ROI Under Scrutiny: The Radical Redefinition of a Core Concept

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SUMMARY • THIS ARTICLE OFFERS a three-part analysis for identifying and assessing return on investment in healthcare information technology (IT) projects. Returns to IT can be financial, clinical, or structural. The goal is to identify key areas of measurable returns to both assess the value of a project before it is undertaken and to assess the actual value returned to the organization. Given the choice, many senior executives still prefer to rely on classic financial analyses, but the true value of a project is often found in the clinical and structural returns. Still, project-specific assessments do not answer the core question of whether long-term strategic investment in IT leads to a systemic strategic advantage to healthcare organizations. This article addresses these issues and indicates opportunities for further investigation.

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THE CONCEPT OF ROI—return on investment—is undergoing a radical process of redefinition, driven in large part by the complexity of assessing the business impact of information technology (IT). This redefinition is taking place throughout the business world, affecting how industries ranging from trucking to financial services to healthcare assess and approve both capital and operating expenses for IT. The pressure to produce demonstrable returns is no less intense with IT than with traditional types of investments.

On the contrary, tight budgets and strong competition for capital have placed investments in IT squarely under the watchful and wary eye of the chief executive officer (CEO), whose job can hang in the balance when a multimillion-dollar IT investment goes bad. The magnitude of these investments requires board scrutiny, so making the analysis clear, concise, meaningful, and relevant is a critical goal. The result of this scrutiny has been a spate of articles and speeches that challenge traditional financial measurement of returns to IT as limited in both scope and value in determining the true costs and benefits of IT projects, but that do not reach any clear consensus on the best approach to alternative analyses.

Some analysts suggest eliminating financial ROI altogether, claiming that accounting tools cloud the picture rather than clarify investment options. Others promote the view that IT is purely an infrastructure investment; because the business cannot exist without an IT infrastructure, such investments should be immune to ROI analytics. In these two cases, the proponents reach the same conclusion from different perspectives.

Other analysts suggest that a series of quantifiable but nonfinancial metrics, such as reduction in medical errors or improvements in process times, be used to assess the benefits of IT. Still others say that even softer measures, dubbed "intangibles," such as patient satisfaction and employee retention, are the key measures of ROI on IT. Meanwhile, some vendors and healthcare chief financial officers (CFOs) alike are still using traditional financial ROI analyses to justify IT investments.

The breadth of opinions should not be misinterpreted, but rather be expected. On one hand, the process of redefining ROI for IT will not be a clean, linear process. Some concepts will be explored and then modified, rejected, or recast. On the other hand, each of these positions has an element of validity, suggesting that the fundamental revolution in ROI may not be in the specific details of the analysis, but in our core assumptions about how to approach determining returns. In other words, the true revolution is in developing a broad industry understanding that assessing ROI is the art of knowing which analytics are appropriate for each situation combined with the recognition of the role IT plays in creating systemic strategic advantage for healthcare organizations.

ROI REVOLUTION

The ROI revolution in healthcare has been two decades in the making. As the hospital merger mania of the

1980s led to large healthcare systems, larger mergers, and IT implementations whose scope and complexity grew exponentially, CEOs began to express the frustration that IT projects consistently failed to achieve the financial targets developed as part of their capital allocation processes. The size of the investment grew, as did the risk and visibility of capital decisions. From the perspective of many healthcare CEOs, the past two decades have been littered with broken promises and increasing costs. At the same time, the role of IT has grown to include a wide variety of core business transactions and critical, interrelated clinical processes. Enter Internet technologies—from secure web transactions to browser-based applications—which transformed the role of IT in healthcare from specialized applications to ubiquitous infrastructure.

Meanwhile, sensing the limitations of traditional financial ROI analytics, innovative hospital executives began to experiment with alternative measures of performance. These measures tied the specific goals of the IT investment to the organizational strategic plan. For example, when Memorial Health University Medical Center in Savannah, Georgia, developed its physician portal, executives also developed a set of metrics for success (Stanic 2001). Those metrics fall into two general categories: portal usage statistics and physician satisfaction measures. Portal usage statistics include:

- number of users
- number of active physicians with access
- average number of physician users per day
- average use time per physician

Satisfaction measures include physician responses to questions such as the following:

- Is the portal easy to use?
- Does it save you time?
- Have you increased referrals to the medical center as a result?

