Mastering the Three Worlds of Information Technology

There are three categories of IT, each of which provides different organizational capabilities—and demands very different kinds of management interventions.

by Andrew McAfee

In the information era, the best of times are the worst of times. Computer hardware keeps getting faster, cheaper, and more portable; new technologies such as mashups, blogs, wikis, and business analytic systems have captured the imagination; and corporate IT spending has bounced back from the plunge it took in 2001. In 1987, U.S. corporations' investment in IT per employee averaged $1,500. By 2004, the latest year for which government data are available, that amount had more than tripled to $5,100 per employee. In fact, American companies spend as much on IT each year as they do on offices, warehouses, and factories put together.

However, as IT's drumbeats become louder, they threaten to overwhelm general managers. One of the biggest problems companies face is coping with the abundance of technologies in the marketplace. It's hard for executives to figure out what all those systems, applications, and acronyms do, let alone decide which ones they should purchase and how to successfully adopt them. Most managers feel ill equipped to navigate the constantly changing technology landscape and thus involve themselves less and less with IT.

Adding to executives' diffidence, corporate IT projects have often delivered underwhelming results or been outright failures. Catastrophes—such as the one at American pharmaceutical distributor FoxMeyer Drug, which went into Chapter 11 and was sold in 1997 when a $100 million IT project failed—may be less frequent today than in the past, but frustration, delay, and disappointment are all too common. In 2005, when IT consultancy CSC and the Financial Executives Research Foundation conducted a survey of 782 American executives responsible for IT, 50% of the respondents admitted that "aligning business and IT strategy" was a major problem. The researchers found that 51% of large-scale IT efforts finished later than expected and ran over budget. Only 10% of companies believed they were getting high returns from IT investments; 47% felt that returns were low, negative, or unknown.

Not surprisingly, any fresh IT proposal sparks fiery debates in boardrooms. Some boards say "Why should we bother? IT isn't strategic, so it doesn't matter in a competitive sense. We should be minimizing our technology expenditures." Others argue "Whether IT matters or not, we shouldn't be doing it ourselves. Companies are becoming virtual, and software is becoming rentable, so why do IT the old-fashioned way?" Thus, executives try to delegate, outsource, rent, rationalize, minimize, and generally remove IT from their already long list of concerns.

Executives need to stop looking at IT projects as technology installations and start looking at them as periods of organizational change that they have a responsibility to manage.

But managers who distance themselves from IT abdicate a critical responsibility. Having studied IT for the past 12 years, I believe that executives have three roles to play in managing IT: They must help select technologies, nurture their adoption, and ensure their exploitation. However, managers needn't do all those things each time they buy a new technology. Different types of IT result in different kinds of organizational change when they are implemented, so executives must tailor their roles to the technologies they're using. What's critical, though, is that executives stop looking at IT projects as technology installations and start looking at them as periods of organizational change that they have a responsibility to manage.

Building an Effective IT Model

Everyone who has studied companies' frustrations with IT argues that technology projects are increasingly becoming managerial challenges rather than technical ones. What's more, a well-run IT department isn't enough; line managers have important responsibilities in implementing these projects. An insightful CIO once told me, "I can make a project fail, but I can't make it succeed. For that, I need my [non-IT] business colleagues." Managers I've worked with admit privately that success with IT requires their commitment, but they're not clear where, when, and how they should get involved.

That's partly because executives usually operate without a comprehensive model of what IT does for companies, how it can affect organizations, and what managers must do to ensure that IT initiatives succeed. As HBS professor Clayton M. Christensen and Boston University professor Paul R. Carlile point out in their working paper "The Cycles of Theory Building in Management Research" (Harvard Business School, February 2005), a good model or theory does two things: It groups important phenomena into categories, and, within categories, it makes statements of cause and effect. Yet even state-of-the-art models of IT's impact consist only of statements about individual technologies, such as "CRM lets you get closer to customers" and "SCM enables you to reduce inventory." Such declarations don't help executives; they're more akin to sales pitches than statements of fact. These assertions are also silent about why technologies will deliver to companies the benefits they have promised. Why will customers start confessing their deepest desires to your customer relationship management system? Why will suppliers start delivering just in time when you set up a supply chain management system? Existing models don't help executives choose among technologies, either. Every business wants both to be closer to customers and to keep inventory levels low—but is it better to first invest in CRM or SCM improvements?

