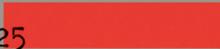


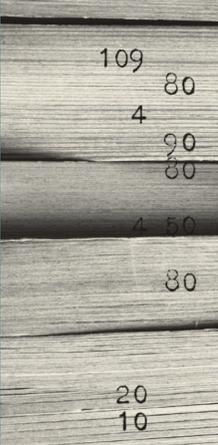
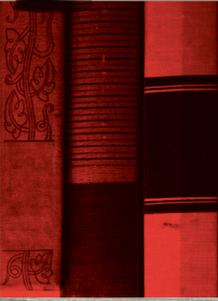
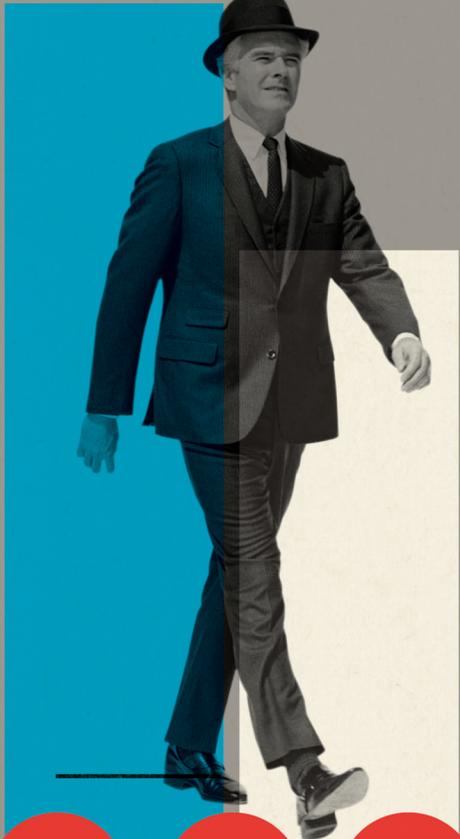
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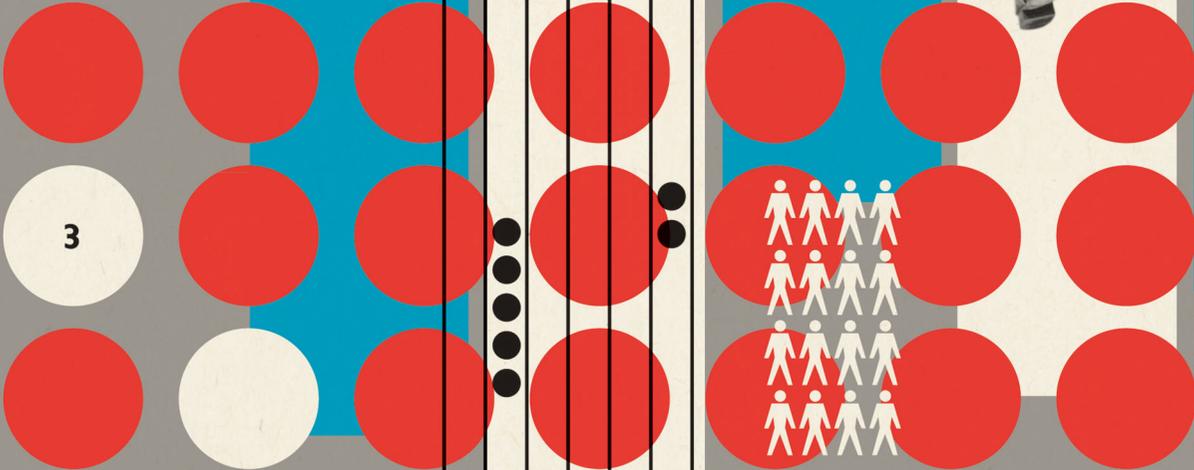
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MANAGING YOUR MISSION- CRITICAL KNOWLEDGE

HOW TO IDENTIFY,
MAP, AND LEVERAGE
SOME OF YOUR
COMPANY'S MOST
STRATEGIC ASSETS

BY MARTIN IHRIG
AND IAN MACMILLAN

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CRISTIANA GOUJERO

When executives talk about “knowledge management” today, the conversation usually turns very quickly to the challenge of big data and analytics. That’s hardly surprising: Extraordinary amounts of rich, complicated data about customers, operations, and employees are now available to most managers, but that data is proving difficult to translate into useful knowledge. Surely, the thinking goes, if the right experts and the right tools are set loose on those megabytes, brilliant strategic insights will emerge.

