CHAPTER 1

Listening to the Future

In ancient times, leaders would perform elaborate sacrifices and rituals in an attempt to gain some cryptic bit of foreknowledge that might give them an advantage against rival armies or palace intrigues. The future, after all, was just one of a great many mysteries that the human intellect had yet to penetrate. The Ouija board, the Zodiac, or the I-Ching seemed as good a technology as any to ascertain the unknowable.

Thousands of years of human history have passed, but accurately forecasting future conditions still requires more art than science. Today we possess more data about the world, better tools for analysis, and mature theories about how the universe works, but as these extremely powerful components come together to highlight trends and explain complex natural phenomena, they highlight the weaknesses of prediction just as often. Greater data about the universe brings into question fundamental beliefs about physics. The mapping of the human genome forces a reevaluation of "junk DNA" as previously hidden connections and functions are revealed. Economic theories that presupposed the

existence of "rational actors" now increasingly contain footnotes about forecasts as underlying assumptions about behaviors and relationships in the economy shift. Although our interpretation of cause and effect is often accurate, many models still reflect outputs whose origins vary greatly with subtle changes to initial conditions. Despite the limitations of forecasting, we can use our analysis, combined with insight, to identify potential problems years in advance and start formulating policies to address them before they become a crisis; or we can spot opportunities and attempt to arrive at the right place, at the right time, to take advantage of them.

Ironically, it is the vast and growing power of our analytical and observational tools that can cause the most trouble in our efforts to plan for the future. Information breeds expertise. Experts become vested in their positions and confident in their analytical powers. Careers are built on knowing things. As confidence hedges toward certainty, experts and those who listen to them start sketching their visions of the future in heavier lines and more vivid and vibrant colors, until these schematics become so convincing that no other alternatives seem plausible. As a result, the market for futures has come to resemble a Middle Eastern bazaar, crowded with gaudy hawkers crying out their wares:

"Globalization is inevitable and irreversible!"

"No, nationalism and fundamentalism will bring down the global order!"

"Aging populations will doom the developed world!"

"The economy is headed for collapse because of peak oil!"

"Technological innovation is pushing us toward a 'singularity' that will trigger the next phase of human evolution!"

Each of these positions, and dozens of others, has its adherents, armed with reams of data and internally consistent modes of analysis that point inexorably toward their mutually incompatible and wildly contradictory conclusions.

The diversity of expert opinion about the future is worse than useless to business leaders, policy makers, and ordinary people who have to

make decisions in the here-and-now based on reasonable expectations of what is to come. At least in the days of séances and sacrifices, the spirits would not argue among themselves about the prophesies they handed down to the faithful. But today, placing a bet on one school of expertise or one convincing method of analysis means placing a bet *against* a score of competing and potentially just-as-likely futures. When the stakes are high, the consequences of leaning the wrong way with unjustified confidence can be disastrous.

EMBRACING UNCERTAINTY

Fortunately, a more humble path can lead to more robust results. For years, many organizations have positioned themselves for success by embracing the concept of uncertainty. That doesn't mean throwing up your hands and saying "I don't know!"—and dispensing with the concept of planning altogether. Rather, it involves sifting through the possibilities, identifying the antipodes of extreme positions, and considering multiple future scenarios instead of one concrete future vision. The goal of the planning process is to identify strategies that are effective and resilient across the widest range of potential futures—not just to hedge bets against unforeseen risks, but to ensure that the organization will be watchful for future events in time to respond with appropriate agility to their forecasted opportunities and contingencies at the lowest possible cost—and with the hope their careful anticipation was more robust than their competitors.

Microsoft's approach to forecasting is modeled on the scenario planning methodology developed by Royal Dutch Shell in the 1970s, and later formalized by the Global Business Network consultancy. Starting in 2003, Microsoft began a series of structured visioning exercises with internal and external groups, including Microsoft employees, customers, partners, and several groups of college-age students (The Information Work Board of the Future) that led to the development of four scenarios, or possible futures, against which we could test ideas about the future of business, technology, and work.

Scenarios start by recognizing the importance of driving forces that will likely shape the new world of work and business: globalization, demographic change, the spread of networks and information technology, the drive toward transparency and regulation, the blending of work and life, and mounting concerns over energy and the environment. These forces are real and are supported by statistics and data, by anecdote and experience, *and* by the weight of expert opinion, as we will explore in later chapters. However, the driving forces by themselves don't predict any certain outcome or set version of the future because they are individual vectors in a complex world. How these forces interact and play out precludes any definitive answer about the future, regardless of how certain we may be of the elements.

