

## THE ROLE OF ENTERPRISE ARCHITECTURE IN THE QUEST FOR IT VALUE<sup>1</sup>

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### *Executive Summary*

*Organizations in virtually every industry are facing unprecedented pressures from many external forces. In an environment characterized by more regulatory mandates, more customer demands for better products and services, and an accelerated pace of technological change, some executive teams are turning to enterprise architecture (EA) to help their organizations better leverage their IT investments. The results of our study show there is a positive relationship between the stage of EA maturity and three areas of IT value: (1) ability to manage external relationships; (2) ability to lower operational costs; and (3) strategic agility. We also found positive relationships between EA maturity and improved business-IT alignment and risk management. Although these findings are based on responses from 140 CIOs working in a single industry that has been slower than others to leverage IT (U.S. hospitals), we believe they provide useful guidelines to help organizations in all industries increase the value from their IT investments.*

## THE ROLE OF ENTERPRISE ARCHITECTURE

More and more, today's organizations find themselves in dynamic environments where internal and external changes are constant. Companies and organizations are attempting to create new, more flexible organization designs, management practices and business processes to cope with these pressures and to become more competitive.

One of the major resources that organizations have used to respond to the challenges has been IT. Yet, in many cases, they have not realized the value originally expected. The cause of this lack of value may not be due to an individual IT solution, but to the overall manner in which IT is managed from an organizational perspective. In many cases, IT applications are implemented to solve local problems without paying much attention to integrating or standardizing them with existing or future applications. Organizations that lack a coherent strategy for integrating, standardizing and leveraging their IT resources are more likely to end up with fragmented systems that are ultimately dysfunctional.

One strategic approach that claims to lessen the propagation of fragmented IT systems is enterprise architecture (EA). EA is the term used to describe the way in which a business logically organizes its IT infrastructure and business process capabilities to address its needs for IT and business process integration and standardization. EA may or may not be captured or articulated in a formal set of plans. Regardless of whether it is formally or informally articulated, EA underpins decisions relating to data, applications, IT infrastructure (technical and human) and management responsibilities. It also informs strategies (both business and IT) that enable organizations to accomplish their business objectives.<sup>2</sup> Ideally, an EA is a guide for current IT implementations and also a roadmap to the future IT resources in the organization. Although the implementation and use of an EA has become a

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<sup>1</sup> Jeanne Ross is the accepting Senior Editor for this article.

<sup>2</sup> Ross, J. W. "Creating a Strategic IT Architecture Competence: Learning in Stages," *MIS Quarterly Executive* (2:1), 2003, pp. 31-43.

top priority for many organizations, it requires a large investment in organizational resources—time, people and financial.

In this article, we report on a study designed to examine three benefits associated with the EA approach, which improves an organization's ability to leverage IT to:

1. Manage external relationships
2. Lower the cost of business operations
3. Be more strategically agile—such as increasing the speed of entering new markets.

We also examined the relationships between EA maturity and business-IT alignment, and two types of risk management (technical and social). Although organizations in many industries are turning to EA to achieve some or all of these benefits,<sup>3</sup> we chose to examine changes in IT value in hospitals at different stages of EA maturity. The research we conducted is described in the Appendix.

As in other industries, top management in healthcare organizations is experiencing enormous pressure from various stakeholders to reduce costs and improve the quality of healthcare (including patient safety), as well as provide more access to medical information and services to patients.<sup>4</sup> Regulatory changes, an increasing number of alternatives to traditional healthcare delivery and more knowledgeable patients have been some of the driving forces. Healthcare organizations (both hospitals and physician practices) are also facing even greater pressures for change resulting from recent federal government legislation. Part of the American Recovery and Reinvestment Act, referred to as the Health Information Technology for Economic Clinical Health (HITECH) Act of 2009, includes incentives for adopting electronic health records, and potential penalties for non-adoption. These provisions of the Act are resulting in rushed implementations of IT solutions.

In addition to the rapid changes resulting from regulation and legislation, for-profit and not-for-profit hospitals alike are becoming more entrepreneurial in terms of service delivery as they explore, create and

enter new markets. These activities are also increasing their need to leverage IT for strategic agility.