Tantalizing as the promise of big data is, an undue focus on it may cause companies to neglect something even more important—the proper management of *all* their strategic knowledge assets: core competencies, areas of expertise, intellectual property, and deep pools of talent. We contend that in the absence of a clear understanding of the knowledge drivers of an organization’s success, the real value of big data will never materialize.

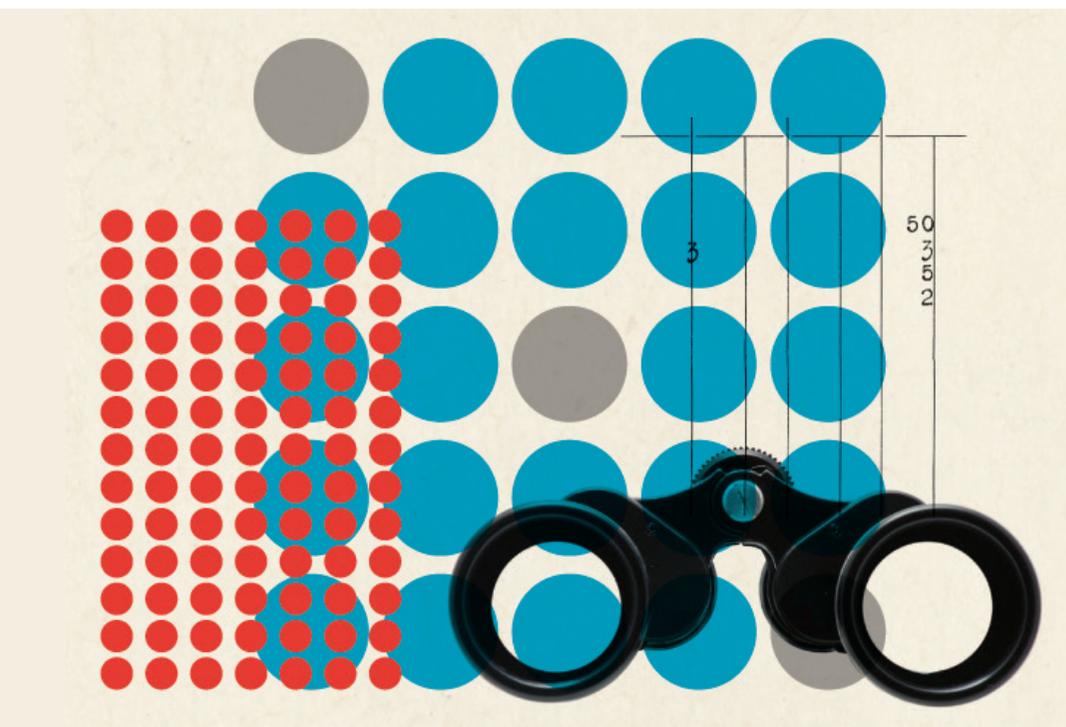
Yet few companies think explicitly about what knowledge they possess, which parts of it are key to future success, how critical knowledge assets should be managed, and which spheres of knowledge can usefully be combined. In this article we’ll describe in detail how to manage this process.

Map Your Knowledge Assets

The first step is to put boundaries around what you’re trying to do. Even if you tried to collect and inventory all the knowledge floating around your company—the classic knowledge-management approach—you wouldn’t get anything useful from the exercise (and you’d suffer badly from cognitive overload). Our goal is to help you understand which knowledge assets—alone or in new combinations—are key to your future growth. We would bet

heavily that if your company has a knowledge-management system, it doesn’t adequately parse out your mission-critical knowledge.

Identifying and mapping strategic knowledge is iterative. In our work with organizations we generally start by assembling a multifunctional team—at the organizational, divisional, or business unit level—to articulate what the members consider to be key dimensions of the company’s competitive performance and the knowledge that underpins them. It can be useful to shape this conversation by giving individuals assignments in advance. Senior managers might be asked to outline the business model and high-level critical knowledge, such as areas of advanced expertise, intellectual property, and the relationships with customers,



Idea in Brief

THE PROBLEM

Most of us work in the knowledge economy, but few companies have a clear understanding of which knowledge “assets” their future will be built on.

