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Assessing and Communicating the Value of IT

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Overview

Prior ECAR studies and other research show that the ability of the chief information officer (CIO) to convey the value and relevance of information technology (IT) is a critical competency in institutions of higher education. One of the most commonly vocalized challenges CIOs face, however, is how to measure and convey the value of IT to other organizational leaders and constituents. Hundreds of models and approaches have emerged for measuring IT value, yet none is fully adequate. The recent debate over whether "IT matters" raised in a *Harvard Business Review* article by Nicholas Carr and subsequently debated in a variety of settings has not helped matters.[1]

This research bulletin addresses the general topic of IT as a strategic asset, rather than a deployment commodity, in higher education. There is much talk about how IT should be viewed as a strategic asset and how CIOs should promote that concept to academic executives, but what kinds of assessments can be used to demonstrate the value of IT? Is there an approach to IT value assessment that CIOs can adopt (or adapt) that easily applies to higher education goals such as faculty and student recruitment and retention and support for research, development activities, learning assessment, faculty development, and so on? IT value assessment is loosely (or perhaps not so loosely) tied to strategic planning in that feedback and validation metrics often are not included in IT strategic plans—and they should be. We have seen metrics that demonstrate IT's "power," but which ones demonstrate IT's value? This research bulletin discusses approaches to assessing and communicating the value of IT.

Highlights of IT Valuation

The problems associated with measuring the value of IT fall into two distinct groupings: those that are common to performance management in general, and those that are uniquely difficult within an IT context. In our quest to find way to assess IT value, we must first understand measurement problems to avoid repeating the shortcomings of earlier models.

Problems with Performance Metrics in General

A number of issues are commonly associated with measuring performance in organizations, whether trying to capture the performance of employees, the IT unit, or various IT investments. Consider the maxim that past performance does not guarantee future performance. The *Oxford English Dictionary* goes a step further and defines *performance* as "often antithetical to promise." In other words, performance measurement is inherently something of a soft process and not always an effective tool for predicting future outcomes from current actions. The question is, why?

Several reasons account for why performance measurement is an imprecise art. As institutions become larger and more complex, identifying which actions affect the bottom line becomes increasingly difficult and less accurate, as more decisions are made, more are actions taken, and more people are involved. As size increases, the factors directly

or indirectly affecting the bottom line also increase. An action or investment that may have had clear impact for a very small organization becomes difficult to value because the impact may be "washed out" or hidden by the influence of other investments or actions.

As organizations grow, it typically takes longer to see the impact of actions or investments. The effect also may be distributed throughout the organization, requiring more sophisticated techniques to capture the organizational impact of a particular action or investment. The distribution of effects may also make it more difficult to capture the right measures or collect data on measures in a timely or consistent way, since the effects are likely occurring outside the IT unit's domain. Thus, from an organizational perspective, it is difficult to place a concrete value on many decisions, actions, or investments because the effects are too distributed or too moderated by other factors to measure them easily or accurately.

A final important issue with performance measurement is understanding that value is a social construct,[2] and therefore assessing it is an inherently subjective venture. Value is defined contextually by the individual making the assessment in order to inform the decision being made. Each stakeholder—student, administrator, faculty member, or other—will assess the value of each action or investment differently. Thus, the inherent challenge of finding a way to measure strategic value precedes some of the unique challenges of IT valuation itself.

Problems with Measuring IT Value

What is it about IT that makes measuring its strategic value so difficult? A simple answer is that there are too many ways to measure it. Every consultant, practitioner, or faculty member has a unique method for capturing IT value. Table 1 provides an incomplete (if overwhelming) list of sample measures, based on Renkema's work.[3] Many of these models were designed for the private sector rather than for higher education, and some are more easily applicable than others to the goals and objectives found in the academic environment. Even if IT leaders can sift through these models and find an appropriate one to use, the unique challenges of IT valuation have only begun.