One way to build a comprehensive model is to place IT in a historical context. Economists and business historians agree that IT is the latest in a series of general-purpose technologies (GPTs), innovations so important that they cause jumps in an economy's normal march of progress. Electric power, the transistor, and the laser are examples of GPTs that came about in the nineteenth and twentieth centuries. Companies can incorporate some general purpose technologies, like transistors, into products, and others, like electricity, into processes, but all of them share specific characteristics. The performance of such technologies improves dramatically over time. As people become more familiar with GPTs and let go of their old ways of thinking, they find a great many uses for these innovations. Crucially, general purpose technologies deliver greater benefits as people invent or develop complements that multiply the power, impact, and uses of GPTs. For instance, in 1970, fiber-optic cables enabled companies to employ lasers, which had already been in use for a decade, for data transmission.

The complements of process GPTs are organizational innovations, or changes in the way

companies get work done. Research suggests that four organizational complements—better-skilled workers, higher levels of teamwork, redesigned processes, and new decision rights—allow process GPTs to deliver improved performance. For instance, in the early twentieth century, factories in America replaced central motors driven by waterwheels or steam engines with newly invented electric motors. These large motors were connected to a driveshaft, which was connected by belts to the factory's machines. At first, electric motors were bolted onto the old driveshafts. As time went on, businesses built smaller electric motors and connected one to each machine. The new motors gave companies the freedom to redesign work flows. They were able to build long, low factories instead of high, narrow ones, for example, and to arrange machines in rows that later became assembly lines. However, businesses had to hire workers who were both more skilled and better able to independently make decisions at each station. Once all the organizational complements to electric motors were in place, they maximized the technology's impact and boosted productivity in the U.S. manufacturing sector.

These insights are also true of IT, but with one distinction: Information technologies, my research shows, don't enjoy the same relationships with the four organizational complements that other process GPTs have. Some information technologies can deliver results without the complements being in place; others allow the complements to emerge over time; and still others impose the complements they need as soon as companies deploy the technologies.

Classifying IT into three types can help leaders understand which technologies they must invest in as well as what they should do to maximize returns.

Based on those variations, we can classify IT into three categories. (See the exhibit "The Three Varieties of Work-Changing IT.") Each offers companies distinctive capabilities, delivers unique benefits, and triggers organizational changes of different types and magnitudes. This classification can help leaders understand which technologies they must invest in as well as what they should do to maximize returns. It can also indicate which IT initiatives are going to be relatively easy to implement and on which projects executives should focus. In that light, IT management starts to look less like a black art and more like the work of the executive.

The Three Varieties of Work-Changing IT

IT Category	Definition	Characteristics	Examples
Function IT	IT that assists with the execution of discrete tasks	• Can be adopted without complements • Impact increases when complements are in place	Simulators, spreadsheets, computer-aided design, and statistical software
Network IT	IT that facilitates interactions without specifying their parameters	• Doesn't impose complements but lets them emerge over time • Doesn't specify tasks or sequences • Accepts data in many formats • Use is optional	E-mail, instant messaging, wikis, blogs, and mashups
Enterprise IT	IT that specifies business processes	• Imposes complements throughout the organization • Defines tasks and sequences • Mandates data formats • Use is mandatory	Software for enterprise resource planning, customer resource management, and supply chain management

The Three Categories of IT

Executives often talk about the revolution that computers have brought about in companies, but, as the IT model I've described illustrates, that's an oversimplification. IT sets off several kinds of revolutions in organizations because technologies fall into three distinct categories.

Function IT. (FIT) includes technologies that make the execution of stand-alone tasks more efficient. Word processors and spreadsheets are the most common examples of this IT category. Design engineers, accountants, doctors, graphic artists, and a host of other specialists and knowledge workers use FIT all the time. People can get the most value from these technologies when their complements are in place but can also use FIT without all of the complements. For instance, an R&D engineer can use a computer-aided design (CAD) program to improve the way he does his work without making any changes in how the rest of the department functions. Furthermore, FITs don't bring their complements with them. CAD software, for example, doesn't specify the processes that make the most of its power. Companies must identify the complements FIT needs and either develop them or allow users to create them.