Next we describe the stages of EA maturity and how we measured them. We then present our findings on the relationship between EA maturity levels and the achievement of IT value for the areas we studied.

## STAGES OF ENTERPRISE ARCHITECTURE MATURITY

Four distinct stages of EA maturity are well documented.<sup>5</sup> These four stages—described in Figure 1—are the Business Silo Stage, the Standardized Technology Stage, the Optimized Core Stage and the Business Modularity Stage.

In the *Business Silo Stage*, organizations focus their IT resources on developing functional applications. Most often, these applications are developed to address specific business needs and usually lead to highly developed applications. Nevertheless, development efforts tend to result in applications that are not integrated and lack the ability to share data sources.

In the *Standardized Technology Stage*, organizations focus their efforts and IT resources on the development of IT standards and a shared infrastructure. IT standards tend to be shared by all applications, leading to better management of IT. The standardization efforts also yield value by helping organizations improve organizational efficiency and cost-effectiveness.

In the *Optimized Core Stage*, organizations shift their focus from shared infrastructure and local applications to enterprise systems and enterprise-wide data sharing. There is also an attempt to identify and define core business processes and the data on which they rely. As such, organizations begin to leverage their IT to integrate business processes.

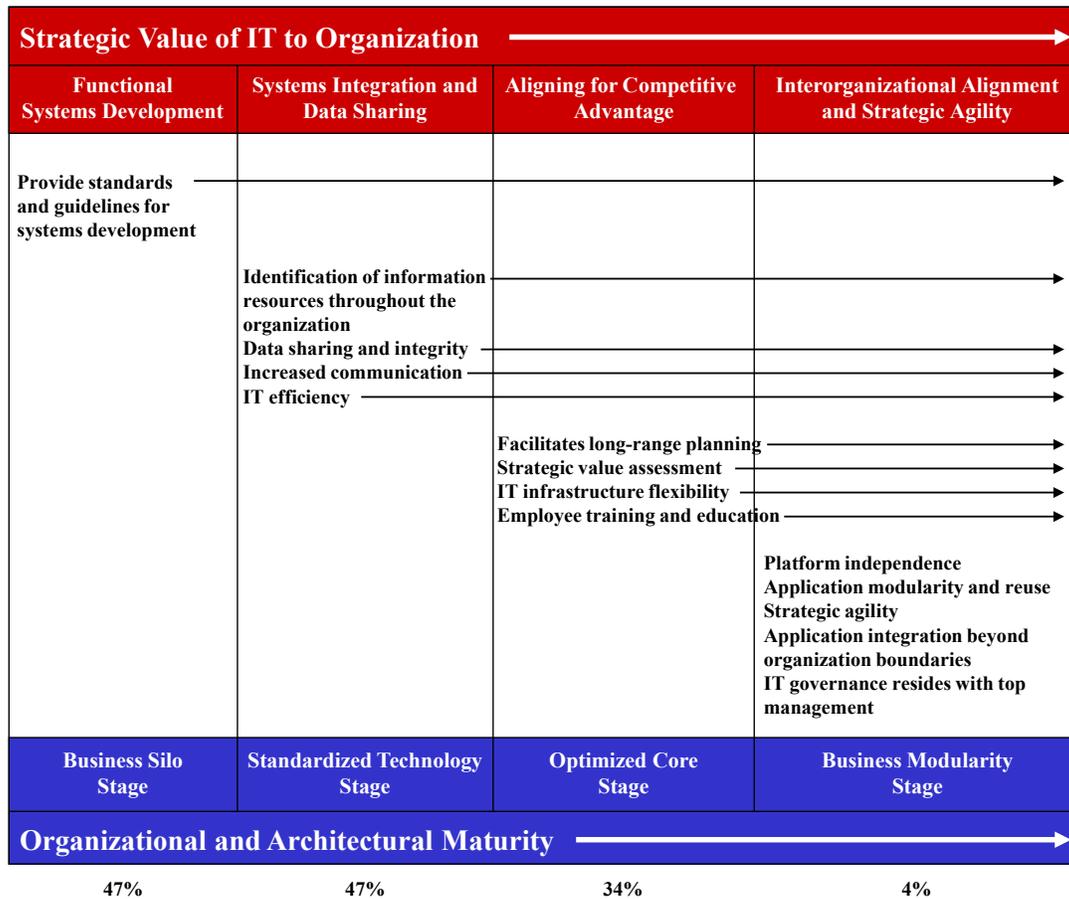
In the *Business Modularity Stage*, organizations focus their efforts and resources on attaining strategic agility through reusable business process modules. The reusable modules are used to link to external and other internal processes. In this stage,