Each driving force suggests questions rather than answers. Will globalization continue on its current course, or trigger a backlash of resurgent nationalism and regional conflict? Will aging workers leave the workforce, stick around beyond traditional retirement age, restart careers late in life, or shed the "workaholic" tendencies associated with Baby Boomers throughout their working lives in favor of a more balanced view of work and life? Will networks and technology help large organizations consolidate their power by leveraging their scale, leaving ever smaller opportunities for competitors, or will power shift to nimble players able to collaborate in opportunistic partnerships in a more innovative, dynamic world?

The outcomes of these and other similar questions don't point to one future but to many, each with its own attributes and implications for work and business. The scenario planning methodology helps lay out the possibilities like points on a compass, with the axes determined according to the two most important uncertainties, per the consensus of the planning group(s). At Microsoft, we chose to define our north–south uncertainty axis as the predominant organizing principle of the world: centralized and hierarchical or distributed and networked. The east–west axis is defined by the trajectory of globalization: towards greater global integration or towards a more bordered, regionally focused world. The resulting grid defines four quadrants, each representing a different combination of characteristics—centralized and global, centralized and

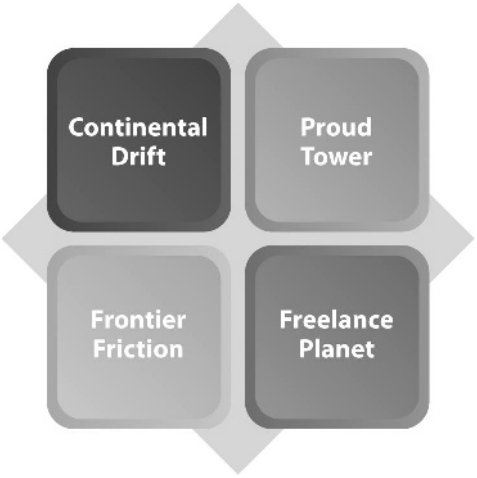

FIGURE 1.1 Microsoft Scenarios

bordered, distributed and global, and distributed and local. Starting with those basic defining qualities, our small teams built up stories around each future scenario, giving each a distinct personality and a distinct name (see Figure 1.1).

Because the poles of the compass represent the most divergent outcomes of critical uncertainties, the scenarios force the reader to accept a new set of logic that is beyond any individual experience or constrained intuition. That is by design. The scenarios create a framework for stories about the future that don't *predict* what will happen, but that create environments that help challenge assumptions, spur creativity, and create a canvas of possibilities that can be monitored.

Although two uncertainties define the scenario matrix, all of the driving forces and the other uncertainties act as characters in the stories about the future. The scenarios gain the richness of logic and direction so that other elements, when played out against these stories (see Four Visions of the Future: Microsoft's Scenarios, below), behave according to the logic of the scenario, and therefore very differently from scenario to scenario. The completion of the stories creates the groundwork for testing assumptions, for exploring the answers to strategic questions, and for asking open-ended questions and seeing where they lead.

Scenarios often recoup their investments within days or weeks of their development because they create a new way of sorting strategic imperatives, starting new projects, or helping shut down projects that prove questionable in light of the scenarios. But scenarios best prove their value over the long-term as entry points for monitoring the future and as a windtunnel for new ideas.

Windtunneling borrows a metaphor from aerospace and automotive design. In traditional windtunneling, air is blown over a design with colored smoke, or in more modern versions, sensors, to help visualize the aerodynamics of a design. Windtunneling has also been used to refine the way ski jumpers hold their bodies and skis for maximum lift. With scenarios, the stories act as windtunnels for ideas, with the narrative blowing over them to see how the design of the idea holds up within the logic of the world. And like traditional windtunneling, an idea that doesn't fare well can be redesigned and retested until it is robust against multiple futures. Ideas can also be deconstructed until certain elements prove their resilience against multiple futures. This helps designers sort out core features, which are robust in all scenarios, from contingent features, which can be added, removed, or modified depending on the direction of future events. It also prevents overinvestment in areas that are most vulnerable to uncertainty and disruptive change.

