

Creating and Evolving a Technology Roadmap¹

If you don't know where you are going, any road will get you there. Lewis Carroll (1865)

The preceding quote applies rather well to technology roadmaps. In the past, companies have followed a number of different technology paths that have not always led to the “promised land” despite conscientious effort. There are many reasons for this. First, the target evolves, which means that development of a technology roadmap should be an ongoing process. To continue the analogy, we are forever “traveling” but never “arriving.” Second, technology has many different masters. Vendors, trade associations, standards-setting boards, alliance and/or trade partners, merger/acquisition initiatives, growth, strategic directional change, new technological development, and economic shifts (e.g., price performance, adoption patterns, and obsolescence) are all continuously influencing where companies want to go with technology. Third, unexpected roadblocks occur—for example, the company that produces the application platform that runs your business just declared bankruptcy. If building and evolving a technology roadmap were easy, it would always be done well.

Why do we need a technology roadmap? IT managers believe that without the guidance of a roadmap, their companies run the risk of making suboptimal decisions—technology choices that make sense today but position the company poorly for the future. There is also a strong sense that the exercise of developing a technology roadmap is valuable even if the actual roadmap that is developed is subject to change. Another adage applies: “Plans are nothing; planning is everything.” It is through the articulation of a technology roadmap that you learn what you did well, where you failed, and how to improve the process. Finally, a technology roadmap limits the range of technology options and reduces the decision-making effort compared to facing one-off decisions repeatedly over time. Because a roadmap has cast the evolution of technology on a certain path, it means that an organization can simply accept this decision and not revisit it repeatedly. Thus, a technology roadmap reduces the organization’s cognitive workload.

This chapter begins with a general discussion of technology roadmaps and presents a model to explain various input factors. It then describes each of the components of a technology roadmap and offers advice derived from the shared experiences of the focus group’s managers.

¹McKeen, J. D., and H. A. Smith, “Creating and Evolving a Technology Roadmap.” *Communication of the Association for Information Systems* 20, article 21 (September 2006): 451–63. Reproduced by permission of the Association for Information Systems.

WHAT IS A TECHNOLOGY ROADMAP?

It is important to develop an understanding of what a technology roadmap actually is. To do so, we can build on the analogy of a travel map. A travel map is a guide that tells you where you are now by positioning you within the greater environs and highlights existing options to get you where you want to go. In offering directions, it can suggest travel times, routes, and scenic alternatives, but that's about as far as it goes. A technology roadmap differs. Unlike a travel map, it is difficult to purchase a technology "map" for the simple reason that organizations all have uniquely different starting points, different goals, and, therefore, different destinations. Travel maps accommodate travel regardless of destination or purpose. Technology roadmaps must also entertain external factors such as industry trends, the competitive landscape, and vendor strategies and offerings. Finally, alternative technology options are not self-evident and must be identified through research and exploration (and sometimes experimentation). Thus, each option bears a different cost and time structure. As an analogy, the travel map provides an excellent starting point, but when creating a technology roadmap, more is needed. The first step is to develop a common understanding of what exactly is meant by the term *technology roadmap*.

In the group, every participant used a different definition of the term. On analysis, we reached consensus on aspects of the definition. It was clear that the main purpose of a technology roadmap is to establish the technology direction for the organization. It has two objectives. The first is to articulate how technology will support the enterprise's overall vision, strategy, and objectives. This was evident in the definition used at one company:

Our technology roadmap is the collective vision of the opportunities for technology to serve the business.

The second goal is to frame and constrain technology solutions to provide coherence and integration among those solutions across the enterprise and to define target architectures to implementers. These dual objectives simply recognize the need for IT to forge a relationship between IT and the business while, at the same time, serving the unique internal needs of IT. After some discussion, the group agreed on the following definition:

A technology roadmap is a mechanism for the identification, justification, planned evolution, and orchestration of technologies to enhance business performance.

THE BENEFITS OF A TECHNOLOGY ROADMAP

That every participating organization had a technology roadmap suggests that there are perceived benefits in building and evolving one. These benefits fit into two categories—external and internal—reflecting the dual purpose of the technology roadmap as described previously.

External Benefits (Effectiveness)

External benefits relate to aligning IT with the business, result in IT *effectiveness*, and include the following:

- **Achieving business goals** A technology roadmap compares the business plan with the current technological environment to identify gaps. To the extent that the

technology roadmap effectively addresses these gaps, business goals should be supported by technology.