Table 1. A Partial List of Methods for Valuing IT

Accounting rate of return	Critical success factors	Quality engineering
Activity-based costing	Customer resource life cycle	Real option valuation
Analytic hierarchy process	Decision analysis	Return on management
Application benchmark technique	Delphi evidence	Requirements costing technique
Application transfer team	Executive planning for data processing	Schumann's method
Automatic value points	Functional analysis of requirements	Seven milestone approach
Balanced scorecard	Hedonic wage model	Strategic application search
Bayesian analysis	Information economics	Strategic option generator
Bedell's method	Infrastructure analysis	Systems investment methodology
Buss's method	Investment mapping	Simulation
Benefits-risk portfolio	Investment portfolio	Sociotechnical project selection
Benefit assessment grid	Information systems investment strategies	System dynamics analysis
Break-even analysis	Knowledge-based systems for information systems evaluation	Systems measurement
Boundary value	Management Information Systems (MIS) utilization technique	Time savings times salary
Cost-benefit analysis	Multiobjective, multicriteria methods	User utility function assessment
Cost displacement/avoidance	Option theory	Value analysis
Cost-effectiveness analysis	Potential problem analysis	Value chain analysis
Cost-value technique	Profitability index	Ward's portfolio analysis
Cost-revenue analysis	Process quality management	Wissema's method

One of the more significant challenges facing the IT manager in valuing IT is perhaps best summarized in *Darwin Magazine*:[4]

> Measuring the value of IT investments was a lot easier when the use of computers could be directly tied to cost savings. For example, by automating bookkeeping, a computer could eliminate eight bookkeepers from the payrolls. Today, establishing value for IT is less straightforward, simply because computing technology is everywhere. IT is no longer expected to trim costs; it's now expected to enhance revenues and profitability.
>
> Why is measuring the value of IT so hard? As IT has permeated organizations, measuring its direct contribution to the bottom line has become more difficult. This is because cost savings—primarily in the form of headcount reduction and productivity improvements—were

gains that were achieved early on in a system's lifecycle. It's fairly easy to calculate the value of eliminating salaried positions, but how to determine value from an ability to close the books faster with fewer errors? Similarly soggy ground surrounds systems that are designed to help customer retention, improve product development, enhance knowledge sharing, and speed time-to-market.

Indeed, as IT evolved over time, the difficulty of calculating the value of IT investments increased, due in large part to refocusing application development away from clerical efficiency and toward a wider range of less well-defined outcomes such as competitive advantage, knowledge management, and improved organizational performance. Adapting the concept of system eras,[5] Table 2 illustrates major eras of system evolution in the context of the general system purposes. As time progresses and new eras evolve, the purpose of applications becomes increasingly less easy to measure in the form of simple quantitative cost savings.

Table 2. The Role of System Evolution

Information Systems Era	Sample Applications	Purpose
Era I: The Accounting Era	Payroll; invoicing; general ledger; accounts payable	Clerical replacement
Era II: The Operations Era	Online order entry; inventory control; airline reservations; credit card processing	Clerical replacement; asset reduction; better service
Era III: The Information Support Era	Tracking key performance indicators; strengths, weaknesses, opportunities, and threats (SWOT) analysis of markets; risk analysis for investments	Increased managerial productivity; improved performance; competitive advantage
Era IV: The Network Era	Groupware; Intranet applications, knowledge-based systems, electronic data interchange (EDI); communications networks	Increased group/team productivity; improved knowledge management; customer value added

With each era, technology becomes cheaper and more ubiquitous, in keeping with Moore's law (which projects improved computer performance) and the law of Turing Machines (which holds that computers are not single-purpose machines). These theories contend that the nature and capabilities of information technologies are constantly changing—and the pace of that change is rapidly increasing. The real challenge of valuing IT investments, however, is the ubiquity dimension. As technology continues to serve an ever-wider range of purposes, often simultaneously, attempting to assign a value to an IT investment is like hitting a moving target. How do you measure the strategic value of something that is many different things to many different stakeholders, all at the same time?

Finally, before addressing alternative approaches to IT valuation, it is important to discuss the most common and certainly most traditional approaches. Traditional approaches typically rely on a range of financial measures to calculate value. Examples

including cost-benefit ratios, net present value, return on investment (ROI), return on equity (ROE), economic value added (EVA), and economic value sourced (EVS) present their own challenges as methods for assessing and communicating the value of IT.