In Microsoft's case, windtunneling can help ensure that a core set of capabilities envisioned at the beginning of a long product development cycle remain relevant to the needs of customers when the product comes to market, perhaps years later. Although it is not possible to *precisely* predict future business conditions and customer needs, the next best thing is to deliver a product, service, or strategy resilient against different scenarios and contexts, rather than optimizing for one possibility that may or may not actually materialize.

The final purpose of the scenarios is to serve as conceptual guideposts to help make sense of developments in the world. In the corridor outside Dan's office at Microsoft, there is a large bulletin board divided into a four-quadrant grid of the scenarios. Clipped news stories are posted on the board according to which scenario they reinforce. In the Proud Tower quadrant, you might see a *Wall Street Journal* article about

the uptick in corporate mergers and acquisitions (M&A) activity, or a piece from *PC World* talking about a new technology for watermarking digital documents. In the upper right ("Continental Drift"), perhaps a story from *The Economist* on the increasing integration of regulation regimes in the EU, or a newspaper editorial advocating increased trade tariffs. Over time, the entire board becomes thickly carpeted with stories, each providing a scrap of evidence for the emergence of one scenario or another. The framework helps us contextualize the constant stream of information and provides early warnings for a swing toward one of the competing poles of uncertainty. It also helps create visceral proof that relying on any one forecast might prove a dangerous assumption.

Although scenario-planning method does not tell us exactly where we are going, it creates a useful frame for conversations and observations, which can then be translated into action. When Microsoft engages in business discussions with customers, the scenarios help define meaningful questions and act as a framework for interpreting the answers. Perhaps most importantly, the scenarios help create a learning dialog about the future priorities and strategies with customers that refines what is important to the market. As Microsoft learns from its customers, the scenarios become ever-richer canvases for strategic conversations.

Four Visions of the Future: Microsoft's Scenarios

SCENARIO 1: PROUD TOWER

Proud Tower describes a future where merger and acquisition activities have led to large, centralized, vertically integrated corporations. These oligopolies have subsumed many of the functions of governments, including education and development of local infrastructure. International laws also favor large businesses and prioritize defense of their intellectual

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property. Globalization creates a fertile climate for transnational commerce, with economic opportunities leading to rapid development in emerging nations, within the constraints of the oligarch investments. Many companies have created their own security and encryption capabilities because of a distrust of commercially available solutions. Since a few large companies dominate the market, it is difficult for small competitors to gain a foothold. Consequently, companies compete at the margins for market growth and revenue opportunities within their existing customer base, while innovation suffers. Many global revenue models look more like annuities, as products and services both offer support plans that rollout updates or replacements on a regular basis. Workers make their careers by climbing the corporate ladder, building relationships within their organization, and blending their personal lives with the culture and priorities of their employers. Most workers earn a comfortable living and are highly educated through strong K-12 programs and corporate universities.

Some additional characteristics of this scenario include:

- Borders are increasingly fluid, with global corporations as the primary organizing principle of commerce at every level.
- Security and intelligence needs tend to outweigh issues of privacy, and U.S. military and global corporations form increasingly close relationships.
- Corporations pay more attention to issues of governance, accountability, and sustainability, recovering some civic trust. But new global and social tensions are rising as people anticipate the century's third decade, even as economic inequalities continue to widen.
- Highly proprietary, structured, corporate-monitored information systems and networks dominate technology infrastructure. The Internet is primarily a means for connecting to work and a place to interact through highly sponsored and corporate regulated sites.
- Corporations, some of which may deploy proprietary algorithms due to distrust among the companies that offer security solutions, control intellectual property.
- Workers are (and must be) loyal to corporations. The rise of *organization person* becomes the politically correct version of Whyte's 1950s *organization man*.[1] The conformist, approval-seeking aspects

of the Millennial workstyle make them a good fit for this kind of culture.

- Emphasis is on intra-organizational collaboration and communication as people use information and process expertise to gain status within corporate meritocracies. Internal networking and politics are more important than external relationships.
- Searching and filtering of internal information proves equally (or more) important than looking for external information as internal efficiencies and consistency drive corporate agendas.
- Organizationally oriented reputation systems help people figure out the best people inside the organization to work with to achieve their goals.
- Organizations are worried about information leaking out as a kind of paranoid overprotection in a world where few, if any, could duplicate a capability. Much of the worry about information is due to the opacity of process and the desire to maintain a certain perception and image in the market regardless of actual operating practices.

