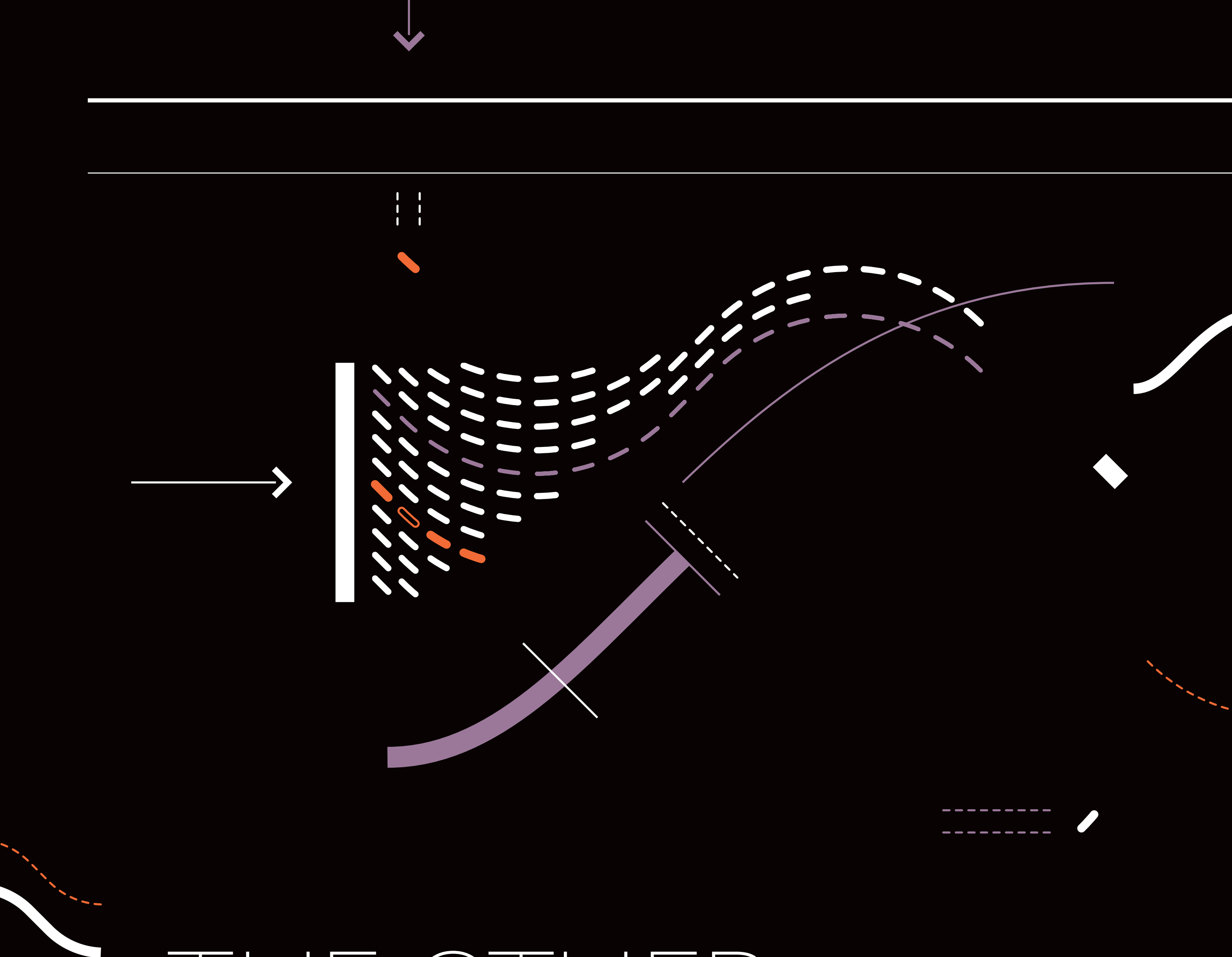
