

The Chief Technology Officer as an Agent of Change

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Peter Drucker wrote in one of his many insightful essays: „The source of wealth is knowledge. If we apply knowledge to tasks we already know how to do, we call it productivity. If we apply knowledge to tasks that are new and different, we call it innovation.“ He went on to say that „the two beacons of productivity and innovation must be the guideposts of industrial management and leadership.“¹

This insight is particularly relevant today, when the fast pace of economic, social, political, and technological change generates tremendous opportunities to increase productivity, to innovate, and to create wealth. In order to seize these opportunities faster than competitors do, technology-intensive corporations must astutely exploit the innovative and productivity-enhancing power of technology.

But technology – which is increasingly expensive to develop or acquire and complex to manage – evades the carefully planned approaches suitable for other assets. Sourcing and deploying technology across worldwide business-unit boundaries is an increasingly daunting challenge, requiring corporate leadership that is strong, bold, and flexible. Toward that end, many technology-intensive firms have appointed a member of the senior management team to oversee and manage technology companywide. Often he or she has the title of chief technology officer (CTO).²

As this is a relatively new position, many companies are still grappling with defining its role. In this article, we outline our view of the role of the CTO as corporate change agent, suggest ways in which the CTO can make this role operational, and offer some thoughts on what it takes to assume leadership as a corporate change agent.

The Evolving Role of the CTO

The CTO’s mission and role typically evolve through five stages:

- Ensuring alignment
- Managing the strategic asset
- Managing technology processes
- Developing measurements
- Driving change

Ensuring Alignment. The CTO’s core task is to oversee the establishment of a technology strategy that is firmly aligned with the organization’s business strategy. The tools and methods associated with this task are now in widespread use. The approach Arthur D. Little pioneered in the early eighties, the Strategic Management of Technology, has guided many firms to master the linkage of technology strategy to business strategy.

Managing the Strategic Asset. Second, the CTO ensures that technology is managed as a strategic asset. He or she determines the core competencies of the organization and its methods for deepening knowledge, as well as the areas in which advances need to be made. The CTO explores a variety of sourcing options and is instrumental in deciding which technologies to pursue internally vs. externally and how to erect competitive barriers around them through patents, licenses, etc.

Managing Technology Processes. Third, the CTO contributes to streamlining, enhancing, and steering the internal technology management processes to minimize duplication of efforts across the organization, achieve critical mass, stimulate skill transfer and cross-fertilization, share assets, and deploy technology across business lines.

Developing Measurements. Fourth, the CTO takes the lead in creating metrics to evaluate technology. What is the value of our R&D? Are we achieving adequate returns from our investments in technology? The CTO develops these metrics, uses them in decision-making, and arbitrates in the case of unclear or undeveloped metrics. (See the article on page 21 of this issue of *Prism* on a related topic, namely measuring technology and innovation performance.)

Driving Change. The first four dimensions create a platform from which the CTO can drive corporate change. Coping with corporate change faster than your competitors do takes leadership and vision. It takes – to borrow a phrase from Derek Abell, a professor at IMD, the European business school – a dual vision: a vision of how to master the present and preempt the future.³ Hence companies need at the same time both a success formula for running today’s business and another strategy for changing that business.

For example, the most successful mass retailers know how to manage the immense amounts of money they are investing today in technology for delivering goods to the consumer through distributed outlets. At the same time, forward-looking retailers are developing business formulas and technologies for winning tomorrow, when

retailing may be driven by home shopping and delivery.

Driving Corporate Change

The CTO can apply the dual-vision framework and successfully realize the role of corporate change agent by following three steps:

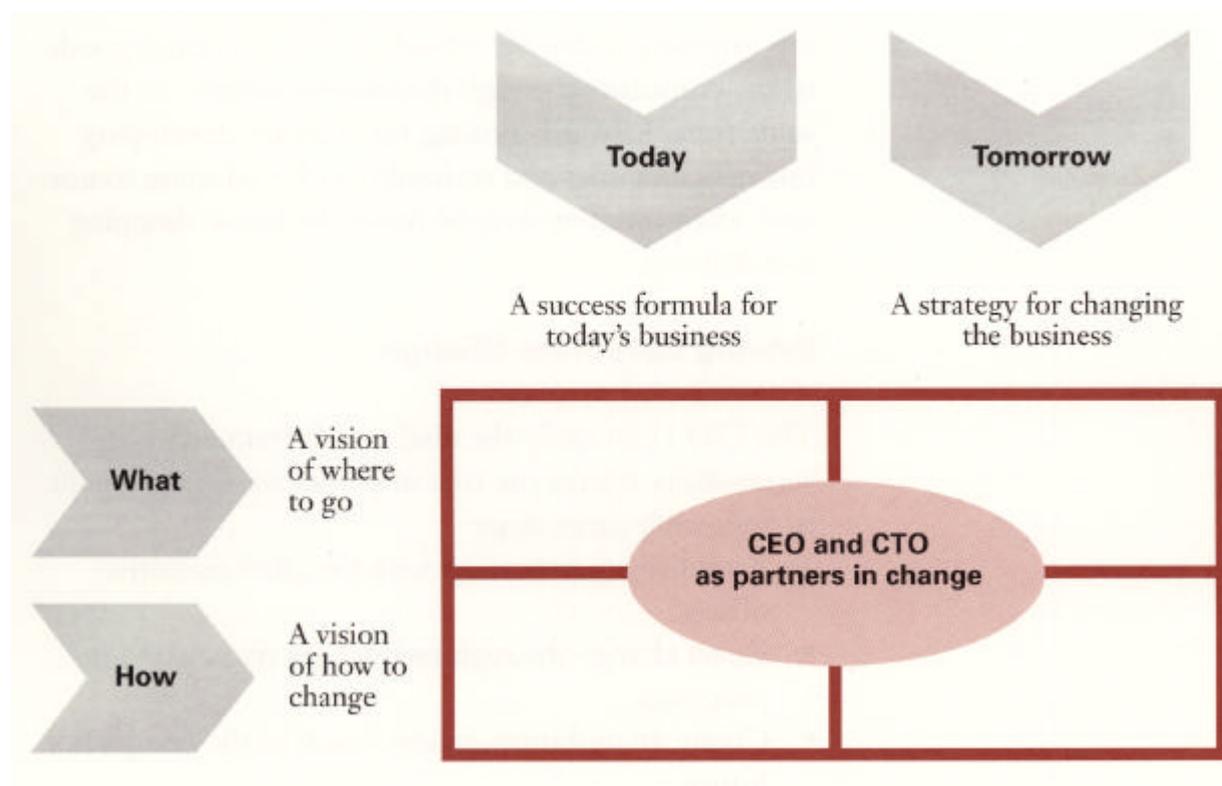
- Establish a partnership with the chief executive officer.
- Enact change through technology management processes.
- Create an ambition-driven vision of the company's future.

Establish a CEO-CTO partnership. Clearly, in industries in which the preeminence of technology is enabling and driving the creation of wealth, companies realize that they must incorporate technology in shaping the dual vision. Successful CEOs and CTOs must co-own the dual vision framework as partners. They must jointly and continuously evolve the vision of where to go, today and tomorrow, and of how to change the organization's processes in order to realize their vision (see Exhibit 1). The core argument in ADL's book, *Third-Generation R&D*⁴ is that such a partnership is immensely instrumental in making R&D more purposeful and creating corporate value.

Enact change through processes. Successful CTOs increasingly focus their approach to change on the technology management processes running through the organization. These processes range from new product development to strategy formulation to intelligence gathering; they also include idea creation, resource development, technology development, and technology sourcing. Exhibit 2 displays how these processes link together in an „upstream-downstream“ framework.⁵