Many of the costs—and benefits—of IT are difficult to quantify, particularly in traditional financial terms. Furthermore, while the costs associated with IT investments might be tangible and occur up front, the benefits are mostly intangible and typically occur over time after implementation—while the cost of technology is evident, the payback may not be apparent or quantifiable. Furthermore, unlike other forms of capital expense such as a new dormitory, gymnasium, library, or student center, the value of information-based assets is often more volatile. An IT investment may have no strategic value one day and mission-critical value the next. IT investments do not follow the normal value trend of most institutional investments, for which traditional financial measures were created. Many financial measures, while widely used, are ineffective for addressing the IT valuation challenge.

Alternative IT Valuation Models

Below are three approaches to creating measures to assess and communicate the value of IT. The first and widely used set of techniques is called portfolio analysis due to its similarity to financial investment portfolio modeling. The second set, known as causal mapping techniques, is perhaps best characterized by the balanced scorecard. The third set is based on scoring models, a technique IT units frequently use to select vendors. While there are many other approaches as noted earlier in Table 1, these three share commonalities and underlying concepts that can help today's campus IT managers wade through some of the confusion. Rather than provide a detailed discussion of each set of techniques, this section will focus on how these techniques can be used to assess IT value as a strategic asset within institutions of higher education.

Portfolio Analysis Techniques

Unlike many traditional financial approaches to IT valuation, portfolio analysis techniques consider IT assets not solely from a cost perspective but instead include other elements such as risk, yield, and benefits. In portfolio analysis, an organization seeks to balance risk and payoff by investing in IT assets (applications, hardware, people skills, and so forth) that both support basic organizational operations and help create and address new or existing strategic opportunities.

A simple and illustrative approach to portfolio analysis could yield a set of three portfolios for the IT unit, the first of which is the operational or primary portfolio. This portfolio identifies or enumerates the entire information architecture for the institution, including but not limited to applications, networks, hardware, operating systems, support services, skill sets, and human resources (both internal and externally contracted). It also includes data and information assets, as these represent an important source of both operational and strategic value. This first portfolio captures more concrete elements of IT assets.

The second project or work portfolio is intended to capture the maintenance, renewal, and expansion of the organization's information architecture. Which projects or IT unit initiatives and what percentages are focused on pure maintenance work such as correcting problems in the existing architecture? Which projects or initiatives renew or update existing IT assets such as an institution's desktop replacement cycle? Finally, what proportion of IT initiatives, projects, or work is being used to expand the enterprise architecture through developing new capabilities or adding new assets to any of the architectural elements? Institutions should strive to balance these types of projects or initiatives, not only based on cost but also expected value added to the institution and levels of comfort with risk.

While the first two portfolios focus on the more tangible elements of IT investment—architectural elements and projects—the third might focus on the intangible elements such as the knowledge embedded in personnel or developing relationships with various stakeholders. This portfolio includes the investments made to help IT staff better understand the institution and to improve communication within the IT unit and across institutional units.

In evaluating portfolios, investments should be diversified. The strategic value of each portfolio might be assessed by evaluating its contribution as a whole to the institution's goals. Portfolios are assessed by costs incurred, expected benefits (tangible or intangible) as defined by the expected impact of an investment on the IT unit and the organization, and the degree of risk inherent in each investment relative to its likely payoff.

Elements of each portfolio can also be evaluated against their distinctive features and goal alignment. Portfolio investment features might include scalability in terms of capacity or functionality, expected longevity, breadth of impact, and adaptability to the introduction of other investments. Goal alignment captures in qualitative or quantitative terms how well a portfolio matches or supports the institution's mission, vision, goals, and objectives, which may be determined in part by the extent to which an investment supports or enables value-added processes.

Portfolio analysis techniques attempt to demonstrate the strategic value of IT investments by classifying or diversifying investments across multiple portfolios, with each portfolio serving relatively discrete value-added functions. Investments of a particular type can be weighed against each other within a portfolio, and the balance of risk and diversification across portfolios can be determined.