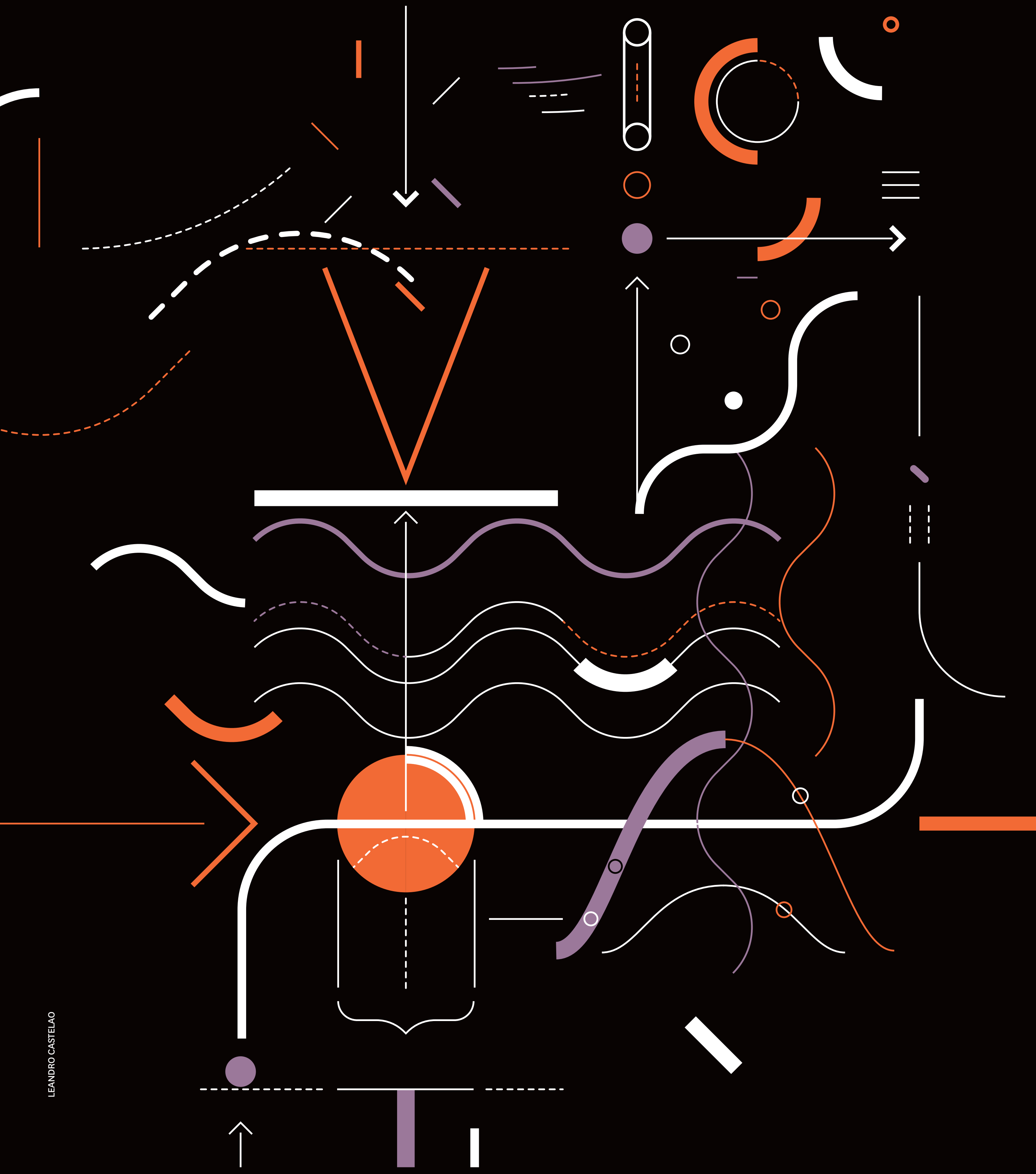


