

Step 1: Building the Fact Sheet

The first step in the process is to gather all of the information relevant for making the appropriate HIT business decision. The IT Governance Institute provides a model form for collecting the necessary data, but our experience suggests that each organization should implement a collection form that works in its environment. The key point is that no category of information can be ignored. At a minimum, the following categories need to be assembled (IT Governance Institute's equivalent terms are given in parentheses):

- *Congruence (alignment)*. The investment must be consistent with documented business strategy (see chapter 4), current HIT management practices, and government regulatory constraints (current and anticipated).
- *Business outcomes*. The investment must deliver an organizational need to achieve intermediate and final outcomes. These outcomes need to be documented and measurable.
- *Financial benefits*. Input for financial benefits should document cost savings, revenue enhancements, capacity and volume growth, and risk mitigation from the investment decision. These include the tangible revenue enhancements or cost reductions in capital, operations, or risk.
- *Indirect benefits (nonfinancial benefits)*. As in the benefit–cost assessment, some benefits are not easily quantified in financial terms but must be seriously considered nonetheless.
- *Costs (resources and expenditures)*. All categories of equipment, human resources, supplies, consultants, and other resources necessary for the HIT investment must be documented.
- *Sensitivity (risk)*. Alternatives that quantify the risk in the investment must be identified. Understanding the best-case and worst-case scenarios for the investment helps the organization select an investment that meets its tolerance for risk.
- *Model (assumptions and constraints)*. Understanding how the HIT investment accomplishes the desired outcomes, with associated benefits and costs, helps to determine the reasonableness of the subsequent analyses. The logic of the empirical claims for outcomes, benefits, and costs depends crucially on the assumptions employed. These must be articulated clearly.

Step 2: Alignment Analysis

Investment alternatives abound, necessitating decision-making. The selected option needs to optimize net benefits from the scarce resources available. Alignment helps to ensure that the HIT-related investments support the organization's strategic business objectives. Alignment statements might

include direct contribution to the objectives of the current organization or to the broader system or contribution to a future vision for the organization. The investment must also be consistent with existing enterprise architecture. Assuming that this architecture has been selected as a guideline for achieving the current vision, each investment must be chosen carefully so as not to move away from that guideline.

Step 3: Financial Benefits Analysis

To gain acceptance in the healthcare corporate environment, HIT investments must pass conventional financial analysis constraints. Discounting of financial benefits and costs is an essential technique. The final decision requires the project to have a positive discounted net value (positive net present value, or NPV) and perhaps have better NPV than alternative investments, so that the organization selects the best investment.

Step 4: Nonfinancial Benefits Analysis

The nonfinancial aspects of business processes must also be considered, especially in not-for-profit healthcare organizations. Building positive relations with constituencies external to the HIT function may create value for the organization. Alternatively, negative relations can destroy value. Consideration of the external or indirect effects of the investment may not fully offset poor financial considerations but may influence a decision that is otherwise close.

Step 5: Risk Analysis

Not every organization tolerates risk in the same way, and not all investment opportunities carry the same risks. Assessing and documenting these risks in outcomes, financial benefits, and resource use or costs are integral steps in the value-assessment process. Both delivery risk and benefit risk are inherent in any HIT investment. One must ask if the investment delivers on the anticipated business processes, human resources, technology, and organizational changes being proposed. Likewise, the outcomes and financial benefits promised may not, in fact, occur. In simple terms, the HIT investment may not perform as promised. The IT Governance Institute (2006) provides many examples of both delivery and benefit risks.

Step 6: Optimizing Risk and Return

As stated in chapter 10, the program planning office (portfolio management office) must assess and review the HIT investment proposal in the context of other applications and broad business needs. The key is that all proposals have the same sets of information collected and reported and that assessment is done in a comparable manner. The best decision emerges if valid comparisons are made by those with the incentive to maximize value to the organization.

Step 7: Documenting Business Case

Nothing can be more important than transparency in decision-making. Documentation of data and information, assessment techniques, and findings all add to the open framework for decisions. This “open architecture” helps to create the culture of critical assessment that is so important to good decision-making. The tendency to not reveal information as a mechanism to protect those making the decision may lead to poorer outcomes and to greater consequences should those outcomes fail to meet standards.

