Every day Chief Information Officers, venture capitalists, technology vendors—and everyone that buys and deploys information technology—confront strategic and tactical technology investment challenges. Should Starbucks continue to invest in technology-based initiatives to attract more customers? Should Wal-Mart continue to invest heavily in radio frequency identification (RFID) technology? Should a private equity fund spend money on a broadband communications company or a software development company? Should Rohm and Haas, a global specialty chemical company, implement a standard financial reporting system? Should Microsoft build a suite of large scale enterprise applications to challenge those offered by SAP and Oracle?

How does this all work? Who sets the agenda? How do options get evaluated? How do we select among competing alternatives? Where are the land mines? How do we exploit opportunities?

Due diligence is a term used for a number of concepts involving either the performance of an investigation of a business or person, or the performance of an act with a certain standard of care. It can be a legal obligation, but the term more commonly applies to voluntary investigations.¹

Technology due diligence refers to the process by which alternative technologies and technology services are vetted. Some organizations and CIOs are disciplined in the way they assess alternative technologies and technology services, while others are not so organized. In a perfect world, every technology investment decision is made with complete information gathered by a team of experienced due diligence
professionals. In the real world, the due diligence process is often rushed, plagued by the unavailability of information, and conducted by people who have limited experience—all the more reason for discipline. Most of the prescriptive research on due diligence applies to mergers and acquisitions (Gordon, 1996; Harvey & Lusch, 1995; Lajoux, 2000; Perry & Herd, 2004), portfolio management (Weill & Aral, 2006) and macro trends in business technology (Andriole, 2005). Some analyses have been applied to venture capital due diligence (Camp, 2002; McGrath, Gunther, Keil, & Tukiainen, 2006), and some in the much larger context of business technology alignment (Prahalad & Krishnan, 2002). Very few analysts have focused on technology due diligence. None have focused on technology due diligence from the three intersecting perspectives discussed here.

Due diligence is the process by which we screen and select options. Some see due diligence as a religion; others are agnostic. The approach described here is part quantitative, part qualitative, part analytical, and part intuitive—because due diligence itself is part art, part science, and part luck. The due diligence conducted around technology decisions is complex. When we get it right, we enable enormous impact, but when we get it wrong we can wreak havoc on the organizations, corporate cultures, and markets we are trying to serve.

Due diligence is organized around a set of constant criteria that can be applied to technology investment decisions of all kinds. The 15 criteria described and applied here were derived from both an analysis of the (admittedly sparse) literature and 15 years of experience conducting due diligence for the three constituencies represented in the book’s analysis of the due diligence process and the case studies. In fact, the final 15 criteria were culled from earlier lists of 20 and 25 criteria. Over time, we realized that the final 15 criteria addressed all of the major risks and opportunities found in most investment situations. A formal due diligence process was then defined around the criteria.

This book develops a due diligence framework for anyone who must select among competing technologies or invest in technologies intended to help their business achieve results. Among the most obvious executives and managers in this group are Chief Information Officers (CIOs), Chief Technology Officers (CTOs), venture capitalists (VCs), and technology vendors who all have somewhat distinct technology acquisition and investment requirements. But there are many more Chief Executive Officers (CEOs), Chief Financial Officers (CFOs), Chief Operating Officers (COO), directors, and managers who wrestle with technology acquisition challenges every day. This book will help everyone who spends serious money on computing and communications technology.

When you have finished the book, you should have a good understanding of how to make good technology investments regardless whether you are sitting at Microsoft, Accenture, Wal-Mart, or Benchmark Capital.
The focus of the book is on technology due diligence that results in a technology investment. The investment targets include everything from software applications, communications, data, security, and technology services. The lenses used to vet investment opportunities and challenges are organized around the specific requirements that all technology investors—including especially CIOs, VCs, and technology vendors—need to satisfy to achieve their objectives.

I have participated in many due diligence projects over the years. TechVestCo, Inc., has developed technology offerings over the years that required due diligence. At CIGNA, an employee benefits company best known for its healthcare offerings, I was responsible for evaluating current and new technology to support the CIGNA infrastructure as well as the applications that contributed to the growth of the business. At Safeguard Sciences, Inc., a public venture capital and operating company, we listened to hundreds of business plans a year, selecting anywhere from 15 to 30 in which to invest. I have consulted with strategists and developers in large and small companies as they have struggled to develop products and services they wanted to sell. I have also developed research and development (R&D) programs for government and industry. One of these assignments was at the Defense Advanced Research Projects Agency (DARPA) where I served as the Director of Cybernetics Technology. The game there—as it is everywhere—is prioritization: given a finite amount of money to spend, which projects should be funded, which should be queued, and which should be permanently shelved? At DARPA, we made trade-offs all the time about which research programs to fund, which ones to delay, and which ones to ignore altogether. As an example of just how important these decisions can be, imagine if DARPA had decided not to invest in the transmission control protocol/Internet protocol (TCP/IP)—the communications foundation of today’s Internet and World Wide Web? More recently, I have continued to refine the criteria and the process at TechVestCo, Inc., and The Musser Group.

