

# American Perspectives\*

2008 2009 2010 2011 2012 2013

2014 2015 2016 2017 2018 2019

2020 2021 2022 2023 2024 2025

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# Leveraging innovation

openness discipline creativity → results

The ground rules of innovation as we know it—how it happens, where it happens and who makes it happen—are changing. But despite reports sounding the death knell for American ingenuity, the numbers show a brighter picture. The US is still very much at the top of the charts in research and development (R&D) spending, patents, publications, citations and awards for innovation.

Traditional measures of innovation may be imperfect, but they do offer insight into what's happening globally. They also carry significant implications for business strategies in the coming decade.

Innovation, like business overall, is rapidly globalizing. Foreign-owned companies and foreign-born inventors account for nearly half of all US patents.<sup>1</sup> And cross-border investment in R&D is gaining momentum. While the usual suspects—Israel, Sweden, Japan and the US—still lead the charge in

innovation, the rest of the world is catching up fast. Countries such as India and China are investing more in education and R&D and are increasingly attracting the foreign-born innovators so important to the US.

To be sure, the educational and demographic trends underlying these global shifts will sway US policy. But far from damping American competitiveness, these changes simply impose a new reality on how, where and why companies will innovate.

Fresh approaches to organizing, supported by emerging collaborative technologies, are helping companies meet the demands ahead and create innovation opportunities.

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<sup>1</sup> Organisation for Economic Co-operation and Development (OECD), Patent Database, May 2003. <http://www1.oecd.org/publications/e-book/922001-04-12987//PDF%5CA43.pdf>.

**Measured success**

# Worldwide trends in innovation present challenges and opportunities to US business

The US outspends every nation per capita on R&D, higher education and software. But our results appear to be underperforming in efficiency. National rates of joint patent filing in the top three global patent offices—the triadic patent family of the US, the European Union (EU) and Japan—are considered indicative of an idea’s economic substance because of the time and cost

involved in filing. Gauged by this measure, the US sits on the low end of the G8 in the rate that our R&D investment generates triadic patent filings. And on a per capita basis, six countries surpass our inventiveness.

Meantime, the cross-border flow of innovation is streaming ahead. Over 40% of working professionals in the US who hold doctorates in science and engineering were born in

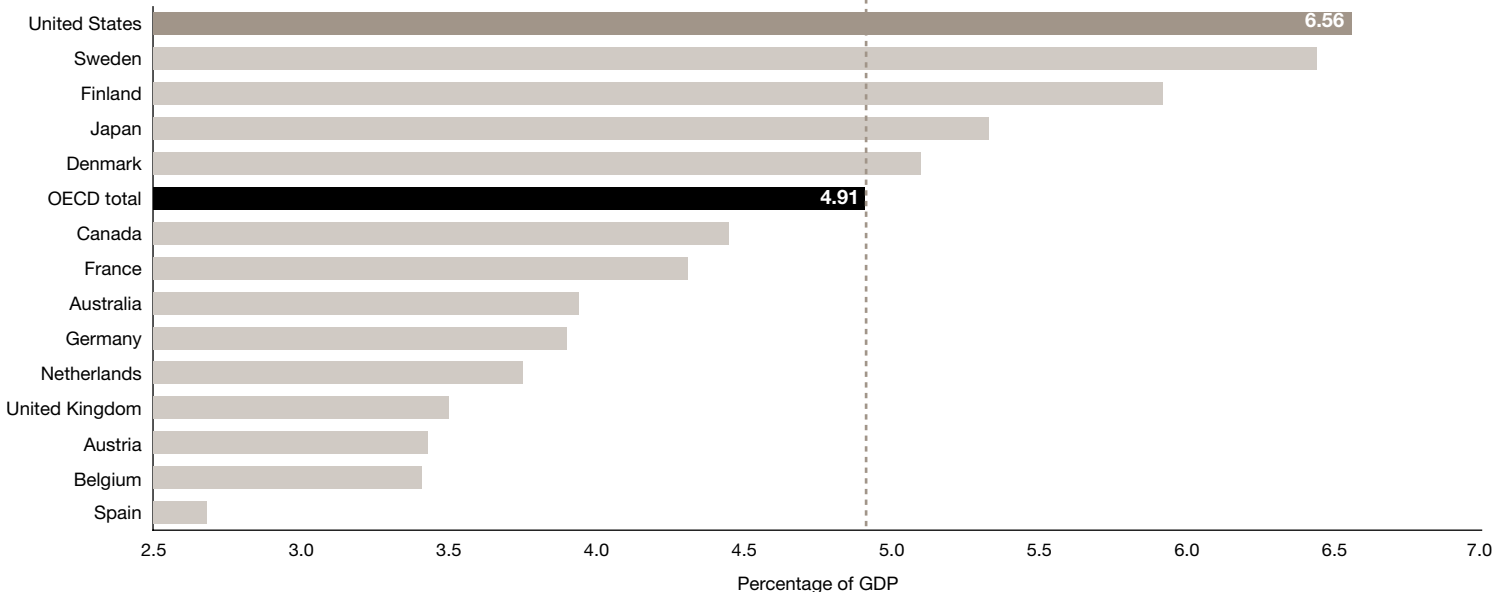
other nations, up 15 percentage points since 1990. Foreign R&D financing is pouring into some nations, particularly the UK and Canada, while Japan remains relatively self-funded. (The US does not report these statistics.) The US itself is quickly outsourcing R&D as measured by the rate at which both US and foreign-based multinationals send employment overseas.

