Shifting Paradigms, New Challenges: Technology and Innovation Management

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In 1995 Arthur D. Little sponsored two Best-of-the-Best colloquia on technology and innovation management, one in North America and one in Europe. The companies nominated and selected by their peers as „Best of the Best“ in the field represent a wide range of industries and face very different markets and competitive dynamics. Nonetheless, as senior executives from these companies worked together over two days at each colloquium, they were able to share some important insights into the shirting paradigms and emerging best practices of the 1990s and beyond. They also identified some important pathways and „stepping stones“ that will lead to even higher performance in technology and innovation management in the future.

Shifting Paradigms, New Challenges

As the late Sam Walton, creator of Wal-Mart, noted, „You can't just keep doing what worked one time, because everything around you is always changing.“ This is particularly true of managing technology and innovation today. Although the phrase „shifting paradigms“ may be overused, it captures the situation that most companies now face. Colloquia participants identified seven major shifts, which provided the foundation for the conversations on emerging challenges and best practices.

• *The shift from technology breakthrough to technology fusion.* The benefits of technology development and innovation will come increasingly from the integration or fusion of multiple technologies rather than from individual technology breakthroughs. Companies are therefore being challenged to create and sustain a more diverse and complex portfolio of technology-related competencies – often involving substantially higher development costs and risks. The key challenge will be to identify, secure, and manage a changing mix of competencies in all the evolving technical areas required to sustain competitive advantage in a given industry or market – while strategically investing to become leaders in those areas likely to give the company the most leverage.

• *The shift from* reengineering and cost *reduction to product development and revenue growth.* Technology and innovation are increasingly recognized as critical to improving profitability, positioning, and performance in the marketplace, particularly as companies and their investors refocus their efforts on growth. (Wall Street values earnings from growth substantially more than new earnings from reengineering.) This shift to a growth focus has prompted a renewed emphasis on creating and capturing substantially increased value from new technologies and innovations. The challenge will be to identify the correct growth investments and to create the organizational behavior that drives the needed improvements and shifts in mindset required for high performance in this arena.

• *The shift from accelerated product development to robust and seamless innovation.* As discussed at both colloquia, the innovation and product creation/commercialization process is more like a rugby game than a relay race – requiring a wide variety of competencies and collaborations, in addition to speed and smooth handoffs. This creates challenges and opportunities far beyond those typically addressed when companies „engineer“ or „reengineer“ the traditional product development process. Seamless innovation demands the true integration of multiple players across the company, as well as customers and suppliers, in a rapidly changing and increasingly complex environment.

• The *shift from internal resource allocation to strategic sourcing and leverage.* As the world of product and process development becomes more complex, as the pace of technology change quickens, and as the cost of rapidly building and leveraging key technology competencies rises, dependence on outside resources increases. The challenge here is to create a new mental model based on a more holistic view of the technology and R&D resources available to a company – from the firm's own business and functional units to its key suppliers, customers, alliance and joint-venture partners, university and association affiliates, and outside service providers. The shift away from an almost exclusive focus on the allocation of limited internal resources presents a major challenge to companies with strong „control“ or „not invented here“ cultures. However, companies that use sourcing and partnering effectively to maximize leverage have experienced dramatic increases in the breadth and depth of their technical competencies and in their ability to launch high-performance products quickly.

• *The shift from metrics focused largely on project justification and ROI to metrics that drive value creation.* Adopting cross-functional, value-driving performance measures – or giving such measures increased emphasis – can redefine individual and organizational behavior and rewards. While directors and CEOs complain that senior and middle managers invest too much effort in justifying value and not enough in delivering value from technology and product development, getting managers to accept responsibility for downstream value creation remains a major

challenge. What well-trained and experienced scientist, engineer, or MBA is really willing to be measured on something he or she can't effectively control?

• *The shift from R&D funding and management to technology investment and management.* Today, senior R&D managers and chief technology officers (CTOs) often manage not only the company's entire technology and R&D portfolio but the full range of technology resources – internal and external – available to the company. Increasingly, CTOs are being held accountable for maximizing the return on this investment through technology sourcing and leveraging, technology commercialization and rollout, and technology venturing and partnering. The challenge has been to give the CTOs sufficient clout and resources – along with well-aligned objectives and performance measures – to enable them to deliver the significant improvements in returns that are now seen as achievable and essential.