THE OTHER DISRUPTION

When innovations threaten the organizational model

BY JOSHUA GANS



LEANDRO CASTELAO

Since Clayton Christensen published *The Innovator's Dilemma*, in 1997, management scholars have focused on innovations that disrupt customer demand patterns. The story usually plays out like this. A new entrant develops an innovative product that is initially attractive only to a niche segment of customers and may underperform mainstream products on traditional measures. At first, customers reject the innovation, but as it improves rapidly along performance dimensions that they care about, they begin to embrace it, and the new entrant becomes a real threat to incumbents.

Over the past two decades, managers have developed a defensive playbook for confronting this kind of "demand side" disruptive innovation. Most commonly, they'll either acquire new entrants or "disrupt themselves" by setting up autonomous units charged with exploring potentially disruptive innovations. The idea is that once the disruptive innovation begins to dominate the industry, the firm will be ready to roll its new technology into its principal operations, transforming itself in the process.

But pulling that off turns out to be more difficult in practice than it sounds in theory: In many cases, disrupted incumbents find themselves unable to transfer the new technologies into their mainstream operations because doing so requires them to fundamentally change the way they manufacture and distribute their products. In essence, the basic architecture of the product—how it is put together—changes along with customer expectations and preferences, creating "supply side" disruption.

Consider the challenge the iPhone posed to the BlackBerry in 2007. By all accounts, the iPhone initially was a poor performer in terms of call quality, battery life, and network usage compared with the BlackBerry, and it did not include the keyboard that BlackBerry users loved. But the iPhone's fundamentally new product design, as we know with hindsight, represented the future, and customers began to embrace it. BlackBerry and its peers moved quickly to include iPhone-like features—such as a touch screen and a better web browser—but they were unable to compete effectively because the innovation required them to redesign the process for making phones from the ground up. Only newer entrants like Samsung, who were not locked into an existing production model and could more easily orient the organization around the new product architecture, were able to really challenge the iPhone.

Though less commonly understood, supply-side disruption is arguably more dangerous than the kind Christensen describes; indeed, disruption of a product's architecture threatens a company's very survival in a way that changes in customer demands do not. The good news is that demise is not necessarily inevitable when product architectures and, therefore, organizational structures are upended. Incumbent firms can survive, and some even thrive on, repeated architectural disruptions. On the basis of research by Rebecca Henderson, Mary Tripsas, and others and my own study of companies facing disruption, I have identified three prescriptions for long-term survival: an integrated organizational model, ownership of a feature important to the end customer, and a strong sense of corporate identity. Let's look at each of these in turn.

The Virtue of Integration

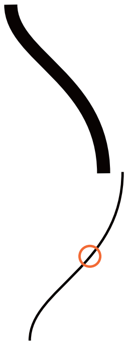
The first rule of surviving architectural disruption—developing an integrated organizational model—has its roots in the work of management scholar Rebecca Henderson. From 1987 to 1988, she collected data and conducted interviews on the impact of innovation on the photolithographic alignment industry. Photolithography is the standard method of fabricating printed circuit boards (PCB) and microprocessors. Henderson found that while the industry experienced continual incremental innovation in aligner technology, it also underwent four separate waves of disruptive innovation. The four waves didn't affect prices, which remained stable—a pattern that differs from Christensen's examples, in which disruptors enter at the low end of the market and apply downward pressure across the industry. Rather, they changed the way the aligners were put together and manufactured, representing a relatively pure example of architectural, or supply-side, disruption.

Idea in Brief

THE PROBLEM
The defensive playbook for confronting disruptive innovations calls for companies to set up separate units to develop competing technologies. In practice, though, companies struggle to transfer new innovations and capabilities back into their mainstream operations.

WHY IT HAPPENS
Many disruptions necessitate changes to the basic architecture of a product—the way it's put together. Adapting to this requires deep organizational integration across tasks and functions, but most large companies organize R&D and operations around product components.