## Hey, big spender

**US leads world investment in innovation, but the bang underperforms the buck**

**Figure 1**

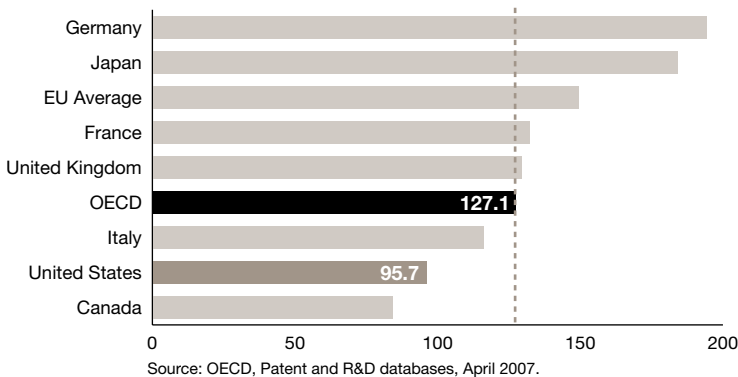
Investment in knowledge (by share of GDP of top 15 countries, 2004 or latest available data)



Note: "Investment in knowledge" comprises total expenditures on R&D, higher education and software. Source: OECD

**Figure 2**

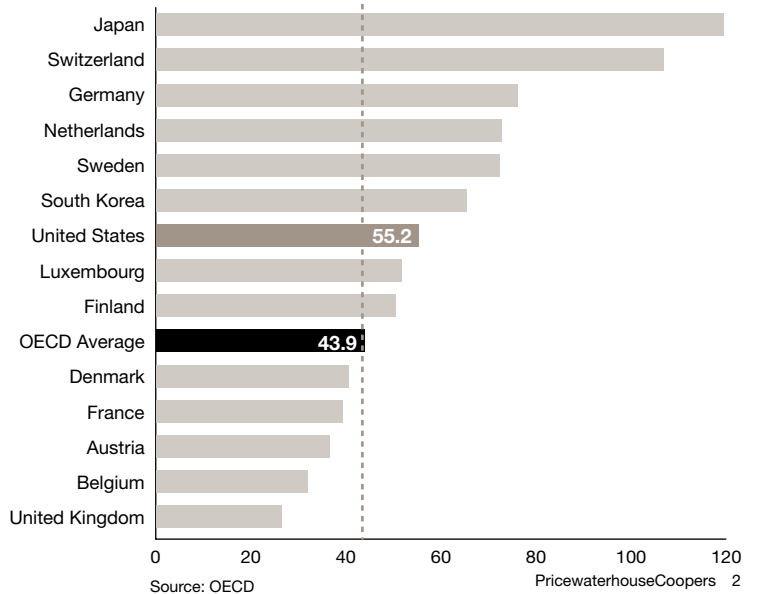
Number of triadic patent families (per billion US dollars of industry-financed R&D)



Source: OECD, Patent and R&D databases, April 2007.

**Figure 3**

Number of triadic patent families (per million inhabitants)

