



Magazine Article / Organizational Restructuring

How Apple Is Organized for Innovation

It's about experts leading experts. *by Joel M. Podolny and Morten T. Hansen*

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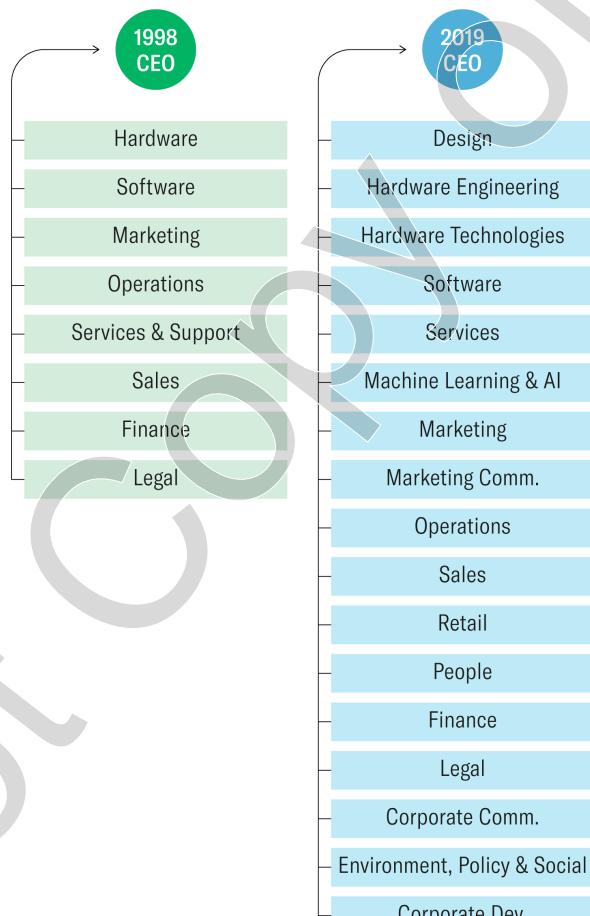
Mikael Jansson/Trunk Archive

Apple is well-known for its innovations in hardware, software, and services. Thanks to them, it grew from some 8,000 employees and \$7 billion in revenue in 1997, the year Steve Jobs returned, to 137,000 employees and \$260 billion in revenue in 2019. Much less well-known are the organizational design and the associated leadership model that have played a crucial role in the company's innovation success.

When Jobs arrived back at Apple, it had a conventional structure for a company of its size and scope. It was divided into business units, each with its own P&L responsibilities. General managers ran the Macintosh products group, the information appliances division, and the server products division, among others. As is often the case with decentralized business units, managers were inclined to fight with one another, over transfer prices in particular. Believing that conventional management had stifled innovation, Jobs, in his first year returning as CEO, laid off the general managers of all the business units (in a single day), put the entire company under one P&L, and combined the disparate functional departments of the business units into one functional organization.

Apple's Functional Organization

In 1997, when Steve Jobs returned to Apple, it had a conventional structure for its size and scope. It was divided into business units, each with its own P&L responsibilities. After retaking the helm, Jobs put the entire company under one P&L and combined the disparate departments of the business units into one functional organization that aligns expertise with decision rights—a structure Apple retains to this day.



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The adoption of a functional structure may have been unsurprising for a company of Apple's size at the time. What is surprising—in fact, remarkable—is that Apple retains it today, even though the company is nearly 40 times as large in terms of revenue and far more complex than it was in 1998. Senior vice presidents are in charge of functions, not products. As was the case with Jobs before him, CEO Tim Cook occupies the only position on the organizational chart where the design, engineering, operations, marketing, and retail of any of Apple's main products meet. In effect, besides the CEO, the company operates with no conventional general managers: people who control an entire process from product development through sales and are judged according to a P&L statement.

Business history and organizational theory make the case that as entrepreneurial firms grow large and complex, they must shift from a functional to a multidivisional structure to align accountability and control and prevent the congestion that occurs when countless decisions flow up the org chart to the very top. Giving business unit leaders full control over key functions allows them to do what is best to meet the needs of their individual units' customers and maximize their results, and it enables the executives overseeing them to assess their performance. As the Harvard Business School historian Alfred Chandler documented, U.S. companies such as DuPont and General Motors moved from a functional to a multidivisional structure in the early 20th century. By the latter half of the century the vast majority of large corporations had followed suit. Apple proves that this conventional approach is not necessary and that the functional structure may benefit companies facing tremendous technological change and industry upheaval.