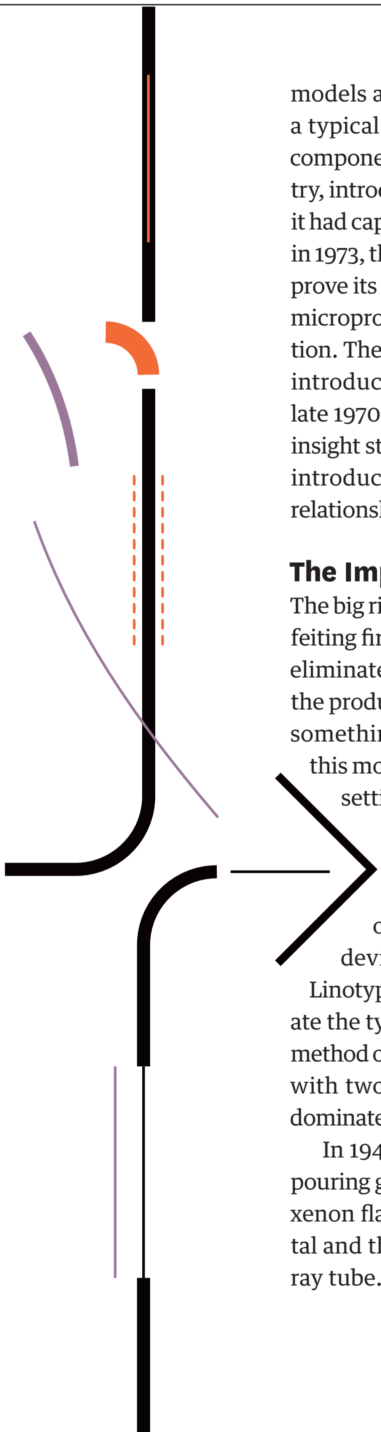
THE SOLUTION
Incumbent firms that survive changes to product architecture usually owe their success to one or more of three key factors: an integrated organizational model, ownership of a feature important to the end customer, and a strong sense of corporate identity.



With each wave of disruption, market share shifted dramatically in favor of new entrants. On average, they captured more than half the market in their first year. When an incumbent was first with a new architecture, it gained only 7% of the market, on average. Incumbents also fared worse in terms of market share gained per dollar of R&D spent on the architectural innovations.

Yet one incumbent company, Canon, bucked the trend and maintained its market share throughout the waves of disruption. Henderson found that what chiefly distinguished Canon from its competitors was its more integrated organization, which supported investments in different generations of technology at the same time. Canon cultivated tightly knit teams that had a wide range of capabilities and experience across all the technology generations. This organizational structure meant that it was able to imagine and respond to new product architectures. By contrast, Canon's competitors were largely organized around the traditional product architecture. Their teams focused on building specialized knowledge of components and generating rapid but incremental innovation, with consequent improvements in efficiency and performance.

Although Canon was routinely a few years behind competitors with next-generation products, ceding first-mover advantage, its organizational structure enabled it to seize other kinds of advantage. In particular, Canon's engineers had the benefit of learning from their competitors' innovations and used those insights to reinvent not just its components but also its product architecture. Indeed, two of the waves of disruption—the proximity printer and scanning projection—were based on technology and processes that Canon had developed internally.



Although other incumbents also recognized the value of emerging technologies, their organizational models appeared to resist the innovations. Here's a typical example. In 1965, Kasper Instruments, a component supplier in the photolithography industry, introduced a contact aligner; just five years later, it had captured half the market. But when it realized, in 1973, that "proximity" capability could further improve its product and launched the new technology, microprocessor manufacturers rejected the innovation. The new technology took off only after Canon introduced an improved proximity aligner in the late 1970s. Kasper's inability to profit from its early insight stemmed from its failure to understand that introducing the capability required changing the relationship between the aligner's components.

