
The Value of Information Technology in Healthcare

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SUMMARY • NOT ONLY WILL healthcare investments in information technology (IT) continue, they are sure to increase. Just as other industries learned over time how to extract more value from IT investments, so too will the healthcare industry, and for the same reason: because they must. This article explores the types of business value IT has generated in other industries, what value it can generate in healthcare, and some of the barriers encountered in achieving that value. The article ends with management principles for IT investment.

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Despite the hype, IT is still just a tool.

MUCH HAS BEEN written about deriving business value from information technology (IT) investments in general, by industry, and specifically in healthcare. One would think the process, metrics, and leadership requirements are well understood and widely practiced at this point in time. However, in healthcare at least, that is not the case. From department managers to physicians to senior executives, the value of IT in healthcare is little understood, hotly debated, and by most accounts exceedingly difficult to achieve. So why is it important to revisit this topic now? The answer is, because healthcare, much like other industries in the past, is faced with severe business challenges at a time when IT is poised to be one of the greatest facilitators to solve them.

Like the automobile, steel, and manufacturing industries in the late 1970s and 1980s, healthcare is facing quality, cost, and service issues that are threatening the industry. Furthermore, as with those other industries in the past, healthcare has spent at least a decade investing in basic IT infrastructure (networks, computers, etc.) and back-office transaction processing systems (human resources [HR], billing, finance, etc.). Just as in these other industries, healthcare for the most part has yet to see the productivity, quality, and decision-making improvements its investments in IT had promised. As other industries proposed in the late 1980s to add to their unproductive IT investments by installing enterprise resource planning (ERP) and customer resource management (CRM) systems, among others, at horrendous cost, so now is

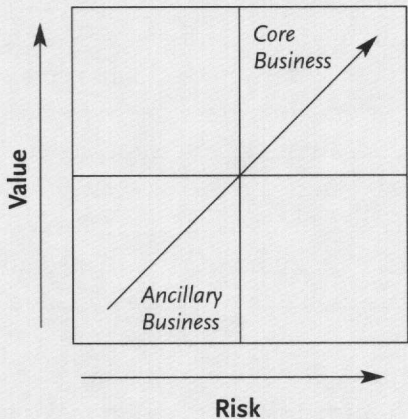
healthcare preparing to invest in these kinds of systems as well as electronic medical records, computerized physician order entry, picture archiving and communication systems (PACS), and other high-cost, highly complex systems. Did these other industries achieve business value from their IT investments? If so, how? What lessons can be learned from their experience to help healthcare better use IT to conquer the challenges it faces?

THE BUSINESS VALUE OF IT

Despite the hype, pervasiveness, and even mysticism surrounding information technology in business, IT is still just a tool. Unfortunately, because of that hype, it is often touted as a panacea for any business ill, an inherent good, and worthy of investment; or it is adopted simply for the privilege of owning the latest technology or because everyone else is investing in it. However, although only a tool, it is expensive and complex, and its value is ultimately dependent on how it is used. Furthermore, in most cases, its value is dependent not on individual use of the tool, but on its use by many people across many organizational boundaries. Lastly, like the home handyman, one seemingly can never have enough new tools.

Tools create value by being used for something. The same is true of IT, and that "something" is to support business goals. The relationship between IT investments and the business goals they are supposed to help achieve is often ill defined, not well communicated, and not ultimately measured. However, when IT is

Figure 1: First Dimension of Value—Core Business Impact



employed as a business tool to support well-defined business goals and with the commitment of the business leaders accountable for achieving them, it can provide and has provided measurable, real business value.

Dimensions of Value

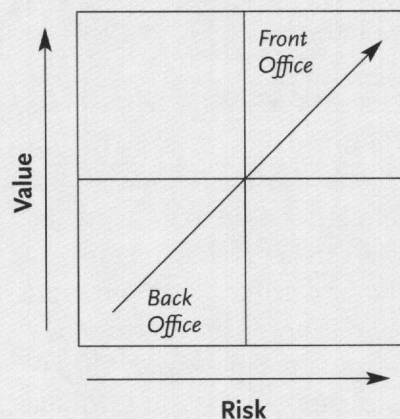
The value that IT can bring to a business may be thought of as existing in one of three dimensions. The first dimension is the relationship of the IT investment to the core business processes. The more the IT investment supports the core business (computer-aided manufacturing, automatic teller machines, etc.), the higher the potential value of the investment and the greater the risk of failure to achieve that value (Figure 1). This accounts for the many examples of catastrophic failures in ERP and CRM investments and for the many other examples of successful business transformations based on these systems. Their value and risk arise from their close relationship to core business processes and the need to change those

processes to achieve value from such IT investments.