Apple's commitment to a functional organization does not mean that its structure has remained static. As the importance of artificial

intelligence and other new areas has increased, that structure has changed. Here we discuss the innovation benefits and leadership challenges of Apple's distinctive and ever-evolving organizational model, which may be useful for individuals and companies wanting to better understand how to succeed in rapidly changing environments.

Why a Functional Organization?

Apple's main purpose is to create products that enrich people's daily lives. That involves not only developing entirely new product categories such as the iPhone and the Apple Watch but also continually innovating within those categories. Perhaps no product feature better reflects Apple's commitment to continuous innovation than the iPhone camera. When the iPhone was introduced, in 2007, Steve Jobs devoted only six seconds to its camera in the annual keynote event for unveiling new products. Since then iPhone camera technology has contributed to the photography industry with a stream of innovations: High dynamic range imaging (2010), panorama photos (2012), True Tone flash (2013), optical image stabilization (2015), the dual-lens camera (2016), portrait mode (2016), portrait lighting (2017), and night mode (2019) are but a few of the improvements.

Apple leaders need deep expertise, immersion in details, and collaborative debate.

To create such innovations, Apple relies on a structure that centers on functional expertise. Its fundamental belief is that those with the most expertise and experience in a domain should have decision rights for that domain. This is based on two views: First, Apple competes in markets where the rates of technological change and disruption are high, so it must rely on the judgment and intuition of people with deep

knowledge of the technologies responsible for disruption. Long before it can get market feedback and solid market forecasts, the company must make bets about which technologies and designs are likely to succeed in smartphones, computers, and so on. Relying on technical experts rather than general managers increases the odds that those bets will pay off.

Second, Apple's commitment to offer the best possible products would be undercut if short-term profit and cost targets were the overriding criteria for judging investments and leaders. Significantly, the bonuses of senior R&D executives are based on companywide performance numbers rather than the costs of or revenue from particular products. Thus product decisions are somewhat insulated from short-term financial pressures. The finance team is not involved in the product road map meetings of engineering teams, and engineering teams are not involved in pricing decisions.

We don't mean to suggest that Apple doesn't consider costs and revenue goals when deciding which technologies and features the company will pursue. It does, but in ways that differ from those employed by conventionally organized companies. Instead of using overall cost and price targets as fixed parameters within which to make design and engineering choices, R&D leaders are expected to weigh the benefits to users of those choices against cost considerations.

In a functional organization, individual and team reputations act as a control mechanism in placing bets. A case in point is the decision to introduce the dual-lens camera with portrait mode in the iPhone 7 Plus in 2016. It was a big wager that the camera's impact on users would be sufficiently great to justify its significant cost.

One executive told us that Paul Hubel, a senior leader who played a central role in the portrait mode effort, was "out over his skis," meaning

that he and his team were taking a big risk: If users were unwilling to pay a premium for a phone with a more costly and better camera, the team would most likely have less credibility the next time it proposed an expensive upgrade or feature. The camera turned out to be a defining feature for the iPhone 7 Plus, and its success further enhanced the reputations of Hubel and his team.

It's easier to get the balance right between an attention to costs and the value added to the user experience when the leaders making decisions are those with deep expertise in their areas rather than general managers being held accountable primarily for meeting numerical targets. Whereas the fundamental principle of a conventional business unit structure is to align accountability and control, the fundamental principle of a functional organization is to align expertise and decision rights.

Thus the link between how Apple is organized and the type of innovations it produces is clear. As Chandler famously argued, “structure follows strategy”—even though Apple doesn’t use the structure that he anticipated large multinationals would adopt.

Now let’s turn to the leadership model underlying Apple’s structure.

Three Leadership Characteristics

Ever since Steve Jobs implemented the functional organization, Apple’s managers at every level, from senior vice president on down, have been expected to possess three key leadership characteristics: deep expertise that allows them to meaningfully engage in all the work being done within their individual functions; immersion in the details of those functions; and a willingness to collaboratively debate other functions during collective decision-making. When managers have

these attributes, decisions are made in a coordinated fashion by the people most qualified to make them.