The Importance of Unique Assets

The big risk in taking an approach like Canon's is forfeiting first mover advantage. This risk, however, is eliminated if the company owns a core element of the product whose architecture is being disrupted—something that the customer values. Nowhere is this more clearly illustrated than in the print typesetting industry.

Typesetting dates back to the 1400s and Gutenberg's invention of movable type. Not until 1886 was the modern approach of using a keyboard as the primary input device invented by Ottmar Mergenthaler. His Linotype machine, which used liquid metal to create the type, reigned for about 60 years as the only method of typesetting. Mergenthaler Linotype, along with two other firms—Intertype and Monotype—dominated the industry.

In 1949 the technology changed, and hot metal pouring gave way to a photographic process using a xenon flash. A decade later, the process went digital and the xenon flash was replaced by a cathode ray tube. Finally, in 1976, today's laser typesetting technology became the standard. You might expect, on the basis of Henderson's research, that with each wave of innovation a new entrant would have become the market leader. Yet Mergenthaler long remained a dominant player in the industry.

When the xenon-flash phototypesetting technology emerged, the three incumbents had time to work out their strategies, and it was the choices they made at this point that decided their futures. All three developed machines that incorporated the new technology. Intertype was the first to market. Allying itself with external partners such as Kodak, it sought to graft the technologies onto its existing machines, leaving its component interfaces and production processes unchanged in any fundamental way.

Mergenthaler took a very different approach, as research by Mary Tripsas, of Boston College's Carroll School of Management, shows. After an initial failed attempt to build a new machine, it went back to the drawing board, recruited people with expertise in the new technology, and integrated them closely with an existing team in order to design not just a new machine but a completely new model for producing it. As was the case with Canon, this process slowed Mergenthaler down: It took 10 years to come out with its first phototypesetting machine. How, then, did Mergenthaler survive the delay to reap the benefits from its superior architecture?

The answer is simple. It owned fonts. The primary customers of typesetters were newspapers and publishers. Each had a look and feel to its products that depended crucially on the font it used. And as it turned out, those fonts were proprietary and owned by the incumbent hot metal typesetters. So if a customer wanted Helvetica (perhaps the most popular font of all time), it would have to purchase the font from Mergenthaler. The company did not own any specific intellectual property other than the trademark on the name, but that proved enough to give the company an advantage. Although the dominant technology of the machines may have changed over the years, customer demand for the fonts never waned.

Of course, all three companies owned fonts. So why did Mergenthaler benefit more than the others? Because it exploited the breathing space provided by its ownership of fonts to explore the architectural disruption that the new technology entailed and eventually offered a demonstrably better typesetter. It could have opted to unbundle its fonts and abandon typesetting altogether, but until digital typesetting appeared, it was not easy to separate the price of a font from the cost of typesetting with it, so supplying the machine remained an integral part of the business. It is only since the advent of full digital typesetting that Mergenthaler has exited the physical part of the business to focus on marketing and licensing its fonts.

The Power of Identity

Both Mergenthaler and Canon demonstrate that firms can ride out architectural disruptions in cases in which the final products (newspapers and printers) remain functionally the same even though the underlying technology of producing them has changed radically. But some architectural disruptions trigger fundamental changes in the value proposition as well, necessitating a reinvention of corporate strategy along with a reconfiguration of the way companies develop and manufacture their products. A good example of disruption on this scale is the photography industry.

We all know the story of how the leading incumbents, Polaroid and Kodak, failed to make the transition from film to digital photography. Although both had anticipated the shift, organizational priorities and internal conflicts made it difficult to

How It’s Made Matters

Early in the evolution of a complex, technology-based product, engineers experiment with different ways of putting the components together. Eventually, a dominant product architecture emerges—one that sets standards for components and how they relate to one another. At this stage, engineers working on the products are consciously aware of the rationale behind the dominant design. They have the architectural knowledge to understand how a change in one component affects the performance of others and to manage trade-offs as components evolve.