What have I learned? First, there are differences among the due diligence that occurs within a company to acquire or deploy technology vs. investors seeking a return on their technology investment, and companies trying to develop technology products and services to sell to existing and new customers. It is not that the evaluation criteria are different; in fact, they are amazingly similar. The differences can be found in how the criteria are analyzed and weighted.

There is also a difference among the targets of due diligence. Technology comes in multiple flavors including hardware, software, and services. The evaluation of each of these flavors requires a different perspective (in addition to the different perspectives that arise from the source and object of the technology investment). Finally, there are differences in the impact the technology is expected to have. Private equity venture capitalists want to make as much money as they can—as quickly as they can—for their general and limited partners. CIOs want to improve operating
efficiencies while contributing to the growth and profitability of their companies. Technology vendors want to discover and build the next “killer app” so they can capture more market share. Here are 15 criteria that apply to all technology investments—regardless of where you sit or the nature of the deal:

1. Products and services that are on the right technology/market trends trajectory
2. Products and services that have the right infrastructure story
3. Products and services that sell clearly into budget cycles and budget lines
4. Products and services whose impact is quantitative
5. Products and services that do not require fundamental changes in how people behave or major changes in organizational or corporate culture
6. Products and services that, whenever possible, represent total, end-to-end “solutions”
7. Products and services that have multiple exits
8. Products, services, and companies that have clear horizontal and vertical strategies
9. Products and services that have high industry awareness and recognition
10. Products, services, and companies that have the right technology development, marketing and channel alliances, and partnerships
11. Products and services that are “politically correct”
12. Companies that have serious people recruitment and retention strategies in place
13. Products, services, and companies that have compelling “differentiation” stories
14. Company executives that have wide and deep experience
15. Products and services companies that have persuasive products/services “packaging” and communications.

These 15 clusters of questions and issues constitute a framework that can be used to examine technology investments of all kinds. Chief Information Officers (CIOs) buy technologies all the time. How should they proceed? Private equity venture capitalists invest in technology companies all the time? How should they proceed? Technology companies must prioritize their research and product or service development budgets. How should they proceed?
The criteria clusters are, however, weighted differently depending on who is using them. We will build a general purpose framework agile enough to enable a variety of technology investment decisions and then apply it to a set of real cases.

Where did these criteria come from? A decade ago we began with an exhaustive set of criteria. In fact, there were well over 30 criteria we used in the early going. We then began to group the criteria according to areas like technology, differentiation, and management and then “test” them through a series of due diligence processes. We learned that 30 criteria were impractical and that the criteria overlapped. So we reduced the number of criteria in half based on the feedback we received from the application of thirty, then 20 and then 15. In other words, the 15 criteria were the result of a systematic analysis of multiple criteria packages and their relative contribution to multiple due diligence test cases.

We also interviewed due diligence professionals at venture firms to verify our application experiences. We found a near perfect correlation with the criteria lists that resulted from our experiments and what the interview data told us.

The objective of the criteria analyses was to develop a set of due diligence criteria that would serve us well over time—and support the due diligence that CIOs, vendors, and venture capitalists conduct all the time. There was a very practical aspect of our reduction procedure: we sought to identify the minimum number of truly diagnostic criteria that looked at the key aspects of a technology and its ecosystem—which we defined around the technology itself, its maturity, place in the marketplace, management, and marketing. In short, the objective was to identify a set of criteria that would “work” for as many analysts as possible.

The criteria were refined at TechVestCo, Inc., CIGNA, Inc., Safeguard Scientifics, Inc., and TL Ventures, LLC over the period from 1990 to 2005. Analysis of the diagnosticity of the criteria continued at Ascendigm, LLC and is ongoing at TechVestCo, Inc., and The Musser Group, LLC. Most of the case study-based evaluation of the criteria occurred from 1995 to 2005, resulting in the final list of 15.

**ORGANIZATION OF THE BOOK**

Section I of the book examines due diligence strategies and tactics.

Chapter I presents the criteria that should drive technology investments. The key aspect of this chapter is that due diligence criteria are generalizable to more than one kind of technology investment decision. In other words, if you master them, you can tweak them to the particular technology acquisition opportunity at hand. Chapter I also turns each due diligence exercise into a project that needs to be staffed, managed, and assessed. This is the proverbial due diligence process that
lots of organizations believe they perform well but actually mismanage more often than anyone wants to admit. There are lots of “hard” and “soft” due diligence best practices. The process is often dangerously political and subjective. Chapter I also examines the range of expected outcomes, or “exits.” What do investors want from their technology investments? Efficiency? Profit? Equity returns? Technology investment decisions should be framed around expected returns.