Deep expertise. Apple is not a company where general managers oversee managers; rather, it is a company where experts lead experts. The assumption is that it's easier to train an expert to manage well than to train a manager to be an expert. At Apple, hardware experts manage hardware, software experts software, and so on. (Deviations from this principle are rare.) This approach cascades down all levels of the organization through areas of ever-increasing specialization. Apple's leaders believe that world-class talent wants to work for and with other world-class talent in a specialty. It's like joining a sports team where you get to learn from and play with the best.



Mikael Jansson/Trunk Archive

Early on, Steve Jobs came to embrace the idea that managers at Apple should be experts in their area of management. In a 1984 interview he said, “We went through that stage in Apple where we went out and thought, *Oh, we’re gonna be a big company, let’s hire professional management.* We went out and hired a bunch of professional management. It didn’t work at all....They knew how to manage, but they didn’t know how to *do* anything. If you’re a great person, why do you want to work for somebody you can’t learn anything from? And you know what’s interesting? You know who the best managers are? They are the great individual contributors who never, ever want to be a manager but decide they have to be...because no one else is going to...do as good a job.”

One current example is Roger Rosner, who heads Apple’s software application business, which includes work-productivity apps such as Pages (word processing), Numbers (spreadsheets), and Keynote (presentations) along with GarageBand (music composition), iMovie (movie editing), and News (an app providing news content). Rosner, who studied electrical engineering at Carnegie Mellon, joined Apple in 2001 as a senior engineering manager and rose to become the director of iWork applications, the vice president of productivity apps, and since 2013 the VP of applications. With his deep expertise gained from previous experience as the director of engineering at several smaller software companies, Rosner exemplifies an expert leading experts.

In a functional organization, experts leading experts means that specialists create a deep bench in a given area, where they can learn from one another. For example, Apple’s more than 600 experts on camera hardware technology work in a group led by Graham Townsend, a camera expert. Because iPhones, iPads, laptops, and desktop computers all include cameras, these experts would be scattered across product lines if Apple were organized in business units. That would

dilute their collective expertise, reducing their power to solve problems and generate and refine innovations.

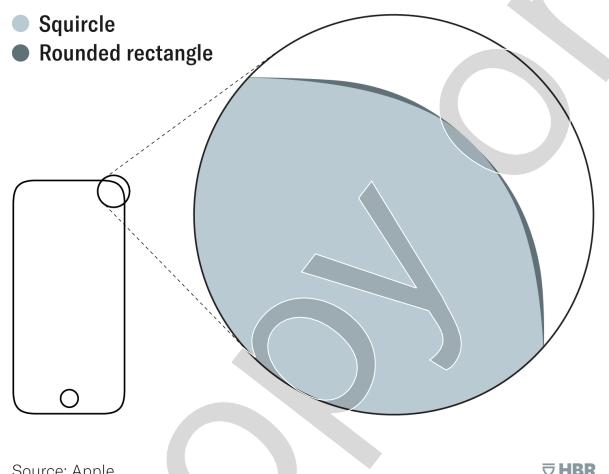
Immersion in the details. One principle that permeates Apple is “Leaders should know the details of their organization three levels down,” because that is essential for speedy and effective cross-functional decision-making at the highest levels. If managers attend a decision-making meeting without the details at their disposal, the decision must either be made without the details or postponed.

Managers tell war stories about making presentations to senior leaders who drill down into cells on a spreadsheet, lines of code, or a test result on a product.

Of course, the leaders of many companies insist that they and their teams are steeped in the details. But few organizations match Apple. Consider how its senior leaders pay extreme attention to the exact shape of products’ rounded corners. The standard method for rounding corners is to use an arc of a circle to connect the perpendicular sides of a rectangular object, which produces a somewhat abrupt transition from straight to curve. In contrast, Apple’s leaders insist on continuous curves, resulting in a shape known in the design community as a “squircle”: The slope starts sooner but is less abrupt. An advantage of hardware products without abrupt changes in curvature is that they produce softer highlights (that is, little to no jump in light reflection along the corner). The difference is subtle, and executing on it isn’t simply a matter of a more complicated mathematical formula. It demands that Apple’s operations leaders commit to extremely precise manufacturing tolerances to produce millions of iPhones and other products with squircles. This deep immersion in detail isn’t just a concern that is pushed down to lower-level people; it is central at the leadership level.

