KEY NOTE TOPIC

BROKERS OF INNOVATION – LESSONS FROM THE PAST

It is not the Eureka moment in a remote laboratory that leads to trailblazing innovations but the intelligent recombination of existing inventions.

Ironically, the modern corporation is best positioned to generate breakthrough innovations and yet least capable of doing so. The key to pioneering progress lies not in the traditional corporate research model – with major investments in laboratories, scientists, and patents – but in the way in which firms exploit the network structures that connect them internally and to the outside world. As we move forward, it helps to take a look at the past.

by Andrew Hargadon

Photo: Neil Michel (Axiom)

A great deal of misunderstanding and ambiguity surrounds the innovation process. For many, it remains a highly uncertain business best left to mad scientists and garden-shed inventors. I spent the last ten years studying the social networks behind breakthrough innovations from Edison's Menlo Park laboratory to IDEO Product Development, from Henry Ford to 3M, from Bell Labs to the IdeaLab. The most successful firms systematized their innovation process in ways that turned traditional assumptions about the pursuit of innovation upside-down.

Rather than chasing wholly new ideas, these firms focused on recombining old ideas in new ways. Rather than insulating their innovation efforts from operating divisions, customers, and suppliers, they relied extensively on these partners.

In sum, these firms pursued an innovation strategy I have termed 'technology brokering.' By spanning multiple, otherwise disconnected industries and markets, they became the first to see how existing technologies in one market could be used to create breakthrough innovations in another. The results, counterintuitively, sparked many of the technological revolutions of the past century and a half.

Best positioned and least qualified

Ironically, the modern corporation is best positioned and least qualified to exploit such network dynamics. Companies often have diverse network connections through their dealings in different markets and across a wide range of customers, suppliers, and competitors. Yet their strategies, work practices, and reward systems rarely support, and more often undermine, their ability to tap these networks for innovation.

What makes technology brokering a valuable innovation strategy? Perhaps the best explanation can be found backstage in what historians have called America's prototypical R&D lab.

From 1876 to 1881, Thomas Edison in his Menlo Park, New Jersey laboratory produced one innovation

after another: high-speed, automatic, and repeating telegraphs; telephones; phonographs; generators; light bulbs and vacuum pumps. Edison built the laboratory, in his own words, for the "rapid and cheap development of an invention" and promised "a minor invention every ten days and a big thing every six months or so." And he delivered. In a single six-year period – Edison's most prolific as an inventor – the laboratory generated over 400 patents and became known worldwide as an invention factory.

The Menlo Park laboratory was one of the first dedicated research and development facilities. Over a century later, it remains the model for R&D in modern firms. But what do we really know about the Menlo Park lab? Countless stories recall Edison's genius and the inventions that flowed from his fertile, if eccentric, mind. A closer look at his laboratory, however, offers a different perspective.

In the public eye, Edison exploited the image of the inventive genius. Backstage, however, he worked hard to create a future from the best pieces of the past that he could find and use. The very icon of invention – the electric light – did not actually spring from Edison's vivid imagination. 30 years earlier, in 1845, J. W. Starr filed a caveat for a patent for the incandescent bulb. So Edison did not invent the electric light. What he did was to put together a system of lighting that tapped many different technologies – existing electric lights, the telegraph networks, and gas lighting – in a way that sparked a revolution.

What made Edison's laboratory so successful? Not the ability to shut itself off from the rest of the world and invent new technologies, but just the opposite. It was the lab's ability to connect that made it so innovative. If Edison ignored anything, it was the belief that innovation was about the pursuit of invention.

Pioneering technology brokering

At Menlo Park, Edison created the ideal conditions for pursuing innovation through technology brokering. Working for a range of clients and in a range of industries, he moved easily through different sectors – enabling him to see like no one before how ideas developed in one industry might be useful in another. Drawing on his initial experience of the emerging telegraph industry of the 1860s, for example, Edison's earliest products brought the ideas and objects of this industry – where electro-mechanics were first commercially introduced – to other markets. His electric fire and police alarms consisted of a dedicated telegraph line from house to police station.

Smart recombinations

As importantly, Edison built a community at Menlo Park that was deeply committed to the process of innovation through recombination. He modeled the laboratory on the machine shops from which he and many of the others emerged, where mechanics and independent entrepreneurs would work side-by-side, sharing machines, telling stories, and passing along promising ideas or opportunities. The group at Menlo Park numbered fourteen. Edison himself worked most closely with Charles Batchelor, whose training as both a mechanic and a draftsman so complemented (and grounded) Edison's more flighty visions that the two split all patent royalties 50-50. Many of the lab's breakthroughs were attributed to Batchelor or one of the others who worked on the projects while Edison dealt with clients or investors. As one such assistant, Francis Jehl, once said (cf. Conot, Thomas A. Edison) "Edison is in reality a collective noun and means the work of many men."