- *Reducing complexity.* The technology environment is highly complex due to the degree of interaction among systems. The adoption of a technology roadmap typically reduces the number and variety of technological choices, thereby simplifying things. Just getting to single versions of applications, such as one e-mail program, greatly reduces complexity.
- *Enhancing interoperability of business functioning across lines of business (LOBs).* Identifying the technology that supports different LOBs is the first step toward integration. The degree of integration and interoperability is first and foremost a business decision. The technology should be designed to support this vision.
- *Increasing flexibility.* This begs the question of whether differentiation or integration enables flexibility. With respect to technology, the argument is usually won by commonalities.
- *Increasing speed of implementation.* Common standards, methodologies, and technology platforms relieve the learning burden and, thereby, increase the time to market with new systems.
- *Preserving investments in new and existing systems.* Mapping technologies on an evolutionary trajectory means that IT investments are based on long-term considerations.
- *Responding to market changes.* Having an up-to-date technology roadmap means that IT can respond accurately and appropriately to market changes. Organizations without the benefit of a technology roadmap are forced to build decisions "from the ground up" as opposed to building from an established framework.
- *Focusing investment dollars.* Having a technology roadmap means that investments in IT can be much more focused. Fewer dollars, better targeted, produce enhanced results.
- *Responding to new legislation.* Compliance with new legislation (e.g., the Sarbanes-Oxley Act, privacy, environmental programs) is greatly simplified with a rationalized technology roadmap.
- *Reducing difficulties associated with deployment of new technologies.* New technologies require learning and change. Therefore, fewer technologies, common platforms, and similar approaches effectively relieve this burden.

Internal Benefits (Efficiency)

Internal benefits attribute to IT directly and result in IT efficiency, including the following:

- *Providing a common design point.* This facilitates the end-to-end integration of reusable components and applications.
- *Building a consistent and cohesive technology base.* Without the proliferation of haphazard technology, one can create a critical mass of skills dedicated to select technologies.
- *Ability to move forward in planned phases.* With technologies mapped onto a life cycle, there is an orderly evolution for each technology, which creates synergies.
- *Consolidating global solutions.* For global technology companies, the local in-country technologies are synched to the global technology roadmap, which introduces even greater consistency across business processes, reducing overall IT expenditure.

- *Lowering the Cost of development & maintenance:* — Technology roadmaps provide an inventory of technology, and thus they make it possible to increase the reusability of system components, leverage commodity components available in the marketplace, standardize techniques across multiple applications, and prevent the “disintegration” and proliferation of execution, development, and operations architectures.

It is interesting to note that no companies in the group were able to demonstrate the financial impacts attributable to their adoption of a technology roadmap. Perhaps more surprising was the fact that the companies had not been asked by senior management to produce such a benefit statement. The initial development of a technology roadmap is typically an initiative of the IT department. This suggests that IT departments understand the benefits of a technology roadmap and appear not to question the value of committing resources to this activity. Perhaps the internal benefits of building a technology roadmap—which are significant, judging from the preceding list—justify the exercise all by themselves. These benefits appear to be more tangible and immediate than external benefits.

ELEMENTS OF THE TECHNOLOGY ROADMAP

The process of developing a technology roadmap is depicted in Figure 8.1. It hinges on a gap analysis to assess the extent to which the current state of technology supports the current and forecasted needs of the business. From this are derived the organization’s future technology requirements, which, coupled with a migration strategy, constitute the core of a technology roadmap. Participants identified seven important activities in developing and maintaining a technology roadmap. These are described below and are interspersed with strategies suggested by the group, based on their experiences. At the outset, it is important to dispel the notion that the development of a technology roadmap is a “once every five years” undertaking. Instead, there was strong consensus that a technology roadmap