The second dimension is that of the IT investment's relationship to the customer. Is it a back-office or a front-office system? Back-office systems (HR, payroll, billing, etc.) generally generate less business value but are less risky to implement (Figure 2). Front-office systems (ordering systems, scheduling, etc.) affect the customer and can be key to determining his or her experience (good or bad) with the business.

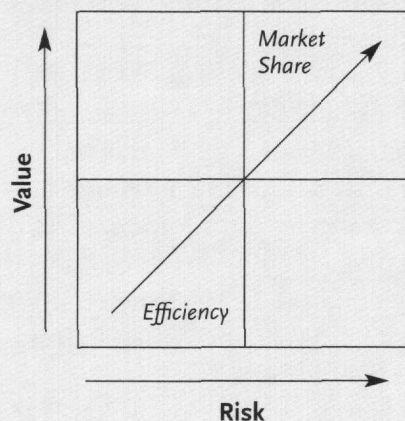
The third dimension is that of the business goal for which the IT investment is made. Is it an efficiency goal (cost or quality), or is it a market-share or new-product goal? Again, efficiency goals are easier to achieve and less risky, but do not hold as much potential value for the business (Figure 3). Market-share and new-product goals usually involve more change, and thus more risk. However, if successful, they bring new revenue and new opportunities.

Figure 2: Second Dimension of Value—Customer Impact



IT investments should be designed to improve productivity ratios, market share measures, and quality metrics.

Figure 3: Third Dimension of Value—Market Share Impact



Using the example of other industries' investments in IT, one can easily see that they have moved along each of these dimensions from the low-value, low-risk quadrant to the high-value, high-risk quadrant. Those businesses that have executed well in this quadrant have reaped the rewards. For example, the financial services industry went from investing in back-office, worker-productivity systems in the 1980s, with little impact on their core business, to investing in front-office, core systems, such as online trading, in the 1990s, which transformed the entire industry.

Measures of IT's Value to Business

The ultimate measures of IT's contribution to business value are the same metrics used to measure the business in general. IT investments should be designed to improve productivity ratios, market share measures, and quality metrics. These investments can do so in a number of ways.

Productivity. IT first produced business value by making workers more productive, typically by automating routine, simple tasks, such as accounting journal entries, payroll production, and inventory management. As systems improved, these productivity improvements also appeared in core business processes such as order entry and manufacturing control. In some cases, the use of IT enabled the elimination of a whole class of labor, such as in robotic manufacturing and automated telephone switching.

Information for decision making.

Although usually difficult to quantify, IT has brought great benefits to improving decision making. From the basic production of management information to advanced systems such as demand management in the airline and other industries, IT has provided a more comprehensive and objective set of information to be used in management decision making. Major business decisions, such as making a new product or building a new store or plant, now are rarely made without the benefit of extensive, objective, and thoroughly analyzed information. For that matter, making routine decisions like inventory replenishment cycles and timing of marketing promotions seems unthinkable without such information.

Product/service customization. IT has made possible a literal explosion of products and services, each slightly different from the next and the best targeted with precision at a particular customer. This mass customization has allowed companies to broaden their product lines and make each more relevant to its particular

customer, thus increasing sales at a reasonable cost.

Quality. Quality improvement is a goal of almost any business or industry. IT has allowed the process to become more objective and more measurable. Whether in improving manufacturing tolerances, reducing instances of lost baggage, or achieving higher connection rates in cellular service, IT has made much higher quality levels possible.

Service. IT has enabled businesses to achieve service levels that were previously unattainable. The potential for high levels of service seen in returning cars in the car rental industry, package tracking in the distribution industry, and just-in-time replenishment in manufacturing would be impossible without IT. More basic service improvements, such as online access to brokerage and bank accounts, notifications for car and pet checkups, and even the pervasive use of credit and debit cards are also the result of focused investment in IT.