SCENARIO 2: CONTINENTAL DRIFT

Continental Drift envisions a retrenchment from globalization and a return to competitive nation-states or regional blocs. Political problems have complicated relationships among the United States, Europe, China, and the Middle East, restricting access to manufacturing capabilities, raw materials, overseas markets, and immigrant labor. Although oil remains in adequate supply, the transportation of oil proves ever more risky, with many nations choosing to reduce the length of supply chains, and in many cases, bringing back goods production to national soil. National governments become much more assertive in creating industrial and labor policies, reflecting a return to economic nationalism and a disenchantment with free market and neo-liberal theories that dominated the prior decades. The decline in trade increases the stagnation of the world economy and lowers the levels of wealth-creation. Increasingly ideological governments disdain pragmatic interest-balancing approaches in favor of strident solutions to domestic and international issues. A few large businesses thrive on government contracts and subsidies while competing among themselves for share of domestic markets. Most businesses become increasingly associated with their

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nation of origin as they pull their edges in toward a more secure, controlled, and predictable core. Some nation-states nationalize industries, eliminating the subsidiaries of multinationals overnight. Political friction rivals that of the Cold War with security measures that make it difficult to do business across borders. Workforce development and education are huge government priorities, and workers in most developed economies have strong leverage in negotiating pay, benefits, and working conditions because of labor shortages caused by demographics, as long as concessions are made to behavior and information requirements within the largely state-controlled labor system.

Some additional characteristics of this scenario include:

- Increasing global problems—terror, economic turmoil, and environmental degradation—lead to the return of big government across the world.
- Though the U.S. remains militarily powerful, a series of strategic missteps significantly weakens its economic and cultural influence relative to rising powers elsewhere in the world.
- Major governments in Europe and Asia raise taxes to pay for large infrastructure projects intended to kick-start a stagnant and more regionalized world economy.
- Regional innovations do not spread globally as the distrust of information causes much duplication of effort, and security barriers at national firewalls often halt the news of regional discoveries until they can be used to political advantage.
- A new generation of young nationalists, particularly in fast-growing economies like China and Brazil, support and spur increasingly confrontational military and economic policies on the part of their governments.
- High regional compliance overhead hamstrings growth as nations promulgate new forms of compliance to keep their local businesses in line and deter international trade except when necessary for survival.
- Differences rule: New local competitors emerge in various regions as the disruption of the global economies creates local niches for businesses once dominated by multinational firms and brands.
- Playing by local rules is as important as (or more important than) efficiency, causing many firms to reduce their profit expectations for business continuity goals, often creating complex relationships to maintain some control over international holdings by

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fragmenting internal operations to comply with local regulatory demands.

- Being culturally competent and being multilingual are valued skills among employees charged with negotiating the increasingly less penetrable boundaries between nations.
- Emphasis is on interorganizational collaboration and communication with the nation-state creating consortiums of suppliers and services operators to meet the needs of central plans.
- High concern over information boundaries leads many national governments to create strict regulations on the movement of information and investing heavily in filtering and encryption technology to restrict access to national assets.
- As standards fragment and fracture, information translation and format transcription will prove invaluable to maintain fluidity. Much early work done by hand will be automated over time.
- Regionally oriented reputation systems dominate with barriers that exclude finding expertise or managing relationships outside of approved boundaries.

SCENARIO 3: FRONTIER FRICTION

Frontier Friction emerges following a severe shock to the global economic system: perhaps a data meltdown in the financial sector following a cyberattack. An attack against information generates a general pushback against technology as people lose confidence in the industries that turned their money, and their lives, into the binary language of ones and zeros. Over a very short period of time, confidence in the old order collapses and authority devolves to regional governments, communities, religious sects, and emergent and traditional clan and tribal affiliations. This is a problematic scenario for business. Companies must create and enforce their own security policies and operate in an environment of low trust among employees, customers, and partners. With economic and educational infrastructure in disrepair, the quality of the knowledge workforce continues to degrade, requiring simpler tools and practical skills. Supply chains are fragmentary if they exist at all, and much of the economy becomes localized, with networks of communities interrelating at the near-local level.