FIT is powerful. Five years ago, Ducati announced that it would enter the MotoGP racing circuit in 2003. Its designers kicked off a project to build a suitable motorcycle in November 2001. They started by using simulation software to build and test virtual engines. The simulations made the team realize that a two-cylinder engine wouldn't be powerful enough to win races, so it decided to build Ducati's first four-cylinder engine. The team finished designing the engine in August 2002; a motorcycle powered by the engine was zooming around test tracks two months later; and the project was largely complete by January 2003. The Italian company participated in the MotoGP circuit in 2003 and outperformed most of its rivals: Ducati placed second in the manufacturers' standings, a ranking of companies that race motorcycles on the circuit, and its riders finished fourth and sixth in the individual standings.

Ducati's experience with FIT vividly demonstrates the capabilities of this IT category:

• *Enhancing experimentation capacity.* Ducati's engineers built thousands of engines and motorcycles and compared their performance without touching a sheet of steel.

• *Increasing precision.* The company's designers came to trust the software so much that if test results disagreed with a simulation, they told me, the first reaction was to mistrust the test results.

Network IT. (NIT) provides a means by which people can communicate with one another. Network technologies include e-mail, instant messaging, blogs, and groupware like Lotus Notes. NIT allows people to interact, but it doesn't define how they should interact. It gives people freedom to experiment instead of telling them what they must do. Unlike FIT, network IT brings complements with it but allows users to implement and modify them over time.

In 2005, investment bank Dresdner Kleinwort Wasserstein introduced three network technologies: messaging software, employee blogs, and a company wiki, a Web site that employees could contribute to or edit without needing permission or HTML skills. DKW's people generate data, get opinions, and find answers by using the messaging software to

contact the firm's traders and analysts across the world. Many managers write blogs or post comments on others' blogs. Some DKW directors see the wiki as a way to deal with e-mail overload and encourage their teams to post agendas, to-do lists, and work in progress on the wiki rather than circulating them via e-mail.

As the DKW example illustrates, NIT's principal capabilities include the following:

• *Facilitating collaboration.* Network technologies allow employees to work together but don't define who should work with whom or what projects employees should work on. At DKW, ad hoc teams have formed because employees read one another's blogs. These teams have used the wiki to accomplish tasks, and they have disbanded without orders from senior executives.

• *Allowing expressions of judgment.* NITs are egalitarian technologies that let people express opinions. DKW employees use blogs to voice their views about everything from open-source software to interest rate movements.

• *Fostering emergence.* "Emergence" is the appearance of high-level patterns or information because of low-level interactions. These patterns are useful because they allow managers to compare how work is done with how it's supposed to be done. Emergence is also valuable for users. For instance, employees can easily search and navigate DKW's blogs and wiki for trends and data even though nobody is in charge of making them easy to use.

Enterprise IT. (EIT) is the type of IT application that companies adopt to restructure interactions among groups of employees or with business partners. Applications that define entire business processes, such as CRM and SCM—as well as technologies, such as electronic data interchange, that automate communications between companies—fall into this category. Unlike network technologies, which percolate from the bottom, enterprise technologies are very much top-down; they are purchased and imposed on organizations by senior management. Companies can't adopt EIT without introducing new interdependencies, processes, and decision rights. Moreover, companies can't slowly create the complements to EIT; changes become necessary as soon as the new systems go live.

In 2002, American retail drugstore chain CVS became concerned about the long wait times at its pharmacies and reexamined two steps in its prescription fulfillment process that it had automated. Initially, its pharmacies had performed the first step, a safety check for drug interactions, one hour before the customer's desired pickup time. After that, it checked whether the insurer would pay for the medicine. Despite automating the process, CVS often was unable to resolve all of the outstanding safety and insurance issues by the promised pickup times, which irritated customers. CVS then decided to reverse the order in which the steps were executed. The change met with resistance from many CVS pharmacists, who felt that since the drug safety check was the more important of the two, it should be the first step in the process. The team that was rolling out the project reasoned with the skeptics but eventually realized that it would not win them all over. So it instructed the pharmacies to perform the insurance review first, when customers dropped off prescriptions, rather than immediately before pickup time. That allowed technicians to work with customers to correct small glitches, such as date of birth errors in health insurance records, that would prevent drug reimbursements and to warn people if they were likely to run into bigger issues, such as the nonpayment of insurance premiums. The new sequence also let CVS's pharmacists incorporate the safety check into their quality control procedures instead of treating it as a separate step. Redesigning the

fulfillment process cut wait times at CVS by as much as 80%, which improved customer satisfaction.