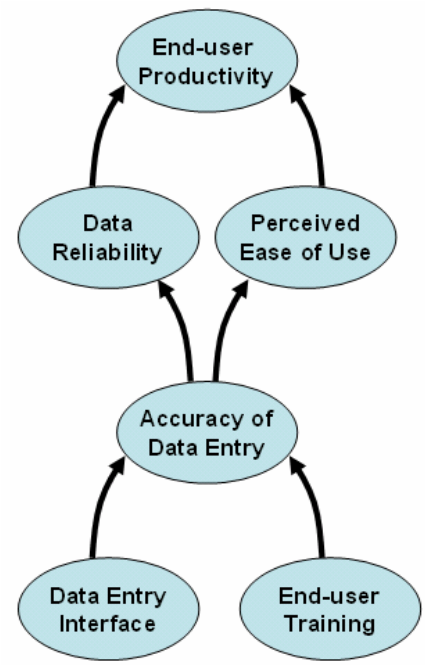
Causal Mapping Techniques

Another common technique for IT valuation that has gained considerable popularity over the past decade is causal mapping. This class of techniques is probably best represented by the balanced scorecard. The value of such techniques is not simply in selecting a range of balanced measures across categories—the real advantage is in the process of selecting, developing, and testing the measures as a reflection of assumptions about the connections in institutional operations. The more formal language for this concept is the idea of a strategy map.[6]

Strategy maps attempt to capture the causal linkages among a set of measures. These maps theoretically capture the impact of a particular investment, strategy, or tactic on the organizational value chain. Measures are selected not because they fit a particular category, but because they represent important measures in tracking the outcome of one action and the input of another. This is useful from an IT valuation perspective, since IT investments frequently do not have a direct or easily traceable impact on the bottom line of an organization. Typically, most IT investments have a tertiary impact—the IT investment impacts something, which impacts something else, which in turn impacts something else, which might ultimately impact the bottom line. The strategy map graphically illustrates how these impacts unfold and can help convert intangible benefits into tangible measures and outcomes.

The exercise of developing strategy maps and tracking the related measures helps monitor the impact or value that IT investments provide to an organization. We may learn that our institutions do not work the way we think they do, or that the impact of technology is not what we first perceived. To illustrate this point, consider the following example: We are concerned about end-user productivity in our institution and believe that it is based on user perceptions of reliability of data and ease of use of available systems. Perhaps we measure reliability of data in terms of how many times we find an error in someone's address. In turn, we believe the reliability of data is most influenced by the accuracy with which people enter data into the system. The ability of people to enter data reliability is based in part on the quality of the user interface and in part on user training. This might yield the partial strategy map shown in Figure 1.

Figure 1. Sample Partial Strategy Map



The strategy map in Figure 1 illustrates fundamental assumptions of how we believe our institution works. If we make the investment in a new data-entry interface, we expect that

the accuracy of the data-entry process should improve, which should in turn improve data reliability and the perceived ease of use. Combined, these should improve user interface productivity—in theory. The value of the causal model is that we can now collect measures and test assumptions. If implementing a new data-entry interface does not follow the course outlined in the map, one of three things is likely occurring:

- The investment did not have the intended effect, and thus is not providing the expected value.
- The investment had the desired effect, but other factors are having a greater impact on the other variables—the strategic intervention is insufficient to effect the change.
- The investment may or may not have the desired effect, but the right things are not being measured.

The first case signals a poor IT investment—one that does not provide value to the institution. The other two signal a lack of knowledge about how the organization works or how IT provides value to it. By refining and further developing measures, the ones that best reflect causal relationships can eventually be determined. The end objectives of the strategy map should be closely tied to organizational objectives. In this way, causal assessment techniques such as the balanced scorecard help measure the strategic value of IT by selecting measures specifically linked to organizationally relevant strategic outcomes and by building an understanding of how IT investments impact those outcomes through the chain of tertiary impacts.