One Example of Apple's Attention to Detail

The standard method for rounding the corners of a rectangular object is to use an arc of a circle to connect the object's perpendicular sides. That can result in an abrupt transition in curvature. To produce softer highlights by minimizing light reflection, Apple uses a "squircle," which creates continuous curves.



Source: Apple

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Having leaders who are experts in their areas and can go deep into the details has profound implications for how Apple is run. Leaders can push, probe, and “smell” an issue. They know which details are important and where to focus their attention. Many people at Apple see it as liberating, even exhilarating, to work for experts, who provide better guidance and mentoring than a general manager would. Together, all can strive to do the best work of their lives in their chosen area.

Willingness to collaboratively debate. Apple has hundreds of specialist teams across the company, dozens of which may be needed for even one key component of a new product offering. For example, the dual-

lens camera with portrait mode required the collaboration of no fewer than 40 specialist teams: silicon design, camera software, reliability engineering, motion sensor hardware, video engineering, core motion, and camera sensor design, to name just a few. How on earth does Apple develop and ship products that require such coordination? The answer is collaborative debate. Because no function is responsible for a product or a service on its own, cross-functional collaboration is crucial.

When debates reach an impasse, as some inevitably do, higher-level managers weigh in as tiebreakers, including at times the CEO and the senior VPs. To do this at speed with sufficient attention to detail is challenging for even the best of leaders, making it all the more important that the company fill many senior positions from within the ranks of its VPs, who have experience in Apple's way of operating.

However, given Apple's size and scope, even the executive team can resolve only a limited number of stalemates. The many horizontal dependencies mean that ineffective peer relationships at the VP and director levels have the potential to undermine not only particular projects but the entire company. Consequently, for people to attain and remain in a leadership position within a function, they must be highly effective collaborators.

That doesn't mean people can't express their points of view. Leaders are expected to hold strong, well-grounded views and advocate forcefully for them, yet also be willing to change their minds when presented with evidence that others' views are better. Doing so is not always easy, of course. A leader's ability to be both partisan and open-minded is facilitated by two things: deep understanding of and devotion to the company's values and common purpose, and a commitment to separating how *right* from how *hard* a particular path is so that the difficulty of executing a decision doesn't prevent its being selected.

The development of the iPhone's portrait mode illustrates a fanatical attention to detail at the leadership level, intense collaborative debate among teams, and the power of a shared purpose to shape and ultimately resolve debates. In 2009 Hubel had the idea of developing an iPhone feature that would allow people to take portrait photos with *bokeh*—a Japanese term that refers to the pleasing blurring of a background—which photography experts generally consider to be of the highest quality. At that time only expensive single-lens reflex cameras could take such photos, but Hubel thought that with a dual-lens design and advanced computational-photography techniques, Apple could add the capability in the iPhone. His idea aligned well with the camera team's stated purpose: "More people taking better images more of the time."

As the team worked to turn this idea into reality, several challenges emerged. The first attempts produced some amazing portrait pictures but also a number of "failure cases" in which the algorithm was unable to distinguish between the central object in sharp relief (a face, for instance) and the background being blurred. For example, if a person's face was to be photographed from behind chicken wire, it was not possible to construct an algorithm that would capture the chicken wire to the side of the face with the same sharpness as the chicken wire in front of it. The wire to the side would be as blurred as the background.

One might say, "Who cares about the chicken wire case? That's exceedingly rare." But for the team, sidestepping rare or extreme situations—what engineers call *corner cases*—would violate Apple's strict engineering standard of zero "artifacts," meaning "any undesired or unintended alteration in data introduced in a digital process by an involved technique and/or technology." Corner cases sparked "many tough discussions" between the camera team and other teams involved, recalls Myra Haggerty, the VP of sensor software and UX prototyping,

who oversaw the firmware and algorithm teams. Sébastien Marineau-Mes, the VP to whom the camera software team ultimately reported, decided to defer the release of the feature until the following year to give the team time to better address failure cases—“a hard pill to swallow,” Hubel admits.