• *The shift from multinational management to global management.* Multinational technology and product development has been difficult to achieve. But truly global technology and innovation require very robust global intelligence networks, proactive global resource management and sourcing, and collective commitments to objectives and investments that will drive global rollout of product, process, and management technologies.

The essence of these seven paradigm shifts and the challenges they raise was captured graphically at the U.S. colloquium with the image shown in Exhibit 1. This image reflects the compelling need for many companies to shift from what is sometimes referred to as the vertical „silo" mentality (with its associated emphasis on functional productivity, efficiency, and excellence and decentralized, autonomous, and self-sufficient business or geographic units), to those critical cross-functional and cross-business processes that are seen as creating and capturing value for the global enterprise – particularly product creation, innovation management, and technology development.

Emerging Best Practices

Having outlined today's new paradigms, together with the challenges they create, participants turned their attention to the future. Building on „lessons learned" in managing technology and innovation today, they outlined the strategies and structures they felt would be needed over the next five to ten years to keep their companies among the Best of the Best. In effect, they charted some important „pathways" to high-performance technology and innovation management in the next century. In the North American colloquium, participants focused on the following nine „best practices" as important ways to sustaining industry leadership through 2005.

• *Develop a mix of strong, empowered teams to drive critical value-creating, cross-functional processes of product creation and technology development.* Participants universally accepted the principle of cross-functional management and empowered teams as essential to future success. They also acknowledged that implementing it presents a daunting challenge for even the best of companies. All participants reported significant difficulties in their attempts to manage technology and innovation across strong functional silos and to motivate team-work and collaborative behavior in cultures that have usually rewarded individual excellence. However, some companies, such as 3M, that have grown organically and have long histories of cross-functional and cross-business flows of technology and innovation, have created fully embedded networks that ensure and reward this flow. Such companies treat all technology and innovation as corporate assets and provide strong corporate support for individual and collective innovation, which they see as critical business success factors. Companies that have grown through acquisition and individual leadership, rather than „organically," have found other ways to create collaborative environments. For example, they physically co-locate teams, transfer people aggressively across functions and geographies, and explicitly reward people for team performance.

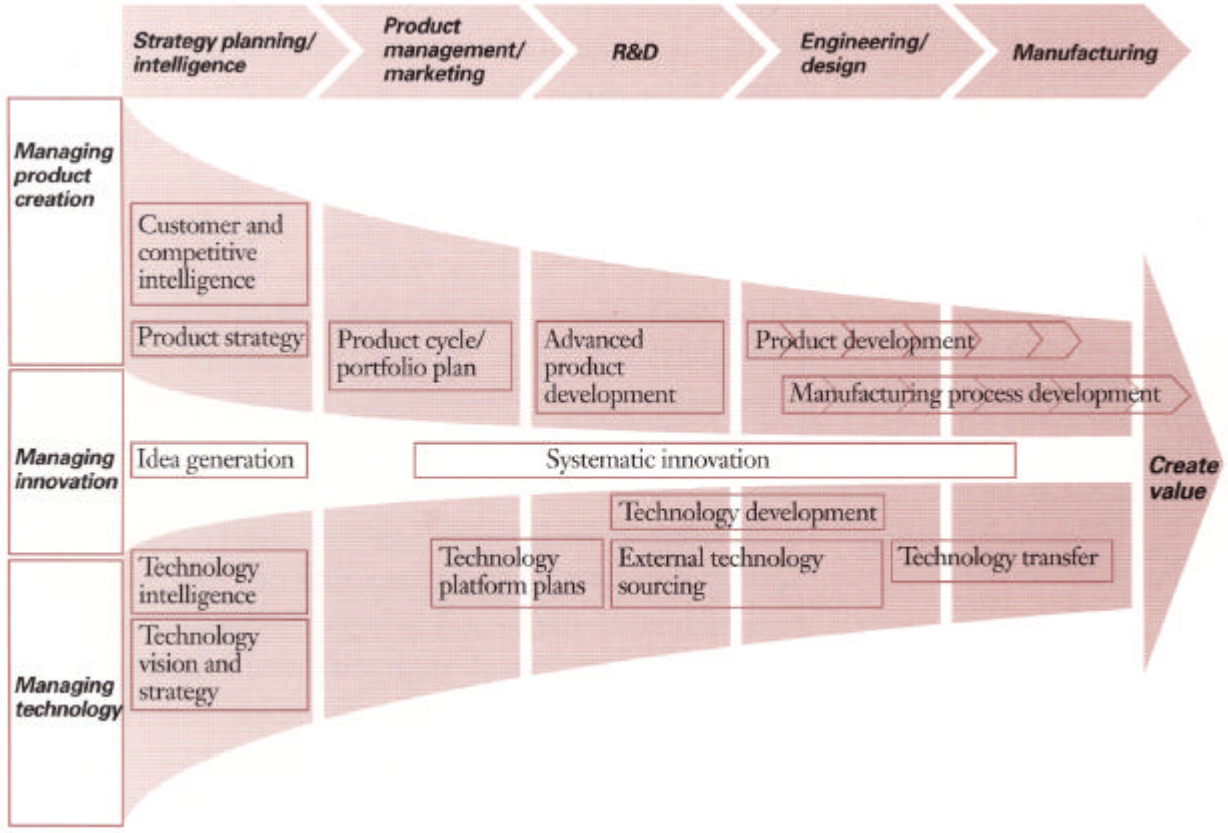
The management of risk-reward trade-offs in technology and innovation management was also discussed as a key element for effective cross-functional teams and networks. No single best practice has emerged. Rather, companies are pursuing various courses that seem to fit their cultures, including their written and unwritten „rules of the game." For example, Ford Motor Company has its global Platform Development Teams, DuPont its Global Technology Networks and „stewards," Corning its co-located Core Technology Managers and Business Technology Managers, Motorola its Motorola Instincts, and S.C. Johnson its high-profile Global Driver Groups. Despite these efforts, colloquium participants reported major gaps between their cross-functional objectives and their actual performance.