Step 8: Feedback Mechanism

The single view of HIT investment value as presented by the value-realization effort is a necessary first step for healthcare organizations, but HIT investment needs, organizational priorities, staffing constraints, and other environmental changes occur continuously. The information collected, assumptions made, benefits observed, and costs incurred should be reviewed periodically throughout the life cycle of the investment. While many decisions cannot be undone, midcourse adjustments in investment scale and scope are often possible. If the organization veers off course as a result of an investment, having a feedback mechanism enables the organization to adjust to minimize loss. CPOE provides a good example of the potential value of feedback. Faced with resistance to the widespread adoption of this technology, an organization could apply a temporary solution, implementing it in only some parts of the organization; that is, it could identify clinical areas or key supportive medical staff leaders and implement only in select areas. This narrowing of focus prevents some of the resistance and presents the areas more likely to be successful. Full implementation might occur later, but the costly failure of the entire project could be avoided.

To close this discussion, a number of investigators and thought leaders have found that the methods for realizing HIT value are often difficult to implement. As Johnston, Pan, and Middleton (2002) suggest, HIT investment decisions continue to rely on “anecdote, inference, and opinion” rather than evidence. They argue that HIT leadership must support a comprehensive assessment of value using existing data. Toward that end, Bates and colleagues (2003) propose a set of ten commandments to follow for effective clinical decision support. While specifically designed to make evidence-based medicine a reality, these commandments also enhance HIT value realization. Four of the ten commandments are particularly important for HIT value. They are as follows (Bates et al. 2003):

1. *Be aware that speed is everything.* Providers will not accept a system that does not respond quickly to their inquiries. System design for rapid access appears to be essential for IT effectiveness.

2. *Fit into the user's workflow.* The HIT investment must support the providers' and other users' current practice processes if it is to be readily accepted. They will not use a system that does not fit seamlessly.
3. *Keep in mind that simple interventions work best.* The HIT investment with grand plans to alter the practice of medicine may not be as effective as a simple solution.
4. *Monitor impact, get feedback, and respond.* The feedback mechanism appears to be essential for success. Even the best systems may not integrate in the manner anticipated; thus, being flexible and adaptable may be keys to success.

You should notice at this point how similar the Benefit Cost Analysis section was to the Benefit Realization. While they differ in detail, they both require a systematic and formal set of activities to ensure analyses yield robust results. As Rudin and colleagues (2014) demonstrate, failure in this regard is still common. Their investigations find major challenges with healthcare IT evaluation studies, prompting them to set three primary, simplifying guidelines to use as you read the evaluation literature:

1. Analyses must include measures of both costs related to the technology (including implementation costs) and its benefits. Four of the ten studies they examined did not include either costs or benefits.
2. Analyses must measure the impact over a long enough time frame to be sure to capture the costs and benefits fully. All of the studies they examined were short term.
3. Analyses must recognize that the benefits and even the costs differ with stakeholder preferences. Studies should recognize and report whose perspective is being considered. Only one of the studies considered provided stakeholder perspectives explicitly.

Health Information Technology Value Findings

Impact of Specific Health Information Technology Investments

Many studies have been conducted on specific HIT investment value recognition, but we find that many are not well done and are thus difficult to evaluate concisely. In this section, we feature three groups or ideas as a way of organizing this aspect of the literature. First, we will start with some early studies that applied the growing literature to the health system (Hillstad et al. 2011). This was a time when consideration of large-scale investments in HIT were not accepted without question by all. Second, once we generally believed that HIT was part of the path to the future, we began to examine

specific applications in particular settings. A common characteristic of these studies is that they tended to report only narrow analyses of the effects of HIT investments. The desire for academic rigor results in such narrow scope. HIT managers need broader evaluations to make decisions for the organization; therefore, we also report some studies of HIT investment impact on organizations and systems. Third, we look briefly at the remaining challenges in implementing HIT evaluations.

Early Justification of Health Information Technology Investment

If we start with Hillestad and colleagues (2005), we see the early promise from their national simulation of the potential cost savings from HIT investments—specifically, adoption of an electronic medical record (EMR, now referred to as an EHR). Exhibit 12.6, from the Hillestad and colleagues study, suggested that in the near term, savings would possibly total as much as \$21.3 billion per year (year 5), more of which was derived from inpatient care than from outpatient care. Once adoption reached the anticipated

EXHIBIT 12.6
Short-Term and Long-Term Annual Cost Savings from HIT, by Selected Major Categories