To get some agreement on quality standards, the engineering teams invited senior design and marketing leaders to meet, figuring that they would offer a new perspective. The design leaders brought an additional artistic sensibility to the debate, asking, “What makes a beautiful portrait?” To help reassess the zero-artifacts standard, they collected images from great portrait photographers. They noted, among other things, that these photos often had blurring at the edges of a face but sharpness on the eyes. So they charged the algorithm teams with achieving the same effect. When the teams succeeded, they knew they had an acceptable standard.

Another issue that emerged was the ability to preview a portrait photo with a blurred background. The camera team had designed the feature so that users could see its effect on their photos only *after* they had been taken, but the human interface (HI) design team pushed back, insisting that users should be able to see a “live preview” and get some guidance about how to make adjustments *before* taking the photo. Johnnie Manzari, a member of the HI team, gave the camera team a demo. “When we saw the demo, we realized that this is what we needed to do,” Townsend told us. The members of his camera hardware team weren’t sure they could do it, but difficulty was not an acceptable excuse for failing to deliver what would clearly be a superior user experience. After months of engineering effort, a key stakeholder, the video engineering team (responsible for the low-level software that controls sensor and camera operations) found a way, and the collaboration paid off. Portrait mode was central to Apple’s marketing of the iPhone 7 Plus. It proved

a major reason for users' choosing to buy and delighting in the use of the phone.

As this example shows, Apple's collaborative debate involves people from various functions who disagree, push back, promote or reject ideas, and build on one another's ideas to come up with the best solutions. It requires open-mindedness from senior leaders. It also requires those leaders to inspire, prod, or influence colleagues in other areas to contribute toward achieving their goals.

While Townsend is accountable for how great the camera is, he needed dozens of other teams—each of which had a long list of its own commitments—to contribute their time and effort to the portrait mode project. At Apple that's known as *accountability without control*: You're accountable for making the project succeed even though you don't control all the other teams. This process can be messy yet produce great results. "Good mess" happens when various teams work with a shared purpose, as in the case of the portrait mode project. "Bad mess" occurs when teams push their own agendas ahead of common goals. Those who become associated with bad mess and don't or can't change their behavior are removed from leadership positions, if not from Apple altogether.

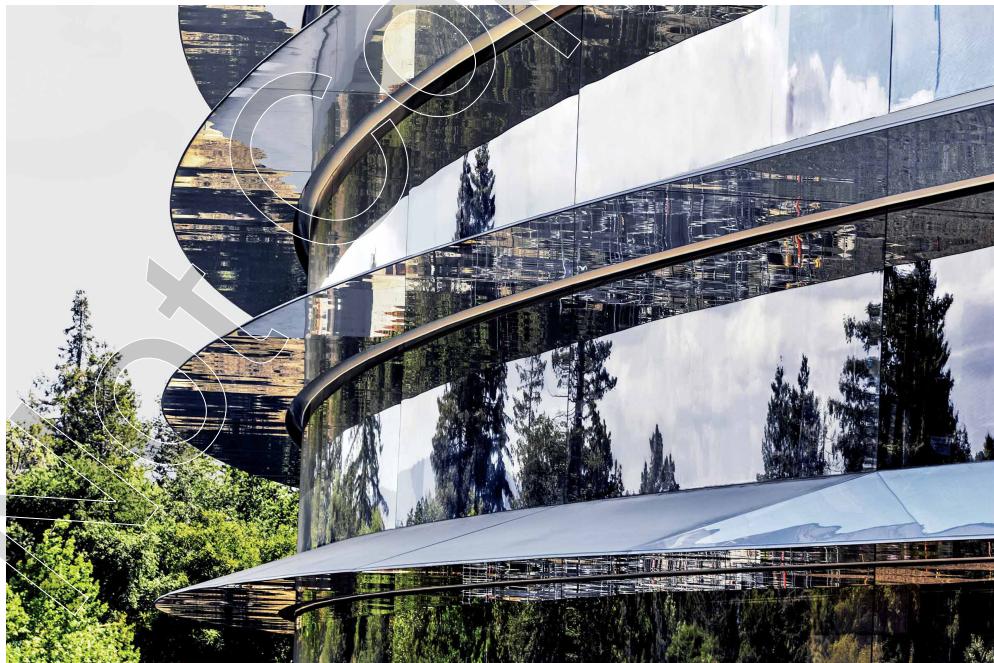
Leadership at Scale

Apple's way of organizing has led to tremendous innovation and success over the past two decades. Yet it has not been without challenges, especially with revenues and head count having exploded since 2008.