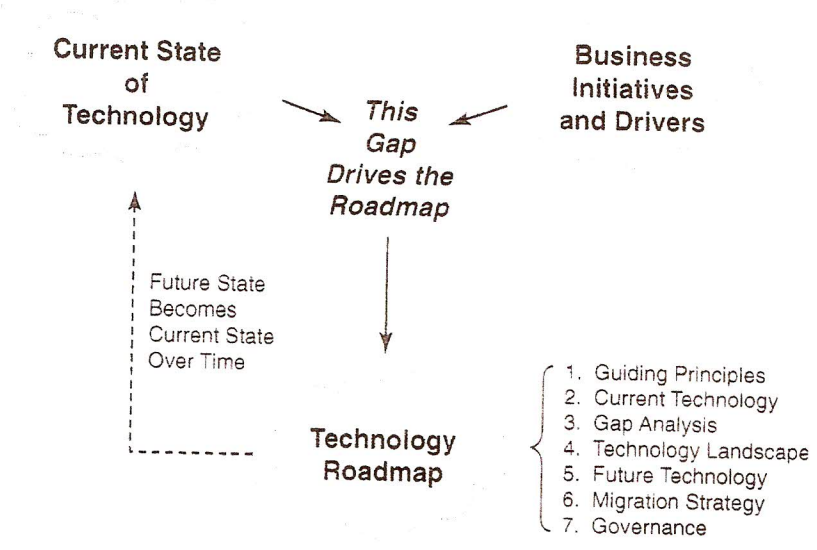


FIGURE 8.1 The Process of Developing a Technology Roadmap

should constitute a working instrument to be updated and revised annually. Otherwise it becomes inflexible, perhaps dated, and, as a result, unresponsive to the business.

Activity Number #1 Guiding Principles

When launching a technology roadmap, it is important to establish a set of principles that will guide its development and enhancement. First and foremost, this is a statement about the role and purpose of technology within the business that should clearly convey aspirations and purpose. It outlines how technology will support the business, stipulating the envisioned role for technology to play. This roadmap should be a statement about the *type* of technology support to be delivered to the business with a sense of performance. For example, contrast the following two statements: “We will provide technology that is proven, reliable, and cost effective” and “We will provide leading-edge technology.”

In addition to establishing the role and purpose for the technology roadmap, it is important to outline its goals. One company’s goal for its technology roadmap was “to increase the speed of developing, deploying, and productively executing future business models.” It then outlined three strategies to accomplish this:

1. Decouple the business processes from the underlying IT applications.
2. Decouple business applications from the infrastructure.
3. Establish a new collaboration environment that supports the rapid introduction and productive use of the new business processes.

This signaled to the organization that IT was adopting a service-oriented architecture (SOA). Because SOA was not well understood by the business, the technology roadmap spoke to the desire to identify components of the business model, which could be designed as reusable software services; to adopt integrated and standardized processes for optimizing cost; to accelerate integrated data/information architecture to enable horizontal integration across the enterprise; and to provide a stable, secure, and ubiquitous workspace for employees to be more effective in their roles and efficient in their jobs by delivering information, applications, and people to easily collaborate within the context of business processes. This established the mandate, purpose, and goals of the technology roadmap, using language appropriate for the organizational context.

With the purpose and goals established, guiding principles can then be articulated to explain other key factors and decisions that would impact technology and, therefore, have a bearing on the technology roadmap. The following statements are examples of key principles used by focus group members:

- *Establish investment boundaries.* “We will invest in technology at a rate necessary to sustain our business growth.”
- *Outline the role of technology for the organization.* “We will adopt a ‘fast follower’ strategy, aggressively adopting proven, architecturally compliant technologies.”
- *Outline the role of technology within the industry.* “Technology is a core business competency.”
- *Reinforce the role of standards.* “All components will adhere to open industry standards.”
- *Specify the role of support.* “We will assist employees with technology problems that occur via call centers, desktop support, self-help, and/or service-level agreements.”

- *Specify the impact on resident IT skills:* "We will draw technology expertise from our existing large skill base."
- *Outline development preference:* "We will buy first, build second."
- *Establish expectations:* "Service levels and availability are outlined for all production systems."
- *Adherence to standards:* "We will be security and privacy compliant."
- *Specify timeframe:* "The 'future' in our technology roadmap has a three- to five-year horizon."

Activity Number #2: Assess Current Technology

This is basically an inventory. It should outline what technologies the business currently has and describe their status (e.g., standard, unsupported, discontinued). The first task is to develop a classification scheme to assist in managing the inventory. For each type of technology domain (e.g., operating systems; hardware, desktops, servers, and storage; telecommunications and networks; applications; and databases), members recommended recording the following minimum information: business process area, platform, vendor, level of support, dependencies (products, applications), critical versus noncritical, and life cycle.

The next step is to assign a technology custodian/owner so someone within the firm is responsible for each technology domain. At one company, these individuals are referred to as technology "domain architects." Typical duties of such individuals include acquiring the technology, maintaining the relationship with the vendor, updating and enhancing the technology, facilitating in-house training for those working with the technology, accreditation regarding the technology, recording all applications of the technology, maintaining documentation (e.g., licensing; financing; and establishing service levels, guarantees, and warranties), and retiring the technology when appropriate. This can be a major responsibility as some individuals will have more than one domain assigned to them.