	Short Term Year 5 (in billions)	Percent of Total	Long Term Year 15 (in billions)	Percent of Total
Outpatient				
Transcription	\$ 0.4	1.9	\$ 1.7	2.2
Chart pulls	\$ 0.4	1.9	\$ 1.5	1.9
Laboratory tests	\$ 0.5	2.3	\$ 2.0	2.6
Drug usage	\$ 3.0	14.1	\$ 11.0	14.2
Radiology	\$ 0.8	3.8	\$ 3.3	4.3
Total output savings	\$ 5.2	24.4	\$ 20.4	26.3
Inpatient				
Nursing time	\$ 3.4	16.0	\$ 13.7	17.7
Laboratory tests	\$ 0.8	3.8	\$ 2.6	3.4
Drug usage	\$ 1.0	4.7	\$ 3.5	4.5
Length of stay	\$ 10.1	47.4	\$ 34.7	44.8
Medical records	\$ 0.7	3.3	\$ 2.4	3.1
Total input savings	\$ 16.1	75.6	\$ 57.1	73.7
Total HIT savings	\$ 21.3	100.0	\$ 77.4	100.0

Note: Numbers and percentages do not sum to totals because of rounding.

Source: Hillestad et al. (2005). Used with permission from Project HOPE, Milwood, Virginia.

90 percent, savings could amount to more than \$77 billion per year (again, more of this savings was derived from inpatient care). The savings in inpatient care would have come from reductions in length of stay followed by reductions in nursing time. On the outpatient side, most of the savings would have come from reduced and more appropriate drug use.

In addition to these cost savings, benefits or value from HIT investments in the simulation were derived from improved patient safety and health outcomes. Hillestad and colleagues (2005) theorized that the safety benefits of CPOE would be seen at the national level for both inpatient and outpatient care. Inpatient care savings resulting from the elimination of an estimated 200,000 adverse drug events (ADEs) amounted to \$1 billion per year once fully implemented. Outpatient care savings resulting from an estimated two million ADEs avoided amounted to \$3.5 billion per year. The findings might not be generalizable to other participants because most of the data they used came from studies involving those under age 65. At about the same time, Featherly and colleagues (2007) found that EMR benefits were largely indirect and came from workflow improvements and reductions in medical mishaps.

Near-term preventive care can benefit from HIT intervention as well. Hillestad and colleagues (2005) generated estimates for two vaccination programs (influenza, pneumococcal) and three screening programs (breast cancer, cervical cancer, colorectal cancer). The findings were highly positive from a health outcome perspective and depended heavily on assumptions regarding current compliance rates in the defined population, compliance rates for the specific vaccination and screening programs, and costs. Taking the midpoints of the estimated effects, the simulated pneumococcal vaccination resulted in a median reduction of 21,000 deaths per year (15,000 to 27,000), 2.25 million median bed days eliminated (1.5 million to 3.0 million), and 150,000 median workdays restored (100,000 to 200,000). These effects came at a program cost of about \$90 million per year. At the same time, however, the program generated median financial benefits estimated at \$750 million per year (\$500 million to \$1 billion).

Focused Studies

To keep up with what has become a large and growing literature on valuation studies in HIT, it is probably best to rely upon investigators to gather, categorize, and summarize the findings (Buntin et al. 2011; Goldzweig et al. 2011; O'Reilly et al. 2012; Reis et al. 2017). These and others review and summarize the findings of others, often presenting concise comparisons of research methods, study findings, and recommendations. In addition, the Office of the National Coordinator for Health Information Technology (ONCHIT) has a rich website with a host of important information,

presented in an organized fashion (ONCHIT 2018). The website includes the following (though it has much more):

- *Health IT and Health Information Exchange Basics.* As the name implies, this section has a great deal of introductory information regarding the EHR, information exchange, and their resultant benefits, among other key topics. Most important, however, it contains a subsection, Case Studies, that presents an ongoing set of detailed descriptions of efforts to implement HIT throughout the country. It also has a subsection, Success Stories, that are more applied and provide discrete examples of HIT use.
- *Health IT in Health Care Setting.* This component of the website delves deeply into specific applications of HIT for you to explore. While not every potential application is included, it has behavioral health, public health, rural health, telemedicine, pediatric care, emergency medical services and emergency preparedness, long-term and post-acute care, and social determinants of care, among other applications.
- *Health IT Resources.* This component contains a host of tools of value to those arguing for value and implementing HIT.
- *International IT Collaboration.* This component hosts a number of specific collaborative efforts coordinated through or with the support of the US government. The content is not specific to valuation, but many innovations in measuring value from HIT have come from and will continue to come from other systems.

The following list contains a sampling of valuation findings organized by key content areas.