The trend in healthcare parallels a broader trend throughout IT to expand the definition of ROI. Citibank Global Securities is in the process of building an executive portal to serve as a central information source for top executives at the 350 largest financial institutions in the world (Colkin 2002). Much like Memorial Health's physician portal, Citibank's executive portal has the potential to either drive new business or alienate key customers. Citibank recognized that the biggest success factors of their portal are price and adoption. In a designed shift from financial ROI analytics to measures of success, the IT department worked with the marketing department to determine a pricing and marketing strategy to drive adoption and use of the portal and to measure success.

Schneider National Inc., a $2.4 billion trucking and logistics company, assigns each IT investment into one of three strategic categories: projects that will lower costs, projects that will increase revenue, and projects that are designed to simplify business processes (Colkin 2002). Schneider then uses a different set of metrics for each of the categories. Senior

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executives say that the application of those metrics is more of an art than a science, applying judgment, business strategy, and insight to the process of selecting metrics and assessing returns.

Simplifying and improving business processes—and results—were at the core of an effort by Montefiore Medical Center in the Bronx, New York (Manzo, Cusick, and Taylor 2002). In evaluating the return on its computerized physician order entry (CPOE) system, Montefiore measured process times for five key stages of medication pre- and post-implementation: (1) from writing the medication order on the unit to sending the order to the pharmacy, (2) from sending the order to the pharmacy to its arrival in the pharmacy, (3) for the pharmacist to enter and verify the order in the computer, (4) for the order to be filled in the pharmacy, and (5) from filling the medication order in the pharmacy to the medication's arrival on the patient unit. The average total time from the order being written on the patient unit to the medication arriving at the unit dropped 118 minutes as a result of implementing CPOE.

For both Montefiore and Memorial Health, the analytics were tailored to the goals of the projects that in turn were tied to the strategic plans of the organizations. Ultimately, the goal is to create value for the organization and its customers. Companies both within and outside of healthcare are beginning to realize that the fundamental goal of technology is value creation, including tangible and intangible qualities of value.

MEASURING THE VALUE OF IT

A survey by *InformationWeek Research* (Gillooly 2002) shows that CEOs across industries find verifying the business value of proposed technology purchases especially difficult. The study, based on 225 interviews with CEOs, CFOs, and chief information officers (CIOs), found that CEOs routinely reject IT projects because of lack of synergy with other initiatives, because they fail to enhance value to customers, or because they do not show promise of improving stock values. At the same time, the survey showed that top-level executives are paying more attention to intangible metrics in determining the business value of IT. Senior executives are evaluating the influence of IT on brand value, customer satisfaction, business relationships, core processes, and patents. Clearly, the redefinition of ROI is by no means complete, with executives paying greater attention to nonfinancial measures, but still favoring assessment of hard financial returns.

Along with CEOs of other industries, those in healthcare organizations are also torn between traditional ROI and other metrics. In a study of 11 leading integrated delivery systems published in *Healthcare Financial Management* (Coddington 2002), executives identified six primary concerns with IT investments:

1. achieving both financial returns and improved patient care,
2. having access to capital,
3. finding qualified IT staff,
4. finding reliable IT vendors,
5. gaining physician acceptance,

6. sharing software and solutions with other systems.

Coddington notes that the 11 systems in the study "anticipate that much of the payoff from IT investments will be realized though improvements in quality of service and patient satisfaction." In addition, executives believe that clinical information can be mined to improve outcome measurement, care processes, and quality.

Another weakness exists in the use of traditional measures of ROI. These analyses are typically conducted prospectively as part of the process to justify IT investments. Once an investment decision is made, however, these analytics are routinely set aside and never consulted again. As a result, management is often left without tools for assessing the effectiveness of the investment. Although business discipline appears to be the driver behind the use of financial analyses, the lack of continuity between the measures used to approve an investment and the tools for assessing the investment actually results in a lack of long-term tools to enforce business discipline on IT projects. By linking projects to key strategies and tactics, such as reducing days in accounts receivable or reducing medication errors, executives can set measurable benchmarks for success.