One of the key tools in managing the technology inventory is a framework to classify technologies. One such tool, the Application System Asset Management (ASAM) Decision Chart (Mangurian 1985), assesses the business importance (i.e., the application's overall value to the business), functional support (i.e., how well the system meets the business requirements), and technical support (i.e., the system's efficiency and effectiveness). This particular tool has been used successfully over a number of years by one firm. On an annual basis, all application systems are evaluated against these three criteria, leading to one of the following actions: maintain, renovate, replace, augment, or eliminate.

Another company uses a two-by-two matrix that evaluates applications on the basis of their criticality to the business (i.e., whether or not they support business processes deemed critical to the business units) and their strategic importance (i.e., those providing global functions that will not be replaced over the next two years). Placement within this matrix (i.e., maintenance classification) dictates service levels: strategic/critical applications receive "gold" service; critical/nonstrategic applications receive "silver" service; strategic/noncritical applications receive "bronze" service; and nonstrategic/noncritical applications receive "blue" maintenance. Yet another company uses the WISE chart to evaluate technologies on the basis of their strategic value and longevity, yielding four life cycle stages: watch, invest, support, and eliminate (McKeen and Smith 2003).

The focus group agreed that the specific classification scheme matters less than the fact that a company has a scheme to manage its technology inventory. The technology inventory also provides input to other processes such as risk management, team development, and skills planning.

Activity Number #3: Analyze Gaps

With a technology inventory in place, organizations can then perform a gap analysis between the technology that is currently available and that which is required. The first step is to identify the required technology. This ties the technology roadmap directly to the business and is perhaps the most crucial step in developing an effective plan. One manager made this point rather emphatically by saying, "Get this wrong, and the roadmap is junk." Others suggested that simply asking business leaders for their future requirements will not work for a number of reasons. First, business leaders do not think in terms of requirements; they think in terms of growth, customers, sales, markets, costs, suppliers, and shareholders. It takes a lot of work and skill to translate this view of the business into technology requirements. Second, the roadmap has to be ahead of the business—that is, it must reflect the fact that because business changes faster than technology, you have to build technology in anticipation of business change and growth. A technology roadmap cannot afford to be reactive; it must be proactive regardless of whether the technology vision is "quick second" or "late adopter." Third, business is driven by innovation and differentiation, while IT benefits from standards, common features, and universality. This will always put IT at odds with the business. According to one participant, it boils down to this question: When is a line of business so different that common systems don't make sense, and what criteria do you apply to test this?

Eliciting business drivers and building a composite picture of the technology required to support the business vision is more of art than science. It requires close cooperation between IT and the business. This cooperation happens at many levels within the organization and should be an ongoing activity. The annual IT planning cycle articulates the applications to be introduced over the next year, but attempting to derive a technology roadmap from this activity is a case of "too little, too late." IT has to be working with the business closely enough to be well ahead of the annual planning cycle. At one company, the domain architects are being reoriented to align them more closely with the business units to create a better early-warning system for application needs driven by growth and changes to the business model. Its manager stated the following:

The enterprise has a vision, and each line of business has a vision, and the job of the domain architects is to put all these visions on the table to expose gaps. To do this, architects need to be 75 percent business and 25 percent technology. Today they are the reverse.

At another company, business analysts work together with enterprise architects to "get a fix on future business directions." We tend to think of architects and technical experts as playing the key roles, whereas the focus group pointed out that the best vantage point for performing a gap analysis between the existing technology and emerging business drivers is the CIO office, due to the fact that the CIO sits at the same table as other senior executives to set the strategy for the business. The focus group pointed out that having the CIO at these sessions provides a significant advantage in terms of forecasting the future for technology within the company.

With a "line of sight" to the business strategy coupled with an accurate technology inventory, all the tools to perform a gap analysis are in place. The outcome of the gap analysis is an articulation of the technology required to support the business's vision and strategy. Unfortunately, a technology roadmap cannot be simply created from this analysis because it must also be governed by trends in the external environment.

Activity Number #4: Evaluate Technology Landscape

The group was unanimous in its recommendation that firms must continuously invest in research and development (R&D) if they are to keep abreast of technology. The size of this investment, however, differs depending on how critical IT is to a firm. The roadmap should articulate how large this investment will be, how it will be enacted, who is responsible, and what guidelines are in place to assist this initiative. Setting these structures in place is the easy part; knowing when enough is enough is more difficult.