1. Electronic health records
 - Electronic prescribing: Devine et al. 2010 (time and motion study); Abramson et al. 2011 (ambulatory prescribing errors); Duffy et al. 2010 (ambulatory medical residency program)
 - Electronic health records: Furukawa, Raghu, and Shao 2010 (greater-capacity EMR related to greater efficiency for California hospitals); Connelly et al. 2012 (EMR data resulted in better outcomes for heart failure patients); Fleming et al. 2011 (cost of implementation and maintenance of EMR in primary care practices in North Texas)
 - Other: Pettit, Zimmerman, Alaniz, and Dorsch 2012 (CPOE evaluation for enoxaparin); Bell et al. 2012 (lab data exchange for HIV); McCormick et al. 2012 (electronic access to lab data);

Stenner, Chen, and Johnson 2010 (generic drug substitution in decision support); Eisenstein et al. 2012 (a study of specific decision-support applications studies found cost increasing)

2. Information access

- Mobile phones: Quinn et al. 2011 (behavioral modification for blood glucose control)
- Web: Gustafson et al. 2012 (pediatric asthma); Lau et al. 2012 (influenza vaccine); Ling et al. 2010 (test results at an urban clinic for sexually transmitted diseases); Palen et al. 2012 (online patient access and use of clinical services)

3. Systems technologies

- Exchange interoperability; Walker et al. 2005 (national model of interoperable exchange); Mäenpää et al. 2011 (five-year follow-up on regional information exchange)

Finally, there are always counter findings to the value of healthcare IT. Carayon, Wetterneck, and colleagues (2017) and Carayon, Du, and colleagues (2017) clearly demonstrate that for some applications (computer-based provider order entry) and locations (ICU), the technologies may introduce errors into the system. Naturally, if outcomes decline and the costs are positive, health systems should not apply the technology (see exhibit 12.2).

Health Information Technology Evaluation Challenges

The challenge in compiling and organizing studies on IT effectiveness hinge on an understanding of the complexities involved in designing the studies. As we examine current studies, we need to classify them to make sense of their application. Not all studies examine the same type of IT, nor do they apply to the same populations. Generalizing individual findings across dimensions is likely inappropriate. A useful paradigm for presentation includes the following elements:

- Type of delivery setting
 - Organization level (e.g., inpatient, outpatient)
 - Kind of organization (e.g., teaching hospital, community hospital for an inpatient setting; physician's office, ambulatory clinic, freestanding surgical center for an outpatient setting)
 - Segment of the organization (e.g., ED, ICU, laboratory)
- Disease application (e.g., high blood pressure, HIV, congestive heart failure)
- Technology studied (e.g., EHR, electronic prescribing, Web-based information)

- Outcome considered (e.g., medication or medical error, readmission, patient satisfaction)
- Patient type (e.g., Medicare, Medicaid, private insurance, male, elderly)

In addition, consistent with the assertion that HIT leadership must reach out to the entire organization in its efforts to invest in HIT, studies have been published that assess the value of HIT investments in terms of their impact on the organization as a whole. Iansiti and colleagues (2005) demonstrate that HIT matters, at least in midsize firms. Their research does not measure the impact of any specific technology intervention or even overall dollars spent. It uses an index of what “IT actually does for a business” to measure impact. Iansiti and colleagues (2005) created an IT scorecard to assess HIT capability in the functional areas of sales and marketing, finance, operations, empowered professionals, and IT infrastructure. They found that greater capability generates business process scalability, which enables firms to do the following:

- Improve process knowledge and standardization
- Streamline operations, allowing the firm to grow without expanding the labor force
- Become flexible enough to take advantage of or respond to new opportunities
- Enhance management’s access to critical business indicators used in decision-making

Similarly, Menachemi and colleagues (2006) demonstrate a robust relationship between HIT adoption and hospital financial performance, at least for hospitals in Florida. Their findings suggest that overall and operational improvement followed from IT adoption. This outcome was observed for their categories of clinical, administrative, and strategic IT.

Summary

HIT should adhere to core business processes. In that context, the decisions regarding how much and what types of HIT resources an organization uses should fall under a valuation paradigm. Finding value in any healthcare investment has proven to be a challenge, however, because data collection, methodology, and application make the use of evidence-based management difficult. Because of the complexity of the problem and the lack of comprehensive data, healthcare executives have largely been forced to make decisions

about HIT investments on the basis of cursory evidence at best and on the basis of instinct or hope at worst. As a result, HIT may fall short in helping to address the problems plaguing healthcare.

From the perspective of HIT leaders, however, HIT is essential for the provision of high-quality care in today's environment—so they must face the decision to invest in HIT. Many factors make such decisions difficult, including the scaling of IT and the systems nature of IT. For example, technology acquisition is not an all-or-nothing proposition; questions of scale, scope, application, integration, and timing are involved. The interdependence of providers in a healthcare “system” complicates the decision further. Healthcare delivery organizations implement interoperable EHRs to enable the exchange of information across venues while still focusing on value creation.