From that point on, most firms begin to organize themselves around the product components. Specialized teams on a smartphone, for example, work on the battery, the casing, the input screen, and so on. It makes sense to have these component teams working furiously on improving their parts of the product: It is wonderfully efficient and leads to a smoothly operating firm. The downside is that engineers and designers become less aware of the overall product architecture and the trade-offs and relationships embedded within it; architectural knowledge becomes tacit and part of the wallpaper.

When technological advances lead to a new product architecture, companies with modular organizations often falter. Because of their specialization, component teams lose sight of technological advances outside their area of focus as well as the larger picture of how components are put together. (At this point, it’s very possible that nobody in the firm is focused on overall architectural design.) When a new architecture emerges, managers tend to undervalue it, because it usually doesn’t initially deliver as good a performance as the continually improving established architecture does.

By contrast, firms whose operations remain more closely integrated across task and function boundaries adapt better to architectural change (at least in principle). Their architectural knowledge is conscious and widely distributed; they are more alert to the potential of a new architecture to deliver very rapid performance improvement in production and to give rise to products that displace those of incumbents.

embrace a radically new business model that did not include high margins from film as a revenue source. One company, however, was able to make the shift: Fujifilm. Mary Tripsas offers an explanation—one that takes a leaf out of Ted Levitt’s seminal HBR article “Marketing Myopia”: When a firm establishes an externally oriented identity built around the needs and desires of customers and the emerging technologies and markets that support them, it can manage the inevitable conflicts over capital and resources without having to sacrifice the strengths.

Fujifilm, like its competitors, realized the potential for digital photography early on. It began researching new technologies in 1975 and produced prototype products in the early 1980s. At the time, the bulk of its sales came from film, photographic paper, and photographic chemicals, but the company also had businesses in x-ray film and processors, microfilm, graphic arts films, magnetic tape, and carbonless copying paper. This breadth of capabilities and scope allowed Fujifilm to define itself as something more than a film manufacturer or photography company like Kodak and other competitors. In 1978 it began describing itself instead as an “audio-visual information recording company.” This was the first step in a longer strategic process that moved the company’s identity away from the rather specific domain of photography to the broader domains of “image and information.”

This orientation had clear strategic implications for Fujifilm. For instance, it could consider launching a high-priced hardware product for electronic radiography without worrying about violating the traditional “razor and blades” business model whereby photography companies sold their hardware cheap in order to get customers hooked on film. The more inclusive identity of Fujifilm made it easier for managers to envision and implement new business models suited to the digital world. Fujifilm also took a path very different from competitors’ in how it approached research and development. For example, its digital imaging units were integrated with the main R&D division, whereas Polaroid’s were distinct. This gave Fujifilm’s digital units legitimacy and minimized internal conflicts during the transition away from film. The company was also able to find new imaging applications for the existing chemistry capabilities it had built up through the film business, notably applying chemicals in display screens for digitally generated images.

By becoming an “information and imaging” company, therefore, Fujifilm was able to thrive in the digital realm in ways its competitors failed to do.

The Real Dilemma

Facing down the threat of architectural disruption does come at a cost. Organizational integration requires managers to move fluidly across teams or develop cross-functional teams responsible for multiple technologies—old and new—simultaneously so that embedded architectural knowledge is brought to the top. This model is diametrically opposed to traditional prescriptions for high performance, which call for modular structures and stand-alone “next generation” product development teams.