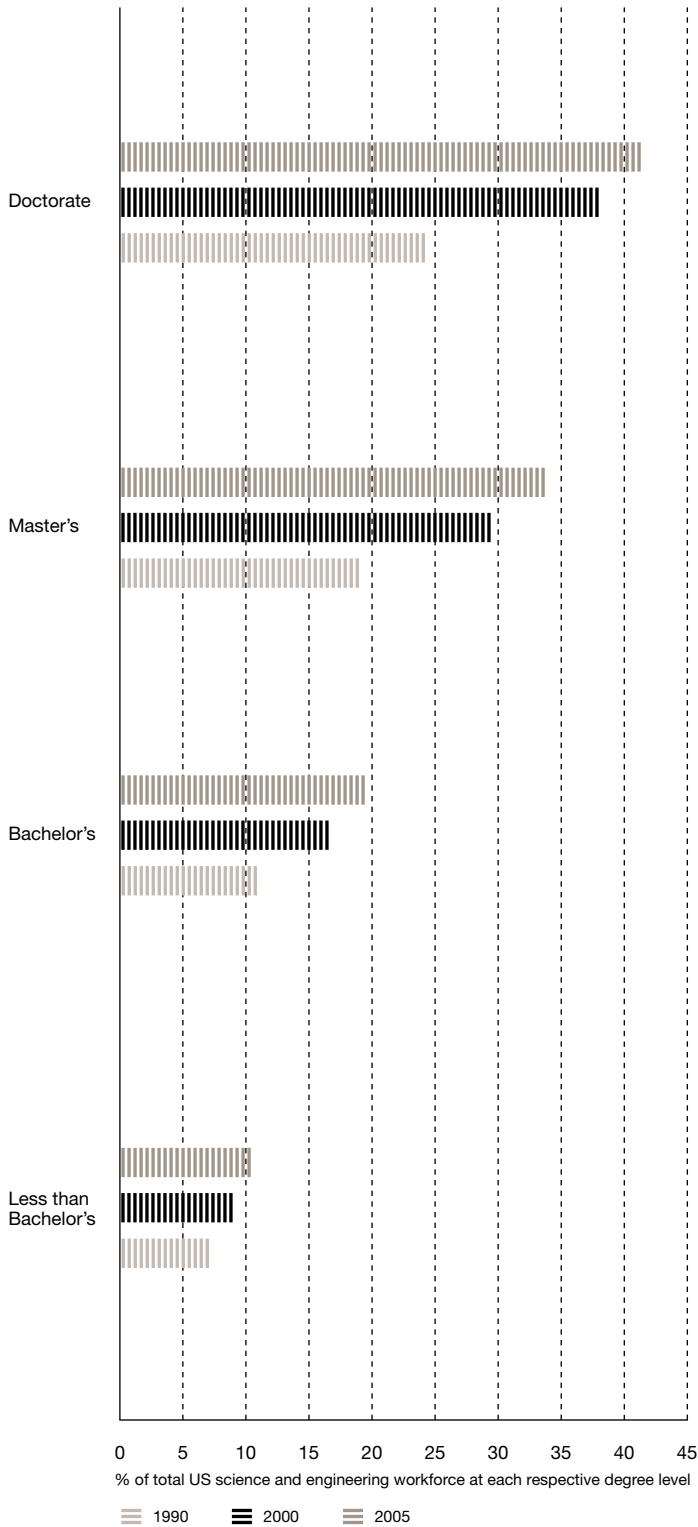


Source: OECD

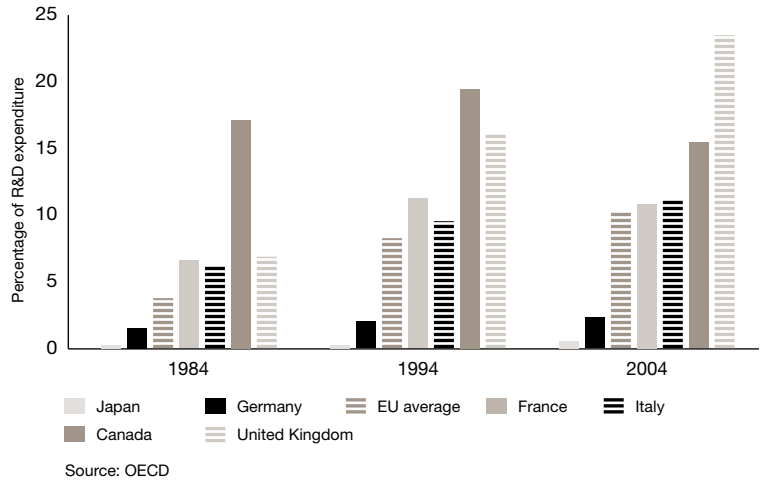
# Going with the flow

More know-how and money are crossing borders

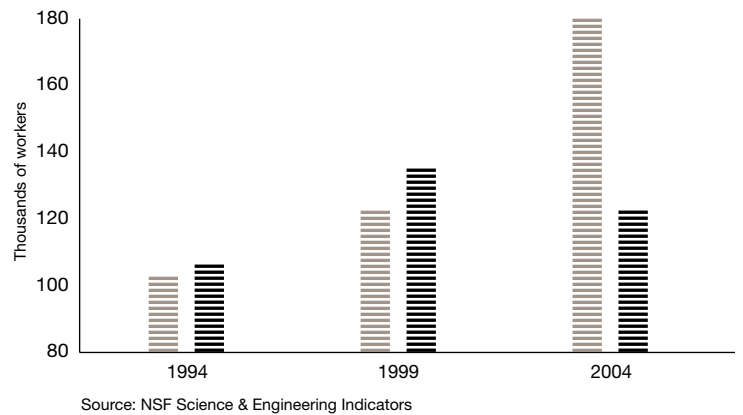
**Figure 4**  
Share of foreign-born individuals in US science and engineering workforce (by degree level)



**Figure 5**  
Share of industrial R&D financed by foreign sources



**Figure 6**  
R&D employment by multinational companies, in the US and abroad



“The most promising entrepreneurial activity around sustainable energy is taking place in the US, with dozens of start-ups in the past year alone.”

Global petroleum

“The US remains the clear leader for now in innovation, but the rapid pace at which others are moving needs to be carefully watched.”

Global technology and consumer goods

“While the US is likely to maintain leadership in core health science, it is not clear that we will continue to lead in commercialization of the science. We have a lot to learn about go-to-market strategies in new growth markets.”

Global health science

“With the ability to protect patents falling, there must be changes in R&D models that allow for more products to be brought to markets after shorter development cycles.”

PwC partner

“A new supplier solved a problem we had been working on for six years—in six months. They latched on to open networks that enable different levels of data collaboration across a common platform. That is a huge change.”

Global financial services

“Technology will play a massive role in the next decade of transportation. Fuel efficiency, route selection and traffic tracking will all be dramatically improved through remote sensors and instant information relays.”

Global shipping and logistics

“We need to keep the innovation function going at all costs. A couple of down years that cut into R&D expenditures could be very bad.”

Global technology and consumer goods

“US companies are leaders in innovation partly because we’ve been such an open society, with immigrants coming from all over with new ideas. As borders close, so does that source.”

Global furniture design/manufacturing

“Our goal is to assemble a complete set of ‘symbiotic platforms’ that span the range of daily uses: from PCs, to phones, to game consoles.”

Global software

“The best of all possible worlds is that the US continues to be innovative and adds pools of innovation in Asia and other places as they continue to evolve. If we do this right, the US can become more effective by leveraging talent pools. We can do more than we do today—and become wealthier as a result.”

University

“The Google-ization of knowledge and data will radically decentralize innovation.”

University

“We absolutely have to shift our focus from teaching to learning, and that’s a big shift. It means more simulations, more problem-based approaches and fewer lectures.”

University

“It is one thing to lead, but it’s something else to be a visionary. Leading involves staying on top and utilizing the talent of your people. Vision involves creating tomorrow rather than just responding to it.”

PwC partner

“The next man on the moon will almost certainly come from the East—and probably from China. And at the same time they are working to conquer outer space, they are attempting to master inner space, the human genome.”

Global consumer products

“Technologies that respond to latent or unexpressed consumer demands are the future. Be on the lookout for devices that help you discover your interests.”

US-focused retailer

“Innovation requires being close to the customer, and this is increasingly difficult for US firms as customers are more broadly spread geographically.”

Global technology and consumer goods

What we’re hearing about innovation

# Systematizing serendipity

Companies are paving a careful but open path to increase the odds of stumbling onto good ideas

“The cutting edge is a long-term proposition. Many of the things at the latest consumer electronics shows were in our lab in the mid-1990s. Longer-cycle innovations are essential to success.”

Global software

Serendipity, by definition, is impossible to predict. But it doesn't happen without two prerequisites: the right time and the right place. From Archimedes' bathtub cry of “Eureka!” more than 2,000 years ago to Isaac Newton's fallen apple, serendipitous events have triggered some of history's greatest thinking, discoveries and innovations. But, in the words of Louis Pasteur, “In the fields of observation, chance favors only those minds that are prepared.”<sup>1</sup>

Fortune, too, smiles on companies that prepare for the unexpected and organize for innovation. By creating the right culture and discipline, businesses increase the likelihood that they'll have the people, infrastructure and investment dollars in the right place, at the right time, to capitalize on unpredictable opportunities.

## Shifting center of gravity

Business is experiencing a fundamental shift in the nature of innovation. While product and service development has traditionally characterized the innovation landscape, the real game changers center on the delivery of products and services and the customer experience surrounding them. By innovating *around* products, companies create and transform markets, business and industry models.

Consider Apple's iPod, launched in 2001 without much fanfare. The iPod represented an incremental improvement over existing music players, but sluggish sales for the first two years signaled that more was needed to drive competitive advantage. For Apple, the “right place” for innovation had moved farther down the value chain, and without any immediate competition, 2003 was clearly the “right time.”

That's when Apple introduced its music downloading service iTunes and redefined the way music is delivered. By some estimates Apple commands more than 70% of today's market for hard-drive-based music players.<sup>2</sup> Moreover, as of April 2008, Apple reportedly has sold over 4 billion songs through its iTunes service, surpassing Wal-Mart to become the largest music retailer in the US.<sup>3</sup>

## Flexible models

There's no single, effective approach to organizing for innovation, and the future lies in a balancing act involving products, processes and people. Innovation is no longer synonymous with R&D, and an integrated view enables companies to tap knowledge wherever it resides. It enables them to channel resources toward promising ideas, making sure that their people are prepared to quickly respond to opportunities.

New models are emerging, and innovative companies are making internal and external connectivity a strategic priority.