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Some additional characteristics of this scenario include:

- Power and influence seep away from hierarchical institutions and corporations, as the old rules stop working and citizens tear down working institutions out of fear and distrust.
- Facing a dynamic and dangerous world, people crave a sense of belonging and focus on communities and relationships; this gives rise to fundamentalism as well as new "swarm" models of communities that assemble and congregate based on current needs rather than long-term thinking.
- Privately funded nonprofits and nongovernmental agencies step in to fill many of the functions of governments starved of resources and crippled by corruption.
- The distrust of all centralized political or social entities heightens the importance of individual security and individual validation of truth.
- Individuals see a need for multiple aliases as they navigate across tribal boundaries, while simultaneously demanding stringent background checks and checkpoints for new entrants to a community.
- Burgeoning youth populations in the world's poorest countries, and among the world's most insular religious sects, generate increasing intolerance, social disorder, and violence. Job skills decline among younger people and many industries are threatened with serious labor shortages.
- The maintenance of older products becomes equally as lucrative as shipping new products as the adoption rate of innovation crawls and people reuse and reapply existing technologies and tools to new problems.
- The ability to move between networks and make new partnerships is crucial as local resources are often very scarce and insufficient to meet needs.
- Translation skills—at every level and in every way—are at a premium as the fragmentation of the world creates new social and cultural pockets that begin to evolve independent systems, even languages, that force the need for people who can navigate through their information and cultural boundaries.

- Information distrust is very high, leading to much missed information. This further enhances ignorance and reinforces insular behavior.
- Home schooling or religious schooling predominates the education environment.
- Community-oriented reputation systems that key off *very* trusted sources are one of the few community applications that remerge as valuable to the new, isolated communities.

SCENARIO 4: FREELANCE PLANET

Freelance Planet is a world transformed by bottom-up networks and mass collaboration on a global scale. The flexibility and speed of networked systems renders centralized command-and-control hierarchies obsolete at all levels. Large corporations become holding companies and managers of relationships between independent contractors and small providers. Governments outsource and devolve their functions to entrepreneurial nonprofits and nongovernment organizations. People seamlessly blend their lives and work, managing multiple identities, networks, and overlapping relationships using technology that pervades every device and environment. Rapid innovation and creative thinking are competitive advantages. People and businesses invest continuously in learning. New hotspots of creative thinking flare up unpredictably all around the world, creating global attention deficit disorder as most people find it hard to sort out what will be important today, let alone tomorrow. Workers manage their own savings and their own healthcare, or join one of the many guilds or associations that attract people who require a sense of physical community in the ever more fluid and impersonal world of business.

Some additional characteristics of this scenario include:

- Network, speed, and creativity rule. Traditional hierarchies become increasingly ineffectual, as emergent systems succeed in surprising new ways, including distributed intelligence networks that greatly enhance security.
- Voices of the previously disenfranchised enjoy growing influence; even so, a rapidly changing technological society is challenging to many institutions and people.

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- More expertise is available online so people create just-in-time learning opportunities, further eroding any hope for the few remaining businesses built on proprietary practices or intellectual property.
- There is increased emphasis on relationship management in all aspects of life, and across "outsourced" borders. People have massive contact lists that are tagged to help locate the right people for the right problem (contacts become contextual).
- Information security moves off the network and the operating system to the object, completely shifting security expectations. Network penetration and operating system hijacking result in interesting experiments but do little to compromise the information encapsulated in content containers, some of which have very protective behavior shells that limit access to their contents.
- A general blurring between enterprise and extra-enterprise networks exists with new security software in play that quickly analyzes objects on a device attached to a network and isolates any threats while allowing the user to connect to authorized data and applications. This development precipitates very open networks and drives closer collaboration among partners and customers.
- Strength and success in open innovation leads to the rapid development of new business models, new businesses, and new products and services.
- The short half-life of success means that many start-ups fail in half the time it took previous waves of innovation to be displaced in the market.
- The experience growing up in the rapid-fire, tech-saturated world of the 1990s serves next-generation workers well, as they come to the workforce with strong skills in collaboration, entrepreneurial instincts, and expectations of dynamic change and transparency.
- Schools are reinvented as open institutions with physical locations acting as education hubs for multiple generations and the Internet providing just-in-time anyplace learning of core topics and extended topics constrained only by the pace of the learner.
- Surveillance is highly distributed and often personal, with individual concerns driving how much peripheral vision is employed. Businesses and governments both gather terabytes of video and audio data on a

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daily basis for later analysis should any law enforcement or regulatory concern require the recall of that information.