Measures of IT's Value to Healthcare

Healthcare is following the same path blazed by other industries in realizing the value of IT investments. However, healthcare is at least ten years behind most other industries in its efforts to dramatically redesign its business and clinical practices to optimize use of IT and thus receive the greatest value from IT investment. That healthcare is lagging behind other industries in using IT is good news because the learning necessary to use IT has occurred in these other industries and should not have to be repeated in healthcare. On the other hand,

healthcare is lagging behind because of some significant and unique barriers, which will need to be overcome before healthcare can reap the same level of benefits from IT as other industries. The potential value of IT to healthcare can be viewed in the same manner as in other industries.

Healthcare investments in IT have not traditionally been made in support of core business (or in this case, clinical) processes. Ancillary departments such as laboratory, radiology, and pharmacy have long been automated, but nursing units, clinics, and surgical services are only recently beginning to use IT. If one considers the proportion of both revenue and cost generated in these areas, they clearly fit in the high-value, high-risk quadrant of the core business impact dimension.

Even in the ancillary departments, in many if not most cases, IT is used for scheduling, inventory management, and other tasks that support the core work of the department but do not actually change that work. Obviously, automated laboratory instruments and PACS in radiology do support the core work of their respective departments, but even in these cases, the workflow of the department is frequently not changed significantly to take advantage of the technology. Therefore, while we no longer have laboratory technicians manually performing many tests, we also do not yet have high-volume, large-scale laboratory consolidation, nor totally automated order entry or distribution of results. In radiology, film has been mostly eliminated by using PACS, but interpretations still are not being

Investments that improve capacity where demand for that capacity already exists are relatively sure winners.

made offsite or around the clock at optimal cost.

Considering the customer impact dimension, IT investments in healthcare have traditionally supported back-office operations. Billing, HR, payroll, and materials management systems are all examples of automating the back office mostly for productivity and cost-reduction benefits. The use of these systems also produces the additional benefit of improved information for decision making. Scheduling and registration are examples of front-office functions that have been automated, with benefits from improved productivity and throughput as well as increased customer satisfaction. However, even here, these systems are often not implemented enterprise-wide, thus reducing the potential benefits. Imagine having to make multiple calls to multiple people using different IT systems to reserve connecting flights on the same airline. That is exactly what happens to many patients trying to make multiple appointments for different services in the same hospital.

Information technology helps eliminate many of the constraints of time and location for customers. We can bank from almost anywhere at anytime; we shop around the clock, even internationally. Yet, we can only receive information from our healthcare providers or schedule services with them during prescribed business hours. The promise of front-end IT is in enhanced customer service, the development of new products and services, and the ability to deliver services without many of the traditional time and location constraints.

The third dimension of IT investments, that of the relationship to either efficiency goals or to market-share or new-product goals, also exists in healthcare. Just as in the other dimensions, healthcare's investments in IT started in the efficiency quadrant and are progressing (albeit more slowly than in other industries) to supporting market-share and new-product growth. As the preceding section outlined, IT makes possible the mass customization or unbundling of products, thus giving an organization more higher-margin products with which to compete. In healthcare, the best example is the contracting process with payers. By offering services bundled or unbundled and priced in a variety of different ways and with varied service levels, healthcare provider organizations are able to package their basic services into different models, each attractive to a different customer or payer.

Although most healthcare IT investments are still made with the expectation of efficiency gains, market-share growth or retention is increasingly a primary goal. Investments in PACS are now driven not only by the need for film cost reduction, but by wanting to match the competition's capabilities. Investments in computerized physician order entry, while still having error reduction as the primary goal, are also being made to grow market share through a better clinical quality reputation. Just as new medical technology has spawned new services, so too has new IT. In-home monitoring and electronic mail communication between physicians and patients are just two

examples of new IT-based services. As IT becomes more ubiquitous, not only in healthcare organizations, but in the offices and homes of its customers, and as competition between healthcare organizations becomes even more intense, product and service innovation based on IT will become increasingly prevalent.

As in other industries, IT investments in healthcare are moving from those supporting noncore, back-office processes to achieve efficiency gains to those supporting core business and clinical front-office processes to achieve gains in revenue and market share. Certainly, for a cost-challenged industry such as healthcare, efficiency gains are still very important, whether in the back or front office; however, the ability to also gain revenue and market share from IT investments is a huge new opportunity.