Procter & Gamble, for example, widely praised as an innovation leader, adopted a networked approach called Connect + Develop (C+D)—a model for open innovation as well as a cultural mind-set. Every P&G employee must consider new ideas, regardless of their source, as the company works with a global innovation network of entrepreneurs, established businesses, government organizations, suppliers, consumers and academic institutions.

Disseminating questions about specific innovation challenges through geographically diverse C+D hubs, P&G estimates that almost 30% of the problems submitted to its external networks are solved within three weeks. Today, C+D closes roughly two deals a week and has helped P&G exceed targets for networked innovation. In 2007, over 50% of the company's initiatives involved at least one external partner.<sup>4</sup>

While broader participation in innovation may mean more ideas, success requires efficient identification, evaluation and, in some cases, abandonment of those ideas. Companies must broker solid ideas into real-world opportunities.

## Science fairs

Companies are borrowing the school science fair model to fuel the competitive spirit among innovators, inside and outside their walls.

The World Bank is a case in point. Looking for ways to tackle global poverty—and working with limited resources—the bank created its Development Marketplace, a grant program that identifies and funds promising, early-stage projects. At competitions on the global, regional and country levels, innovators present their ideas to the public, and an expert jury selects the winners, who walk away with seed money to pursue their innovations.<sup>5</sup>

### Incubators

While open innovation is important, companies are also looking inward, creating cloistered environments where thinkers can bar outside distractions and, simply, think.

At consumer electronics manufacturer Samsung, teams of innovators are put into what amounts to an idea incubator at a center near the company's main manufacturing plant outside of Seoul. The self-contained facility houses a team of designers, programmers and engineers for weeks or months at a time, allowing them to focus and brainstorm whenever inspiration strikes.<sup>6</sup>

Some companies are tapping into—and segregating—their inner start-ups to fast-track powerful ideas. In 2007, Yahoo! set up an off-site innovation incubator hoping to improve its speed to market. Brickhouse, the company within the company, fast-tracks the best 5 to 10 ideas submitted by any of Yahoo!'s 13,000 employees.<sup>7</sup>

### The chief executive innovator

The days of consolidated authority for corporate innovation have largely gone the way of Henry Ford's Model T, but there remains a corps of business leaders deeply focused on innovation. These chief executive innovators include in their ranks Bill Gates, Steve Jobs and Eric Schmidt. But the top-down approach to innovation needn't conflict with a flattened, open, networked model.

In 1999 global household appliance manufacturer Whirlpool faced waning customer loyalty. In response, former CEO Dave Whitman challenged company leadership to turn Whirlpool into a font of rule-breaking, customer-pleasing innovation.<sup>8</sup> By 2008, follow-

ing a program of employee mentorship and training, \$4 billion of Whirlpool's \$19 billion in revenue was coming from the company's innovation areas, up from \$2.7 billion in 2007 and \$1 billion in 2006.<sup>9</sup>

As the enlightened innovator, a CEO can drive major cultural change through an organization. In many cases, a focus on innovation at the top of the pyramid filters down to employees at the base to trigger rapid innovation.<sup>10</sup>

At Google, for example, CEO Schmidt instills a top-down corporate culture that empowers all employees. That mind-set enables the company's small teams to function almost autonomously in pursuit of big ideas. "Listening to each other is core to our culture," Schmidt said at Management Lab's 2008 inaugural conference. "We don't listen to each other just because we're all so smart. We listen because everyone has good ideas and because it's a great way to show respect. And any company, at any point in its history, can start listening more."<sup>11</sup>

1 *A treasury of the world's great speeches*, ed. Houston Peterson, p. 473, 1954.

2 Eliot Van Buskirk, "Zune eats Creative's meager lunch, grabbing 4 percent of MP3 player market," *Wired Magazine* blog network, May 12, 2008 (<http://blog.wired.com/music/2008/05/ipod-loses-mark.html>).

3 "iTunes store top music retailer in the US," Apple press release, April 3, 2008.

4 A.G. Lafley and Ram Charan, *The game-changer: how you can drive revenue and profit growth with innovation*, Crown Publishing Group, 2008.

5 [www.developmentmarketplace.org](http://www.developmentmarketplace.org).

6 A.G. Lafley and Ram Charan.

7 Reena Jana, "Case study: Yahoo!'s hot innovation incubator," *BusinessWeek*, November 15, 2007.

8 Gary Hamel, "The why, what, and how of management innovation," *Harvard Business Review*, 2002.

9 Peter P. Roosen and Tatsuya Nakagawa, "Innovation 101: Whirlpool's spin on innovation," *IndustryWeek*, July 16, 2008.

10 PricewaterhouseCoopers, *Technology forecast*, Summer 2008.

11 [http://blog.hbs.edu/faculty/amcafee/index.php/faculty\\_amcafee\\_v3/eric\\_schmidt\\_reveals\\_googles\\_secret/](http://blog.hbs.edu/faculty/amcafee/index.php/faculty_amcafee_v3/eric_schmidt_reveals_googles_secret/).

"Technology development will continue to accelerate, and this will produce many surprises. We see an era in which individual performance can be magnified substantially by a technology-to-human add-on."

Global consumer products

# Gerard J. Tellis

...Shares his findings on what drives innovation to commercial success

Innovation is a critical component of competitive success for businesses and economies. But how do you spark innovation, measure it, nurture it and finally make all the research and development effort pay? Gerard J. Tellis has dedicated himself to answering those questions as director of the Marshall School of Business's Center for Global Innovation and as a professor of marketing at the University of Southern California. Professor Tellis has written widely on innovation and won many awards for his achievements in advancing the field. In an interview with PwC, excerpted here, he draws on his research—across a range of companies, time periods and international borders—to share thoughts on the crucial challenge of innovation: how to drive an idea to its ultimate success in the marketplace.

**PwC:** Your research has focused on the commercialization phase of the innovation process. Why target that area?

**GT:** Many firms have a large number of innovations which they fail to introduce for fear of cannibalizing their existing products. Success ultimately can be defined only in terms of results—commercializing innovations. And what we've found is that innovations initially experience a long period when sales are dormant before—in cases of successful innovation—they experience a rapid takeoff. That is a critical stage in the life cycle of any successful innovation. Our research attempts to find out: What are the drivers of takeoff? Can you predict it? Can you control it?

**PwC:** Have researchers and enterprises established any golden rules when it comes to understanding how enterprise innovation can be managed successfully?