Still, given the choice, many senior executives would prefer to rely on classic financial analyses. This ambivalence between traditional analytics and softer measures is a result, at least in part, of the simple fact that traditional analytics remain appropriate for some projects. It is also driven by the huge investments being made in IT. Anderson (2002) estimates that total healthcare IT spending—including vendor applications, vendor services, staffing, and customized applications—will be more than $50 billion in 2003, an 18 percent increase over 2000. According to these forecasts, healthcare organizations will spend $22 billion on vendor applications and services in 2003. With that much money at stake, senior management and boards of trustees want to know what they are getting in return.

APPLYING METRICS

Project-specific returns comprise three key categories: financial, clinical, and structural.

Financial Returns

Financial returns are direct increases in revenue or direct reductions in expenses.* Examples of financial measures include days in accounts

*We are specifically excluding cost savings from reductions in the labor force. First, these savings are typically more theoretical than actual, often resulting from a calculation of time saved multiplied by a component of the workforce, like technicians or nurses, not from any changes in the total staff size. Second, these calculations typically fail to account for any upstream or downstream increases in staff tasks that may offset the savings. Finally, given the severe workforce shortage faced by key healthcare professions, the true power of IT is to leverage the current workforce to make staff more efficient and productive, such as allowing pharmacists time to consult with physicians rather than process paper orders or ensuring that greater nursing time is spent in direct patient care.

Whether an organization focuses on classic ROI or clinical returns, successful implementation of CPOE will require process changes.

receivable, average days from discharge to bill drop, average days from bill drop to collection, total small balances outstanding, number of denied claims, total managed care revenue, total inventory carrying costs, and paper and storage costs. These metrics are easiest to operationalize because baseline numbers for many financial measures are already captured in the financial accounting system.

Clinical Returns

Clinical returns are direct improvements in care processes, such as reductions in medication errors and improvements in discharge planning. To measure clinical improvements, organizations often must conduct baseline analyses. Direct clinical returns include

- reductions in medication prescribing errors,
- reductions in medication administration errors,
- increases in the use of appropriate therapies (e.g., beta-blockers in certain cardiac patients),
- reductions in nosocomial infections.

Structural Returns

Structural returns are process improvements that affect the overall operational functioning of the institution and may in the process also deliver financial or clinical returns. The process improvements are found either within a specific department or across a variety of activities and functions. Examples include

- improving throughput from the emergency department (ED) to either the operating room or admissions;
- streamlining the patient admission and discharge processes;
- providing easier access to clinical decision support tools;
- improving patient transport;
- reducing waiting time in the imaging department;
- providing secure online access to patient information for doctors, nurses, and other clinicians.

These changes are perhaps the most difficult to measure and interpret. In most cases, they should result in financial or clinical returns, but in themselves they are simply process improvements.

Understanding the Nature of Returns

Most projects provide returns in all three categories. This is another explanation why executives could easily opt to rely on classic measures of ROI for all projects, as some aspect of a project usually can apply these techniques. As a result, hospital executives must find the appropriate balance among the financial, clinical, and structural returns for each project, and they must recognize that for each project that balance will shift. IT projects with purely financial goals are easiest to categorize, with these efforts falling squarely into the category of the classic ROI analysis.

True success of these projects depends on the efficiency and effectiveness of other internal processes. For example, streamlining the discharge

and bed-turnaround process should improve bed utilization and in turn improve the organization's revenue generation. However, if the organization's collections process is poor, the increase in revenue may not result in an increase in actual cash. The argument could be made that regardless of a weak collections process, the increased throughput will leave the organization better off financially. As a result, an organization may be tempted to focus primarily on the potential financial returns. However, streamlining the bed-turnaround process has broader, and arguably more important, implications. For an organization with an ED backlog, improving bed turnaround can reduce ED overcrowding and increase patient, nurse, and physician satisfaction.