As CVS's experience shows, EIT's primary capabilities include the following:

• *Redesigning business processes.* Because CVS employees couldn't fill prescriptions until they had completed the two checks in the new sequence, the revamped fulfillment process wasn't just a good idea in theory—CVS employees had to execute the process in that particular sequence. EIT gives managers confidence that employees will execute processes correctly.

• *Standardizing work flows.* Once companies identify a complementary business process, they can implement it widely and reliably along with the EIT. CVS rolled out its new process in 4,000 outlets across the United States in less than a year.

• *Monitoring activities and events efficiently.* EITs can allow managers to get an accurate and up-to-date picture of what's happening throughout the enterprise, often in something close to real time. CVS's software lets executives know how many prescriptions are filled every day in each location, how long it takes to fill each prescription, and what kinds of fulfillment problems employees had to tackle.

Managing the Three Types of IT

Across the three IT categories, executives have three tasks. First, they must help select IT applications that will deliver the organizational capabilities they desire. Second, they must lead adoption efforts that result in the creation of complements for those technologies. And third, they must shape the exploitation of IT by ensuring that technologies, capabilities, and complements stay aligned.

IT selection. Companies often select IT applications after one of their executives hears about a new technology and wonders why his or her organization hasn't invested in it yet. This approach is pervasive. How often do you hear, "Shouldn't we take a look at Technology X?" or "Why can't Technology Y do that for us?" Companies will even invest in a technology because everyone else in the industry has purchased it or because it comes with glowing recommendations from consultants, analysts, and journalists.

Trouble is, there's an endless supply of new applications, partly because of innovation and partly because of clever rebranding. Companies can't possibly evaluate all the new applications that cross their paths. Another, more fundamental, problem is that this method of choosing applications reflects an outside-in approach: Executives describe a technology that's available in the outside world and propose that it should be brought into the company. No one stops to think about whether the organization actually needs the capabilities that the technology offers. Between 1999 and 2001, American companies spent $130 billion on IT they never used, according to one estimate. An outside-in mentality was surely behind much of that waste.

A more sensible question for executives to ask is "What do we need IT to do for us?" For instance, they might consider, Do our company's engineers need to increase their experimentation capacity? Do our sales and marketing departments need to collaborate more often? Do we need to standardize fulfillment processes throughout the world? Managers should also set IT priorities. They must decide, Is it more important to have a single source of employee data or to get weekly reports from the sales force about client contacts? Would the R&D department be better off if it could conduct more simulations or

if it had an online space for brainstorming? Would it be more valuable to enhance the enterprise system by adding a layer of analysis software or by extending it to suppliers through a private data exchange? These are tough choices, but they are appropriate ones for top management teams to talk through. (See the sidebar "The IT Dialogue.")

The IT Dialogue

An inside-out approach puts the spotlight squarely on the business before evaluating the technology landscape; it focuses on the capabilities that IT can provide rather than on the technologies themselves. A discussion among executives about capabilities will highlight what the business most wants to be good at—and it will show whether there's agreement about what the business needs to be good at. Once the company's business needs are clear, the technologies it requires will come into focus. Typically, FIT delivers productivity and optimization, NIT increases collaboration, and EIT helps standardize and monitor work. Thus, when executives decide what capabilities they need, they will know what kind of IT to buy and the nature of the initiatives they must manage.

Once the company's business needs are clear, the technologies it requires will come into focus.

In our 2004 case study "Enterprise IT at Cisco," two HBS colleagues, F. Warren McFarlan and Alison Berkley Wagonfeld, and I described how Cisco used the inside-out approach to refocus the IT selection process. Cisco realized that there were drawbacks in its IT decision-making process as it was trying to recover in late 2001 from a fall in revenues. CIO Brad Boston found that Cisco had nine order status tools. Each of them used data from different sources, which used different definitions for key terms. As a result, the systems couldn't give the company a clear picture of its orders. There were similar problems in the sales organization. Boston and his colleagues realized that Cisco needed to improve its standardization and monitoring capabilities, so they selected an upgraded ERP system and a customer database. They also decided to implement the new technologies across the company even though it was costly and time-consuming to do so. The ERP project required three years to implement and cost the company approximately $200 million. Since Cisco couldn't gain the capabilities it wanted without those technologies, however, it chose to invest in them.