**GT:** Well, a problem in the business world is that cycles of different ideas become popular and then fade away. I will mention just three popular ideas. One of them is called the S-curve of technological evolution. It says that performance of new technology has an initial flat period, followed by a period of rapid improvement until maturity sets in when performance is again flat.

Then, a replacement technology emerges and follows a similar S-curve that crosses the first one at some time when the old one is flat. The trick for companies is to switch from the old S-curve to the new one before that crossing.

We researched this in a number of markets across a number of technologies and found the rule doesn't really apply. A large number of technologies coexist at the same time. There is not just one S-curve. But the ironic thing is that the curve is not S-shaped to begin with. It has multiple-step functions, with a fresh jump in performance after a period of apparent maturity. You might think it's maturity, but it might not really be so. If you jump ship because you think it's mature, you may have jumped ship prematurely.

A second golden rule of innovation uses a disruption paradigm, popularized by Clayton Christensen. The thinking is that you should be aware of these disruptive technologies and be ready to embrace them before they disrupt you. To begin with, the concept may contain a bit of circularity, because if a new technology doesn't really disrupt incumbents, then it's not called disruptive innovation, whereas if it does disrupt incumbents, then it is called so,

but it may be too late for them. One challenge is to try to categorize new technologies without using the word *disruptive*—namely, based on scientific principles—can you actually identify it as disruptive before learning the outcome? For example, in lighting, incandescence, fluorescence, and electric arc technologies have all coexisted. When you examine the introduction of these technologies and the firms that introduced them and distinguish survivors and losers, you find that so-called disruptive technologies don't always disrupt. The real challenge is not so much to find or detect a disruptive technology. The real challenge is to find out why some firms are disrupted by innovation and why others are not.

That brings me to a third golden rule of innovation. The most popular concept today is open innovation. And the idea is that the enterprise should be open to ideas whatever their source, internal or external, from partners or customers. It should not be secretive about its own ideas and let others borrow them. I think while that is a very promising approach to innovation, it still does not overcome one of the basic problems we have found—namely, why there are some firms which are highly innovative and are not disrupted while other firms get disrupted.

**PwC:** Do you have any empirical data on that? Can you predict successful innovation?

**GT:** Yes. We surveyed the innovations of 770 companies across 17 different countries. What we've found is that it's not so much these golden rules, which talk about external market conditions for innovation. We found there were two determinants of successful innovative firms. One not surprising is the total investment in R&D within the organization. The second is the internal culture of the organization, which we break down into three components. One is future orientation, being focused on the future rather than on past glories or present crises; another is the tolerance for risk; and a third is cannibalization of one's own successful products. And I think that's the most difficult for companies to do, and that's the one which trips up companies most often. An innovative firm is one that risks cannibalizing its own successful products to introduce new innovations for the future.

**PwC:** Can you identify a company that in your research comes out high on all three of those and as a result is very innovative?

**GT:** Well, you could say that Apple is pretty much like that. There was a lot of criticism when they came out with the Nano very quickly after the mini and cannibalized the mini. A lot of people said, "Why would you kill a profitable product?" And now they have come out with the iPhone, of which they've already had three generations in less than two years.

**PwC:** What can a management team do to create a culture that is more likely to deliver successful innovations?

**GT:** We've identified a few things that companies can do to make the culture more innovative. One is to empower product champions, where a product champion is entrusted with a technology, people and resources, and told to go out and capture a market. It is important that this take the form of empowering a champion, as opposed to doing things by committee. Because when you have large committees with a series of approvals at different levels, not only does it slow down the process, but a lot of good ideas get laid by the side. A second approach is to create internal competition, allowing competing divisions to cater to the same market. A third approach is to have incentives for innovation—as opposed to incentives for seniority or age—to encourage people to take risks with new products. It's important that these incentives be asymmetric in the sense that you would reward success but not penalize failure.

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Read more at:  
[www.pwc.com/AmericanPerspectives](http://www.pwc.com/AmericanPerspectives)



“A product champion is entrusted with a technology, people and resources, and told to go out and capture a market.”

# Getting social

Network innovation is growing... person to person  
in online forums and office corridors

Innovation has gotten a bad rap. The term evokes scientists toiling over test tubes under the harsh glare of laboratory lights. To be sure, a good deal of R&D, particularly around specific product development, results from such structured discovery. Increasingly, however, radical innovations are being hatched outside the lab. And companies are often learning that open communication unlocks innovation better than reliance on lonely pursuit does.

Informally, in online forums and office corridors, people from divergent backgrounds learn of each other's interests and challenges and discover unexpected business opportunities. And as companies pursue innovation, technology becomes a vital tool in connecting global networks of consumers, suppliers and even competitors.

## Weak ties drive powerful connections

Social networking isn't new, but the level of mass connectivity available today has upped the ante on understanding—and leveraging—the phenomenon.

In his landmark 1973 study, "The Strength of Weak Ties," renowned sociologist Mark Granovetter shed light on the social and economic benefit that people and, ultimately, firms derive from loose collections of acquaintances.<sup>1</sup> "In scientific fields, new information and ideas are more efficiently diffused through weak ties," Granovetter wrote, noting that the phenomenon can have a powerful impact.<sup>2</sup>

Using today's social networking technology, companies worldwide are beginning to leverage the same weak ties that have driven the massive consumer popularity of social networking Web sites such as Facebook, Flickr and Myspace. According to recent reports, spending on Enterprise 2.0 or social technologies is expected to soar from \$764 million in 2008 to \$4.6 billion by 2013, with US businesses accounting for roughly 60% of that (see Figure 7).<sup>3</sup> They aim to improve the keys to innovation: communication, teamwork, problem solving, learning and creativity.

## You don't know what, or who, you don't know

Until recently, you may have known enough about the work or interests of perhaps 10 colleagues to be able to refer their expertise to a friend. While an organization's output may have been easy to find on a corporate intranet, the social context in which those products or services were created has been largely invisible.

That's changing quickly. Companies on the leading edge of the social technology revolution are implementing "Facebook cultures" to help uncover weak ties within their organizations. According to Forrester Research, one global software provider empowers employees with a collaboration tool "in which a single query searches 80,000 colleagues' contact info, professional affiliations, skills, personal interest, personal blogs, communities, and person documents to find who can help" with a specialized technical question.<sup>4</sup>

California-based Serena software has adopted Facebook—a Web site already familiar to many of its employees—as its corporate intranet. Through Facebook, employees provide secure links to internal business documents. By exploring the information itself, employees also learn about the people providing and developing it, creating the social context to nurture innovation.<sup>5</sup>

## Building a connected culture

Adopting popular, consumer-based Web sites as corporate intranets may seem extreme, but big brands are also exploring social technologies—many with great success.