THE RESEARCH

It’s instructive to map your most important knowledge resources along two dimensions:

- Is it tacit or codified?
- Is it restricted or diffused?

THE TAKEAWAYS

To create value and growth, you can develop tacit knowledge, help spread expertise where it’s needed, put old knowledge to new uses, or spot connections between different spheres of expertise.

suppliers, and distributors that make that model successful. Market researchers and sales managers might be asked to delineate the attributes of new products and services that customers will need in the near future. Technical and operations managers might describe organizational routines that support needed areas of expertise. And so on. (The right mix of people will depend on the business context and how clearly the senior team has thought through its future strategy.)

This step alone can be quite challenging the first time around. When we worked with a group of decision makers at ATLAS, the major particle physics experiment at the European Organization for Nuclear Research (CERN), we interviewed many stakeholders to get a holistic view of the knowledge underpinning its success and then surveyed nearly 200 other members of the organization. Ultimately we mapped only a portion of the ATLAS knowledge base, but in the process we whittled down a list of 26 knowledge domains to the eight that were deemed most important to organizational outcomes.

Your list of key assets should ultimately include some that are “hard,” such as technical proficiency, and some that are “soft,” such as a culture that supports intelligent risk taking. You may also have identified knowledge that you should possess but don’t or that you suspect needs shoring up. This, too, should be captured.

The next step is to map your assets on a simple grid along two dimensions: tacit versus explicit (*unstructured versus structured*) and proprietary versus widespread (*undiffused versus diffused*). The exhibit “What Kind of Knowledge Is This?” which includes a mapping grid, will help you figure out where to place your knowledge assets on your own map. (We owe a debt to Sidney G. Winter, Ikujiro Nonaka, and the late Max Boisot for their work on

these dimensions. Had he lived, Boisot would have been a coauthor on this article.)

Unstructured versus structured.

Unstructured (tacit) knowledge involves deep, almost intuitive understanding that is hard to articulate; it’s generally rooted in great expertise. World-class, highly experienced engineers may intuit how to solve technical problems that nobody else can (and may be unable to explain their intuition). Rainmakers in a strategy consulting firm know in their bones how to steer a conversation or a discussion, develop a relationship, and close a deal, but they would have trouble telling colleagues why they made a particular move at a particular moment.

Structured (explicit or codified) knowledge is easier to communicate: A company that’s expert in the use of discovery-driven planning, for example, can bring people up to speed on that methodology quickly because it has given them recourse to a common language, rules of thumb, and conceptual frameworks. Some knowledge is so fully structured that it can be captured in patents, software, or other intellectual property.

Undiffused versus diffused. To what extent is the knowledge spread through—or outside—the company? One division may have expertise in negotiating with officials of the Chinese government, for example, which another division totally lacks. That knowledge is obviously undiffused. But most companies have certain broadly shared competencies: Those in the consumer packaged goods industry tend to have company-wide strength in developing and marketing new brands; and many employees in the defense industry know a lot about bidding on government contracts. Some knowledge, of course, is diffused far beyond the boundaries of the organization.

ABSENT A CLEAR UNDERSTANDING OF YOUR KNOWLEDGE ASSETS, BIG DATA’S VALUE WON’T MATERIALIZE.

Interpret the Map

Simply mapping your knowledge assets and then discussing the map with your senior team can uncover important insights and ideas for value creation, as our experience with decision makers at Boeing and ATLAS demonstrate.

Global sourcing at Boeing. Sourcing managers at Boeing were aware that their relationships with internationally dispersed customers, suppliers, and partners were changing. The whole ecosystem was sharing in the creation of new aircraft technologies and services and in the associated risks. Future success would depend on learning to manage this interdependence.