SOLVING THE ROI DILEMMA

The institutional approach to adoption of a technology may drive how that organization solves the ROI conundrum. For example, current interest in CPOE is largely a result of the recent reports by the Institute of Medicine (IOM 2000, 2001) targeting medication errors as a key safety issue for hospitals, as well as standards set by the Leapfrog Group for use of CPOE in hospitals. Nevertheless, some organizations will be motivated to purchase CPOE systems only after classic ROI analyses estimate reduction in costs associated with both medical errors and unnecessary medical care. Others will be motivated by the potential for direct financial returns from improved efficiency of claims administration after the implementation of point-of-care systems. Still others will move forward with CPOE because of the pressure that the IOM reports and the Leapfrog Group standards place on the institutions. Their goals will likely have two key features: (1) reducing medication errors both for perceived competitive advantage and as part of the core mission of quality and (2) defending market share with large employers and employer groups who have adopted the Leapfrog Group standards.

Whether an organization focuses on classic ROI or clinical returns, successful implementation of CPOE will require process changes. Those changes can be measured as structural returns, which may, in fact, be the most important to the organization. Yet, the institutional approach to adoption will yield very different metrics and methodologies for accessing ROI.

Furthermore, experience with a reliable vendor supplying a proven solution—that is, its functionality is defined, meets a need, and is deployable—coupled with a well-designed and -implemented strategic plan are key components of a successful initiative. All three forms of ROI measurement must be tied to the goals of the strategic plan, but identifying metrics for success is not enough. Those measures must be tracked against results actually achieved, but do not need to be immutable. Experience with the solution over a period of time may provide enough knowledge to allow the further refinement of ROI metrics that capture the data points specific to an organization's objectives. In

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addition, the results achieved by a particular project may be influenced—either positively or negatively—by future projects that have structural implications. As a result, specific target levels of return for specific projects should be evaluated and, if appropriate, modified. The organization may also benefit from global ROI metrics for the use of IT. In the end, ROI measurement will be unique to each institution and each project.

SYSTEMIC STRATEGIC ADVANTAGE: TWO STUDIES

Traditional ROI analysis focuses on project-specific returns. Even the softer measures of return focus on specific technologies. Although these analyses can be useful as part of prioritizing capital investments and assessing effectiveness, project-specific assessments do not answer the core question of whether long-term strategic investment in IT leads to a systemic strategic advantage to healthcare organizations.

Two studies attempt to evaluate whether healthcare organizations gain demonstrable systemic benefit from investment in IT. Each tackles the problem from opposite perspectives. One study is based on data developed as part of the 2002 Most Wired Survey and Benchmarking Project developed by *Hospitals & Health Networks* (*H&HN*) (Solovy 2002). That study poses the question of whether healthcare organizations that excel in IT have significant clinical or financial advantage over other hospitals. The second study, developed by North Coast Consulting (Golob 2002) in Bellevue, Washington, uses three benchmark groups for clinical excellence and poses the question of whether they have made significantly greater investments in IT.

The 100 Most Wired

The nation's most-wired hospitals and health systems appear to have lower mortality and complication rates than the nation's healthcare organizations as a whole. However, the evidence is far from conclusive.

Using the 100 most-wired health systems as a benchmark group of IT leaders, *H&HN* examined measures of financial and clinical performance, enlisting CareScience, Inc. in Philadelphia, Pennsylvania; Cleverley & Associates in Columbus, Ohio; and Standard & Poor's Corporation in New York to conduct portions of the analysis. The results indicate that the most wired are ever-so-slightly better than the nation as a whole on mortality and complication rates when those rates are controlled for a variety of key risk factors, such as diagnosis, comorbidity, patient demographics, and transfer status, according to CareScience. The differences are small—less than 1 percent—but they are statistically significant at the 95 percent confidence level.

If the most-wired institutions are quality leaders, other studies should show them among the nation's top hospitals. Thus, *H&HN* compared the 100 most-wired hospitals and healthcare systems with four lists published by the *U.S. News & World Report*, AARP, and Solucient. Most-wired hospitals appeared frequently on each. We found that 29 of the most wired appear on the *U.S. News & World*

Report's 100 Best Hospitals list, 18 appear on AARP's 2002 Top 50 Hospitals list, 17 appear on Solucient's 2001 Top 100 Hospitals list, and 16 appear on Solucient's 2002 Top Cardiology list.