- Popular spiritual movements help people stay connected to each other in some way other than electronically.
- Computer viruses are rampant, but not as lethal because they are often used as calling cards and proof points for freelancers looking to be hired.
- Aggregate wealth increases rapidly but is unevenly distributed. Localized boom-bust cycles come and go quickly based on innovation-learning-adoption curves.
- Very little loyalty remains between employees or employers. Many people work for more than one organization, and most organizations negotiate nonbinding agreements with employees. Some guilds and associations formed around scarce skills negotiate longer term, more binding contracts that cover classes of workers, but not necessarily the individual (e.g., the company agrees to employ fifteen graphic designers—it does not specify which designers, but what class, which also defines skill requirements and pay).
- Personal prioritization and attention management are the hot software categories as people use software to help figure out what is important and help maintain balance in their lives.
- People lose their distrust of cloud-based information providers, leading the way to global identification systems that span the breadth and depth of the global talent pool.

THE SHAPE OF THINGS TO COME

Listening to the Future is the distillation of Microsoft's efforts to think about the future of business and work—the challenges and opportunities facing organizations, the transformations that will ripple through the political, economic, and social environments, and the implications for different industries. The scenario work provided a way to test ideas, and the best and most resilient of those ideas are explored here in depth.

In the first part of the book, we investigate four central challenges of doing business in the second decade of the 21st century:

1. **Managing a Dynamic Business:** What are the changes in markets and business models that will shape the future landscape, and how can businesses make themselves resilient?
2. **Prospering in a Blended World:** How can large organizations thrive in an environment of unprecedented diversity in the workforce, the marketplace, and the IT landscape?
3. **Gaining Insights from Complexity:** How can businesses transform the flood of data into useful intelligence to drive decision-making?
4. **Building Strategic Advantage Through IT:** How can the right investments in software and systems help organizations compete in a world where requirements and processes change continuously?

From these four themes of change, the book pivots to a discussion of several factors that are shaping the work experience from the perspectives of the employer, the employee, and parties interested in workforce development and productivity, such as governments, educators, non-government organizations, consumer groups, and industry associations. We have grouped the themes into four main topic sections:

1. **One World of Business:** The drive toward globalization, its implications and consequences, and the role of people and technology in a more integrated global labor market.
2. **Always On, Always Connected:** How pervasive networks and mobile devices are reshaping our understanding of the workplace and workday, and the new set of choices facing people and businesses that arise from an expanded set of possibilities.
3. **Transparent Organizations:** As the costs of opacity grow increasingly unsustainable in a world of constant information and conversation, will the pressure for transparency come from the top down (through regulation) or from the bottom up, via community pressure and new technologies?

4. **Workforce Evolution:** How demographic change, new approaches to education and training, and the diversity of backgrounds and perspectives in the global workforce are challenging workers, managers, educators, and governments.

Knowledge and Talent in the New World of Work brings all of the elements to bear on a single problem: the renewed recognition that knowledge capture, learning, and collaboration will be a major competitive differentiator in a world where high percentages of skilled workers will retire over the coming decades, a world where their successors may not be interested in learning the skills of older workers leaving the workforce, and a world in which ever increasing amounts of work are distributed, along with the knowledge and skills to support that work.

Finally, the book examines various industries, including manufacturing, financial services and insurance, retail, professional services, government and public sector, and healthcare, through the lens of our scenario framework, identifying how the key themes of the new world of work and business might play out in those segments of the economy.

TECHNOLOGY AND THE CHANGING WORLD

Information and communication technology (ICT) is both the means and the motive for many of the changes that have swept over the world in the past 20 years, and new innovations in ICT will help people and organizations manage the changes that are to come. As part of our work, we track the development of new innovations in ICT that may just be appearing on the long-range radar—as research projects, demos, or pilot programs—and think about how they might be incorporated into the mainstream applications that people will use at work in the next 10–20 years. Some of the technologies we are watching include:

- Contextual collaboration
- The evolution of devices
- Interfaces and user experiences
- Machine learning

- Metadata for physical objects and environments
- Modeling and simulation
- Pattern recognition
- Reputation systems
- Smart content and metadata
- Social computing and consumer-generated content (see IT Innovations Shaping the New World of Business below for brief descriptions of these technologies)

Developments in any of these areas are as likely to surface in consumer applications such as Web services, electronic devices, or videogames, as in work or enterprise environments. In fact, if the experience of the past decade is any indication, popular innovations in the consumer economy and uptake by workers will lead enterprise IT planners—sometimes kicking and screaming—to the discovery of the business value of these new tools, rather than vice versa.