3 For a sampling of organizations and their impetus for turning to EA, see Ross, J. W., Weill, P. and Robertson, D. C. *Enterprise Architecture as Strategy: Creating a Foundation for Business Execution*, Harvard Business School Press, 2006.

4 For an earlier report on the role of IT in healthcare by thought leaders, See Blumenthal, D. and Glaser, J. "Information Technology Comes to Medicine," *New England Journal of Medicine* (356:24), 2007.

5 For more on the EA maturity stages see: Ross, J. W., 2003, op cit; Ross, J. W. and Beath, C. M. "Sustainable IT Outsourcing Success: Let Enterprise Architecture Be Your Guide," *MIS Quarterly Executive* (5:4), 2006, pp. 181-192; Ross, J. W., Weill, P. and Robertson, D. C., 2006, op cit.; and Rai, A., Venkatesh, V., Bala, H., and Lewis, M. "Transitioning to a Modular Enterprise Architecture: Drivers, Constraints, and Actions," *MIS Quarterly Executive* (9:2), 2010, pp. 83-94.

Figure 1: Stages of EA Maturity and Key IT Governance and Management Mechanisms



Adapted from Ross, J. W. "Creating a Strategic IT Architecture Competency: Learning in Stages," *MIS Quarterly Executive* (2:1), 2003, pp 31-43.

organizations continue to leverage the organizational competencies in technology and data, and the process standardization created in previous stages.

Organizations that develop and implement architectures representative of the four stages of EA maturity gain the organizational and EA capabilities shown in the middle section of Figure 1. These capabilities are needed to develop synergy between business strategy and EA.

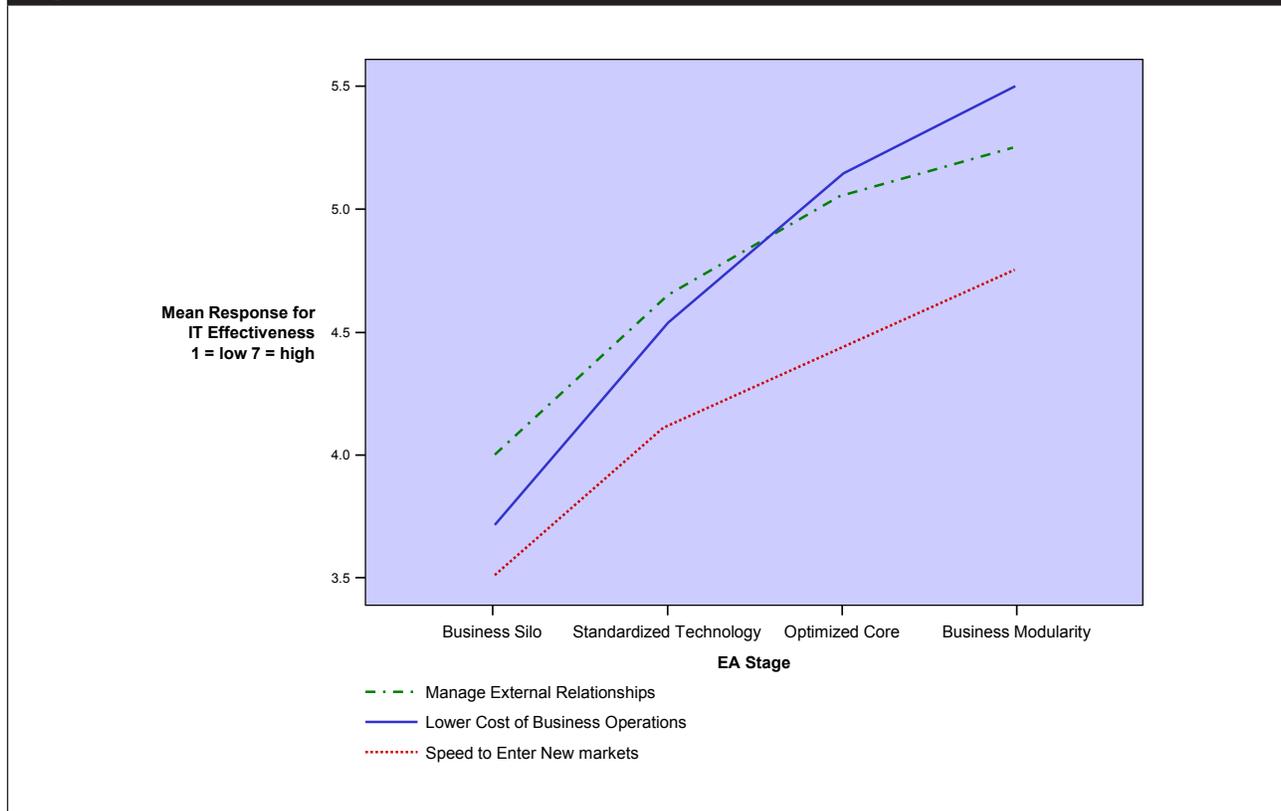
At the bottom of Figure 1, we have listed the percentage of organizations in our study at each stage of EA maturity. Over 80% are at the Standardized Technology and Optimized Core stages. These percentages are consistent with those reported from other industries in the original source article.<sup>6</sup>