SPECIFIC BENEFITS TO HEALTHCARE

What, specifically, are the types of benefits available to healthcare organizations as the result of their IT investments? Not surprisingly, the same categories of benefits are available in healthcare as in other industries. Only the business processes that are supported differ.

Productivity. This is still the most prevalent benefit both proposed and achieved by healthcare IT investments. Whether the goal is to reduce days of accounts receivable or to improve throughput for computed tomography scans, productivity gains can be a major benefit of IT investments. However, all too often, the goal seems to be to install the new IT system, not

to achieve the productivity gains. This again supports the point that the benefits to be achieved from IT investments are business benefits and must be described as such.

Although gaining commitment for increased productivity is always difficult, only that commitment from the business sponsor will ensure that the benefits are achieved. Productivity benefits are easiest to achieve by automating simple, repetitive tasks. However, the labor savings from doing so arise from the elimination of relatively low paying jobs, and therefore the overall benefit is frequently not great. A better goal (although more difficult to achieve) is to improve the productivity of those on the high end of the pay scale. Even a small productivity improvement for physicians and nurses results in large savings. Similarly, improving the productivity of the highest-cost assets or those that have the largest-margin contribution, such as magnetic resonance imaging procedures, is preferable. Lastly, IT enables productivity gains both from lowering the cost of a process and from increasing the capacity of that process. Thus, investments that improve capacity where demand for that capacity already exists are relatively sure winners.

One of the most common subsets of IT-supported productivity investments, particularly recently in healthcare, is the consolidation of functions across multiple entities. These projects usually start with nonclinical functions such as patient accounting and payroll. The benefits from consolidating these functions are well documented and relatively easy to achieve.

Just as in other highly complex, process-bound industries, both improved information and the use of that information for process control are required.

Now, healthcare organizations are extending their consolidation activities to clinical functions such as laboratories, diagnostic imaging, and medical records. Although these consolidation goals are harder to achieve because they have more effect on core clinical processes, they also may potentially achieve larger benefits because they affect larger-volume and more-expensive operations. In addition, consolidation of clinical activities can also bring second-order benefits such as quality and satisfaction improvement.

Information for decision making.

Information reporting was probably one of the first benefits touted from computer systems. In fact, much of what is reported from systems is data, not information. While data are certainly useful in decision making, only recently have information systems have been able to broadly integrate data to generate information not otherwise available to decision makers. Reporting has changed from presenting the decision maker with huge volumes of data to analyze to giving the decision maker unique, new information synthesized from various sources and analyzed in ways impossible to achieve without IT. For instance, compare the value of payroll reporting that documents employees' pay rates to retrospective clinical decision support that reveals the cost and efficacy of various treatment approaches.

All modes of reporting provide information from computer systems, but the payroll example above provides much more benefit and has a larger impact on the organization.

However, it should also be said that such systems are progressively much harder to implement and may only exist in a few institutions. Fortunately, collecting information as a by-product of doing the work almost always provides extra benefit. In many cases, the value only becomes apparent years after the system is implemented, so although the benefit is real, it does not usually provide sufficient reason to make an IT investment unless the entire purpose of the system is decision support.

Product/service customization.

Customization has been little used outside of bundling services for contracting purposes. Regulation and habitual use have limited mass customization and variation in service levels in healthcare. However, given the fact that Americans can select from a menu of service levels at varying costs in almost any other industry, predicting that the practice will come to healthcare does not seem unrealistic. Especially as costs are increasingly shifted from payers to healthcare consumers, one could expect the emergence of "bargain shopping." IT will enable this mass customization, if not by individual consumer need, then certainly by product and service, and has the potential to affect customer satisfaction and market share.

Quality. The current issues in healthcare concerning quality almost demand IT investments. Whereas in the past we have addressed quality improvement through the refinement of mostly manual processes, that is no longer sufficient. Just as in other highly complex, process-bound

industries, both improved information and the use of that information for process control are required.