Consumer electronics giant Best Buy, for example, launched its own internal, online community called BlueShirt Nation (BSN) in early 2007. Within a year, BSN had over 20,000 members—roughly 15% of the company's employee base—all joining based on referrals or word of mouth. BSN was built on free, open-source software, and the site's start-up costs rang in at a mere \$100 for the domain name and one year of Web hosting.

"How do you get feedback from 10,000 customers directly to the board? The underlying question is, How do companies make sense of unstructured data like that being created on blogs and chat rooms?"

PwC partner

“Consumers are building their own digital lockers where they store whole aspects of their lives, and we need to be invited in. Think of next-generation media outlets as private living rooms where people manage their lives while being amused or entertained.”

US-focused media and entertainment

Best Buy’s networking site works to “embrace innovation and collaboration from anywhere...It challenges people to think differently,” company cofounder Gary Koelling says.

“BlueShirt Nation is the result of a reorganizing force that’s coming to bear on American corporations,” Koelling wrote on his personal blog on June 6, 2008. “The social contract is being rewritten. The nature of our relationships to each other is being redefined.” Koelling continues: “Organizing as a hierarchy is no longer enough. A network is no longer defined as names in a Rolodex or an Outlook address book; it’s how we organize, connect and collaborate. To make stuff. To do stuff. To know stuff.”<sup>6</sup>

### Lowering the drawbridge

Increasingly, organizations are using social technologies to plumb communities outside their own walls, looking toward consumers, suppliers and even competitors. Famously, LEGO, the Danish toy manufacturer, released the software behind its robotics product as open source in May 2006 to a Web community of enthusiastic users.

“Most often, innovation comes from the core community of users,” says Søren Lund, director of LEGO Mindstorms at the time of the open-source announcement. “When we launched the legacy Mindstorms platform in 1998, the community found ways to do these things on their own, and we were faced with the question of whether to allow it, which we decided to embrace and encourage. Now, given the strong user base and versatility and power of the [product], the right to hack is a no-brainer.”<sup>7</sup>

The open-source movement, begun by software developers, now extends into fields such as scientific R&D. Farmavita.Net, a community of pharmaceutical executives, innovators and researchers, is using social technologies to spur pharmaceutical development in less-developed economies where production falls short. The organization invites established manufacturers to share critical knowledge, such as information around active ingredients, formulation and manufacturing instructions and quality control methods.<sup>8</sup>

### Beam me up, Scotty

Teleportation may not be on the horizon, but telepresence is here now, and it’s changing the way people interact.

Unlike typical videoconferencing, telepresence gives participants a sense of immersion—of truly “being there,” no matter how remote their location. It does this through high-definition, life-size images, cameras that capture eye contact, and surround sound.

Telepresence suites allow real-time sharing, review, revision and documentation, bringing a true convergence of our physical and virtual social worlds.

DreamWorks Animation SKG, whose products are founded almost entirely on collaborative innovation, adopted telepresence early, equipping each DreamWorks production site with a telepresence studio. “Innovation is a critical part of the filmmaking process at DreamWorks Animation,” says Ed Leonard, the company’s chief technology officer, noting that telepresence has fundamentally changed how the company does business. “Studio executives say it’s like the difference between using a typewriter compared to a computer,” he says.<sup>9</sup>

Looking ahead, business conversations supported by telepresence could become part of a company’s social history and lead to further collaboration and innovation. Supported by other Enterprise 2.0 tools, these meetings can be captured on video and published internally for colleagues who weren’t part of the initial conversation. Each video might be commented on, updated and linked to other interactive documents in a self-perpetuating network of fungible knowledge.

And, more important, every act of viewing, reading, commenting or linking establishes another tie between people with common interests and innovative ideas.

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1 Mark S. Granovetter, “The strength of weak ties,” *American Journal of Sociology*, Vol. 78, No. 6 (May 1973), pp. 1360-1380.

2 Mark S. Granovetter, “The strength of weak ties: A network theory revisited,” *Sociological Theory*, Vol. 1, 1983, pp. 201-233.

3 G. Oliver Young, “Global Enterprise Web 2.0 market forecast: 2007 to 2013,” Forrester Research, Inc., April 21, 2008.

4 Matt Brown, “‘Facebook for the enterprise’: Catchy phrase or a strategy for collaboration?” Forrester Research, Inc., July 8, 2008.

5 “Serena Software adopts facebook as corporate intranet,” Serena press release, November 2, 2007.

6 Gary Koelling, “Breaking it down redux,” June 6, 2008, <http://www.garykoelling.com/?q=node/398>.

7 “Hackers, get ready! LEGO Group announces open source firmware, developer kits for LEGO® MINDSTORMS® NXT,” May 1, 2006, <http://mindstorms.lego.com/press/2057/Open%20Source%20Announcement.aspx>.

8 Open Source Pharmaceuticals—new business model, <http://www.farmavita.net/content/view/336/84/>.

9 DreamWorks speeds film production with HP Halo Collaboration Studio, Hewlett-Packard Development Company, 2007.

# Clay Shirky

...Traces the connections between people that spark innovation



Clay Shirky divides his time among consulting, teaching and writing on the social and economic effects of Internet technologies. His consulting practice focuses on the rise of decentralized technologies. He is an adjunct professor in New York University's graduate Interactive Telecommunications Program. Shirky has written about and been interviewed extensively about the Internet since 1996. His most recent book is *Here Comes Everybody: The Power of Organizing Without Organizations*, published in 2008. We asked him how he defines innovation and about some of the emerging models of team-based innovation.

**PwC:** What has surprised you about the innovations you've tracked over the past decade?

**CS:** One surprise relates to the social origin of good ideas. A lot of the innovations inside businesses are coming from people who see across disciplines. It's not just designers or engineers. It's designers who talk to engineers and vice versa. It's a small group of polymaths working together, as opposed to a focused team working on a particular problem.

In collaborative efforts in the software industry, we're seeing that the users' mental model of what they're doing matters more than the features the software provides, and the users' mental model of what other users are doing matters more than the mental model of the individual user. When everybody approaching a particular problem has the same basic assumptions about what's going on, you get what the military culture calls shared awareness. This turns out to encourage innovation that is distributed across many different users, and it supports the emergence of communities of practice.