<sup>6</sup> Ross, J. W., 2003, op cit.

## EVIDENCE OF THE RELATIONSHIP BETWEEN EA MATURITY AND IT VALUE

Although, organizations can derive value from their IT investments in all four EA maturity stages, our study shows that IT value and the governance of IT resources increase as an organization's EA matures. We define IT value as the intrinsic or extrinsic impact of IT use on or within the organization. Our assessment of IT value involved examining the impact of IT on an organization's market responsiveness, management of external relationships and ability to lower operational costs. The first two are concerned with externally oriented capabilities, and place an emphasis on anticipating market requirements, creating durable relationships and understanding competitors. The third is internally oriented, emphasizing the performance of tasks to yield labor

Figure 2: IT Value Increases as EA Matures



productivity and efficiency, and thus the cost-effective improvement of organizational operations.

The purpose of our study was to assess the strategic value of EA by examining the relationship between EA maturity and IT-enabled performance. With the exception of a few large hospitals, our survey sample comprised CIOs in mostly small- and medium-sized hospitals; we asked participants to provide feedback on the maturity of their hospital's EA and the value derived from their IT as measured by its contribution to organizational performance over the most recent five-year period. To determine each hospital's stage of EA maturity at the time of data collection, we provided a list of four broadly defined, aggregate IT capabilities associated with each stage of the EA maturity model. (For details about the survey methods and population sampled, see the Appendix.)

As shown in Figure 2, the CIOs in our study reported a significant and positive relationship between EA maturity and IT value in all three areas: (1) ability to manage external relationships; (2) ability to lower hospital operational costs and (3) speed of entering new markets.

### ***IT Value in Managing External Relationships***

The CIOs were asked to rate the extent to which IT has improved their organization's ability to work with external suppliers to leverage shared IT capabilities to create high-value IT resources. Figure 2 clearly shows that, in the area to managing external relationships, hospitals with the most mature EA (Business Modularity) report significantly higher IT value than those at Stage 1 (Business Silo). Specifically, as EA matures, the responding CIOs strongly agree that their organization's use of IT has enabled them to better manage and benefit from their external relationships. IT enables organizations to better manage and benefit from their external relationships because:

- EA paves the way for more effective use of IT in supporting business needs and interorganizational communication and collaboration;
- EA maturity enables IT to be leveraged to manage external relationships by documenting the interrelationships of data availability and information needs across organizational and application boundaries;

- The increased IT infrastructure integration that accompanies EA maturity makes interorganizational communications between systems possible via a shared infrastructure.