Increasingly, healthcare organizations are recognizing that (1) they require more and better information to support quality improvement initiatives and (2) their manual processes must be replaced by automated processes to achieve the quality improvements they are seeking. Healthcare has already applied these concepts in ancillary areas such as the laboratory and the pharmacy. Information systems have been used in these areas not only to record and distribute information (lab reports, medication administration reports, etc.), but also to control the workflow in these departments. In addition, these kinds of systems were among the first to use the type of automated alerts and reminders now being proposed for use by nurses and physicians.

The difficulty with IT systems employed to support quality improvement efforts centers around the need to achieve agreement on the data to be used, its accuracy, the rules to be used, and the processes to be changed. This agreement is difficult to achieve in a single department like the pharmacy, and it is orders of magnitude more difficult across multiple departments and disciplines, as is required for a physician order entry system or a medication administration system. Notwithstanding these difficulties, the demand for quality improvement in healthcare clearly will continue, and IT will be a major tool used to increase quality and safety. The only question is, how successfully

will these quality improvement tools be used? That question will only be answered when the industry has more experience in using IT to improve quality and when some of the barriers to doing so are removed.

Service. IT has led to a quality-of-service revolution in most industries other than healthcare. The same kind of service improvements in responsiveness, availability, relationship integration, and customization are available in healthcare, but the demand for them has yet to be significant. Attempts in the late 1990s to implement e-health services mostly resulted in too little value too soon for the available technology and business processes to support them. However, increasing competition in healthcare, increasing consumer involvement in healthcare decisions and payments, and increasing customer demand for the same levels of service they have come to expect almost everywhere else suggest that healthcare will compete more based on customer service. The same IT capabilities used in other industries (web-based services, electronic mail, customer recognition and management) will become increasingly commonplace in healthcare. The widespread use of call centers in healthcare is only a start at satisfying customer expectations and thereby generating increased revenue and market share.

BARRIERS TO GETTING VALUE FROM IT

With all these opportunities to realize value from healthcare IT investments, why do most organizations report

*More IT is
not necessarily
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implemented IT is.*

difficulties in capitalizing on them? Part of the answer lies with execution, and part lies with the many barriers that exist, some of which are unique to healthcare.

Complexity of the Industry

The first (and probably the most significant) barrier to achieving value from healthcare IT investments is simply the complexity of the industry. Even the smallest hospital is a collection of very different business units with different objectives, processes, and metrics. It is quite common to find midsize healthcare organizations with a collection of hundreds of information systems, each supporting a different business unit and most sharing little to no information with others. To the extent that the business goal for the investment requires integration of information and processes across these systems and business units, it quickly becomes a hugely complex undertaking.

Lack of Standards

Healthcare does not have the standards in place that other industries do. From vocabulary standards to transaction standards to performance metrics, healthcare is highly variable and therefore difficult to automate in an efficient manner. The language used in financial services, transportation, retail, and other industries allows the design of standard processes and the application of metrics to measure and govern those processes. In healthcare, however, each organization still speaks its own dialect. In addition to vocabulary standards, technology standards are largely absent in

healthcare. The wide variety of technology vendors supporting healthcare is one reason why standards do not exist, and another reason relates to the merger and acquisition activity in the past decade, which resulted in organizations with a smorgasbord of IT. In addition, in most healthcare organizations, standard processes do not exist. Although standard processes for finance, billing, and human resources are beginning to take hold in many organizations, most still operate separate systems for each facility. This requires at least unique configurations of the same system, if not completely different information systems for each supported facility. The absence of such reconfiguration leads to additional complexity and the lack of comparable information.

Economies of Scale Not Available

Healthcare has difficulty using the economies of scale offered by IT. Most systems in use today are capable of supporting multiple facilities, thousands of users, and hundreds of processes. However, they are often implemented to support a single facility or even a single department. This makes recovering the cost of an expensive new information system extremely difficult. The overwhelming trend in other industries is to buy fewer, more expensive, more complex, but more functional systems and then to implement them widely in a standard fashion to support the entire enterprise. Certainly in healthcare, the vendor-supplied systems have been difficult to operate at this scale in the past; however, that is changing rapidly.

Lack of Sponsorship

Business sponsorship for healthcare IT investments has often been lacking. The healthcare chief information officer (CIO) is still the primary champion for IT, not the managers whose departments should be deriving the benefits. Just as a business manager should be accountable for justifying a new building, new medical technology, or any other new investment, and thus should be responsible for realizing the business value from that investment, so should that manager be accountable for IT investments.