Multicriteria Techniques

A third and commonly used class of approaches to assessing IT value are referred to as multicriteria models and multiattribute utility (MAU) models. Collectively known as scoring models, they are frequently used in IT, particularly for assisting with vendor selection. They can also structure the discussion of what value IT investments provide to the institution.

Scoring models begin with establishing a set of criteria, both financial and nonfinancial, for evaluating IT investments. Once criteria are selected, they are typically assigned weights. Fairly intangible criteria can be used and relative weights can be assigned. For example, *improves academic decision making* could be a criterion for evaluating a set of campus applications. How can a dollar value be assigned to this criterion? We could gather from qualitative or other methods that the importance of improved academic decision making to the organization is high, medium, or low, or make an assessment that its institutional importance is greater or less than the value of improved student services, for example. Weights are assigned based on institutional priorities.

The next step is to take each IT investment and evaluate it based on how well it satisfies each of the criteria. Again, with more intangible criteria or difficult-to-quantify criteria, a relative scale such as a 4-, 5-, 7- or 10-point scale could be used. For items that cannot be rated, data or information need to be collected to determine the investment's value to the institution. The result should be a set of ratings on each criterion, which is multiplied

by the weights for each criterion, with the products being added together to produce a score. The higher the score, the higher the perceived value the investment provides to the institution.

If there are a number of intangible criteria or measures, weights and ratings can be adjusted to determine the impact on perceived value. This process, referred to as sensitivity analysis, helps determine what criteria or ratings to use to measure the investment value to the institution. Attention can be focused on IT investment areas that will maximize potential value and payoff through an easy-to-understand and easy-to-communicate mechanism for calculating the strategic value of IT that reflects the institution's primary strategic objectives. It is not uncommon, however, to see different sets of criteria applied to different types of IT investments, producing hybrid approaches to portfolio analysis and scoring models.

What It Means to Higher Education

The three approaches to assessing the value of IT covered in this bulletin share common elements—employing subjective data, using multiple measures from multiple viewpoints, and developing a culture of evidence and analysis.

These techniques all use some degree of "soft" or subjective data. IT value is difficult to quantify or measure, necessitating the use of techniques or methods that can provide surrogate measures for intangibles. Soft value measures can provide a basis for discussion and for highlighting assumptions about how value is achieved in terms that multiple stakeholders can understand. This valuation process helps monitor perceptions of reality and can provide another mechanism to encourage learning regarding IT's contribution to the organization both within and outside the IT unit.

In addition, these approaches use multiple measures and multiple viewpoints. One challenge of IT valuation is that it means different things to different stakeholders. The flexibility to classify or reclassify measures, criteria, weights, causal factors, and so forth provides robust, adaptable models for various stakeholders. Typically drawn from a wide array of value definitions that represent internal versus external perspectives and control versus change orientations, these multifaceted approaches should measure four things:

- *Effectiveness*—did the investment improve quality?
- *Efficiency*—did the investment make things faster or less costly?
- *Flexibility*—did the investment improve the ability to be responsive to changes in the technology, the institution, or the environment?
- *Creativity*—did the investment improve the ability to introduce new innovations in the institution?

Most modern techniques for IT valuation include the use of multiple measures from multiple perspectives.

Finally, these approaches focus on developing a culture of evidence and analysis. To determine the strategic value of IT, higher education leaders must develop a culture of evidence. Each of the techniques presented here emphasizes developing measures that provide some evidence of value—whether relative, causal, or subjective. By gathering evidence, however imperfect, a good technique provides an easy-to-understand mechanism for communicating that evidence or value framework to refine measures and an understanding of how IT provides value to the institution. Each of the techniques also links the gathering of evidence to the institution's strategic mission, vision, goals, and objectives. The techniques therefore force an understanding of how IT provides value in institutional and strategic terms. Developing a culture of evidence using flexible techniques helps the entire higher education community—students, faculty, administrative decision makers, and others—assess value.

A final relevant concept comes from the Malcolm Baldrige National Quality Award Program[7] administered by the U.S. National Institute of Standards and Technology. The Baldrige framework is focused on quality in organizations. One of the most heavily weighted Baldrige award factors is the demonstration of evidence that performance is at specified levels within each of the other evaluation categories. One evaluative category is specifically focused on assessing the degree to which an organizational culture of evidence exists.