Early evidence from HIT investment studies indicates that EHRs, HIEs, clinical decision support systems, and a host of other technologies have the potential to improve care and contain or lower costs. However, value has not been identified consistently, and the potential benefits may be less than estimated. Furthermore, not all HIT leaders are yet fully behind HIT implementation. Providers will come to expect electronic information exchange as they increasingly work in teams that require functions in real time. The incentives offered by the HITECH Act encouraged widespread adoption of HIE and other HIT technologies, but impediments still exist. HIT leaders face many barriers to full adoption and remain reluctant to facilitate or implement an HIE.

Business decisions faced by the CIO—and indirectly by the CEO and board—come down to the dilemma of deciding among competing alternatives, leading to the evaluation challenge. The questions that must be asked are whether the HIT investment increases or decreases positive organizational outcomes and whether it increases or decreases costs to the organization. Economists have frameworks for assisting in making these decisions, called benefit–cost analyses, cost–effectiveness analyses, and cost–utility analyses. Further, business models suggest a similar evaluation process for value realization that consists of conceptualizing, capturing, analyzing, and reporting detailed financial and nonfinancial information. In addition, the IT Governance Institute (2006) has developed a detailed value-realization process that can direct HIT leadership to achieve their goals.

A number of challenges hinder the efforts to maximize the value of HIT investments, including lack of proper, detailed documentation of key information and conceptual problems of assigning benefits and costs to a particular investment. These investments garner benefits from and impose costs throughout the organization, thus posing problems of assignment to evaluate uniquely the net effect of any single investment. These effects are

now extending even outside of the confines of the traditional organizational entity. Obtaining that data and generating reliable estimates of net value are problematic at best.

Web Resources

A number of organizations (through their websites) provide more information on the topics discussed in this chapter:

- The Advisory Board has prepared an evaluation tool kit for HIT (www.advisory.com/research/service-line-advisor/tools/2015/technology-evaluation-toolkit).
- Agency for Healthcare Research and Quality provides summaries of their funding products in the area of HIT value (<https://healthit.ahrq.gov/funding-mechanism/demonstrating-value-health-information-technology>).
- Agency for Healthcare Research and Quality has developed a tool kit for practitioners along with other, related evaluation materials (<https://digital.ahrq.gov/health-it-tools-and-resources/evaluation-resources>).
- The American Hospital Association provides helpful information on HIT evaluation (www.hret-hiin.org/resources/display/health-it-evaluation-toolkit).
- Check out Blue Cross and Blue Shield's Health of America project for a number of healthcare-related topics, including technology (www.bcbs.com/the-health-of-america/topics/healthcare-technology).
- The Center for Information Technology Leadership offers specific HIT intervention evaluations (www.citl.org).
- Centers for Disease Control and Prevention's Health-Related Quality of Life provides quality-of-life measurements (www.cdc.gov/hrqol/index.htm and www.cdc.gov/policy/polaris/economics/index.html).
- Colleague, an open source network, provides a broad range of HIT evaluation and other information (www.colleague.org/tools/health-information-technology-evaluation-toolkit).
- The Office of the National Coordinator for Health Information Technology has an expansive and continuously updated website on all aspects of HIT (www.healthit.gov/topic/health-it-and-health-information-exchange-basics/health-it-and-health-information-exchange).
- Large organizations have become sources for healthcare evaluations (see Blue Cross and Blue Shield's Health of America project for more information on many related topics, including technology [at www.bcbs.com/the-health-of-america/topics/healthcare-technology]).

Discussion Questions

1. Explain why obtaining value from HIT investments is so important in today's healthcare environment.
2. How valid and reliable do you think HIT investment decisions are currently? Why?
3. What is the system nature of healthcare, and why does it affect value estimation?
4. What do you think will drive adoption of interoperable EHRs—cost savings or consumer preferences? Why?
5. What is the evaluation problem faced by HIT investment decision-makers? Why does the matrix in exhibit 12.2 help in understanding that problem?
6. Why do we not observe examples of all of the cells in exhibit 12.2?
7. Compare and contrast benefit–cost, cost–effectiveness, and cost–utility analyses. Which do you prefer, and why?
8. List and assess the eight steps in conducting benefit–cost analysis, cost–effectiveness analysis, or cost–utility analysis.
9. What is value realization? In what ways is it similar to and different from economic evaluation techniques?
10. Explain the four questions proposed by the IT Governance Institute and why they are important.
11. Describe how the nature of the HIT investment application affects the quality and nature of the value determination.

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