• *Create a well-aligned technology vision and strategy.* Several Best-of-the-Best companies reported a need to significantly clarify and refocus their technology visions and strategies to align with new corporate visions and business strategies that are focused more on growth. Implicit technology visions rooted in the concept of serving just internal customers are no longer adequate to the new paradigms of the 1990s. Technology visions need to be explicit and well-aligned with corporate visions so that technology strategies can be based both on evolving business strategies and on enduring technology visions. These visions increasingly address the need to use leadership and leverage to create and capture the maximum company value from technology. Well-aligned technology strategies

address both the need to support the business strategies with the successful development and innovative application of technologies, and the need to support the technology vision by building strong leadership in selected core technical competencies, and by leveraging key technology resources and assets across the company's functions, geographies, businesses, and partners.

Exhibit 1

The Technology and Product Development Process



• *Develop a strong and well-balanced portfolio of key and pacing technology application platforms that can drive or enable a stream of product or process innovations.* Targeted investments in key application platforms are seen as critical to sustainable differentiation and competitive advantage. Some participants reported concerns that their companies may have moved too far toward exclusively business-driven technology application projects with short-term, relatively low-risk profiles. Most participants have initiatives underway to revitalize their long-term portfolios of technology development activities. Their goal in this age of ever-faster reverse engineering and proliferating copycat products is to create sustainable advantage across the globe. Even leading companies such as Ford, DuPont, and Corning reported the need to reestablish a credible process that would enable their business and technology communities to agree on which technology platforms would ensure future market and technology leadership and thus merit investment. Participants see „scenario planning," „visioning," „contingency planning," „signaling theory," and „trigger planning" as useful steps in these initiatives. George Arnold, Product Management and Development Process Vice President of AT&T Bell Laboratories, said, „A major challenge for us right now is determining what R&D functions ought to be done and how to integrate them across the globe so that we are creating global technology platforms, as opposed to a bunch of redundant activities."

• *Build a robust and seamless innovation management process, from concept to customer.* Most Best-of-the-Best participants in North America reported that by following this practice, they had already dramatically accelerated their core product development processes. However, they saw significant further improvements to be made, both in the upfront ideation/championing and „skunkworks" part of the process and in the downstream commercialization and rollout phases. Many agreed that future improvements would yield four to five times the return of past improvements, which had focused on reengineering the core product development process.

Participants also viewed the globalization of this innovation process and the effective integration of suppliers, customers, and other partners as major areas for achieving differentiation and competitive advantage. Representatives from Gillette, S.C. Johnson, and AlliedSignal see the physical co-location and the integration of preferred customers and suppliers on their product creation teams as crucial to future success. The „seamlessness" achieved through effective integration of the supply chain is also a critical pathway to future breakthroughs in time to market, product performance, product cost, and risk management. Internal seamlessness, similarly, is essential to true globalization. Said GE's CTO Lonnie Edelheit in discussing one of his projects, „We had video conferences, daily faxes, even newsletters. The people on that team were doing everything they could to, in effect, co-locate. *Yet,* I don't think any of us are sitting here saying it's going to be business as usual or that it will take just a little bit of incremental change to become global."

