The Examination on Return on Investment for Information Technology in Healthcare Industry

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Abstract

This report is an examination on the Return on Investment (ROI) for information technology (IT) in the healthcare, primarily the hospital, industry. Almost every hospital organization has been moving from a paper based (legacy) system to a somewhat automated method to achieve quality of care for patient care services. Many hospitals now are moving to a total electronic medical record (EMR). Many institutions are embracing this change, where many other institutions are not, due to the high dollar cost associated with these systems. With IT now comprising for the largest budgetary item of any hospital's forecast, regardless of where they are with their systems approach, it becomes necessary to justify and rationalize the costs of these systems to the overseeing bodies of the organizations to purchase these systems. ROI is necessary for this justification, but is very difficult to quantify in hard dollars and to attribute the direct savings from the systems where other processes are reviewed and changed as well.

This research paper is prepared for the 3rd International Conference on the Management of Healthcare & Medical Technology (7 – 9 September 2003) at Warwick University (England).

Introduction

This research began with an analysis of the implementation of an Electronic Medical Record system at Naples Community Healthcare System in Naples Florida. The research is ongoing and has been expanded to include the 285 hospitals in Florida. Currently, surveys have been issued to all 285 hospitals and results are being collected and analyzed. The end result will be consensus of how "Return on Investment (ROI)" for "Information Technology (IT)" is treated by the hospital system in Florida. The end product will include a management model for including ROI in every phase of conversion to a new technology system beginning with a much neglected implementation phase.

Currently, according to healthcare workers and management of hospitals, the biggest problem with an EMR legacy system is trying to find the chart to access this information. This is an extremely inefficient method of record keeping where healthcare workers (doctors, nurses, secretaries, etc.) can spend up to 40% of their time looking for the chart (Cerner Corporation 2001). This lack of a quick method to access the patient's record causes duplicate tests and medication errors. Thus adding to the risk of a patient death and additional costs. In order to maximize profits of an organization, workers need to be able to be more efficient and have all of the information readily accessible. Additionally, the constant hunt for the chart means workers are not at the patient's bedside.

The first step many institutions take is to automate manual clerical tasks and specific processes such as admissions, discharges and transfers (ADT), test processing, reporting and storage (Lab, Radiology, Cardiology, etc.) and scheduling. The next step is to create the electronic medical record (EMR); however, the systems needed are extremely large and are an expensive undertaking due to the complexity of the software and hardware to maintain these records so that they can be accessible at all times. In some instances, these projects can be the single most expensive undertaking an organization has every encountered.

Although the EMR system improves healthcare and accuracy, the high price tags for these systems, it is necessary to justify the return that will come from this investment. However, it is very difficult to document the direct savings these systems will return. ROI for these endeavors are measured primarily by eliminating medication errors, process improvement and getting the workers back to the patient's bedside to increase the perception of better care to the patients and their families. This process improvement will then increase patient satisfaction, which will also increase return business and word of mouth advertising.

The implementation of these systems necessitates an analysis of the organization and the current processes the organization is utilizing, called "current state" and a projection of what the processes will look like when they are automated and updated called "future state". Through these analyses it is determined that many processes currently in place are not effective and need to be changed as well as the revised processes automated through the EMR. This process change and electronic information add to the value of the investment, but hinders the measurement process of the ROI for the EMR system itself.

Problem Statement

This research paper is prepared for the 3rd International Conference on the Management of Healthcare & Medical Technology (7 – 9 September 2003) at Warwick University (England).

This research centers on Return on Investment (ROI) as it relates to information technology (IT) and the impact of two important constructs – performance measurement and processes. Searching for value in information technology is something that has been measured and analyzed at various levels. However, few managers or theorists are satisfied that the search for value has produced viable outcomes. Rarely are the variables that are most valuable for quantifying uncertainty such as performance measurement and processes included in the cost-benefit spreadsheets.