Exhibit 1

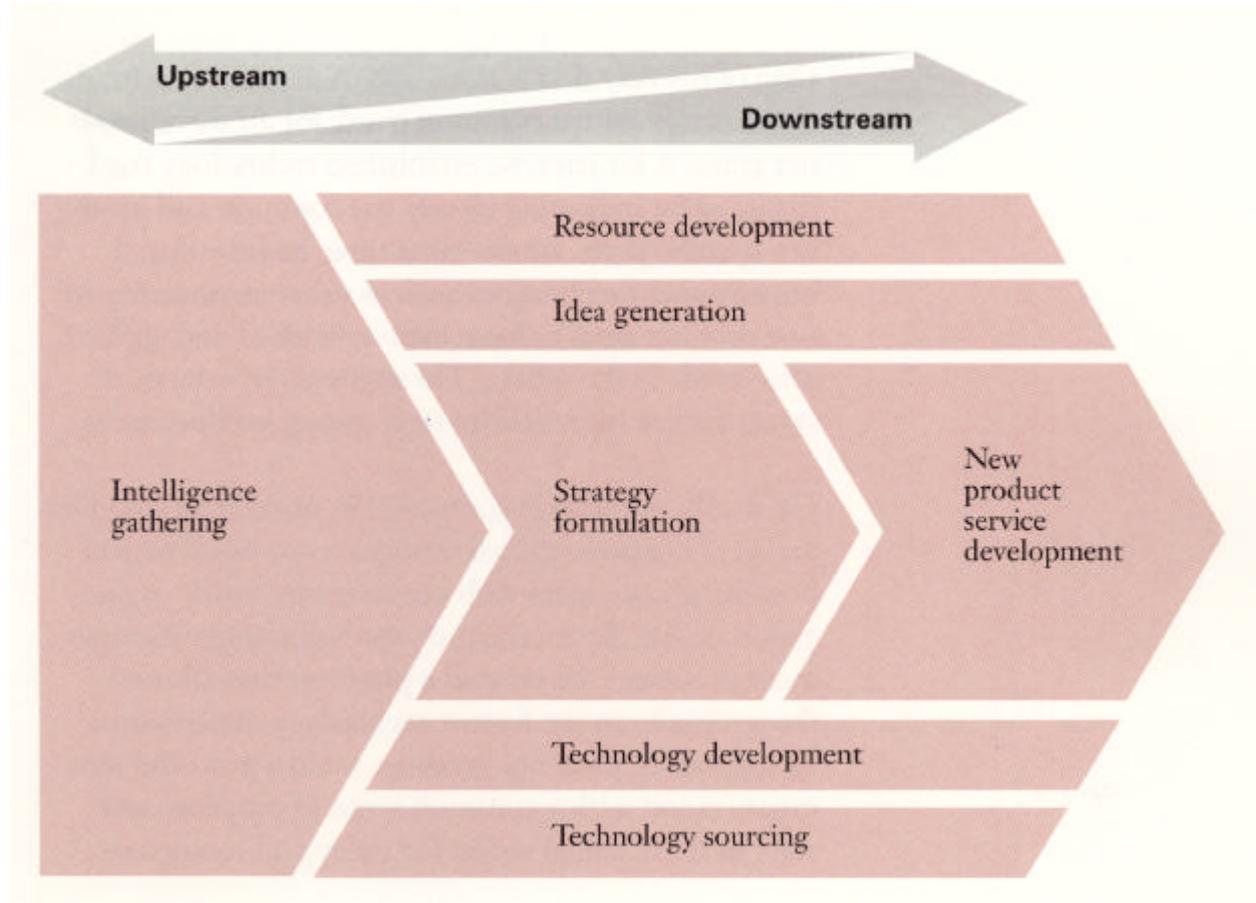
Co-ownership of the Dual Vision by the CEO and the CTO



These processes provide a natural platform on which the CTO can embrace the mission of change agent. First, no single functional manager owns any of these processes. Second, the processes are so interlinked that disparate improvement efforts by individual managers, however well-intended, run the risk of obstructing each other. Full benefits do not accrue unless successful efforts are implemented across the board.

Exhibit 2

Driving Change Through Technology Management Processes



One consumer goods company we know well made the bold decision a few years ago to create a single technology division – covering radical research, development, and production engineering – to serve all three product divisions. Until then, each product division had managed its own technology department, despite having major common technologies. The forceful market entry of a strong competitor led the company to rethink its structure and pushed the need for radical change. The company entrusted the president of the new technology division with the mission of creating a technology powerhouse to challenge the new competitor. The division was set up in matrix form, with the common technologies as one dimension and the product areas as the other. This organization concept in itself is not so remarkable. What is remarkable, though, is how the division president, acting as chief technology officer, succeeded in making the organization perform effectively within a short period of time by focusing on technology management processes.

One of his very first actions was to develop a technology strategy with a common trunk for all three product areas. A bit later, he established technology road maps, again indicating clearly the common and product-specific parts. At the same time, he introduced improvement techniques such as value engineering in one product area, to have them enhanced and applied afterwards in the others. Throughout, he selectively rotated a few high-caliber staff among product areas.

He would never have succeeded in turning around this merger of organizational transplants so fast if he had become preoccupied with the structure in the organization charts. By focusing on the technology management processes, he created a platform that allowed the people from the former technology departments to step out of their old loyalties, build a powerful new organization with a common sense of purpose, and start to share a dual vision for today and tomorrow.

Create an ambition-driven vision. CTOs who have been successful in introducing stable technology management processes realize that they must continue to reinvent the vision of the company's future and integrate their technology vision into the corporate vision. Increasingly, these CTOs are not satisfied with planning for the future on the basis of today's conditions. They coach the firm to envision a new business context that sets the firm's ambitions at a radically higher level. Again, they use technology management processes as the

starting point (Exhibit 3).

The CTO has a major role to play in setting stretch targets for new product development. Much management focus in new product development has been on reducing time-to-market. Firms that have reduced lead time by 30 to 50 percent have proven that speed is a formidable competitive weapon. Because speed in new product development has become a base requirement for being in business, forward-looking CTOs make sure that their organizations create entirely new products and markets. They put genuine innovation at a premium.

