Development of an Integrated IT Research Methodology

Rabindra N. Chakraborty[1] and Jay H. Burgess[2]

[1] Consulting Architect, MIS, Access360., USA,
E-mail: rabi@worldnet.att.net;

[2] CIO, MIS, Hilti Inc., USA,
E-mail: burgjay@us.hilti.com;

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ABSTRACT: *Information technology can no longer viewed as a strictly business supportive mechanism incurring expenses to an organization. With the advent of the global economy concept, it is rather thought to be the vehicle that will carry the business into the future. The paradox lies in determining what makes technology sense in conjunction with business sense. The purpose of developing an integrated IT research methodology is to properly guide the business into the future using right technology, right strategy and right organizational behavior. The proposed methodology is divided into three sub-methodologies, e.g., mapping technology to business functions, researching new technology and measuring IT effectiveness. Implementation of these sub-methodologies in an integrated way ensures a standard uniform research approach for the evaluation and adoption of new technology as well as the alignment of technology with the business vision. Additionally, it favors the gradual transformation of IT infrastructure and competency that prepares the organization for the future, resulting in a more predictable cost and value proposition for technology.*
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AIM OF RESEARCH

In the past, Information Technology (IT) has played a traditional supportive role in business with the worth of IT assessed from the measurement of operational factors, such as, "system downtime", "system performance" etc. However, this thinking is changing fast around the globe. The threat of Y2K was an excellent learning lesson for businesses to realize that IT is an integral part of their success, and it can indeed make or break a company. Yet another example is the huge boom in the "dot-com" business and the critical role that IT plays. In fact, it is becoming obvious that the existence and the health of a business is directly related to a proper IT infrastructure and its timely management.

However, the transition from the old mindset to the new requires a lot of changes in an organization e.g., changing old habits, a new outlook towards the adoption of technology, contribution value measurement of IT etc (Earl & Feeney, 2000). The task becomes even more challenging due to the fact that the rate of change of technology in IT is rapidly increasing with time (Gartner, 1999).
The purpose of this paper is to discuss the rationale and ways to develop an integrated IT-research methodology, which an organization can use for going through this challenging transformation.

INTRODUCTION

Those who are in touch with the changing environment of IT know that its future success directly depends upon the blending of four major areas: information, processes, vision and human behavioral patterns. With the increasing use of the Intranet and Internet, the distribution of information has been dramatically streamlined. But the "new" availability of information is raising a new question: How to utilize information and resources "ahead of others" thereby benefiting the business? One answer is the development of a research function in IT to ensure the use of appropriate technology for the business, moving it "ahead of others" or at least "along with others". A methodology helps to guide the research functionality to be consistent and systematic and also helps to answer the following three major questions:

A. Which IT research topic is appropriate for the business and why

B. How to standardize the quality of the research output for future business decision

C. How to evaluate and improve the IT research contribution to the advancement of business into the future.

Though the metrics for IT contribution will be dependent on the nature of business and its future vision, some of the factors show commonality between organizations; the most essential commonality being the substitution of the cascaded view of IT by a more complete model. Our proposed research methodology is broken into the following three major sub-methodologies, each focussed to answer one of the three questions, mentioned above:

1. *Mapping technology and business:* This component tries to identify appropriate research topics for a business at a given time. This way the research relevance and impact on the business is maximized.
2. *Researching new technology:* This sub-methodology attempts to standardize the quality and uniformity of the research output.
3. *Measuring "IT Reach" and Effectiveness:* This section is required to determine the IT contributions to the business in its advancements.

If the above three sub-methodologies are followed in an integrated way, an organization can slowly establish a rock solid foundation required for the new era where technology readiness is expected to dominate the results in business competition and customer satisfaction. Moreover, the constant interactions between the technology, business functions and IT research definitely improve the overall competency of the IT, which is a major concern for all IT leaders around the world. In the next section, we try to break down the steps in each sub-methodology to establish a more detailed guideline.