With that insight in mind, the managers mapped the critical knowledge assets in their global sourcing activities, which ultimately resulted in a research paper that one of us (Martin Ihrig) coauthored with Sherry Kennedy-Reid of Boeing. They saw that cost-related knowledge—performance metrics, IP strategy, and supply-base management—was well structured and widely diffused. However, knowledge about supplier capabilities, although codified, had not spread throughout the Boeing sourcing community. And other knowledge that was important to future value creation—how to leverage Boeing’s potent and technically sophisticated culture for effective communication and negotiation, determine Boeing’s business needs and global sourcing strategy, and, most important, assess the geopolitical influences on global sourcing decisions—was neither codified nor widely shared.

Taken together, these observations suggested that Boeing was placing greater emphasis on technical efficiencies, such as improving processes and productivity, than on strategic growth, such as creating research initiatives with suppliers or building a shared innovation platform. As Boeing’s business became progressively more intertwined with that of its ecosystem partners, the development of knowledge assets would need to change.

Insights from this mapping exercise enabled the team to recommend several initiatives aimed at developing and disseminating tacit knowledge, such as a program to help employees who had a deeper understanding of geopolitical influences to put some structure around their knowledge and pass it on to others in the company, and a program to identify the capabilities of key suppliers and determine how Boeing could work more strategically with them.

Advanced physics at CERN. The experimental work done at ATLAS is carried out by thousands of visiting scientists from 177 organizations in 38 countries, working without a traditional top-down hierarchy. This extraordinary operation has had spectacular results, including the discovery of the Higgs boson, for which Peter Higgs and François Englert were awarded a Nobel Prize in 2013. Our mapping of ATLAS’s knowledge base was done in a research partnership with Agustí Canals, Markus Nordberg, and Max Boisot.

Our team had a surprising insight when a study of that map revealed that “overview of the ATLAS experiment” was one of the top eight knowledge domains. We hadn’t given much thought to that domain, but we quickly realized how central it was to a knowledge-development program like ATLAS. Changes in the overall direction of a project can’t easily be codified when the project is so complex. The direction is continually evolving, and not necessarily in a linear fashion, as the technical and scientific work advances; but individual researchers can’t adapt their work accordingly when they don’t know what that direction is. ATLAS requires that huge numbers of people, from many countries and cultures, understand what others are learning and how it affects the overall technical direction.

Without the knowledge map, the leadership team at ATLAS would have predicted that scientific and technical knowledge were regarded as mission critical—indeed, most existing resources went to helping those domains make progress. But we found it extraordinary that the soft domains of project management and communication skills also emerged as central to ATLAS’s performance. Retrospectively, that made sense: A consensus on overall direction depends on the successful sharing of knowledge among specializations and between scientists as they cycle back to their home organizations and new people take their place. These important soft domains were much less developed and not well diffused; clearly, they needed more resources and attention.

Identify New Opportunities

Mapping knowledge assets and discussing their implications often leads directly to strategic insights, as it did at Boeing and ATLAS. But we also find it helpful to systematically explore what would happen if knowledge were moved around on the map

What Kind of Knowledge Is This?

You can plot your mission-critical knowledge on a map like the one below.

or different spheres of it were combined. Here are some examples:

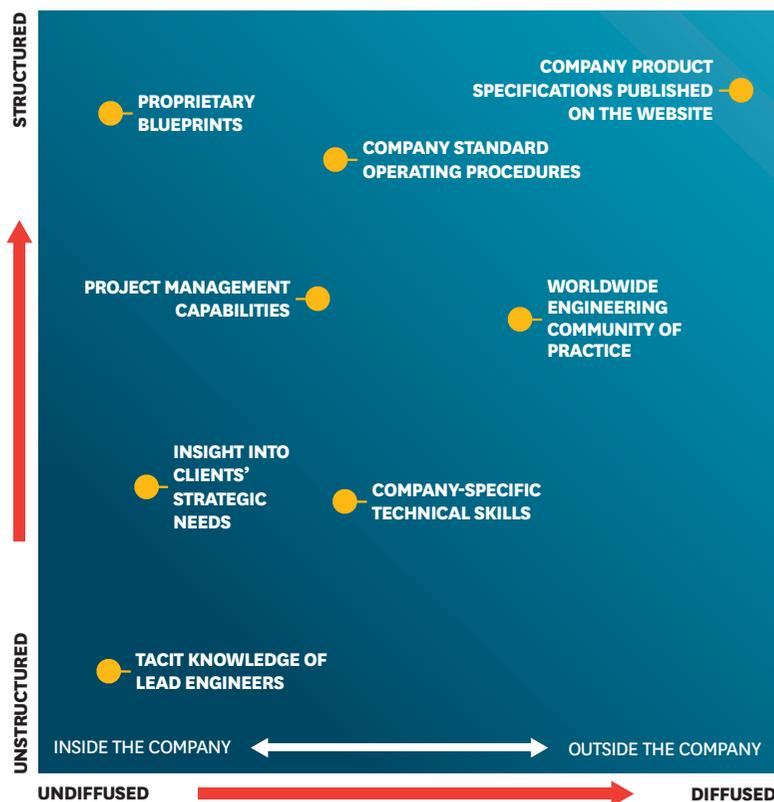
Selectively structure tacit knowledge (move it up on your map's Y axis). The proprietary knowledge assets in the lower left corner of your map are often the most important knowledge your company has—the deep-seated source of future strategic advantage. You need to think about which of them can and should become more structured so that (for example) your basic research will lead to the creation of bona fide intellectual property that can be developed into new products, licensed, or otherwise monetized. Structuring tacit knowledge often involves capturing expert employees' insights with the ultimate goal of disseminating them to many more people in the company. In general, speeding up codification will increase the value of knowledge. But making the tacit explicit can also be dangerous. The more codified the knowledge is, the more easily it may be diffused and copied externally.

When you're trying to decide what to structure further and what to keep tacit, it can be useful to distinguish between *product* and *process*. Suppose you've decided that your expertise in some technical domain can be codified into intellectual property. You may want to capture some of your process knowledge—whether it's an engineer's know-how or the conversational routines your marketing people use to tease out emerging customer needs—only informally. That way, even if a patent expires or codified knowledge is leaked, essential experience stays within the company.

Disseminate knowledge within the company (move it to the right on your map's X axis). Purposefully deciding which knowledge to diffuse internally can pay huge dividends. Very often one division is wrestling with a problem that another division has solved, and close study of the map will reveal the potential for productive sharing—as it would with the exemplary business unit's expertise in negotiating with the Chinese. Productive sharing can also be done between functions: Korean chaebols (conglomerates) expend considerable money and effort to ensure that knowledge is transferred from company to company as well as from headquarters to subsidiaries.

The ease of knowledge sharing is directly proportional to the degree of knowledge codification, of course: A written document or spreadsheet is easier to share than tacit experience accumulated

A GENERIC ENGINEERING COMPANY'S KNOWLEDGE ASSETS



USE THESE CATEGORIES TO HELP PLACE YOUR ASSETS ALONG THE Y AXIS FROM BOTTOM TO TOP:

- An expert can use the knowledge to perform tasks but cannot articulate it in a way that allows others to perform them.
- Experts can perform tasks and discuss the knowledge involved with one another.
- People can perform tasks by trial and error.
- People can perform tasks using rules of thumb, but causal relationships aren't clear.
- It's possible to identify and describe the relationship between variables involved in doing a task so that general principles become clear.
- The relations among variables are so well known that the outcome of actions can be calculated and reliably delivered with precision. (Knowledge assets covered under patents or other forms of copyright protection generally fit here.)

USE THESE CATEGORIES TO HELP PLACE YOUR ASSETS ALONG THE X AXIS FROM LEFT TO RIGHT:

- Only one person in the organization has this knowledge.
- A few people in the organization have this knowledge.
- Many people in one part of the organization have this knowledge.
- People throughout the organization have this knowledge.
- Many people in the industry have this knowledge.
- Many people both inside and outside the industry have this knowledge.