Dichotomy is defined as "division into two usually contradictory parts or opinions." Therefore, the dichotomy of truth or falsehood in the area of IT Return on Investment (ROI) lies in how senior management in the public and private healthcare sells IT expansion to the Corporate Board compared to what actually happens once the system is approved. As organizations expand their technology assets in hope of improving productivity, it becomes increasingly important that the investment is justified.

Research by Lucas (1999) indicates that this is a paradox rather than a dichotomy. According to Lucas, there are many dimensions to the value of information technology. IT produces value in many different ways, some tangible and others intangible. Therefore, measuring the competitive advantages of IT creates a reliable framework for success in today's organizations. The tangible benefit of lower operational costs and increased revenues and cash flows have always been the hallmark of traditional ROI models. However, to realize value from IT procurement, the intangibles such as increased customer satisfaction and enhanced decision making capabilities must be considered.

Why organizations invest and the planning process involved in the investment is paramount to the success of the investment. Lucas (1999) is quick to point out that private sector organizations may invest in IT because others in the industry invest and they do not want to be left behind, or that IT investment may be a fad such as reengineering or total quality management. Researchers agree that the organizations that invest wisely and measure their productivity will be successful in the 21st century.

There are several research questions that bear empirical study in the field of information systems. These questions specifically pertain to managers' ability to select a system and then successfully implement a system. While performance measurement is not the central key, the empirical analysis will lead to measuring the probability of future success. These questions include:

1. What analysis should be accomplished prior to preparing the Request for proposal (RFP)?
2. What organizational divisions and personnel should be involved in the analysis and selection of a system?
3. Are managers capable of understanding the choices even if presented by experts on a consulting team?
4. Are the hospital managers' hands-on computer users?
5. Do hospital managers' understand the holistic approach to systems analysis and design?
6. What strategic constituencies and competing values will be prevalent in the company during the selection process?
7. Are system-wide processes understood?
8. Has the current system been evaluated and deemed ineffective?
9. Were processes built into the implementation phase to ensure ROI?
10. Does control and feedback processes exist?

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The research questions are not inclusive. However, as our research indicates it is extremely difficult to begin the process after the system has been purchased. However, the manager must start somewhere and beginning late is better than ignoring the problem.

Research Hypothesis

The following hypothesis were used to develop the survey administered to 285 hospitals in Florida.

Dependent Variable

- Managers' use or ROI for IT

H1: There is a significant relationship among the indicators of Managers' usage of ROI for IT included as independent variables in the study.

H2: There is a significant relationship among the indicators of Managers' usage of ROI for IT included as demographic variables in the study.

Independent Variables

- Measurement of ROI for IT.

H3: There is a significant relationship among the indicators of Managers' usage of ROI for IT and Managers' measurement of ROI for IT.

- Use of ROI for IT for Decision-making.

H4: There is a significant relationship among the indicators of Managers' usage of ROI for IT and Managers' use of ROI for IT for decision-making.

- Inclusion of ROI for IT in the Implementation Process.

H5: There is a significant relationship among the indicators of Managers' usage of ROI for IT and Managers' inclusion of ROI for IT in the Implementation Process.

Literature Review

Quality, affordable healthcare is every person's concern and goal when they or a loved one go to a hospital for care. However, as Merry and Crago (2001) points out: The healthcare industry continues to offer us lower quality at ever-increasing cost! Americans have lauded the remarkable technical capability of modern medicine – "miracle" drugs, transplants, genome therapy – were astounded by the Institute of Medicines landmark report, "To Err Is Human." It turned out the same system accomplishing technical miracles was also responsible for 44,000 to

98,000 deaths annually in hospitals due to medical errors. As the IOM report made painfully clear, the health care system itself was between the fifth and ninth leading cause of death in the United States (Merry & Crago, 2001).