The CIO's role is one of designing an overall IT strategy supporting the needs of the business units and achieving as much synergy between the investments made to support them as possible. The CIO is then accountable for delivering and supporting the information systems required by their customers. Also, the CIO's responsibility is to ensure that IT investments are justified and that, once made, the sponsoring business manager is held accountable for achieving value from the investment. If the CIO and IT department only champion technology in general and then simply fulfill orders, maximum value from IT investments will not be achieved.

Infrequent Process Redesign

Healthcare IT investments are frequently made without redesigning the processes they are to support. The value of IT investments is usually in enabling more efficient business and clinical processes, not in supporting existing ones. Changing processes is hard, detailed, and somewhat risky

work, but it is almost always required to achieve value from IT investments. Where is the business value in replacing a patient accounting system if business office operations do not change? Yet, all too often, the new system is purposefully configured to replicate the functions of the old one. Healthcare IT investments should be designed to support different, better business processes, and the changed processes should be the goal of the investment, not simply the installation of the new system.

Underinvestment

One may argue that a significant barrier to IT value in healthcare is simply underinvestment in IT. Most healthcare organizations are struggling with their current levels of IT investment and gaining value from it; they should recognize that they may not have invested enough money. More IT is not necessarily needed, but better-implemented IT is. How often are new systems implemented under severe cost constraints, resulting in undersized hardware and poorly running systems that do not meet customer requirements, much less support new, more efficient business processes? Those investments that are made in IT must be funded at a sufficient level to meet the business goal for which they are being made. This sounds rather basic, but it frequently does not occur.

CATEGORIES OF IT INVESTMENT

Four major categories of IT investment are currently under consideration by healthcare organizations:

1. Investment that supports standardization or consolidation of IT systems within an organization. Many organizations found themselves with diverse collections of information systems after the merger and acquisition activities of the 1990s. Most are now trying to reduce that diversity by replacing multiple systems for the same function with a single system that will support that function for all the entities within the organization. In most cases, the goal and the value is not simply having standard systems, but rather building standard business practices using these systems (consolidated business office, central labs, etc.).
2. Investment that supports process improvement in business and clinical operations. Workflow systems for the business office, medication administration systems, and even PACS fit in this category. The value of these investments is in the quality or efficiency improvements in the processes they support.
3. Investment that supports decision making. Physician order entry systems, financial decision support systems, and even reporting systems are in this category. The value from these investments derives from the better decisions made using them.
4. Investment intended to support better service. Call center systems, scheduling systems, and voice response telephone systems fit in this category. The value of these investments comes from increased

customer satisfaction leading to repeat business and ultimately more market share.

FUNDAMENTAL PRINCIPLES FOR OBTAINING VALUE

The pressures forcing healthcare to improve quality, service, operational and clinical efficiency, and ultimately profitability will also force healthcare to continue to invest in IT to achieve these objectives. Choosing not to make these investments is not an option. How can healthcare be more successful in obtaining value from its IT investments?

Business Sponsorship

If the investment is to have business value, someone accountable for the part of the business affected by the investment must also be accountable for deriving that value from the investment. If it is a laboratory system, the lab director must commit to achieving sufficient value to justify the investment.

Documented Business Objectives

The objectives to be achieved by the IT investment must be clearly documented, agreed to by the sponsor and by the project team, and stated in business, not IT, terms. The objective is not to install the new system, but rather to use it to achieve higher quality, lower costs, or some other business objective.

IT Leadership

The IT department must be held accountable for implementing the new system or technology in

accordance with the customer's requirements. This does not mean that the IT group simply takes orders for its customer's technology desires. The IT department must strike a balance between the customer's cost, schedule, and deliverable needs and the organization's IT strategy and architecture.

Emphasis on Process Change

To achieve value from an IT investment, some process or set of processes must be changed. These must be identified before the project is started, and their change must remain one of the primary goals of the project.

Measurement

The intended value of the IT investment must be measured (projected) before the investment is made. Progress toward achieving that value should be measured during the course of the project, and after the project is over, its value should again be measured.

The discussion above, including the case studies, suggests some fundamental principles for making IT investments in healthcare and managing them to produce value. If followed, these principles do not by themselves guarantee success, but if not followed, success will be very difficult to achieve.