These findings lead to a key question: Do these hospitals perform better because they are most wired, or is something else reflected in the data, such as size or teaching status, that affects the outcome?

The analysis turns complex quickly. If the same data are case weighted—that is, giving more influence in the results to larger organizations—the advantage that the most wired enjoy in mortality rate measures increases. However, the complication rate moves in the opposite direction: the larger and more complex among the most-wired institutions have better mortality but worse complication rates than the most-wired benchmark group as a whole.

The results may seem strange, but actually make sense, says Ron Paulus, M.D., president of CareScience. "If something goes dreadfully wrong, they're better able to handle it. Mortality issues can be nipped in the bud," Paulus says. "At the same time, aggressive therapies and complex systems can make you more susceptible to complications. It's not as if an institution becomes better at all aspects of care" (Solovy 2002).

The difference in the results using case-weighted and unweighted data indicates that size is not driving the mortality and complication rates among the most-wired benchmark group. That conclusion is corroborated through correlations between mortality rates, complication rates, bed size, and teaching status. The correlations are not statistically significant. In other words, the makeup of the most-wired group, which tends to have larger hospitals and more teaching hospitals, does not appear to drive the results of this analysis.

The analysis is clearer for some measures of financial success. CareScience, Cleverley & Associates, and Standard & Poor's compared the financial profiles of the most-wired hospitals and health systems against the nation as a whole. The most wired are more profitable and are in better financial condition than the average hospital. They have more cash and higher margins, but also slightly more debt and a slightly older physical plant, according to William O. Cleverley, president of Cleverley & Associates (Solovy 2002).

These results are consistent with higher credit ratings and better access to capital. Indeed, the most-wired institutions have a greater percentage of AA ratings—the top rating category for any U.S. hospital†—than the nation as a whole, according to Standard & Poor's. Only 13.3 percent of all hospital debt rated by Standard & Poor's is rated AA, compared with 41.3 percent of the most-wired hospitals (Table 1). The most wired include two of the nation's three AA+ rated hospitals. "You're looking at a stronger set of hospitals. There's a pretty good difference," Cleverley says. "They have more margins and more cash" (Solovy 2002).

However, the source of those margins is not clear. Both CareScience

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Table 1: Credit Rating Distribution (%), Most Wired vs. All U.S. Hospitals, 2002

Rating Category	*Most Wired*	*All U.S. Hospitals*
AA	41.4	13.3
A	39.7	42.5
BBB	17.2	37.7
Speculative	1.7	6.4

*Includes plus and minus designations in each category. Example: AA includes ratings of AA+, AA, and AA–.

Source: Solovy (2002).

and Cleverley & Associates examined measures of operational efficiency. Both show that the most-wired institutions have significantly shorter lengths of stay. Cleverley found that case-mix-adjusted Medicare lengths of stay among the most wired were one-fifth of a day shorter than the nation as a whole. CareScience found that Medicare lengths of stay for the most wired were nearly a full day shorter after using its risk-adjustment methodology. Although the order of magnitude in these results differs, both analyses show that the most wired have significantly shorter lengths of stay.

Unlike the length-of-stay analysis, Cleverley and CareScience reach different conclusions on the nature of cost advantage. Cleverley's analysis shows a virtual dead heat between the most-wired hospitals and health systems and those in the rest of the nation in case-mix- and wage-index-adjusted Medicare cost per discharge. The CareScience analysis shows that the most wired have a 22 percent cost advantage over the nation as a whole in cost per risk-adjusted case.

When considering outpatient activities, Cleverley's analysis indicates that the most-wired institutions have a significant cost advantage. By combining inpatient and outpatient cost measures using volume, Cleverley's data show that the most wired have a 3.5 percent advantage in operating costs, adjusting for both case-mix differences and cost variations from market to market. "A 3.5 percent cost differential can create a very significant effect on operating margins," Cleverley says (Solovy 2002).

Whether the advantage comes in the form of efficiency on inpatient activity, as the CareScience analysis shows, or efficiency on outpatient activity, as the Cleverley report shows, both agree that the most wired have a significant cost advantage over the less wired.