Quality of Care in a healthcare setting is relatively a new concept. Until 1987, healthcare quality concepts remained isolated within a learning science tradition dating to Hippocrates (third century B.C.). Medicine was then, and still is, taught and learned as a craft. Medicine traditionally relies on the unique truism that "patients may die, despite the consummate skill of the practitioner…." (Merry & Crago, 2001). No other field has this ready plausible explanation for poor outcomes. It is inconsistent quality of care that generates these widely variable patient outcomes from region to region and health system to health system (Merry & Crago, 2001).

Compare healthcare's quality statistics with those of other industries. To compete in world class markets, manufacturing and service industries must operate with quality systems capability in the range of 5 to 6 Sigma, that is between 230 and 3.4 defects per million opportunities (Swinney, 1990). In recent studies, healthcare today ranges from 2 Sigma to 4 Sigma, which translates to between 308,000 defects per million to 6,210 defects per million (Merry & Crago, 2001).

To improve quality of care, automation of tasks with checks and balances must be done to assist the healthcare worker with their care for the patient. In healthcare, the investment of information and communications technology (ICT) is expected to positively affect patient care. But, how do we measure success of the investment of technology to patient care and quality of care? Two factors must be looked at; the quality-of-care outcomes and the return on investment of the technology.

RETURN ON INVESTMENT

Traditional ROI methodologies for deciding if one investment will enable the organization to successfully implement another initiative in the future include a variety of models. One approach that appears to suit IT investment is the options pricing framework. The philosophy of the options pricing model is that one project can provide the structure for another project in the future. While this approach is controversial among theorists, it has merit when analyzing the intangible benefits of IT investment.

One famous options pricing model is the Black-Scholes model of 1973. This model, as described by Lucas (1999) was built on several assumptions: (1) the interest rate is constant and known up front; (2) there is a stock price with a variance proportional to the square of the price; (3) no dividends are paid on the stock; (4) the only time option exercised is at expiration; (4) there are no transactional costs; (5) the organization can borrow at the beginning interest rate; and (6) there are no selling short penalties. While this model is controversial, it does fit the scenario of investment in IT with anticipation of receiving a return for an organization's investment. Built on the premise that a current investment will allow future technology initiatives, this model is a viable methodology for analyzing technology projects.

Benaroch and Kauffman (1999) evaluated the theoretical basis of evaluating a range of optimal pricing models to IT investment when they looked at a shared electronic banking network. In this research they determined that the Black-Scholes model is effective for IT evaluation in light of the underlying assumptions. They further supported the use of this model,

asserting that information systems literature makes a strong case for the use models such as Black-Scholes. Their research indicates that due to the hard decisions necessary in information systems management, traditional models such as net present value (NPV) and discounted cash flow (DCF) are not enough to accurately predict return on investment (Benaroch & Kauffman, 2000).

Organizations utilize a variety of methods to evaluate payback. These include economic value added (EVA) to measure the after-tax operating profits, a standard cost/benefits analysis to measure return on investment, and historical analysis such as data warehousing. However, the most common method is still the net present value method to determine if the initiative justifies the investment (Violino, 2000).

Uncertainty still clouds the methodology when using ROI methods such as NPV. Static valuation models such as NPV and DCF tend to undervalue investments made under uncertain conditions. Analysts then resort to instinctive methods such as "synergy" or "strategic importance" to compensate for the uncertainty. In these cases, analysts call for real options such as a call option. By using the call option, the analyst gets flexibility often missed by DCF and NPV methods. The value of the call option increases as the value of the stock increases (Latimore, 2000).

Other traditionally utilized financial applications to measure ROI include the payback method, accounting rate of return on investment, and a cost benefit analysis. Historically, measuring the time required to pay for the purchase or calculating a rate of return for the investment that includes depreciation and income earned by the investment, was sufficient to measure the return to stakeholders. The vast, but hard to measure intangible benefits of IT, create a unique challenge for managers.

Potential value, as described in research by Davern and Kauffman (2000), is the ability to assess the theoretical framework of potential value with some certainty in order to realize a return on the organization's IT investments. Traditional financial modeling is deemed biased by some researchers when measuring intangible benefits. Information technology creates an immediate financial expenditure, but the payback is over a considerably longer period of time than traditionally reviewed in a typical financial model (Laudon, 2000).