In the past much of a company's technology was dictated by its choice of vendor; if asked what its technology roadmap was, a firm could simply reply by naming a single vendor. Today's lock-in by vendors is much reduced, particularly with the widespread adoption of open standards, interoperability among various platforms, and Web services. Interestingly, this has probably resulted in the need for downstream firms to bear a greater portion of the R&D burden, whereas in the past they could leverage the vendor's R&D to a greater extent. Focus group members shared a number of different approaches to R&D, but all shared a common challenge: capital funding.

At some companies R&D flies "below the radar" as "skunkworks." Here the IT department uses its own money that it has squirreled away over time, treating R&D similar to a cost of doing business. In others R&D is financed by a technology investment fund (i.e., a tax to the business levied as a percentage of technology usage). This fund is governed by a committee composed of senior managers who guide the investment in R&D. In another firm, IT maintenance is reduced by 10 to 15 percent per year, and the dollars are reallocated to strategic IT investments, much of which are funneled to a "technology adoption program" described as a "sandbox where new technologies are tried, improved, tested, scaled, and assessed for business value." These latter approaches are preferable because they don't attempt to hide R&D. In fact, they make R&D transparent to the organization. Business leaders understand the need for reinvestment in the physical plant; IT is no different.

Activity Number #5: Describe Future Technology

This part of the IT roadmap should contain a description of the technologies to be adopted in the future. These future technology roadmaps should not be simple lists. They should also include the *logic* that was used in the decision to follow a certain path. If, for instance, the technology roadmap depicts a preferred vendor strategy, equally if not more important is the reasoning that was used in selecting this strategy. Making this explicit within the roadmap permits others to challenge the logic without challenging the actual decision. This is essential, particularly if you wish to obtain constructive input from business managers when creating your technology roadmap.

As important as the logic behind the roadmap are the assumptions built into the roadmap. IT professionals are frequently guilty of assuming that it is obvious to others why a certain strategy has been adopted. Hence, there is value in making all assumptions explicit. As with the need to present the logic of the roadmap, it is also vital to expose all

embedded assumptions. These assumptions may reflect trends in the competitive marketplace (e.g., vendor A will continue to dominate with its software offerings), the general environment (e.g., open standards adoption will accelerate), specific technologies (e.g., thin client architecture's time has arrived), or general trends (e.g., new development will move toward SOA). This exposure provides the basis for meaningful conversation to help clarify the roadmap's dependence on widely accepted (but perhaps not articulated) assumptions.

The group felt that describing the technology was fairly straightforward, using major technology domains such as hardware, software, applications, and networks. The difficulty often is in regard to the granularity of future technology. The question is this: How do you decide the level of detail in future technology platforms? According to one manager, "If your roadmap is severely impacted by business change, your roadmap is probably too tactical." The opposite, creating a technology roadmap that is too high level, is equally inadequate. The goal is to find the "sweet spot" between the two extremes, which is "more art than science," he said.

Activity Number #6: Outline Migration Strategy

A technology roadmap should also outline a migration strategy to get you from today's technology platforms to tomorrow's. At first glance, the implementation of a technology roadmap appears similar to the accomplishment of other major IT initiatives. The focus group, however, was quick to point out the differences. Of these, the primary one is that a technology roadmap is not a self-contained project; it affects *every* project as technologies are embedded within the entire spectrum of applications, many of which cross lines of business, geography, and generations. By positioning each technology domain on a life cycle (e.g., watch, invest, support, eliminate), two dominant migration strategies emerge: "gradual" versus "big bang."

The gradual strategy focuses on the application (i.e., as new applications are implemented or reworked, their technology is updated to fall in line with the new technology directions). The big bang strategy emphasizes the technology (i.e., all instances of a given technology are updated across all applications). The choice is not an either-or situation, nor is it a "technology only" decision. Rather the choice is (or should be) dictated by the business. There are few situations where the big bang approach is absolutely necessary simply because there are always means of staging the conversion over time, applications, business lines, and/or platforms. As one participant noted, "Even large architectural builds/deployments are typically done within a program across several phases." Sometimes, though, the big bang is a business necessity due to the need to reap advantages in a reduced timeframe.