Assessing and communicating the value of IT in strategic terms is difficult, yet it is one of the most important tasks CIOs and top IT leaders can engage in to be effective in their institutions. With shifting IT budgets and greater demands for accountability, IT leaders must consider alternative methods to determine and convey the value that IT provides to the institution.

This bulletin describes widely used techniques to meet the difficulties and challenges IT leaders face in assessing the value of IT. Managers may find that no single technique is adequate. In some cases, multiple techniques might be used to capture and convey the value of IT investments. The critical element here is that poor measures are worse than no measures, and without a culture of evidence, it is nearly impossible to promote organizational learning or solve the challenges associated with valuing IT.

Key Questions to Ask

- How do you convey the value of your IT investments in strategic terms? How do the measures you have selected to monitor your IT investments relate or link to your institution's mission, vision, goals, and objectives?
- What types of measures do you use to assess value? Are they purely financial measures? Do you measure the intangible costs and benefits, or only those that are tangible? If you measure intangible costs and benefits, how do you calibrate your measures?
- To what extent do you use your current processes for valuing IT as a mechanism for organizational learning, both within and outside the IT unit? Are

there opportunities to use your current processes to foster discussions with key stakeholders regarding what they perceive to be strategically important?

- Does your IT unit or academic institution have a culture of evidence in place? How do you know? What evidence is there that you have a dynamic and effective process to capture the value of IT?

Where to Learn More

- T. J. W. Renkema, *The IT Value Quest: How to Capture the Business Value of IT-Based Infrastructure* (Chichester, U.K.: John Wiley & Sons, Ltd., 2000).
- R. S. Kaplan and D. P. Norton, "Having Trouble with Your Strategy? Then Map It," *Harvard Business Review*, Vol. 78, No. 5, September/October 2000, pp. 167–176.

Endnotes

1. The original article "IT Doesn't Matter" by Nicholas Carr can be found in the May 2003 issue of *Harvard Business Review*, with a series of response letters to the editor appearing in June 2003. The entire collection can also be found as the *HBR* OnPoint series, product #3566.
2. M. W. Meyer, *Rethinking Performance Measurement: Beyond the Balanced Scorecard* (West Nyack, N.Y.: Cambridge University Press, 2003).
3. T. J. W. Renkema, *The IT Value Quest: How to Capture the Business Value of IT-Based Infrastructure* (Chichester, U.K.: John Wiley & Sons, Ltd., 2000), pp. 119–120.
4. This quote came from M. Santosus, "Measuring IT Value Learning Center," *Darwin Magazine* (January 1, 2002). As *Darwin Magazine* has discontinued its Learning Centers, the full reference is no longer accessible.
5. The concept of system eras originally appeared in the work by Richard Nolan on the Stages Theory over 30 years ago. Stages Theory continues to be a dominant model for understanding the evolution of IT and how to understand and manage the adoption of IT innovations in organizations. While there are many books and papers that reference the Stages Theory framework, a classic is R. L. Nolan, *The Stages Theory: A Framework for IT Adoption and Organizational Learning* (Cambridge, Mass.: Harvard Business School Press, 1993).
6. The concept of strategy maps appears in numerous pieces regarding the Balanced Scorecard, but one good reference is R. S. Kaplan and D. P. Norton, "Having Trouble with Your Strategy? Then Map It," *Harvard Business Review*, Vol. 78, No. 5, September/October 2000, pp. 167–176. A later article extends this discussion to specifically cover the use of strategic mapping to valuate intangible investments, such as information capital in an organization. See R. S. Kaplan and D. P. Norton, "Measuring the Strategic Readiness of Intangible Assets," *Harvard Business Review*, Vol. 82, No. 2, February 2004, pp. 52–63.
7. For more information on the Malcolm Baldrige Quality Award Program, visit the Web site for the National Institute of Standards and Technology (NIST), <http://www.quality.nist.gov>.

About the Author

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