Limitations of traditional financial models include consideration of the political position in the organization. While the political position has very little to do with IT, it usually affects the period of time allowed for ROI. Additionally, traditional ROI models assume that costs and benefits are known and expressed in a common metric such as money (Laudon, 2000). This is not always the case when measuring ROI for IT.

According to Davern and Kauffman (2000), the firm's realization of value is influenced by complementary assets such as human capital and business process design. The research considers potential value for information technology investment by examining the relationship among potential value, conversion contingencies, and realized value. It is understood that IT purchases have value at project selection and post investment evaluation in addition to the actual production required of the system. Therefore, the attitudes and opinions of those managers responsible for IT purchase, implementation, and control become extremely important to the success of the overall project.

Davern and Kauffman (2000) divided ROI for IT into three distinctive categories; (1) potential value, (2) conversion contingencies, and (3) realized value. The premise was to measure ROI at separate phases of the process to ensure processes were in place to increase the success of receiving a return for the technology investment. Many managers go directly for the potential value and forget the contingency impacts on the project. This affects the organization's ability to

realize potential from the investment. Additionally, there are a variety of issues that can affect the value once an application or infrastructure has been built.

Measuring ROI in information technology is a noble idea carved from idealists who actually think it is possible to make a plan and work that plan. Experience shows that organizations are reluctant to measure ROI for various reasons. Job security, computer phobia, management freedom, and that ever-prevalent line "we've always done it that way" are among the reasons why it is difficult and sometimes undesirable to measure ROI.

Success through information technology can be defined in numerous ways. If an organization is successful at changing processes to utilize technology for increased productivity or a reduced workforce, then this is a positive action. Additionally, an organization reducing its paperwork or increasing customer access could also be termed a positive action. Any number of technological victories such as the examples cited would reflect positive managerial initiatives. The key is to plan for these from the beginning and build this success throughout the design and implementation of the system. The most effective and efficient organizations throughout the world find a way to do this. It usually begins with dynamic, in-touch, leading-edge management.

According to Collins (2000), the best way to measure ROI is through the combination of document management and workflow analysis. This combines to be the automation of the business process where information and tasks are flowcharted through the system and improvements are made. This allows for timescales and measurement to increase efficiency and improve productivity. Collins (2000) believes that managers must change how they view data. In the past, data mining, data warehousing, and information storage were joined together with document management and workflow. However, while they interact with each other, they must be managed separately. Processes and workflow are the keys to successful document management.

New technology for document management is expensive and the skills to run the equipment are not necessarily available in some public agencies. As much as 80% of businesses expect their document management costs to rise in the next five years. Of the respondents, 24% felt that expenses would rise by more than 61%, while 25% felt that costs would increase between 21% and 40%. However, despite this, the respondents rated easy document sharing, time critical document access, and improving staff efficiency as major concerns for this decade (Document Management, March, 2000).

Managers are behind the power curve when it comes to measuring the impact of their IT purchases and productivity. In fact, there are those who feel that the size of the budget is sometimes the sole determining factor in the purchase and use of computer systems. Another point is that ROI for technology management is an evolving process. It is still relatively expensive and more technology is being developed as this is written. Issues such as digital paper, imaging, workflow management, wireless technology, bandwidth, and web-based companies are emerging to create a relatively new industry. The implications of these changes are still in question resulting in reluctance among companies and governmental agencies to move quickly (Gingrande, 1999).

Reliable research indicates that managers have adapted to change for generations. End-user computing is relatively new to the business world and prior research is limited. Reacting to change efficiently by using end-user computing innovations is a challenge for today's managers (Mintzberg, 1990). Computing is still in its infancy for most applications, prompting managers to determine if they should delegate tasks or be a hands-on leader. However, expanding computer capabilities are numerous and remaining a hands-on manager is extremely dangerous.