IT adoption. After IT selection, executives' attention turns to adoption: the hard work of putting the technologies they've invested in to productive use. At this stage, managers' main responsibility is to help create the complements that will maximize IT's value. FIT doesn't bring its complements with it, so managers must find ways of identifying them. That's what BMW's chief designer, Chris Bangle, did in the late 1990s when he wanted designers to use computer-aided styling (CAS) software in addition to paper, clay, and wood. As Bangle explained to HBS professor Stefan Thomke during an interview, the designers were reluctant to use the software, even though Bangle had hired CAS specialists to work alongside them. One day, Bangle declared that within three months, the CAS team would have to pay for itself—or he would sell the team's computers. He didn't twist the designers' arms; he pressured the CAS specialists and modelers. They helped the designers adopt the software and create new design processes. Bangle knew he couldn't force the technology's adoption or merely hope that complements would emerge. He had to allow his team to discover new ways of working—although he could prod it a little.

There's an interesting dichotomy in executives' roles when it comes to NIT adoption.

Because the use of such technologies is voluntary rather than mandatory, they make users feel more, rather than less, in control of their work. As a result, their adoption isn't difficult. However, managers still have to intervene with new technologies, such as groupware, wikis, and blogs, by demonstrating how they can be used and by setting norms for participation. Once network technologies are properly established, their use takes off, and the challenge for managers is to refrain from intervening too often or with too heavy a hand.

In stark contrast to FIT and NIT, enterprise IT is hard for companies to adopt. The benefits look great to people at the top, but employees usually dislike EIT technologies. Unlike network technologies, they don't just enable new ways of working; they dictate them. Enterprise systems define new cross-function business processes, impose the processes on employees without allowing employees to modify them, and bring higher levels of oversight. Most employees don't like having new processes dictated to them by a piece of software and will use a variety of techniques to prevent the adoption of enterprise technologies. Executives must intervene forcefully throughout EIT adoption efforts because new processes, changed decision rights, and greater interdependence come hand in hand with these technologies.

In fact, the biggest mistake business leaders make is to underestimate resistance when they impose changes in the ways people work. In 2002, a Boston-based hospital set up an IT system that replaced handwritten prescriptions with online orders. The system instantly checked doctors' prescriptions for harmful doses or drug interactions and transmitted the orders to the hospital pharmacy. Even though studies had demonstrated that the system would reduce medication errors, physicians bitterly resisted. They complained that the computer-based process was slower and less convenient than paper-based ordering and that the built-in error checking didn't work. They protested so strongly that the hospital was able to roll out the system in only a few departments. Today, most of the doctors continue to write prescriptions on paper and fax them to the hospital's pharmacy. The system's champions were caught completely off guard by the doctors' reaction to the monitoring and standardization capabilities that the hospital sought.

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EIT adoptions can give rise to several kinds of problems. For example, EIT projects often become delayed as employees and managers negotiate the use of complements, such as new processes, that the technology has imposed. Companies often settle for solutions that are more modest than originally planned and gain only some of the capabilities they had initially sought. Firms may even abandon EIT adoptions altogether. Even worse, some businesses don't abandon an EIT project when they should, which wreaks havoc on performance. For instance, in the late 1990s, both Hershey and Nike implemented technologies that were a poor fit with their business needs and processes. As a result, the finances and share prices of both companies suffered.

All the successful EIT adoptions I've studied have used the same process for avoiding failure, and all the unsuccessful EIT adoptions I've studied have not used it: They have decided at the outset how key issues about configuration and other aspects of the adoption will be raised and how they will be settled. The most important participants in this task are not IT specialists or consultants but business leaders from the areas affected by the new technology. The more areas there are, and the more their work is being

changed, the more the adoption effort needs a seasoned leader. A midlevel project manager doesn't have the formal or informal authority required to make and implement these tough decisions. At CVS, for example, the leader of the EIT project was responsible for both IT and store operations, so he had the authority to deploy the new process despite opposition from the chain's pharmacists. Similarly, despite Cisco's decentralized culture, the company set up a business process operating committee (BPOC) that consisted of six senior executives and the CIO. The BPOC met throughout the EIT adoption effort to make policy and process decisions and to signal that Cisco wouldn't back away from establishing the complements that the technology needed even though there was resistance within the organization.

Leaders who successfully implement EIT try to build consensus in the organization, but they're also willing to push ahead without having everyone on board every step of the way. Their decisive style runs counter to the usual advice about how executives should get users to accept and own new technologies. For example, in 1999, when a mutual fund company set up a CRM system, it asked its salespeople to enter the information about their meetings with brokerages and institutional investors into the system. The sales reps saw this, correctly, as an attempt to capture knowledge that existed only in their heads. They refused to use the system, which delivered little value to anyone for years. The situation changed with the arrival in 2001 of a new sales president, who demanded that reps enter information into the CRM system, threatened to withhold commission payments from those who didn't, and instructed her direct reports to cross-check the sales reps' entries against expense reports. The president's policy was met with stiff opposition, but the reps quickly realized that they had to accede to the demands of the new boss if they wanted to continue working for the company.