• *Develop a dear and well-leveraged sourcing and partnering strategy.* The increasingly important role that customers, suppliers, and other outside sources play in leveraging a company's technology competencies and in improving the company's innovation process is widely accepted by Best-of-the-Best companies. Leading companies such as Apple, Sun Microsystems, Microsoft, and Chrysler are already experiencing successes and driving dramatic industry changes as the result of new sourcing and partnering strategies. However, few believe they are managing the process of sourcing and partnering today as strategically as they will need to in the future to remain Best of the Best.

AlliedSignal's CTO Isaac Barpal said, „We used to say don't put all your eggs in one basket. The idea was to have more suppliers so we could pit them against each other in order to get another half a penny. Now all that is changed. Chrysler told us the other day that they went from 10,000 suppliers down to 2,000 and now they want to go down into the hundreds." Chrysler has clearly turned the North American auto industry around on the whole sourcing and partnering issue. It actively negotiates with many of its preferred suppliers on collaborative technology development ventures, as well as „contract" product development. Many suppliers now view Chrysler as their preferred (although not largest) customer. As another indicator of changing practices in this area, Gillette's Vice President of Corporate Research and Development John Bush noted, „In the last budget cycle, I was given a significant pot for external R&D. 'Go use it wisely,' my boss says, 'because I'm going to measure you on it, but it's a separate part of your budget.' That was a revolution for us."

• *Foster a market-oriented, customer-driven culture that is conducive to creativity, innovation, and managed risk.* Several of the Best of the Best have observed that their organizations are less enthusiastic about innovation and risk-taking, in part as an indirect consequence of reengineering and downsizing. Other companies, such as 3M, have been able to sustain a strongly innovative culture, committed to innovation as a fundamental competitive weapon. There was general consensus among the participants that their ability to sustain innovative cultures would be critical to their remaining Best of the Best. David Duke, CTO of Corning, told participants that, after 10 people spent a year looking at Coming's culture of risk, it became apparent that „at the top we think we are really risky, while farther down they don't think so at all." It also depends on what part of the company you talk to, he discovered. „For example, in consumer products they said, 'Look, just take some risk instead of running all these market studies and focus groups for six to ten months. Just do it!' But in the blood testing business, they said, 'We want no risk – zero.' Depending on the part of the company, we want some people to be very risky and others to take no chances at all."

• *Create a more comprehensive budgeting and resource management process to address the company's network of technology assets and investments.* The process should recognize technology as a key asset in which to invest and leverage value. It should account for technical resources, assets, and capabilities that are being managed across the company (far beyond Research, Development, and Engineering). Several Best-of-the-Best companies are already moving in this direction. Gillette has integrated budgeting of external and internal resources. The increasingly important role of CTOs on global sourcing and procurement councils is another way leading companies are moving toward integrated technology resource management. One participant reported that more and more pharmaceutical R&D heads are now envisioning a world in which 70 percent of their dollars will be spent outside the company, compared to 30 percent today.

• *Develop an active technology and innovation competency network and global intelligence system.* This system should go far beyond the rudimentary databases and informal networks common today. All the Best-of-the-Best companies already have very active technology resource networks and monitoring systems or databases. Nonetheless, participants agreed that this area will advance rapidly during the next several years – with major shifts likely among leaders and followers.

• *Find inspiring and committed technology leadership through a strengthened CTO role.* Business leaders must support the management of technology and innovation across the company's functional silos and businesses, through its customers and suppliers, and among all its global markets. Participants universally agreed that leaders need to

have a passion for new products, speed, and customers – not just processes. John Berschied, Jr., Vice President, Worldwide Consumer Products, Homecare R&D and Overseas Labs, for S. C. Johnson, noted, „I have people who are absolutely obsessed with what they call 'product plus' [meaning, a significant number of people will find a perceptible, usable plus in the product without knowing whose brand it is]. With strong leadership, our people are saying that 80 percent of our products ought to show product plus in blind label testing. That's quite a challenge in consumer products, but they are committed to it."