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Guimares (1986), in a study of 173 "Fortune 500" companies, identified a lack of company-wide perspective on information systems as a major problem. The ability of managers to improve decision-making capabilities and employee production depends on management innovativeness. The ability to determine if the system is working is dependent upon performance measures. Other examples of task difficulty and lack of productivity were cited by Peters & Waterman (1986) in a study of Frito-Lay, Proctor and Gamble, IBM, and Digital. The solution was to implement performance measurement policies and procedures.

The intense usage of computers incorporated into the workplace in the 1980s and 1990s forced managers to change their traditional methods of management (Williams, Rice, Rogers, 1988). Since different individuals provide different solutions to similar problems, management's approach to end-user computing could produce a vast difference in productivity. This creates a need to address the managers' use of end-user computing by measuring the effects of managerial innovativeness. There is a tremendous gap in the abilities of today's managers and the technical personnel in an organization. Combining technical expertise with the needs of the organization is extremely difficult. Many times the budget drives the change. Managerial innovation is a key to creation and evaluation of performance measures that will ensure efficiency and effectiveness in the use and purchase of computer assets. Managers must know exactly what they want to get from the system they have or propose. Yet, they listen to sales personnel, other managers, their own technical personnel, and any other source of information they have and fail to begin with a basic problem statement prior to jumping into the purchase or use of information technology.

Today's managers must supervise personnel, providing computer utilization guidance to achieve and demand maximum output. However, individual managers may lack the knowledge required to determine efficient computer information system utilization. The level of innovativeness may determine if managers effectively influence change in organizations. Downs and Mohr (1976) contended that technical innovations require a completely different decision process than administrative decisions. Management of end-user computing falls into the technical category and prompts managers to examine the process from a different angle than they are accustomed to (Kimberly, 1981).

Management demands performance measures to improve operations and productivity. Van de Ven (1986) describes four problems relating to management that should be addressed by performance measures: (1) the human problem of managing attention; (2) the problem of managing ideas; (3) the problem of managing a part-whole, or managing an idea as it develops over time; and (4) the problem of institutional leadership, where management must create a structure conducive to measurement. In short, the managers' inability to cause employees to think outside of the box, or innovatively, is a major problem that must be addressed through performance measurement

Poister (1999) indicates that performance measurement is becoming a major issue with public sector organizations. Contemporary management is examining how to integrate the holistic approach of utilizing performance measurements to create efficiency and productive work environments. The IRS recently underwent massive changes spearheaded by improved performance measurement with outstanding results. Three elements now comprise performance measuring under the new IRS plan: (1) customer satisfaction, (2) employee satisfaction, and (3) business results. The focus of the IRS will continue to be ease of filing. They plan to use performance measurement of their three key elements to reach this goal (Jones & Luscombe, 2000).

There are many horror stories about lessons learned in the world of MIS management. However, the one that perhaps rings the most true is that processes are the key to long-term

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success. Viewing the system in a holistic manner and working the processes will produce solid management principles and consistent application. According to Kueng (2000) process organizations are replacing functional organizations in order to create a competitive advantage in today's fast-paced, ever-changing environment. The key to this is performance measurement and management.

Organizations that invest in information technology, whether public or private, continue to wrestle with how to measure and calculate ROI and how to make that knowledge work for them. While the theory surrounding ROI may be on its face applicable to both the private and public sectors, research may actually find that the practice is not as applicable to both. While the private sector examines its "bottom line," the public sector must consider its policy initiatives. Therein may be the real difference between the two sectors. ROI for the sake of reduced costs and increased revenues sounds good to the corporate managers; the public administrator must consider the public good and the public trust.

QUALITY OF CARE

In the past, Donabedian's structure for assessing Quality of Care was the most well known method and has been used for many aspects of healthcare (Donabedian, 1980). According to Hebert (2001), in this model the overall dependant variable is quality of care. It includes three sub-categories of variables: structure, process and outcome. Structure includes the human, physical and financial resources that are needed to provide healthcare. Process of care is the set of activities that goes on between practitioners and patients. Outcome is the change in the patient's current and future health status that can be attributed to the preceding healthcare. The underlying premise in the Donabedian's structure is that the relationship between structure and process or process and outcomes must be understood before changes in one will result in the expected changes in the other.