While the speed and direction of ICT innovation is itself an uncertainty in the new world of business, it is a theme that plays across all the scenarios. Technology alone does not create and cannot solve the complex challenges of the new world of business, but technology can be deployed strategically to empower businesses to choose the right things to do, and allow them to do them at a place and time that balances the needs of the organization with the needs of the worker and the consumer. Being smart and strategic about the way we use ICT in work and business can also help us avoid creating new problems as we solve old ones—the "two steps forward, one step back" dilemma that usually accompanies rapid change.

IT Innovations Shaping the New World of Business

Contextual collaboration: The different modes of communication and collaboration, including everything from e-mail and instant messaging to social networks and blogs, are still largely isolated, standalone applications that require people to leave one work context and enter another one (e.g.,

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leave a document to go to a shared workspace). However, many vendors are starting to make collaboration capabilities available as Web services, which can be integrated into customized environments and applications based on each user's role and workstyle. As these efforts mature, collaboration and communication will become easier to use and manage for workers and IT, making possible more connected and transparent work practices.

The evolution of devices: Every day yields promising new developments across the spectrum of hardware and devices, from ultra-bright, thin high-resolution displays to long-life fuel cell batteries for notebooks and mobile computers. Communication and computing continue to converge in the form of powerful portable devices that combine telephony, data networking, media recording and playback, information applications, and access to enterprise data. The $100 laptop program is helping to close the digital divide in emerging economies, and this trend will only accelerate as hardware continues to become more powerful, more eco-friendly, and less expensive.

Interfaces and user experiences: For most of the PC era, the keyboard and mouse have provided the primary mode of interaction with computers, and the desk-mounted monitor and printer the primary output devices. Now we are seeing new modes of capturing and outputting data arriving in the workplace, often via the world of videogames. Data gloves, three-dimensional joysticks, and position-sensing devices are joining pens and tablets as alternative ways to input, navigate, and manipulate data; voice-based input is becoming more common and more accurate; smart conference cameras automatically swivel to the person speaking. Software-based interfaces are becoming more immersive, extending to 3D multiuser environments like SecondLife. New wide-screen displays, data surfaces, and digital paper provide alternative means of displaying video data, while 3D printers are coming into wider use for prototyping, product design, and manufacturing. Many of these innovations will find their way into the workplace over the next 10–12 years, bridging the physical gap between people and information.

Modeling and simulation: Now that we are collecting and distributing data in quantities far beyond the ability of the human mind to comprehend, we need ways to abstract and represent that data in a useable format so it can be acted upon. Modeling tools are now starting to enable people to overlay (or "mashup") data from different sources into customized views to reveal

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hidden relationships. For example, sales data from internal systems can be plotted onto satellite maps from public Web sites and weather information from meteorological agencies to show how weather conditions influence sales of particular items across different regions. Simulation tools enable people to test hypothetical conditions against real-world data to conduct tests of prospective products and services, or perform regression analysis on statistical data to isolate relevant factors.

Machine learning: Machine learning refers to the capability of software to modify the way it behaves based on observation of user preferences or external conditions. Machine learning is used today in self-healing hardware systems and applications that diagnose and troubleshoot problems and either alert IT or fix it themselves. The same kinds of capabilities can be used to create adaptive interfaces that configure themselves based on the workstyles of individual users. Dictation and natural language recognition programs also use machine learning to recognize and adapt to the voice mannerisms of their users.

Metadata for physical objects and environments: Radio-frequency identification (RFID) tags have become a cheap and pervasive way to track physical inventory. RFID and successor technologies such as smart-dust, environmental sensor networks, and surveillance systems that integrate facial recognition and other forms of intelligence, will make it easier to blur the boundaries between the physical and the virtual world. Physical objects can be tracked like data in a network, removing many elements of risk and uncertainty from supply chain management and logistics.

Pattern recognition: Statistical algorithms enable computers to infer relationships from complex or incomplete data, simulating the intuition that people use to make sense of words that are missing letters, for example. Improved pattern recognition will help software and interfaces become "smarter," less intrusive and more context-aware, as well as enabling better natural language capabilities and implicit security policies that do not require passwords. The current limits of pattern recognition software can be seen in the changing styles of the random letter-number-symbol security codes sometimes required to sign up for Web sites, used to screen out automated sign-in programs. As pattern recognition gets better, the security codes need to become more "fuzzy" and abstract to fool the intruders.