Further Reading

For more on the theoretical underpinnings of ideas in this article, see the following:

“Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms”
by Rebecca M. Henderson and Kim B. Clark (Administrative Science Quarterly, 1990)

“Product Development Capability as a Strategic Weapon: Canon’s Experience in the Photolithographic Alignment Equipment Industry”
by Rebecca M. Henderson (Managing Product Development, 1996)

“Surviving Radical Technological Change Through Dynamic Capability: Evidence from the Typesetter Industry”
by Mary Tripsas (Industrial and Corporate Change, 1997)

“Managing in an Age of Modularity”
by Carliss Y. Baldwin and Kim B. Clark (HBR, September–October 1997)

“Disruptive Technologies: Catching the Wave”
by Joseph L. Bower and Clayton M. Christensen (HBR, January–February 1995)

Therefore, companies face a dilemma: Organizing around a modular structure is extremely efficient in developing component innovation; however, the separate divisions create organizational barriers, closing off paths by which new architectural knowledge can be integrated into the primary business.

So what's the most coherent strategy for survival? Demand-side disruptions can often be managed reactively through acquisition or even cooperation with the emerging disruptors. In many industries, my research shows, disruptors and incumbents do in fact cooperate very successfully, suggesting that the conventional disruption narrative—whereby the plucky disruptor displaces the incumbent—is not the standard plot. Much more often incumbents acquire the disruptor or license from it. This is not to say that managers facing demand-side disruption should sit idle. Even reactive management requires the development of internal capabilities, and, as empirical evidence emphatically shows, few companies are good at acquiring or integrating other companies or at managing relationships with entrepreneurial firms.

That said, companies should put most of their focus on managing proactively for architectural disruptions, because they are more likely to be firm-ending events. Managers should organize the firm toward deeper integration and build a more inclusive identity so that architectural innovations can be absorbed and exploited, while ensuring that they retain control or ownership of key aspects of the end customer experience that will remain relatively constant through disruption. This will represent a substantial shift in managerial focus and best-practice assumptions—which is hardly surprising considering the general lack of attention paid to architectural disruption.

A New Narrative

Most managers are very familiar with the disruptive innovation narrative described by Clay Christensen: Disruptors enter a market and compete fiercely with incumbents, gobbling up market share as their innovations gain traction. So it may come as a surprise to learn that more often competition between disruptive innovators and incumbents morphs into cooperation.

In a recent study of more than 50 years of start-up strategies in the automatic speech recognition industry, Matt Marx, David Hsu, and I examined innovations in the industry that fit Christensen's definition of disruptive: technologies that entered at the low end of the market and improved steadily over time on traditional metrics. New entrants introduced most such innovations, but they typically ended up being acquired by or cooperating with incumbents.

A case in point is Vlingo, which in 2010 developed a mobile speech recognition app. Unlike existing software, the new technology did not confine users to a predefined set of recognizable phrases but rather allowed them to speak naturally. Not surprisingly, it was initially less accurate than previous technologies.

Vlingo's long-term goal was to embed its technology in mobile devices and other companies' apps under license, but because of its poor performance early on, it needed to prove to mobile providers that consumers would take to the technology. So it went to market with its own app, competing directly with companies it hoped to eventually secure licensing deals with. This strategy worked: Customers began to embrace the technology, and Vlingo was able to switch from competing against incumbent firms to cooperating with them.

Vlingo was not alone: We found (controlling for other factors) that among new entrants who started out competing with incumbents, those with disruptive technologies were four times as likely to switch to cooperation as those with nondisruptive innovations. This suggests that for incumbents, waiting until a disruptive technology has been proven and then cooperating with the most promising entrant is a successful strategy for dealing with demand-side disruption.

WHEN IT comes to disruption, companies that survive best generally don't perform best. They may be solid competitors, but they are unlikely to be the leading player. By the same token, companies that perform best may ultimately be doomed—sooner or later they'll encounter a disruption that will render them obsolete. To some extent, this is also nature's model. Large, specialized animals like pandas and polar bears struggle to survive the depredations of humanity. By contrast, adaptable, usually smaller mammals—think foxes and monkeys—seem to be carving out a successful niche for themselves in towns and cities. The difference is that animals can't choose whether to be adaptable or not. Companies and their managers can.

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