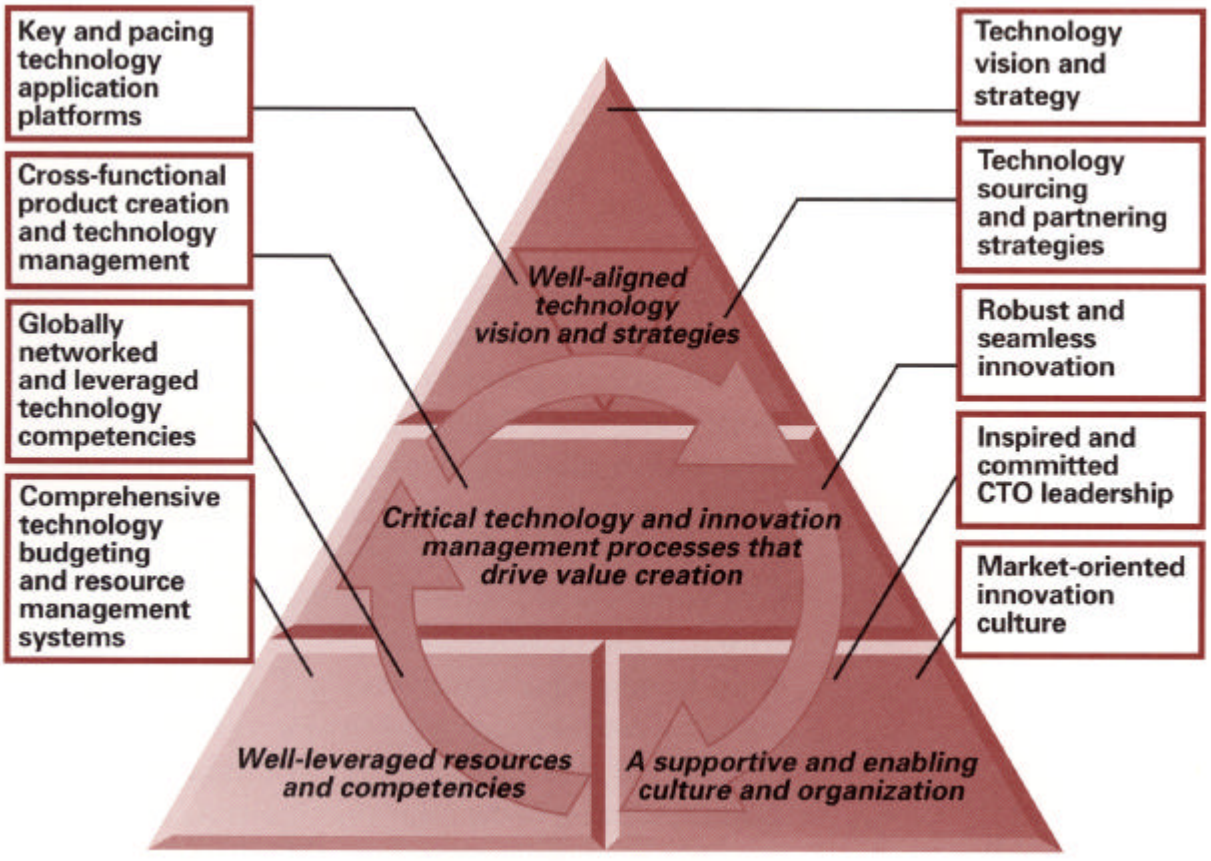
There was also considerable discussion about the need to broaden the scope of integrated technology and innovation management responsibilities. This wider scope is necessary if the firm is to create and deliver value from a robust innovation process and to manage a variety of technical resources and competencies. One way to achieve this is through the creation of the CTO role. David Duke, CTO of Corning, and Isaac Barpal, CTO of

AlliedSignal, shared their experiences at the leading edge of the evolving CTO role. Barpal discussed his transition from Senior Vice President of R&D to CTO and noted, „In balancing cost-cutting against investing in the company's future, CTOs will have an enormous impact. I see CTOs becoming a more critical part of organizations as we try to understand the real value of R,D&E, and the E includes design engineering, process engineering, and manufacturing engineering. I chart my particular function from the beginning of the process to the end of the process." From these discussions it is clear that the CTO role is still going through substantial change – it differs at every company – and there should continue to be opportunities for shared learning.

On the basis of the discussions among the Best of the Best, these nine pathways to continued leadership appear to provide an initial framework for moving toward high-performance technology and innovation management in the future (see Exhibit 2).

Exhibit 2

High Performance Technology and Innovation Management in the Future



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