As the company has grown, entering new markets and moving into new technologies, its functional structure and leadership model have had to evolve. Deciding how to organize areas of expertise to best enable collaboration and rapid decision-making has been an important

responsibility of the CEO. The adjustments Tim Cook has implemented in recent years include dividing the hardware function into hardware engineering and hardware technologies; adding artificial intelligence and machine learning as a functional area; and moving human interface out of software to merge it with industrial design, creating an integrated design function.

Another challenge posed by organizational growth is the pressure it imposes on the several hundred VPs and directors below the executive team. If Apple were to cap the size or scope of a senior leader's organization to limit the number and breadth of details that the leader is expected to own, the company would need to hugely expand the number of senior leaders, making the kind of collaboration that has worked so well impossible to preserve.



Apple Park, Apple's corporate headquarters in Cupertino, California, opened in 2017. Mikael Jansson/Trunk Archive

Cognizant of this problem, Apple has been quite disciplined about limiting the number of senior positions to minimize how many leaders must be involved in any cross-functional activity. In 2006, the year before the iPhone's launch, the company had some 17,000 employees; by 2019 that number had grown more than eightfold, to 137,000. Meanwhile, the number of VPs approximately doubled, from 50 to 96. The inevitable result is that senior leaders head larger and more diverse teams of experts, meaning more details to oversee and new areas of responsibility that fall outside their core expertise.

In response, many Apple managers over the past five years or so have been evolving the leadership approach described above: experts leading experts, immersion in the details, and collaborative debate. We have codified these adaptions in what we call the *discretionary leadership* model, which we have incorporated into a new educational program for Apple's VPs and directors. Its purpose is to address the challenge of getting this leadership approach to drive innovation in all areas of the company, not just product development, at an ever-greater scale.

When Apple was smaller, it may have been reasonable to expect leaders to be experts on and immersed in the details of pretty much everything going on in their organizations. However, they now need to exercise greater discretion regarding where and how they spend their time and efforts. They must decide which activities demand their full attention to detail because those activities create the most value for Apple. Some of those will fall within their existing core expertise (what they still need to *own*), and some will require them to *learn* new areas of expertise. Activities that require less attention from the leader can be pushed down to others (and the leaders will either *teach* others or *delegate* in cases where they aren't experts).

Rosner, the VP of applications, provides a good example. Like many other Apple managers, he has had to contend with three challenges arising from Apple's tremendous growth. First, the *size* of his function has exploded over the past decade in terms of both head count (from 150 to about 1,000) and the number of projects underway at any given time. Clearly, he cannot dive into all the details of all those projects. Second, the *scope* of his portfolio has widened: Over the past 10 years he has assumed responsibility for new applications, including News, Clips (video editing), Books, and Final Cut Pro (advanced video editing). Although apps are his core area of expertise, some aspects of these—among them editorial content for News, how book publishing works, and video editing—involve matters in which Rosner is not an expert. Finally, as Apple's product portfolio and number of projects have expanded, even more coordination with other functions is required, increasing the *complexity* of collaborating across the many units. For instance, whereas Rosner is responsible for the engineering side of News, other managers oversee the operating system on which it depends, the content, and the business relationships with content creators (such as the *New York Times*) and advertisers.