Chapter II examines the range of possible investments including software applications, data, communications, products, services, solutions, and “advanced technology.” This last category is especially interesting to venture investors and corporate “bleeding edge” (early) technology adopters.

Chapter III looks at the special role that business technology trends analyses play in the technology creation, acquisition, and deployment process. I cannot emphasize more the importance of trends analysis. So many investments are out of sync with where the industry is going, where the major corporate R&D programs are going, and where corporate requirements are taking us. It is essential that investments be made in technology trends analyses prior to making investments in specific technologies or technology companies. Appendices A, B, and C at the end of the book present examples of formal trends analyses in three broad areas, pervasive computing, intelligent systems technology, and business technology integration. They are included here to provide you a feel for the critical role that technology trends analyses play in the due diligence process. Chapter III also discusses “5 Technology Trends that Matter” as an illustration of the trends analysis process and the value of using trends analyses as a foundation upon which the due diligence process rests.

Section I of the book describes “what,” “how,” and “why.” Section II illustrates how the process can work extremely well—or fail miserably. Each of the cases in Section II are preceded with a situational context and followed by an analysis of how the due diligence criteria apply to the examples. All of the cases are real. These cases differentiate the book from others that have addressed due diligence methods and tools. The cases are “true”: the descriptions of the investment opportunities are the actual descriptions presented to investors that had to decide which investment to make and which to avoid. The cases demonstrate how the 15 criteria can be used to conduct due diligence around the full range of investment opportunities discussed in the book. The cases adopt the three primary perspectives of technology investors: users of technology, venture investors in technology, and vendors looking to invest in technologies that will increase their market share.

Chapter IV examines how a venture capitalist decided to invest in a wireless communications technology company called ThinAirApps. This case explores the due diligence process that a team undertook that eventually resulted in an investment and an “exit,” though the twists and turns of the story are interesting enough in and of themselves.
Chapter V looks at how a large real estate and mortgage broker decided to invest in a remote access technology for its 3,000+ agents. This case examines the criteria-based evaluation undertaken by Prudential Fox Roach/Trident, the largest real estate/mortgage brokerage in the northeast.

Chapter VI switches gears back to venture capitalists and their due diligence process around a voice-over-IP (VOIP) investment. The significant thing about this process was the timing: the due diligence occurred before VOIP was as proven as it is today.

Chapter VII follows Oracle’s decision to invest in RFID (radio frequency identification) technology and develop a series of data and services offerings around the new technology. The application here is primarily focused on transportation and, specifically, the tracking of passenger luggage with RFID tags. Oracle decided—through the application of the due diligence criteria—to make major investments in the technology and roll out substantial data and service offerings to a variety of clients.

Chapter VIII follows LiquidHub’s decision to invest in a service offering wrapped around enterprise architecture. Should the company hire staff, develop engagement models, and market itself as an architecture consulting firm? Should it position itself as a service-oriented architecture (SOA) vendor? The due diligence criteria suggested that they do so—and they did.

Chapter IX looks at e-mail and a company’s decision to dive deeply into the trusted e-mail management and performance area. The E-Privacy Group was way ahead of its time. The due diligence discussion focused on technology and services offerings in the messaging space.

Chapter X looks at the application of knowledge based expert systems to software design. In this case, the investment decision focused on the development of a knowledge-based system to design and test alternative user-computer interfaces. The decision was made to invest in the development of the platform and while the criteria suggested that the lights were green, the outcome turned bright red. The lesson? Good due diligence processes can lead to bad outcomes, or, put another way, discipline is not a guarantee.

Chapter XI changes the venue to a university—Villanova University—that used the criteria to decide upon a new communications infrastructure, specifically whether they should invest in pervasive wireless technology. This is a classic “go/no go” investment decision driven by the university’s CIO. The decision was “go” and the outcome was good.

Section III of the book transitions from cases to prescriptive tools, and sends everyone off to make sound technology investments with a due diligence template. Chapter XII also identifies some specific tools and techniques as well as an overarching process methodology. Chapter XII is the book’s “take-away.” The three appendices
illustrate what technology trends reports look like. They are integral to successful due diligence, since all technology investments are based on an understanding of where technology is going and the large context of our digital world. Figure 1 presents the book in a picture; Figure 2 includes the case studies.

Figure 1. Focus of the book

Figure 2. Focus of the book with cases
REFERENCES


ENDNOTE