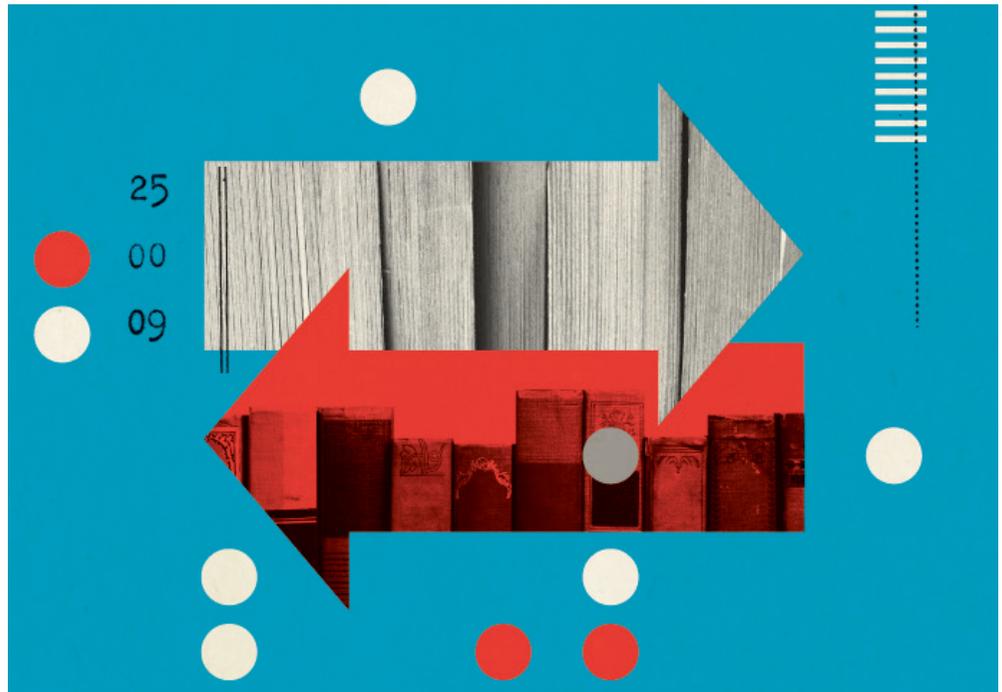
SOURCE THE MAP AND ITS DIMENSIONS ARE BASED ON MAX BOISOT'S CONCEPTUAL FRAMEWORK INFORMATION SPACE.

over many years. Some tacit knowledge can't be codified but can be shared. One powerful way to do so internally is to run workshops that bring together people who have subject matter expertise with people facing a particular problem for which that expertise is relevant. Apprenticeship programs, too, have long been an effective way to transfer difficult-to-codify tacit knowledge.

Diffuse knowledge outside the company (move it farther right on your map's X axis). The most straightforward way to create value through knowledge dissemination is to sell or license your intellectual property. DuPont, for example, commercializes only a small fraction of the hundreds of patents it owns; the rest can be licensed, sold, or shared with other companies. Even companies without patents can often identify new markets for existing IP. This magazine is an example: Reprints of HBR articles have been sold to MBA and corporate learning programs for decades. A few years ago someone had the idea of collecting the best of those articles in "Must Read" collections for individual buyers, and a profitable business was born.

Many companies are experimenting with less familiar ways of sharing knowledge across organizational boundaries. If suppliers, customers, and even competitors that work together on projects are creating value within your ecosystem, as at Boeing, this is worth considering. But you should keep in mind what knowledge must be protected; your map of assets will help you make those judgment calls.

Some companies even give away knowledge, ultimately making more money than they would if they kept it proprietary. In the early 1990s Adobe Systems saw an opportunity to develop a file-sharing format that would retain the text, fonts, images, and other graphics in a document no matter what operating system, hardware, or software was used to send and view it. Adobe was among the first to develop the idea behind the PDF. It then structured that knowledge in the form of the Adobe Acrobat PDF Writer



SOME COMPANIES GIVE AWAY KNOWLEDGE AND STILL MAKE A BIG PROFIT.

and Adobe Reader. It shared the Reader on the internet, thereby creating demand for the Writer (at \$300 and up), which was free from competition for years and remains one of Adobe's leading products. Similarly, McKinsey shares selected insights through *McKinsey Quarterly*, generating demand for its proprietary problem-solving skills.