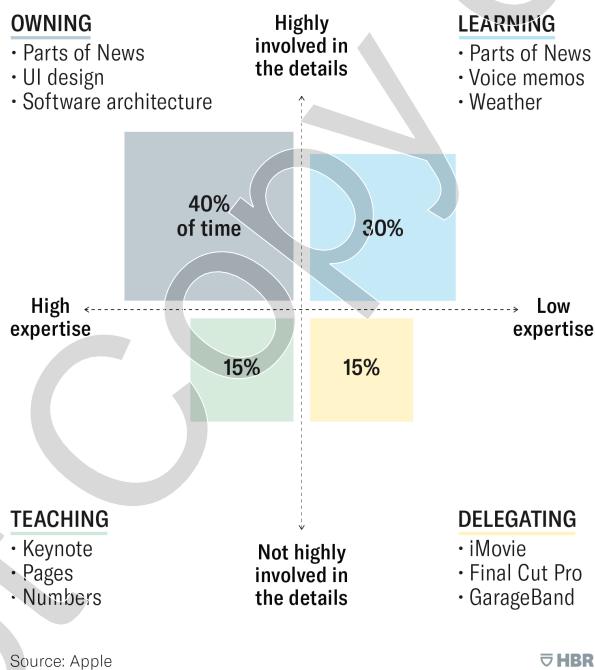
To cope, Rosner has adapted his role. As an expert who leads other experts, he had been immersed in details—especially those concerning the top-level aspects of software applications and their architecture that affect how users engage with the software. He also collaborated with managers across the company in projects that involved those areas.

But with the expansion of his responsibilities, he has moved some things from his *owning* box—including traditional productivity apps such as Keynote and Pages—into his *teaching* box. Now he guides and gives feedback to other team members so that they can develop software applications according to Apple's norms. Being a teacher doesn't mean that Rosner gives instruction at a whiteboard; rather, he offers strong,

often passionate critiques of his team's work. (Clearly, general managers without his core expertise would find it difficult to teach what they don't know.)

Roger Rosner's Discretionary Leadership

Apple's VP of applications, Roger Rosner, oversees a portfolio comprising four distinct categories that require varying amounts of his time and attention to detail. In 2019 it looked like this:



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The second challenge for Rosner involved the addition of activities beyond his original expertise. Six years ago he was given responsibility for the engineering and design of News. Consequently, he had to learn about publishing news content via an app—to understand news publications, digital advertising, machine learning to personalize news

content, architecting for privacy, and how to incentivize publishers. Thus some of his work fell into the *learning* box. Here managers face a steep learning curve to acquire new skills. Given how demanding this is, only critical new activities should fall into this category. Over six years of intense learning, Rosner has mastered some of these areas, which are now in his owning box.

As long as a particular activity remains in the learning box, leaders must adopt a beginner's mindset, questioning subordinates in a way that suggests they don't already know the answer (because they don't). This differs starkly from the way leaders question subordinates about activities in the owning and teaching boxes.

Finally, Rosner has delegated some areas—including iMovie and GarageBand, in which he is not an expert—to people with the requisite capabilities. For activities in the *delegating* box, he assembles teams, agrees on objectives, monitors and reviews progress, and holds the teams accountable: the stuff of general management.

Whereas Apple's VPs spend most of their time in the owning and learning boxes, general managers at other companies tend to spend most of their time in the delegating box. Rosner estimates that he spends about 40% of his time on activities he owns (including collaboration with others in a given area), about 30% on learning, about 15% on teaching, and about 15% on delegating. These numbers vary by manager, of course, depending on their business and the needs at a given time.

The discretionary leadership model preserves the fundamental principle of an effective functional organization at scale—aligning expertise and decision rights. Apple can effectively move into new areas when leaders like Rosner take on new responsibilities outside their

original expertise, and teams can grow in size when leaders teach others their craft and delegate work. We believe that Apple will continue to innovate and prosper by being organized this way.

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Apple's functional organization is rare, if not unique, among very large companies. It flies in the face of prevailing management theory that companies should be reorganized into divisions and business units as they become large. But something vital gets lost in a shift to business units: the alignment of decision rights with expertise.

Why do companies so often cling to having general managers in charge of business units? One reason, we believe, is that making the change is difficult. It entails overcoming inertia, reallocating power among managers, changing an individual-oriented incentive system, and learning new ways of collaborating. That is daunting when a company already faces huge external challenges. An intermediate step may be to cultivate the experts-leading-experts model even within a business unit structure. For example, when filling the next senior management role, pick someone with deep expertise in that area as opposed to someone who might make the best general manager. But a full-fledged transformation requires that leaders also transition to a functional organization. Apple's track record proves that the rewards may justify the risks. Its approach can produce extraordinary results.

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