Clinical Excellence

The study by North Coast Consulting (Golob 2002) focused on three benchmark groups for clinical excellence: Solucient's annual 100 Top Hospitals list, the *U.S. News & World Report*'s 100 Best Hospitals list, and a comparison of hospitals with "favorable" versus "unfavorable" ratings in the Florida Agency of Health Care Administration's *Guide to Hospitals in Florida*. The analysis compared IT staffing

†Excluding insured debt issues.

levels and IT spending to hospital performance to determine if any correlations exist. IT staffing and spending are used as proxies for investment in IT. In essence, the study asks whether hospitals recognized for clinical excellence invest disproportionately more in information technology.

In assessing IT staffing, North Coast controlled for hospital size and vendor selection. Analysts used staffing ratios, rather than actual staffing numbers, to minimize the effect of hospital size on the results. They also checked the ratios for any potential economies of scale attributable to larger hospitals. In addition, North Coast assessed staffing ratios based on the core system installed and determined that different systems require different levels of IT staff for normal operations and support. The analysis factored in this variation. North Coast then used this analysis to calculate an "expected" IT staffing level for each of the hospitals in the benchmark groups.

North Coast found that the *U.S. News & World Report* list of the 100 best hospitals had 43 percent higher IT staffing ratios than expected, and Solucient's top 100 hospitals had staffing ratios 5 percent higher than expected. For Florida hospitals performing better than expected for length of stay, the average staffing ratio was 12 percent higher; for Florida hospitals performing worse than expected for length of stay, the average staffing ratio was 12 percent lower. In other words, all three benchmark groups for clinical excellence have disproportionately large investments in IT as measured by staffing levels. North Coast also conducted the analysis for IT spending with similar results. However, with limited data on IT spending, this analysis serves only to corroborate the analysis of staffing.

COMBINING THE RESULTS FROM THE STUDIES

The analysis of the data from the 100 most-wired hospitals and healthcare systems and the study by North Coast approach the questions from opposite directions. The most wired analysis starts with a benchmark group that represents IT excellence and then asks, do these organizations perform consistently better for measures of financial and clinical effectiveness? The North Coast study begins with benchmark groups for clinical excellence and asks, do these organizations invest more in information technology? Based on these two studies, initial evidence indicates a systemic link between clinical performance and investment in IT. However, they do not establish causality. Therefore, from a research perspective, the pivotal question remains: Does investment in IT lead to better outcomes, or do hospitals with better outcomes invest more in IT?

We believe strongly that systemic strategic advantage accrues to the investment in IT, provided that the appropriate systems are installed, the necessary process changes accompany those systems, and adequate training and staffing are provided. This view is reflected in the 2000 IOM report, *To Err is Human: Building a Safer Health System*, which calls for a national IT

infrastructure to eliminate medication errors.

CONCLUSION

Healthcare executives have both a fiduciary and a clinical responsibility to ensure that the limited resources of their institutions are spent wisely to improve outcomes.

Healthcare is in the awkward and perhaps painful process of reassessing the role of ROI for information technology. In this, at least, hospitals and health systems are in the same stage of development as the broader corporate world. Companies in all aspects of business are struggling to find the best approach to assess the business value of information technology. Clearly, no simple, magical answer exists to the question of how best to assess ROI for healthcare IT projects. Even though organizations struggle with tight budgets and the need to prioritize investments, healthcare IT investments are regularly based on broader organizational strategic goals, combined with both the intuitive feeling of senior executives and the mission of the organization. In an era of ever-expanding and ever-improving choices for clinical IT solutions combined with the evolution of medical technology and the external push for safety and quality, measuring all aspects and every detail of returns is complicated and impractical. The solutions are simply too massive and are influenced by many variables. That said, healthcare executives have both a fiduciary and a clinical responsibility to ensure that the limited resources of their institutions are spent wisely to improve outcomes.

Additional research is needed to determine whether organizationwide systemic returns to information technology accrue in healthcare and whether systemic returns can be measured. We will use data from the fifth annual *Hospitals & Health Networks* Most Wired Survey and Benchmarking Project to further this research.

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