### **IT Value in the Cost of Business Operations**

CIOs were asked to rate the extent to which IT has improved their ability to lower the cost of business operations. Figure 2 shows that as EA matures, CIOs reported an increase in ability to leverage IT to lower the cost of business operations. A mature EA enables more cost-effective operations because it aids organizations in standardizing business processes and increasing data transparency throughout the organization, which results in less data redundancy, a reduction in duplicated efforts and fewer associated errors.

### **IT Value in Strategic Agility**

We asked CIOs to rate the extent to which IT has improved the speed at which their organization can enter new markets. Figure 2 shows that organizations are more strategically agile as their EA matures. This agility derives from a mature EA enabling the optimization of IT investments to digitize core business processes.<sup>7</sup>

Figure 2 clearly shows there is a strong correlation between IT value and increasing EA maturity. In other words, moving from one stage of EA maturity to the next leads to greater IT value in general. For example, the CIO of a hospital in Stage 3 (Optimized Core) said:

*“Infrastructure standardization is something we do well. Standardization on desktops and servers has also allowed us to reduce our TCO [total cost of ownership] while maintaining a solid foundation for deploying applications.”*

In contrast, the CIO of a hospital at Stage 2 (Standardized Technology) said:

*“[There is] resistance by some of [the] senior management due to cost and perception of [IT] value [and] reluctance of senior management to participate in assessment and evaluation of IT needs and strategic planning.”*

In addition to the relationships between EA maturity and the three areas of IT value shown in Figure 2, our

study identified two other interesting relationships with EA maturity.

### **EA Maturity and IT-Business Alignment**

We asked CIOs to rate the level of alignment between business and IT processes, priorities and objectives. We found a positive relationship between EA maturity and business-IT alignment (see Figure 3)—as EA matures CIOs report a greater level of alignment between the business and IT. A mature EA facilitates the realization of business objectives by aiding decisions on and the identification of IT resources that can potentially support business objectives, strategies, and priorities. One reason for better business-IT alignment is that a mature EA contributes to an improved understanding of the enterprise. This understanding creates an environment that fosters and enables shared domain knowledge.

Our findings suggest that moving from Stage 1 (Business Silo) to Stage 2 (Standardized Technology) yields the greatest increase in IT-business alignment. Two different CIOs in hospitals in the next stage (Optimized Core) described their IT-business alignment as follows:

*“Because we empower users and include them in all of our planning processes, IT, for the most part, is being pulled through the organization, rather than pushed by IT ... IT systems are no longer considered IT projects, but are <owned> by the business units, and IT acts as a facilitator.”*

*“Alignment of business/clinical needs with IT priorities has gone well, especially with the addition of a Chief Medical Information Officer, in addition to the CIO.”*