**PwC:** How do you define innovation?

**CS:** The word *innovation* is so overloaded. It's become the official good of the current business climate. We used to say, "We improved the product, and now the client is happier." But now we feel compelled to say, "We innovated on the product, and the client is happier."

Innovation buys you the ability for a brief period to have a noncopyable competitive advantage. What companies don't want from innovation is to invent the product that will destroy their existing high-margin product.

**PwC:** How, then, would you advise a company to spur innovation?

**CS:** The canonical approach to this that drives me berserk is starting an innovation department—basically by rounding up all of the malcontents in one place so you can ignore them in a group rather than individually.

To do it right, first you have to decide on what time scale you're making your bets. Are you looking to upgrade your products and services in 3, 5, or 10 years? If you're closer to the three-year part of that spectrum, that suggests cultural change rather than organizational change. The 10-year time frame suggests cultural and organizational change.

For example, if, in three years, you want highway mileage to be 35 instead of 23, you really just need to get everyone focused on continuous improvement. And this can't be just a top-down edict; you need to change the culture. To do that, you only have to recruit half a dozen people who care and let them start a conversation that attracts other, equivalently bright, engaged people. And then reward them for good ideas. And you have to pay attention to the special sauce that really makes these kinds of

communities work, and that's the quality of the group facilitation. We've learned how important that is from the open-source community.

**PwC:** And where does organizational change fit in?

**CS:** If you want radical change, if you want an all-electric car that can be fully recharged in an hour, then you also need to change your organization. You need to pull your best people out of the current culture and constraints and say, start from scratch. You want the group to be small so there's no social loafing. You have to give them the ability to talk to anybody in the organization that they think they can learn from.

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# Crude reality

Who will pay the bill for energy innovation?  
Your company, my company and Uncle Sam

The quest for sustainable, clean energy supplies is arguably the next global economic frontier poised to create new markets, spur growth and revolutionize the energy industry. But investment in innovation is a critical condition for success. Who will foot the bill?

The public and private sectors stand in delicate balance over investment in energy innovation. But if necessity is indeed the mother of invention, energy represents an experiment too important to fail because of pressure on natural resources, the realities of climate change and the staggering growth of a new, global consumer class. However, for public-private collaboration to work, the dynamics of business-government partnership must be recalibrated—effectively and quickly.

Global energy R&D spending reached \$16.9 billion in 2007, with corporate investment accounting for \$9.8 billion and government funding \$7.1 billion.<sup>1</sup> In the US, federal investment in total R&D over the past five years has hit a plateau, even in the critical area of defense (see Figure 8). Recent research, however, indicates that Washington's commitment to energy research lags even in comparison to other key areas of nondefense research.

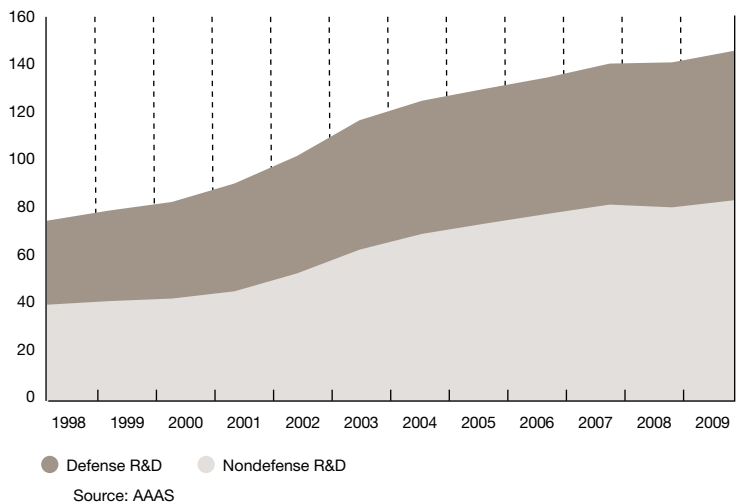
According to the National Science Foundation, federal funding for energy efficiency and conservation remained flat over the past decade while investment in life sciences research, for example, grew by more than 6% a year.<sup>2</sup> In real dollars, federal funding for basic energy and applied energy R&D fell a staggering 60% from 1978 to 2004.<sup>3</sup>

While energy consumption and transportation account for roughly 15% of US gross domestic product—about the size of the US healthcare system—federal funding for energy research (excluding nuclear power) amounts to less than \$2 billion and would be cut by an additional 27% to \$1.3 billion under the Department of Energy's 2009 budget proposal.<sup>4</sup>

The public sector's contribution to energy innovation remains critical, but as the cost continues to rise, industry can no longer wait for government to adjust the public-private ratio.

Companies across industries have a stake in the energy innovation game—some bigger than others. And executives are recognizing that to ease the pain around energy pricing, environmental sustainability strategies are crucial. In a 2007 Economist Intelligence Unit Survey, 62% of respondents said improving energy efficiency across global operations will be a top priority in their organizations in the next five years.

**Figure 8**  
**Washington levels off on R&D**  
Trends in federal expenditures for research and development  
FY 1998–2009 (in billions of constant FY 1998 dollars)



“Environmental policy will evolve very rapidly over the next 10 years, and trillions of dollars will change hands between the private and public sectors as a result.”

International public policy expert

## Venture capital strikes deals

As companies identify their biggest pain points, they will increasingly seek the partnerships and investment opportunities needed to accelerate energy innovation. The automotive industry, for example, has been understandably aggressive in this regard.

Toyota recently invested \$1.4 million in a joint research initiative with the Pew Center on Global Climate Change to document company-wide energy strategies. The automaker is also one of a consortium of corporate sponsors of Stanford University's \$225-million Global Climate and Energy Project. Similarly, Ford Motor Company partnered with Massachusetts Institute of Technology to become the first member of the MIT Energy Initiative, a research partnership focused on new power train, fuel and energy technologies.<sup>5</sup>

Still, in the race for energy breakthroughs, the fastest-growing investment source is venture capital. Since a spike during the tech boom in 2000, total US venture capital investment has remained steady, hovering around \$20 billion. But investment in renewable energy and alternative fuels has soared. In 2007, venture capitalists poured more than \$2.2 billion into US cleantech companies, a 45% surge over 2006 levels (see Figure 9).

Venture capitalists seem bullish about cleantech investment, and the trend is poised to continue—at least for the next year or two. Of the 170 venture capitalists responding to the National Venture Capital Association's 2008 Predictions Survey, 80% said they believe the sector will continue to grow.