Reputation systems: Reputation systems allow people to rate and tag content such as blog posts or documents in a repository, or the quality of a process. The reputation score is aggregated and visible to everyone else, making high- and low-quality content immediately obvious. Reputation systems are also used by e-commerce sites such as online auctions to help build trust into anonymous transactions by letting trading partners see the past reputations of the people they are dealing with. The use of reputation systems is already spreading to non–Web-based transactions (such as Angie's List service, which assigns reputations to building trade contractors based on user input) and the methods for assigning reputation will become easier and more implicit.

Smart content and metadata: Metadata describes the content of the data it is attached to, such as an ID3 tag associated with an mp3 file that contains artist, album, track number, and so on. Static metadata requires that search engines or databases provide a superstructure of organizing principles (business rules) to locate and organize content (e.g., sorting a music library by artist, then by album, then by year). Smart content is described by *dynamic* metadata that can update itself based on evolving conditions. For example, the metadata of a smart document might include not just the author, date created, date modified, etc., but also a constantly updated list of people to whom it was e-mailed, terms that discovered it in a search, number of times it was printed, and other information including security permissions. Smart content can improve search and content management, help keep documents up to date automatically, and enable content-level security.

Social computing and consumer-generated content: Over the past several years, enterprises have begun to discover the business value of social computing applications that originated in the consumer world, such as blogs, wikis, and social networks. These types of systems are evolving every day, and new channels are starting to extend to social experience to mobile devices via short message service and micro-blogging. These developments will continue, and end-users, particularly younger workers, will likely be out in front of IT departments through grassroots adoption. It will be an ongoing challenge for organizations to rationalize new social computing applications into existing business and IT frameworks, and adopt business practices and culture to a world with permeable boundaries between work and personal life.

PEOPLE MAKE THE FUTURE

The early information age saw large-scale enterprise systems deployed to gather system data and automate business processes. While automation and data collection still deliver value, further refinements to these capabilities will yield only marginal gains. The important innovations of the next decade will come not from large backend systems, but from workers and consumers taking control of data and processes to gain insight into the organization, its customers, and its infrastructure so that new paths to value can be realized.

As social computing and mass collaboration make their way into enterprise environments from the consumer marketplace, they are creating turbulence in work practices and culture: The walls of the enterprise have become more and more permeable, collaboration extends beyond employees to partners, customers and external colleagues, and the free-form communication expectations of sophisticated "digital natives" are clashing with more traditional approaches to work. Blogs, wikis, instant messaging, interactive multimedia, subscription-based content, remote and mobile computing, social networks, content filtering, mashups, and all the other accoutrements of the Web 2.0/Enterprise 2.0 toolset are redistributing power from centralized hierarchies to the network, changing the way decisions are made, and affecting processes, technology investments, and the shape of the workforce itself.

The latest technologies challenge long-held assumptions about the governance role of ICT as it distributes control to end users and blurs the boundaries between organizations and the broader Internet. Combining business intelligence from consumer platforms with internal data, or deploying collaborative cocreation innovation sites with customers, is not like retooling an assembly line. There is no mechanical equivalent for the closely held relationship between people, process, and information that constitutes today's business environment. Concentrating on data and automation may reduce costs and drive efficiencies, but industrial age models applied to knowledge economy companies will prove crippling and ultimately counterproductive.

The future is far from certain, which is why it is more robust to develop agile, responsive, and fluid business models, and to deploy the technologies to support them, than it is to create rigid, inflexible systems. As history frequently demonstrates, it is easier to reinstate rigidity than to unleash agility.

That dynamic is playing out today as consumer expectations of computing overwhelm the industrial age approach to information. The book is about transition. It points toward new frameworks for business while recognizing the need to move toward new futures as they unfold. In some cases those moves will be cautious, such as when it comes to protecting personal information. Other times, they may be dramatic, such as when it comes to creating new forms of open innovation.

No matter which future unfolds, technology will be a factor in shaping that future, and will provide the tools to help organizations and individuals navigate through the change. This book represents a marker along the journey toward the future, one that we hope proves useful as an input to minimizing risk and discovering the opportunities that will face us all in the new world of business.

NOTE

1. W. H. Whyte, *The Organization Man* (New York: Doubleday, 1956).