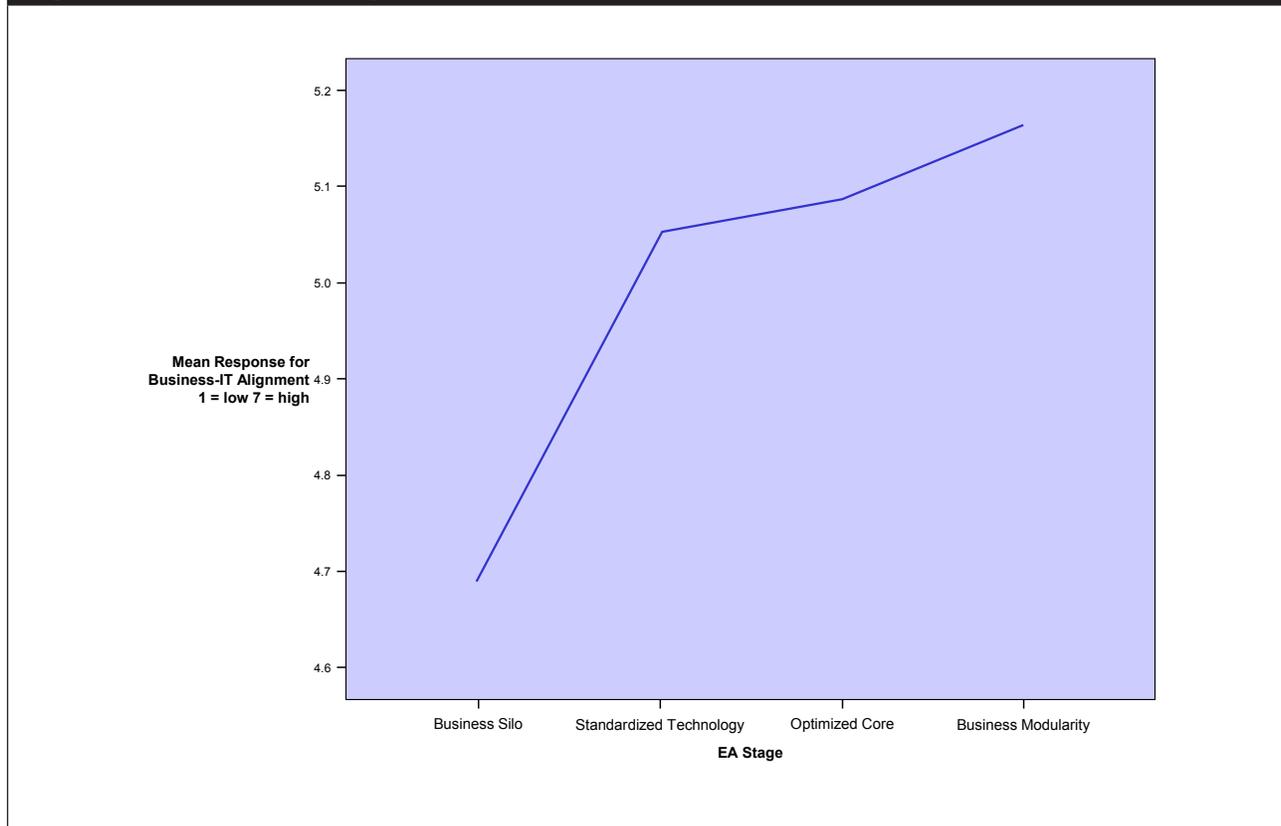
### **EA Maturity and Risk Management**

We also identified relationships between EA maturity and two different kinds of risk management:

- *Technical risk*: the risk that exists when new or unfamiliar technology, in the context of its intended use, adds to the complexity of IT projects.
- *Social risk*: the risk, commonly referred to as behavioral risk, posed by business executives' negative attitudes toward IT and IT initiatives. Social risk also includes risk associated with an organizational environment that may be unstable or highly politicized, causing

<sup>7</sup> Ross, J. W., Weill, P., and Robertson, D. C., 2006, op cit.

Figure 3: IT-Business Alignment Increases as EA Matures



reductions in commitment and resources needed to successfully complete IT projects.

Figure 4 suggests that as hospitals move through the stages of EA maturity, they increase their emphasis on managing social risk and decrease their management of technical risk. For example, the CIO of a hospital at Stage 3 (Optimized Core) cited “bureaucracy” as adversely affecting the hospital’s EA initiatives. Similarly, the CIO of a hospital at Stage 4 (Business Modularity) cited “[organizational] culture” as a dominant issue negatively affecting the organization’s EA initiatives.

## GUIDELINES FOR ACHIEVING MORE VALUE FROM IT

In the light of our survey findings and conversations with several of the participating CIOs, we present three guidelines that we believe can help organizations in any industry achieve more value from their IT investments.