Edison was not alone in pursuing such strategy for innovation. The history of technological revolutions is a history of recombinant innovations. Henry Ford neither invented the automobile (the first was demonstrated a century earlier) nor the components of mass production that he used to build his Model T. Instead, Ford succeeded because, between 1907 and 1914, he brought together the best people, ideas and objects from fields as diverse as meatpacking, grain storage, sewing machine and bicycle construction, and brewing. As recorded in John Steele Gordon's The Business of America, Ford once testified, "I

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Illustration: Tod Davidson

invented nothing new. I simply assembled into a car the discoveries of other men behind whom were centuries of work."

Recombinant innovation

You could be forgiven for supposing that while the intelligent recombination of existing technologies and innovations may have been sufficient to drive a breakthrough in the early years of industrialization, today far more refined and sophisticated methods would be required. But you would be wrong. Such recombinant innovation can also be found at the heart of the biotechnology revolution. Polymerase chain reaction (PCR), for example, is the biochemical process by which specific genetic material can be 'mass produced.'

Echoing Henry Ford almost a century later, Nobel laureate Kary Mullis once explained: "In a sense, I put together elements that were already there, but that's what inventors always do. You can't make up new elements, usually. The new element, if any, was the combination, the way they were used... The fact that I would do it over and over again, and the fact that I would do it in just the way I did, that made it an invention..." (in Paul Rabinow, Making PCR: A Story of Microbiology).

Mullis recognized that disparate but already developed laboratory techniques could be combined in a way that created a chain reaction. With PCR, the time and money needed to produce a workable quantity of genetic material plummeted while the commercial potential of biotechnology exploded.

The history of innovation at Microsoft is also built firmly on past technologies. Bill Gates' first commercial effort, BASIC for the Altair, borrowed from existing versions of BASIC (written for mainframes and minicomputers) and from work done by DEC. MS-DOS, Microsoft's operating system for the IBM PC, was acquired for $75,000 from tiny Seattle Computer Company. Microsoft Word was originally written by Xerox PARC engineers (but never marketed). And the

graphical user environment that is Windows first appeared at Xerox PARC, then on the Apple Macintosh, before becoming Microsoft's flagship product.

The technology brokering mastered by Edison, Ford, and their modern-day counterparts requires organizations to integrate two often contradictory strengths into their strategies, work practices, and reward systems. First, the ability to bridge distant communities: Firms that move easily across a range of different industries or markets are in a better position to see how the technologies of one market can be used in new ways (and in new combinations with other technologies) to solve the problems of another. This position provides two advantages. Bridging distant industries enables innovators to build on the decades of development behind the technologies they find there. Bridging also avoids the entangling alliances – both internally among departments and divisions, and externally among suppliers and customers – that make change so difficult for firms focused on only a single industry. But that's just the first step.

Technology brokering also requires building new communities around those innovative recombinations. Rather than rebelling against the old social order, technology brokering focuses on building new networks – new social orders – around the emerging ideas. Here lies the central challenge in technology brokering, because the strengths that enable organizations to build new communities – focus, economies-of-scale, strong ties to customers and suppliers alike – inhibit those same organizations from moving easily into new markets and experimenting freely with other technologies. Those who find a way to master these competing strengths stand to gain a powerful advantage in the pursuit of innovation.

Tapping the networks of innovation

For these companies, the foundations are in place. The networks that surround and constitute modern corporations hold the same innovative potential as those that surrounded Edison's lab. The challenge for managers is to recognize and tap into these networks.

There are many opportunities, for example, to bridge the otherwise disconnected communities in a firm's external network. For some, this means bringing the firm's technical expertise to new markets and industries. Hewlett-Packard did this initially in moving from engineering diagnostics into medical imaging, communications, computing, and printing, and advances in one field often led to breakthroughs elsewhere. Others may make dramatic gains simply by solving the problems of one division with the technologies already developed in another – as 3M did by applying its micro-replication technology across the range of its markets. Yet other firms may benefit by bridging between their customers or suppliers – as Toyota did in sharing best practices across its suppliers when developing its lean production methods.

Devoting more resources to building new networks around a potential innovation can prove equally beneficial. To start with, this means deliberately avoiding inventing (or re-inventing) anything internally. Companies can generate breakthrough products by actively pursuing the best people, ideas, and objects that exist already outside the firm – as Apple did with its tremendously successful iPod MP3 player, pulling together circuit designs, chipsets, and other technologies from half a dozen firms.

This means that rather than rewarding R&D teams for patents produced, papers published, or technologies developed in-house, it is the relationships R&D teams build across the organization and outside that must be rewarded. How much revenue comes from innovation projects? What percentage of new technologies come from outside? Such measures and reward systems force R&D centers to build stronger ties to the operating divisions and outside communities.

Leaders in modern organizations attempting to pursue innovation must recognize that success won't come through the individual pursuit of invention. As the science fiction author William Gibson once said, "The future is already here, it's just unevenly distributed." The firms that best exploit their innovation networks will shape that future.