A major challenge facing the migration strategy is the need to assign priorities to the various technology components that need to be changed. One organization uses the following criteria to assess the criticality of migration in order to assign order of execution:

- Technology elements that are inflexible
- Elements that do not meet the strategic direction
- Components that are expensive to maintain
- Components that do not meet nonfunctional requirements (e.g., scalability, extensibility)
- Architectural designs built to reflect obsolete business strategies (e.g., segmentation silos, line-of-business silos).

Once priorities are assigned, timelines can be established for the migration of various technologies.

A migration strategy should explicitly recognize a number of dominant trends within technology, such as the movement toward service-oriented applications and the reconstruction of applications into layers (e.g., presentation, business process, and data). Although such trends provide useful high-level guidance, they need to be augmented by more tactical guidelines (see Appendix A). Of particular interest here is the need for a migration strategy to explicitly plan for the migration of *people* skills in alignment with the future technology demands.

Activity Number#7: Establish Governance

Every organization should have an established process in place to articulate who is responsible for creating the technology roadmap, how and on what basis, by whom it is updated and enhanced, and finally who approves the technology roadmap. Most organizations in the group felt that the technology roadmap was legitimately the responsibility of the enterprise architecture function, which is responsible for mapping out the architectural platforms to support the various lines of business. The majority of companies recognized the need for two distinct levels of architecture governance within their organizations:

- **Strategic:** Individuals and groups at this level (typically, senior executives from IT and the business) set the overall architecture direction and strategy and ensure alignment with business objectives. They set standards and approve deviations from these standards. In addition, they monitor the overall attainment of the goals as articulated within the technology roadmap.
- **Tactical:** Members of this tactical group tend to be from the IT ranks, including architects, analysts, and managers. They typically work across lines of business as well as within lines of business with responsibility for the execution of the strategy (as opposed to its development). A key role is the provision of architecture consulting services to project teams.

At one company the key personnel of the tactical group are domain architects who have responsibility for broad categories of technology (e.g., server platforms), subdomain architects who have responsibility for technologies within a larger domain (e.g., desktops), and product stewards who have responsibility for specific products (e.g., Microsoft Windows XP). Accountability cascaded down this hierarchy with domain architects responsible for setting strategy, understanding the marketplace, and controlling proliferation of technology and product stewards responsible for new releases and versions of technologies as well as troubleshooting. At this organization, ultimate accountability rested with the executive architecture review board—a committee composed of senior business and IT architects—who ratify the technology roadmap and make final decisions regarding proposed deviations to the roadmap. If a need arises for an “off-profile” (i.e., “noncompliant”) technology, it must be brought before the architecture review board for an “opinion.” According to the manager, this is a very effective mechanism because “most people don’t want their project elevated to the executive architectural review board!”

A major part of governance is enforcement. Effective enforcement requires IT to develop a new breed of “corporate” architect who is business focused and business-centric.

- Focus on using technology to solve business problems and deliver business value.
- Know when it is appropriate to choose leading-edge technology over being a late adopter/quick second.
- Ensure that the roadmap is flexible, extensible, and attainable to change with the business.
- Ensure that the organizational structure supports the delivery of a technology roadmap.

3. Secure support for the roadmap.

- Ensure that the funding model supports a technology roadmap.
- A migration strategy and roadmap require an executive sponsor, ownership, and accountability. Ensure that strategic decisions are made at the right level.
- Stay the course!

4. Don't forget the people

- Every technology change requires changes in people's skills.
- Map new technologies to required skill acquisition.
- Take steps to ensure that IT personnel understand the technology roadmap and its logic, ramifications, and time frame.

5. Control, measure, and communicate progress.

- Measure progress along the way; use leading indicators.
- A successful roadmap must be measurable and updated at appropriate checkpoints.
- Communication of the roadmap is essential to success.
- Establish a governance process to manage technology and vendor choices.

Conclusion

The purpose of a technology roadmap is to guide the development of technology in an organization. But as pointed out in this chapter, it serves a much greater purpose for a business. It communicates the role that technology will play in advancing business goals. It outlines the explicit assumptions on which the roadmap is based and describes how these assumptions directly affect the rate and order of attainment of goals. It suggests the impact of future technology on the set of required

in-house skills for the IT department. And it provides a vehicle for explaining the logic of technology-related decisions to business managers who otherwise interpret such decisions as overly rigid and unproductive. As such, a technology roadmap should be viewed as an important opportunity for IT to engage the business in meaningful and productive dialogue focused on furthering business goals. To limit this activity to simply forecasting technology is to miss a significant opportunity.

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