MAPPING TECHNOLOGY AND BUSINESS

Companies that have been in business for a long time and have an IT department that evolved accordingly, most often find obsolete items in their technology and process inventory, which either needs to be dropped or updated from time to time. Our proposed methodology monitors these and looks for opportunity in these loosely hanging technology pieces (Figure 1).
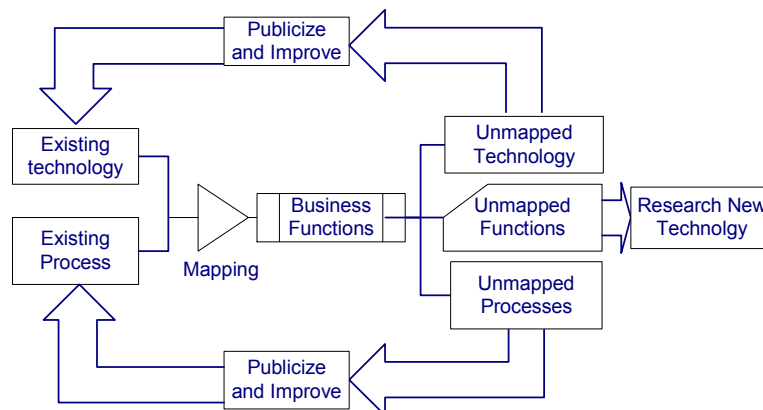

Figure 1: The process loop

The usefulness of a mapping and feedback mechanism in IT planning effectiveness is pointed out by earlier researchers (Baker, 1995), especially in new system development. However what we are stressing here is a continuous practice of the same, a life-cycle approach, not only in the area of new development but also in change management. The following steps briefly describe the sub-methodology of mapping technology with the business functions:

1. *Review existing technology and business functions:* A business changes its course with time. Often the need of a particular technology is finished but unless the technical inventory of an organization is reviewed and cleaned routinely, the unused or infrequently used technology remains and bears expenses. Periodically all the existing technology should be listed and a relation between the technology and the business function should be identified. A familiar metaphor of this activity is updating one's knowledge and skills through education and training. If this conscious choice is not made to keep pace with the dynamics of knowledge boundaries, an individual will soon be outdated and the productivity can go down drastically. Time and again we have seen that the technology change has paved new way of life, outdating our old process and eventually a section of business that was attached to the old technology. For example, as Utterback pointed out, "one hundred and twenty five years of innovation in typewriters, word-processors, and personal

computer had one fundamental objective: to put words on paper neatly and efficiently. Over the period we have witnessed the shift from handwriting to manually operated machines, a dramatic shift to electric machines and the introduction of a radically different technology - digital technology" (Utterback, NS). Thus reviewing technology with business function helps IT to remain current with the marketplace innovation.

2. *Review process and business mapping:* Often obsolete processes remain in a business without having any significant yield. During this review process, the organization gets an opportunity to modify some of these processes. Many times, classical business approach becomes ineffective with the arrival of a newer technology. Reviewing the business and process map helps updating the process and its corresponding technological function in a systematic way and on a regular basis.

3. *Identify the loosely hanging technology or processes:* This step is critical to recognize any opportunity in IT or process research and helps to focus on a "loosely hanging" technical infrastructure. If the existing technology seems to be obsolete, this step gives the IT a chance of getting rid of it resulting in cost saving. If there exists an opportunity to utilize and grow on this unused piece, then research is directed optimally to improve its utility.

4. *Publicize internally to improve awareness:* This step is essential for two reasons: first, to generate awareness among the business and technology side of the houses in an organization and thus increasing the ownership of change requirements, second, to promote proactive behavior in an organization. This step helps to generate a company-wide cross-functional competency for the future.

5. *Accept suggestions for improvement:* When an updated business-technology map exists within access to everyone, more people tend to give feedback. This improves the ownership, clarity in thought process and opportunity for IT to be more closely aligned with business.

RESEARCHING NEW TECHNOLOGY

By nature, the investment in research can be both expensive as well as valuable, depending primarily on the focus and the guidance of the research. For example, the return on application oriented research can be made effective only by developing and enforcing a concrete, consistent and high-quality methodology. The approach presented here takes a comprehensive view of business into account where business can be thought of as an environment and the IT as a system (March & Smith, 1995). The interactions between the environment and the system can evolve into a customer-oriented business culture and a competent IT infrastructure. We have divided our sub-methodology, "Researching New Technology", into seven steps or layers. Below, we try to elaborate on the function of these layers and show how a research team works with its internal customers, external customers, vendors and products, thus making research a joint effort of both the business and technical sides of the house as shown in Figure 2. This type of close interplay can also bring out more effective innovation (Schrage, NS).

1. *Find the appropriate research topic:* During this period of technology boom, the market fills with newer technologies all the time and finding the relevant research topic for an organization is not always very easy. Today, gaining and maintaining the competency for the future success is the major objective for all leading organizations (Hamel & Prahalad, NS). Executing the "Technology and business mapping" methodology, helps both the IT and business people to become more futuristic in thinking and also influences determining an appropriate research topic.