IT exploitation. A business leader's third IT-related responsibility is to extract the maximum benefit from technologies once they are in place.

Companies can best exploit FIT by fine-tuning organizational complements. When HBS professors Marco Iansiti and Alan MacCormack studied the 1995 America's Cup sailing competition, they found that all of the teams used simulation software to help them design their boat keels. Most teams worked with universities and aerospace companies to build sophisticated simulations and used either mainframes or supercomputers to do the work. They were all beaten by Team New Zealand, which used less powerful workstations but brought the computers down to the docks where its boats were built. The New Zealand team also encouraged experimentation and teamwork and pushed keel modification decisions down the organization. Because the other teams didn't do all of those things, they couldn't harness the full power of the FIT.

Employees exploit older NITs such as e-mail and instant messaging on their own, but business leaders have a role to play in exploiting newer technologies like blogs and wikis. They can help sustain and increase the use of complements to make the technology continually more effective, primarily by guiding users. Darren Leonard, a managing director in the global equity derivatives business at Dresdner Kleinwort, recalls how he got his colleagues to use the company's wiki: "First, if a wiki has no structure, it's perceived not as an opportunity but as anarchy, and our people have no time for anarchy. I went back to my initial pages and rewrote them to be a lot more directive. For example, I made a page with the agenda for an upcoming meeting and asked people to add to it. Second, wikis have to be clearly better than other ways of collaborating. There have to be uses [for them] that demonstrate their power. One of these uses came prior to a special senior management meeting where we could bring questions from our groups and get them answered. I put up a page…asking my [team members] what questions they wanted me

to ask on their behalf. People used the page to post questions, edit them, and discuss which ones were the most important and why. That really accelerated wiki use. Finally, old habits are hard to break. The tendency is for people to keep using e-mail because that's what they know....I have to [tell them], 'I'm not reading e-mails on this topic. Use the wiki' or 'Everyone's assignments are on this page—use the same page to report on progress.'"

Interestingly, EIT's exploitation is often easier than its adoption. Since the work of imposing new processes is done by this stage, the manager's task is to leverage already standardized data and work flows. Few employees and managers have problems with that; they're eager to get the most out of a system that was so much trouble to set up. Exploiting EIT sometimes requires adding a new FIT on top of it. In the mid-1990s, food services giant Sysco implemented an ERP system and data warehouse across its 80 regional businesses. Sysco's executives realized that because all of the companies were now recording orders in the same way, it was possible to analyze the standardized data to answer two questions: Which customers were most likely to defect? and What other products could it be selling to existing customers? Sysco invested in business intelligence software, which sits on top of the ERP system, extracts data from it, and facilitates its analysis. As a result, salespeople and managers gained something akin to a crystal ball that could provide two critical answers they needed.

Other companies have exploited enterprise systems by extending them to customers, suppliers, and joint-venture partners. That expands businesses' monitoring capabilities and provides levels of control that they could otherwise have achieved only by employing more people. For instance, the $107 million Argentine grain producer Los Grobo uses an EIT system to track all the work done on its farms. Los Grobo rents most of the fields, and contractors plant, spray, harvest, and oversee them. The contractors enter their activities into Los Grobo's system through a Web interface, which allows managers and specialists at the company's Buenos Aires headquarters to make informed decisions about land management and yield improvement. This platform has helped Los Grobo grow its sales at a rate of 40% per year since 2000—without buying more land or hiring as many employees as it used to.

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For a resource to have an impact on a company's competitive position, it must be valuable, rare, inimitable, and nonsubstitutable. Oil wells and diamond mines meet the test; pencils and paper don't. What about IT? At first glance, it would seem that all three IT categories fail to meet these criteria. Vendors offer a wide range of FIT, NIT, and EIT, so these technologies are not rare and seem to be highly imitable. However, people often forget that while the software itself might not be any of those things, a successfully implemented system isn't easy to replicate. Because of the managerial challenges inherent in its implementation, IT meets all four criteria when a company succeeds in applying a technology and, consequently, gains valuable capabilities.

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