Hebert (2001) goes on to say DeLone and McLean's work in identifying six variables used to measure success from the Management of Information Services (MIS) perspective were: System, Quality, Information Quality, System Use, User Satisfaction, Organizational Impact and Individual Impact. DeLone & McLean's work in identifying MIS success measures assists in conceptualizing the structure-process-outcome variables in a technology context as well as contributes to developing a framework useful for accumulating results (DeLone & McLean, 1992). Similarities between Donabedian's and DeLone & McLean models are:

- Structure – information quality, system quality
- Process – system use, user satisfaction
- Outcome – individual and organizational impact

Return on investment of the technology used for patient care goes one step further and asks not only if the technology works, but at what cost and whether it is a good replacement for current practice. An analysis may consider a number of elements: specification; performance measures (time, quality, cost); outcomes (safety, efficacy, effectiveness); summary measures (cost comparisons); operational considerations (access, acceptability); and other issues (confidentiality, legal) (Hebert, 2001).

Hebert (1996) indicates that automating manual clerical tasks (process) is one of primary reasons for technology in patient care. In contrast to the prediction that computers free up time to spend with patients, users feel they have less time. This is because the number of staff remains the same, but they are also able to complete more tasks and the acuity of the patients is ever

increasing. Also the learning of changes in process and automation of the nursing tasks can be daunting at first.

There are several reasons for this, first, the average age of a registered nurse is 45 years-old and workers at this age have more difficulty adapting to change, hospitalized patient acuity status has been increasing and their care becoming more complex, thus requiring more time for the care givers and a well recognized national shortage of healthcare staff, most notably nurses, has resulted in higher patient staff ratios (Georgia Baptist College of Nursing, 2001).

Hebert (1996) goes on to say that "The well defined roles and responsibilities of healthcare professionals may change as automation blurs the distinctions between structure and process". These changes are experienced primarily by nurses and physicians, as changes in process are expected to occur as a result of changes in structure. For many participants the computer provides more timely information, but whether their actual decisions change is not clear. Role changes also occur when technology is used by one group to accomplish tasks formally completed manually by another group. An example could be that prior to total automation, the physician would write their orders on paper, the secretary would input it into the computer and the charge nurse would verify them. Now with automation, the physician and the nurse enter their orders and documentation directly into the system; all three roles change (Hebert 1996).

Hebert (1996) also states that visible accountability can be seen with the changes in professional roles which can also result when scrutiny of professional decisions and actions becomes possible through integrated systems. This change is experienced by all groups of caregivers, but occurs primarily in measures of structure for lab technologists and pharmacists. Automating tasks such as reporting results or medication profiles creates an electronic audit trail documenting the volume and accuracy of work accomplished (Hebert, 1996).

In a manual paper system, lost requisitions plague both nursing and ancillary departments, often meaning delays in-patient care decisions. It is difficult to identify who made the error and this creates an organizational dynamic with whole departments or units deemed by others as "incompetent" and always losing or not completing requisitions correctly. Use of an integrated system creates opportunities to identify individuals who have incorrectly completed requests, collected specimens or entered results and take corrective action (Hebert, 1996).

For nurses and physicians, this change occurs primarily in process measures such as patient-care decisions that are recorded and immediately available for inspection by other professional groups. Prior to automation, decisions, use of resources and certain aspects of patient care are often not communicated well or are invisible. They maybe known only by an individual practitioner and are expected to occur as part of a professional practice. With the use of an integrated system, this information is on-line and is available and laid out for all of the patient care givers. Also, the information is available for scrutiny within one's own department or peer group, as well as across departments. Examples may be that it becomes easier for pharmacists to make suggestions for drug administration because of an interaction for that patient, or for nursing to identify potentially inappropriate orders (Hebert, 1996).