The recent decision of the business magnate and inventor Elon Musk to share Tesla Motors patents with anyone who wants to use them was also very astute. Clearly, Musk believes that Tesla (like Adobe) will make more money if more people build on the platform he has provided. His decision also recognizes that in order to thrive, Tesla (like Boeing) needs to create a strong ecosystem. It's a vote of confidence in the company's capacity to protect enough tacit knowledge to stay ahead of the competition. (Musk told a reporter for *Bloomberg Businessweek*, "You want to be innovating so fast that you invalidate your prior patents, in terms of what really matters. It's the velocity of innovation that matters.") This is one of the most interesting examples of open innovation that we've seen: Musk is betting not just that he can pull more partners into the world of electric cars but that he can pull the mainstream automobile industry into a more responsible position with respect to climate change.

Contextualize knowledge (move it down on your map's Y axis). Codified knowledge can be applied in less structured spaces in a variety of ways. Sometimes it's a matter of taking well-established routines and applying them to new businesses. This approach is central to the growth strategies of many companies. Procter & Gamble, for instance, uses world-class brand-building competencies when it moves into new markets and develops new products. Similarly, Goldman Sachs rapidly generates new investment banking offerings by applying its analytics capabilities to changes in financial market conditions.

Contextualization can also come from combining structured and unstructured knowledge. The people who originally tried to build knowledge-management systems for consulting firms quickly discovered that most consultants used codified information as a networking tool: They would notice who wrote an article on sourcing from Indonesia (for example) and then talk with that person directly, picking her brain for more-tacit insights. Indeed, many companies build competitive advantage on just such combinations.

To be applied in a new setting, codified knowledge must generally be contextualized. If Boeing USA comes up with a new production process and then ships the related knowledge to China in the form of supporting documents, Chinese engineers have to assimilate the knowledge and adapt it to their context.

Discover new knowledge (move it to the left on your map's X axis). The most challenging—and highest-potential—opportunities often come from spotting connections between disparate areas of expertise (sometimes inside the company, sometimes outside it). The analytic techniques that can turn big data into big knowledge are used partly in hopes of finding such unexpected connections.

In the pursuit of innovation, flashes of insight can come from many sources. Sometimes a new technology embedded in an existing product makes it possible to change your value proposition. That happened when Rolls-Royce's jet engine sensors provided the company with new performance data, which in turn made it more profitable to sell power by the hour than to sell engines outright. Thinking about someone else's business model can lead to strategic insights as well. After managers at CEMEX studied how FedEx, Domino's, and ambulance

squads operate, they decided to charge for delivering truckloads of ready-mix concrete within a specified time window rather than for cubic meters of the product. Changes in the external environment can create new opportunities. Subway went from an also-ran to a high-growth fast-food business when it capitalized on consumers' growing interest in tasty, more-nutritious, low-calorie food. Your company may have developed valuable process expertise that you could sell through consulting to other companies even outside your industry. IBM has done that many times over.

It's not easy to systematize this part of the knowledge-development process, which arises to some extent from intuition, tacit knowledge, and time spent studying the map. The ATLAS team's insight about the importance of soft skills is an example. So is Boeing's insight that becoming part of an interdependent ecosystem had major implications for what kinds of knowledge would have to be developed. A small publishing industry that is devoted to helping companies make innovative connections of this kind includes the book *MarketBusters: 40 Strategic Moves That Drive Exceptional Business Growth*, which one of us (Ian MacMillan) wrote with Rita McGrath; William Duggan's *Strategic Intuition: The Creative Spark in Human Achievement*; and Frans Johansson's *The Medici Effect: What Elephants and Epidemics Can Teach Us About Innovation*.

One thing we can assure you: Your competitors will have access to the same kinds of data and general industry knowledge that you do. So your future success depends on developing a new kind of expertise: the ability to leverage your proprietary knowledge strategically and to make useful connections between seemingly unrelated knowledge assets or tap fallow, undeveloped knowledge.

COMPANIES INVEST tens of millions of dollars to develop knowledge but pay scant attention to whether it contributes to future competitive advantage. The process we've outlined here is meant to prevent that lapse. Once you've mapped your mission-critical knowledge assets, the challenge is to be disciplined about which of them to develop and exploit, keeping future growth front and center. (Remember, strategy always includes deciding what *not* to do.) If your company thoughtfully manages its knowledge portfolio, it will achieve a distinct competitive advantage. ♥

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