### **Guideline 1: Avoid the Traditional Approach to Strategic Planning**

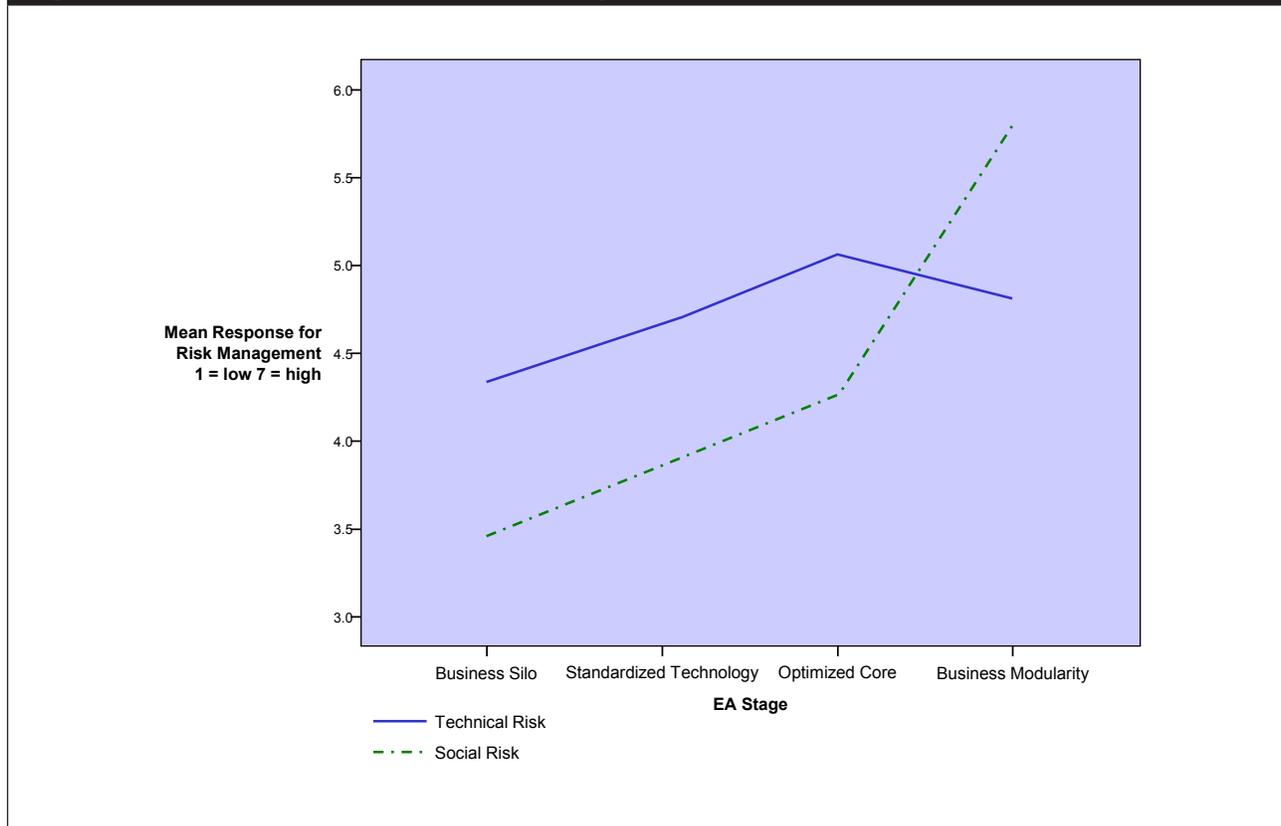
The traditional approach to strategic planning starts with top management defining a strategy or strategic trajectory. Next, business and IT managers co-design IT solutions to support the articulated strategy, and then the IT infrastructure and platform to implement the designed solutions are delivered.<sup>8</sup> The result of this traditional approach is that all efforts are concentrated on putting in place an infrastructure to support a supposedly stable strategy, and on delivering additional IT solutions rather than new IT capabilities.

However, a shift or major change in the business environment can dramatically reshape the industry structure, and often leads to a new round of traditional strategic planning. Thus, the traditional strategic planning approach does not result in business and IT strategies well-suited for dynamic and uncertain environments. As stated by one CIO:

*“The culture of this organization to stay with the ‘time tested’ [comfortable], rather than explore new ideas, presents problems when trying to adapt to a rapidly changing regulatory*

<sup>8</sup> Ross, J. W., Weill, P., and Robertson, D. C., 2006, op cit.