After examining some of the issues for the utilization of the system and the technology, we need to examine how we need to measure the effectiveness of the return on the investment. To do this, we need to evaluate the different stages of the evaluation of the ROI outcome process.

ROI in Healthcare

In healthcare, information systems are not a commodity that is sold to the patient. There are no billable services and therefore no direct income. The inherent benefit of an information system is indirect – it is a tool and only a tool to improve and record patient care. The value of any tool lies in its ability to help accomplish a desired task. In this case that task is the delivery of the highest quality care for the lowest cost, while meeting all regulatory and third party payer requirements (Dunbar, 2000).

The decision to purchase new equipment in the manufacturing industry has always been decided based upon Return on Investment calculation, or in other words does the new machine pay for itself in terms of reduced expenses and/or increased profits. In healthcare the purchase of an electronic medical record (EMR) has been subjected to the same cost scrutiny as other new equipment but the calculation is almost immeasurably complicated (Dunbar, 2000).

Many healthcare organizations are still investing significant time and effort in complex measurement processes to attempt to track returns. However, some are now beginning to question the value of the entire exercise. For many, the ROI of the IT investment is a pointless question with no meaningful answer. The reason for this change of perspective is the ever-increasing integration between technology and the core business processes and operations. The pervasive impact of technology now means that in many cases information technology is so inextricably intertwined with people and processes that the identification of specific technology-related benefit streams is of marginal value (Axson, 2001).

Axson (2001) then goes on to say that during IT's first 25 years, there was still a clear distinction between the technology and the other elements of the business. Inputs and outputs were highly regulated and structured, and the handoff from people to machines was clear-cut. Starting with the PC and accelerating with WEB and wireless mediums, those clear boundaries have been obliterated, making it almost impossible to isolate each element.

A secondary influence has been the realization that many technology investments have failed to deliver the expected returns, not because of technology failures but because of poor process design or inadequate training or education. Too many investments have simply automated inefficient processes or have delivered incredible functionality that no one fully understands how to leverage. It is only the combination of the judicious use of technology, optimized business processes and suitably trained and motivated people that in concert deliver the true value of a technology investment. As such, isolating a single input and attempting to measure its impact is akin to assessing the direct contribution of cheese to a pizza.

So, how should we measure and evaluate ROI of Information Systems? We have examined many aspects on clinical process improvements through the use of technology; however, we can not call all of these an "IT" project in itself, but a project targeted at developing new or improved activities, more productive workers or more efficient services. The best method to measure the ROI is through three areas: people, process and technology, and then translating these into quantifiable returns related to utility of the products and services offered and the cost of delivering them (Axson, 2001).

If we used an example of an Orders Management system, we could expect the benefits in terms of better worker productivity, decrease and elimination of duplicated tests, on-line access to test information, improved customer satisfaction and so on. However, implementing the new system is only one element of ensuring the full value realized. Having every order accurately inputted and processed through the system cannot be done without adequate training and education of the workers. Creating a system that is not user friendly and does not works within

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the correlation of the department's workflow objectives will not be used by the workers and does not add value. Better customer service is not generated if the workers are frustrated by the system and comment to the patients about this frustration.

Axson (2001) indicates an investment evaluation would address the following:

1. Training workers to work effectively on the system and have experts close by when there is an issue for assistance (people).
2. Getting worker input on the design of the product. Having a work group to continually review the system and make recommendations and changes to the system (process).
3. Returns to be gained from implementing a new order management system (technology).

Axson (2001) states, once investments are viewed in this context, it becomes easier to define expected benefits and subsequently measure those returns. One other crucial consequence is that this explicitly demands the creation of a multi-skilled, cross-functional team with shared accountability and responsibility for success. No longer can users point fingers at IT and vice versa, because the degree of mutual dependency for success is explicit (Axson, 2001).