Exhibit 3

Ambition-Driven Visioning in Technology Processes

	Condition-driven planning: Productivity Procedures Today's business	Ambition-driven visioning: Innovation Paradigm shift Preempt the future
<i>Intelligence gathering</i>	Collect data about existing markets and competitors	Create insights about emerging markets and competitors
<i>Strategy formulation</i>	Employ technology for winning with today's business formula	Exploit technology for reformulating the business equation
<i>New product development</i>	Reduce product time-to-market	Create new products and markets
<i>Resource development</i>	Replenish the resource as slots open up	Build competencies in pacing technologies
<i>Idea creation</i>	Screen ideas for fit with existing business	Nurture ideas for validation of new business opportunities
<i>Technology development</i>	Strive to boost the performance of today's technology	Explore the potential for leapfrogging into new terrain
<i>Technology sourcing</i>	Tap and enrich the established network	Set up new networks

The CTO can help the organization pay attention not only to technologies that support the profitability of today's business but also to those that fundamentally change the rules of the game. For example, steel mini-mills using electric-arc furnaces fed with scrap iron have turned upside down the economics of traditional steel-making based on big blast furnaces.

Similarly, extrapolating the performance of today's technology in order to set development targets is insufficient. The CTO can play a critical role in triggering efforts to develop uncharted terrain. For example, in the mid-eighties the entire diaper industry was busily improving absorption performance of the all-pulp-fiber product by a couple of percentage points every year, until Procter & Gamble took its competitors by surprise and incorporated super-absorbent polymers, yielding a giant improvement in performance.

Finally, the CTO has a critical role to play in visioning the internal and external resources needed to make the firm's ambitions come true. More of the same may not be good enough. For example, rather than enlarging the resource base with ever-better-educated people, it may be wise to look for people with an entirely different orientation. Different organizational concepts may be required. By the same token, rather than adding nodes to the established network of external partners (e.g., yet another equipment supplier), it may be better to grow a new, as-yet-unconnected network (e.g., a contract research firm). The Dutch electronics giant Philips, for example, back in the mid-eighties created a new network of software development partners for its CD-Interactive hardware business, long before multimedia and interactivity were on everybody's lips.

What these examples show is that the CTO can successfully operate as a change agent by questioning the extrapolation of today's conditions to the future, envisioning alternative scenarios for future business, building commitment to the new ambition, and accelerating the transformation of the organization.

Having the Right Stuff

Not everyone is cut out to be a CTO. The CTO who aspires to be a corporate change agent and an architect of the future as well as a caretaker of today's business must offer a unique combination of capabilities. During the course of our professional work, we have observed a few common – if often paradoxical – traits that distinguish successful CTOs.

To be successful, a CTO must be grand in his or her business vision, yet respectful in dealing with people. The CTO must be determined to change the place, yet courageous enough to take the time needed to do it right, recognizing that he or she can accelerate change but can't force-feed an organization.

Above all, successful CTOs should combine personal functional expertise with corporate process management skills. They must have a solid understanding of technology and sound business judgment, so that they can add substance to problem-solving and develop solutions that work. At the same time, they need to know how to help others accelerate their learning, and thus elevate the capabilities of the organization as a whole. Finally, they too must actively partake in this learning process, continuously developing their personal leadership skills.

Unlike many technology managers, effective CTOs must also be good people managers. The CTO has to understand what motivates and drives behavior among scientists and engineers and use this understanding to implement change. He or she must know how to explain to the CEO what it takes to ensure successful technology development in terms of people, training, recognition, and rewards.

Empowering a CTO to be an agent of change is not a luxury. It is a sine qua non for companies that want to lead and create wealth. As a partner of the CEO, the CTO is uniquely qualified to envision the future and accelerate the transformation of technology-intensive firms. When realized, this partnership will condition the firm to compete successfully – both today and tomorrow.

¹ Peter F. Drucker, *Managing for the Future*, Truman Talley Books, 1992

² Paul Adler, Kasra Ferdows, „*The Chief Technology Officer*,“ *California Management Review*, Spring 1990

³ Derek F. Abel/, *Managing with Dual Strategies*, The Free Press, 1993

⁴ Philip A. Roussel, Kamal N. Saad, Tamara J. Erickson, *Third-Generation R&D: Managing the Link to Corporate Strategy*, Harvard Business School Press, 1991

⁵ Adapted from Jean-Philippe Deschamps and P. Ranganath Nayak's forthcoming book, *Product Juggernauts: How Companies Mobilize to Generate a Stream of Market Winners*

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