a requirement and the encouragement to consider all alternatives at an abstract level and provides tools for creating solutions in the Analyze phase of Design

for Six Sigma, the phase where scientific creativity comes into play. Before the arrival of Six Sigma at DuPont, this was done loosely by R&D scouting, but there was no real

process discipline to it. The Six Sigma methodologies provide the process discipline and help the organization winnow down possibilities to things that are doable. And the product portfolio methods implemented in the selection and resourcing phase are giving DuPont developers the information they need at the right time to make better decisions.

“The businesses I’m working with are meeting their growth objectives because of Six Sigma,” Hockman says. Today, some DuPont businesses employ Black Belts on every growth initiative.

Bailey points out that innovation requires a balance between discipline and exploratory freedom, and he acknowledges that in some organizations the innovators may have been exposed to too much rigor. “Use the right amount of rigor to get through to the next stage gate,” he says.

“Doing development is a risk management game—you have to move forward in the presence of risk,” Hockman adds. “So how do you know when you’ve got low enough risk to move forward? Six Sigma helps you with that. It has tools to help you manage that.”

DuPont began using Six Sigma in non-operational areas in 2000 with a Design for Six Sigma program that was introduced in R&D. About two years later the marketing aspects of development were folded in and a Design for Growth curriculum became part of the training process. At about the same time a Green Belt curriculum was introduced for developers in Central Research and Development. Bailey and Hockman say these programs were introduced with no more resistance than was felt when Six Sigma was earlier introduced in DuPont operations.

One major reason for the relative ease of internalization of Six Sigma methods in the R&D organizations may be that Du Pont does not emphasize Six Sigma separately. Rather, it is embedded within the larger, stage-gated new product commercialization framework alongside strategic marketing methods. The emphasis is never on the tool, but on the commercially viable end result for the customer.

The quality of the innovation process is a prime determinant of superior results.

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