Figure 4: Mean Response for Risk Management



and economic environment. This culture even permeates the thinking as it applies to the IT infrastructure and planning.”

### Guideline 2: Strategize For The Future, But Maximize The Moment

It is important for strategies to be flexible enough to accommodate expected and unexpected changes in both internal and external environments. An EA is especially valuable in helping to meet this challenge because it focuses on both the present and future business and technological pressures organizations are facing or are likely to face. Using EA to strategize for the future, while maximizing the moment, is an example of “push-pull.”<sup>9</sup> The optimal level of innovative activity will occur when there is both maximum pull, as in the future-oriented map of the EA, and maximum push, which comes from the knowledge and experience through using EA as a guide to responding to major pressures.

<sup>9</sup> For more on push-pull, see Zmud, R. W. “An Examination of ‘Push-Pull’ Theory Applied to Process Innovation in Knowledge Work,” *Management Science* (30:6), 1984, pp. 727-738,

### Guideline 3: Assess the Complementary Intermediate Effects of IT to Reveal its True Value

In some cases, it is hard to assess the value an organization is getting from IT because it is not clear what should be measured and how it should be measured—i.e., organizations do not recognize where the value comes from. In particular, ignoring, overlooking or not properly evaluating or assessing the *complementary, intermediate impacts* of IT can potentially lead to flawed conclusions about the actual value derived from IT investments. Consider, for instance, the following comparison. Organizations in Group A invested in radio frequency identification (RFID) and electronic data interchange (EDI) to take advantage of the complementary effects of the two technologies. Organizations in Group B invested only in RFID. However, there was no significant difference in the financial ratios (return on equity, return on assets and debt-to-assets ratios) of the two groups. But, as a result of investing in both technologies, Group A organizations held their inventory for two fewer days than those in Group B, which resulted in an increase in available cash, and thus the ability to minimize debt financing, withstand unprecedented losses due to business interruptions and quickly

seize investment opportunities, even during times of economic turmoil. We believe the web of intermediate contributions of IT can be determined not only for a particular domain but also for the enterprise.

## CONCLUDING COMMENTS

The findings from our study suggest there are some valuable and identifiable benefits from an EA approach. Specifically, an EA strategically positions an organization to leverage its current IT capabilities and also provides a dynamic roadmap to the future. Our survey results also provide strong evidence that as an organization moves to a higher EA maturity level, it also gains more overall value from its IT investments. Although EA is not the panacea for all issues associated with achieving value from IT, we believe it is definitely a vital piece to the puzzle.

## APPENDIX: RESEARCH METHOD

In 2006, we surveyed 140 CIOs of U.S. hospitals representing a broad spectrum of size, geographic reach and comprehensiveness of patient care. We limited our study to independent hospitals and hospitals that are part of a conglomerate (e.g., those with an integrated delivery system or network) and that have a CIO at the hospital level. Our sample comprised 17% for-profit and 83% not-for-profit hospitals. On average, participating hospitals had 178 beds and 844 full-time employees. Thus, with the exception of a few large hospitals, our sample comprised mostly small and medium hospitals.

To determine each hospital's stage of EA maturity, we provided a list of four broadly defined, aggregated IT capabilities that we believe are associated with each of the four stages of EA maturity, based on Ross.<sup>10</sup> We asked each CIO to choose the description that best matched his or her hospital's current IT capabilities. Based on the CIO's selection, we inferred the hospital's stage of EA maturity. We found no significant correlation between hospital size (i.e., number of beds) and EA maturity.

The value derived from IT was measured by its contribution to organizational performance in the following three areas:

1. Ability to manage and benefit from external relationships
2. Ability to lower hospital operational costs

3. Strategic agility.

The CIOs were asked to rate the value of IT in each of these three areas over the most recent five-year period on a scale of 1 to 7 (with 7 being the highest).

In addition to the survey questions, we asked CIOs to respond to two open-ended questions about the successes and issues/problems relating to their EA initiatives.

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<sup>10</sup> Ross, J. W., 2003, op cit.

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