Remenyi (2000) indicates that measuring and managing of IT benefits is a difficult challenge that has plagued the IT industry, IT professionals, consultants, academics, CEO's, Boards of Directors, CIO's and other managers for many years. Remenyi (2000) states that the main reason for this is that despite the considerable amount of research conducted by academics and consultants so far, no comprehensive or rigorous economics of information has been developed. By economics of information is meant a systematic series of concepts and theories that explain the role which information and information systems play in assisting individuals or organizations in their conception, production and delivery of goods and services both in private and public services. There are probably several reasons why the economics of information has not been developed. One of the most important reasons is that the subject of the economics of information is a very difficult one both from a theoretical and a practical point of view and most practitioners respond to the challenges it offers by either attempting to ignore it or alternatively coping with the problem by understanding its importance.

Conclusion

As stated in the beginning, this research paper is one in a series in the process of conducting an analysis of the healthcare industry in Southwest Florida. Measurement of Return on Investment (ROI) is critical to the budget process and strategic planning. Further study of this issue is dictated by the costs of technology and the failure of organizations in healthcare to implement processes that take advantage of the full potential of technology.

Return on Investment for Information Technology in the Healthcare (Hospital) Industry to achieve quality of care is an important issue for patients, healthcare workers and hospital managers. Information Technology is needed in this industry to provide access to information to save patients lives each and every day. However, there is no specific formula or rule of thumb which is able to measure the effectiveness from a return of the dollar investment alone. Computer based products are needed to eliminate the paper. Connectivity to the system is needed for the healthcare workers to access the system in a confidential and secure manner. Reliable and redundant systems need to be in place for continuous accessibility to the information at any time for the care of the patient.

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These systems are expensive and necessary. They are also needed to streamline productivity of the patient's care. Automation of drug entry systems can prevent medication and medical errors which are made each day due to handwriting errors and human error at a savings of $4,700 per admission is one aspect of ROI for an EMR (Graham & Snowe, 2001). Also adding to the value of the system and the ROI are: the reduction of duplicated tests, worker productivity gains, better patient satisfaction survey results, reduction in over-time costs, reduction in paper and form costs, employee satisfaction, physicians satisfaction, length of stay reductions, risk reductions from better tracking of slips and falls, etc.

Many institutions have invested millions of dollars into wireless infrastructures so that healthcare workers can access patient information to assist with the decision process of the patient's care. Richard M. Scrushy, chairman and CEO of HEALTHSOUTH indicated that they have saved between $40 to $50 million annually in their facilities by building wireless infrastructures and capturing all aspects of patient and billing information with the implementation of an EMR. Currently HEALTHSOUTH is building the first entirely digital hospital to the tune of $100 to $125 million (Fickel, 2001).

The September 11, 2001 tragedy stressed the need for hospitals to have accurate, up-to-date and readily available information for patient care. When anthrax was found in four Washington area postal workers, Kaiser Permanente was able to identify hundreds of postal workers who may have been at risk of infection and had nurses contact the workers to inquire if they were symptomatic of the disease. The hospital updated physicians and the CDC twice daily with e-mails and automated voice mail (Kolbasuk-McGee, 2001). Without this automated system, other postal workers could have died if they were not treated, or knew about their exposure.

However, if the healthcare workers do not like the system, the system is not readily accessible or when the workers do not have the ability to vocalize and request positive changes to the system, then no matter how much money has been invested into the system, it will fail.

All three aspects: technology, optimized business processes and suitably trained and motivated people are necessary to provide true ROI of any system. "As such, isolating a single input and attempting to measure its impact is akin to assessing the direct contribution of cheese to a pizza"(Axson, 2001).

As noted earlier, this research is ongoing and should be concluded in early 2004. Currently, forty-six of the 285 hospitals in Florida have responded with more surveys coming in daily. Once the survey count reaches an acceptable sample, statistical analysis will help determine the management model for ROI. It is the opinion of this team of researchers that such a model will create a significant impact in the healthcare field.

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