As the numbers show, no single source of funding can run the race toward sustainable energy solutions—at least not as quickly as businesses require. The key lies in increased collaboration, with private industry assuming a more active role in identifying partnerships across business, academia and the public sector.

1 Global trends in sustainable energy investment 2008, United Nations Environment Programme and New Energy Finance Ltd. 2008.

2 Science and engineering indicators 2006, National Science Foundation, Federal obligations for total research by detailed science and engineering field: FY 1984-2005, Table 4-32, February 2006.

3 Ending the energy stalemate, National Commission on Energy Policy, p. 101, December 2004.

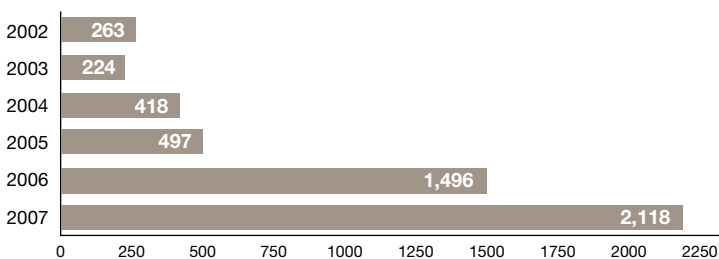
4 "2009 R&D budget a tough sell: Bush's final budget is a mixed bag for science; big changes are expected from Congress," *Chemical & Engineering News*, Vol. 86, No. 07, February 18, 2008.

5 "MIT, Ford announce energy partnership," Massachusetts Institute of Technology press release, October 1, 2007.

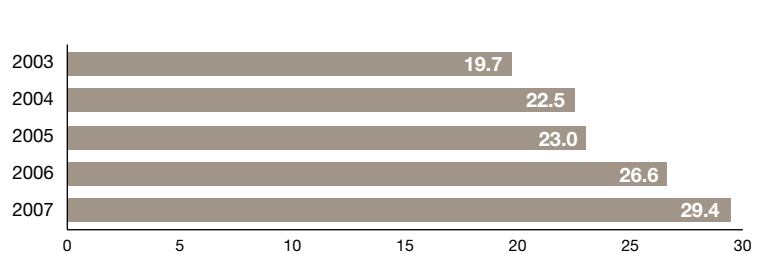
In real dollars, federal funding for basic energy and applied energy R&D fell a staggering 60% from 1978 to 2004

**Figure 9**  
Cleantech: The fastest-growing venture capital investment sector

**Total cleantech investments (millions of dollars)**



**MoneyTree total investments (billions of dollars)**



Source: PricewaterhouseCoopers/National Venture Capital Association MoneyTree™ Report (Data: Thomson Reuters)

# The world's sustainable energy investment portfolio

In the US and around the world, the cleantech industry is growing at a remarkable clip. Complementing investment in renewable and alternative energy, public- and private-sector commitments to energy efficiency, waste and water treatment are creating a portfolio of sustainable solutions for business and society (see Figure 10). Last year, new investment in sustainable energy reached record levels of \$148.4 billion, a 60% spike over investment levels in 2006.<sup>1</sup>

## Solar

Across the clean energy portfolio, solar energy generation experienced the most profound growth in 2007, attracting almost \$4 billion in venture capital and private equity investment and growing at a rate of roughly 254% a year since 2004.<sup>2</sup> According to the Solar Energy Industry Association, 2007 saw 314 megawatts of new solar energy systems installed in the US, up by 125% from the previous year.<sup>3</sup>

## Wind

Globally, wind attracted more investment in 2007 than any other non-fossil-fuel-based technology, including nuclear power. In the US and Europe, wind capacity additions accounted for 30% and 40%, respectively, of new power capacity last year. And as of March 2008, global installed wind capacity surpassed the 100-gigawatt mark.<sup>4</sup>

## Biofuels

With US corn and feedstock costs spiking in 2007, the profit margins on ethanol production shrank, and venture capital and private equity investment in biofuels fell by almost one-third to \$2.1 billion. However, biofuels investment has not dried up altogether, shifting to lower-cost economies such as Brazil, India and China.<sup>5</sup>

## Pollution, recycling and watertech

As water shortage pressures intensify, watertech companies, particularly those focused on purification and filtration technologies, have increasingly attracted the attention of venture capitalists. The pollution and recycling sector (which includes water and waste technologies) emerged as a promising growth area for US venture capitalists in 2007, attracting roughly \$203 million, up from \$137 million in 2006 and \$82 million in 2005.<sup>6</sup>

## Energy efficiency

Of late, many have deemed energy efficiency the new frontier in sustainable energy innovations. For businesses, it's clearly low-hanging fruit. According to the International Energy Agency, every dollar invested in more-efficient electrical equipment and appliances saves more than \$2 in the costs of power generation, transmission and distribution infrastructure.<sup>7</sup> In 2007, investment in energy efficiency technology reached a record \$1.8 billion, a 78% increase from 2006, with North America attracting the most funding globally.<sup>8</sup>

1 Global trends in sustainable energy investment 2008, United Nations Environment Programme and New Energy Finance Ltd. 2008.

2 Ibid.

3 Solar Energy Industry Association, "Solar energy is economic engine for US economy," January 23, 2008.

4 Global trends in sustainable energy investment 2008, United Nations Environment Programme and New Energy Finance Ltd. 2008.

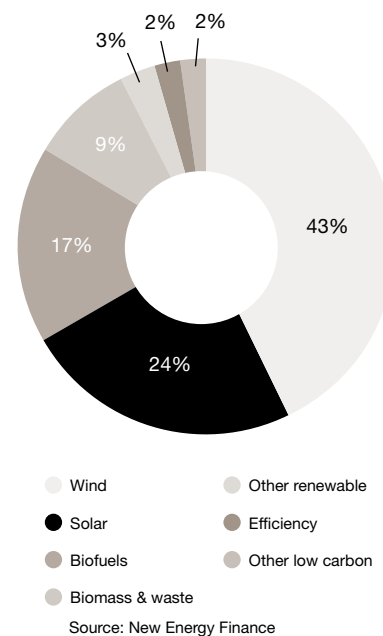
5 Ibid.

6 PricewaterhouseCoopers, Cleantech comes of age, 2008.

7 International Energy Agency, "World energy outlook 2006," 2006.

8 Global trends in sustainable energy investment 2008.

**Figure 10**  
Global energy investment by technology, 2007



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