2. *New technology analysis:* The purpose of this step is to be aware of general IT trends outside an organization. This is usually done through extensive literature review. It is also required to understand whether a sought-for technology is applicable to the nature of the concerned business. To minimize risk, it is often advised to target a technology, which has the potential to grow, and has been time-tested in providing its promises. The "maturity" of technology is a relative term and depends upon the risk-taking capability of an organization. It is important to point out that over-mature technology has a chance of becoming obsolete in a short period. Therefore, balancing the trade-off between the growth potential and risk of choosing an "infant technology" is often a tricky challenge.
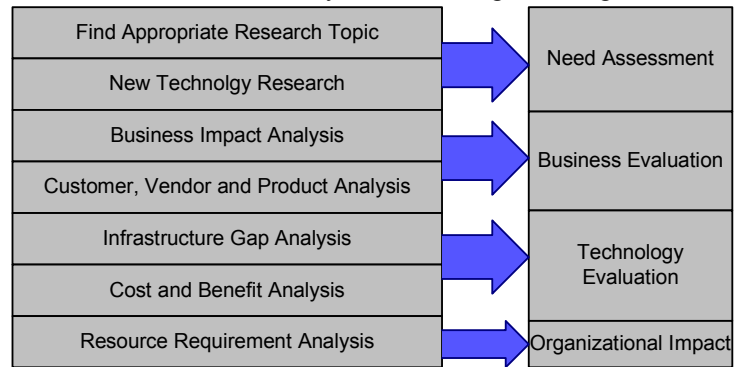
Find Appropriate Research Topic	Need Assessment
New Technolgy Research	
Business Impact Analysis	Business Evaluation
Customer, Vendor and Product Analysis	
Infrastructure Gap Analysis	Technology Evaluation
Cost and Benefit Analysis	
Resource Requirement Analysis	Organizational Impact

Figure 2: Layers of new technology research

3. *Business-impact analysis:* Technical research is important to acquire the knowledge of the availability of various technologies in the market however, the decision of implementing a new technology should come from the business impact analysis rather than by the availability of an "attractive technology". In fact, business impact analysis should also be the main driver for prioritizing a research topic over others.

4. *Customer, vendor and product analysis:* Once the need for a new technology is realized and the technology availability is reviewed from existing IT literature, the choice of products is estimated during this phase. Usually the decision of choosing a new product is driven by the budget, so the product features and its overhead needs to be carefully analyzed. A focus of the product analysis is to ensure the future support issues; often an established vendor can influence the change in technology and help popularize its product, thus minimizes the risks in supports at customer end.

5. *Gap analysis:* In many cases, implementing a new technology involves modification or improvement of the current technology infrastructure. Gap analysis gives the picture of modifications required in terms of technical infrastructure and business need. In addition, the skills and knowledge gaps are also to be evaluated during this phase.

6. *Cost and benefit analysis:* A comprehensive cost-benefit analysis can be performed at this stage. Procurement of a product, changing the technical infrastructure and updating the end-users and IT skills can all contribute to expenses. However, the corresponding benefits will also have to be properly projected. Some of benefits are usually hidden, especially the changes of infrastructure which if done slowly and smoothly, yields a more predictable IT cost and avoids the expense spikes of IT. The spikes are seen due to lack of IT planning. In reality, most business changes to a new technology mainly because of the vendor threat of lack of support on an old product. When an organization does a change like this, the "lack of readiness" to accept a new technology and lack of technical preparation causes heavy stresses and even occasional disruption of a business. One of the reasons of developing an integrated IT-research methodology is to avoid such stresses on business.

7. *Requirement analysis:* This analysis decides the resources required for implementing a new technology. During this phase, more concrete project documentation is required for first piloting the proposed new technology and then implementing the same. Estimation of timeline, planning and the project management are critical components for this smooth transition.

MEASURING IT REACH AND EFFECTIVENESS

Once we have introduced a new technology, we need to measure how it has impacted our business. Rather than evaluating the contribution from each piece of technology, a systematic complete approach is described here. The measurement of the "IT reach and effectiveness" is a periodic process and is executed to obtain an overall picture of IT impact on business. This type of an index is often required to share the IT understanding with the business side of the house (Dutta & Doz, 1995). Following are the suggested steps for developing such a sub -methodology:

1. *Survey the IT effectiveness from IT standpoint:* Often the IT people sees the reason and responsibility from a certain angle that is not visible by the business people. The purpose of this survey is to understand the IT point of view.
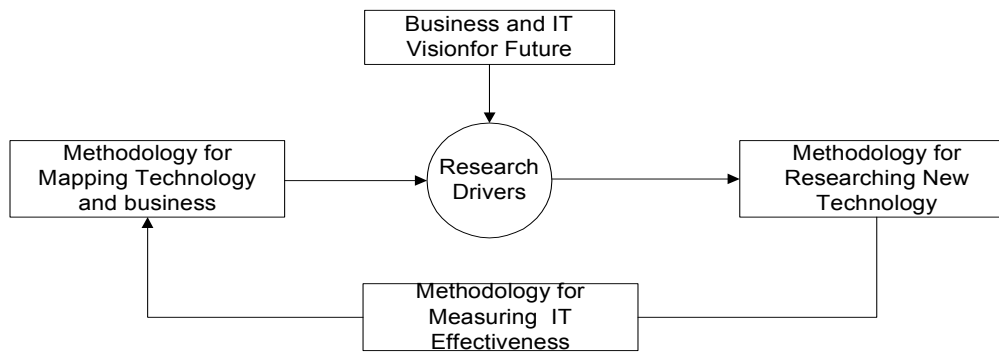
Figure 3: Interconnections between sub-methodologies and vision

2. *Survey the business side of the house to evaluate IT effectiveness:* This helps evaluating the effectiveness of IT as realized by the internal customers. Sometimes, this information may reveal the lack of understanding from the business people, which means that a better communication has to be established between the two sides of the house. This also helps the IT to realize their standing in the business.

3. *Translate feedback into numbers:* Often the quantification of the "feel" into a data can be very challenging. However, these measurements are relative and the purpose of these measurements is to gauge the IT effectiveness against time. Therefore consistency in following the methodology is more important than the value of measure.

4. *Establish an effectiveness index to represent the true picture:* Once the view from two sides of the house is obtained, a true picture needs to be presented to business and IT personnel. This feedback, in turn improves the awareness and internal communication thus helping the improvement of existing process and technology with time (Figure 1).

Each of the sub-methodologies mentioned above are required for specific functions to improve the IT effectiveness and they are interconnected to each other (Figure 3). Please notice that "business and IT vision" is an additional component shown in the above diagram. The development of the methodologies implicitly uses the vision and tries to build the required resources and infrastructures for the business to meet its future needs. It is important to emphasize here that an integrated approach in realizing the interconnections between business functions and technology and their simultaneous mutual improvements are the critical objective of an organization today and is addressed in this paper (van der Zee & de Long, 1999). This dependency and thus the relationship between the technology growth and the business vision is expressed in Figure 4, where the three sub-methodologies represent the three pillars that hold the business and pushes towards the future. Many organizations use part of these methodologies, however, the real success comes from continuously balancing the thrusts in each of these methodologies in an integrated way (Markus, 2000). Obviously, challenge of implementing an integrated IT Research methodology is tackling the resistance from changing the organizational culture and behavior. Often the pre-requisite of implementing such an impacting methodology is to generate a strong commitment from the senior management and influence the organizational behavior in a favorable way where isolated thinking is discouraged and a system thinking is invoked. When a new technology goes through a booming and hype phase, most businesses tend follow the general trend; for concrete example, we can turn towards the handheld technology that is in a boom right now. Most companies are dreaming to deploy the handheld technology to their sales force or customer service as soon as possible, mainly because of the perceived hope of constant connectivity and mobile access to the data. However, rolling out a new product means aligning oneself with a "bundled technology" that the product vendors aligned themselves with. Our research methodology tries to identify the real business values behind bringing in that "bundled technology", and how those technologies can evolve to become a future IT infrastructure. Additionally, the business alignment with the new technology, say handheld, tries to see how much of tangible value is brought to the business, for example, time saving of the salesperson achieved.
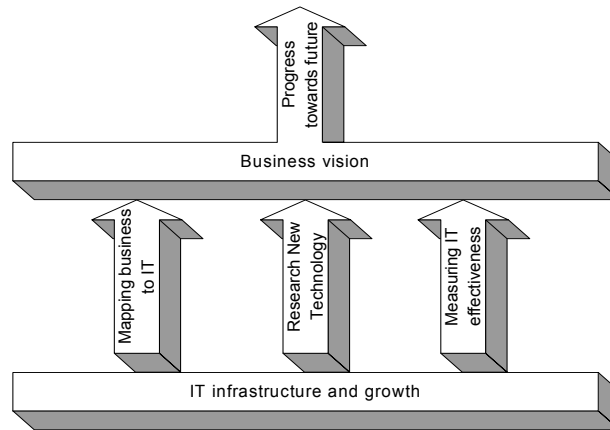
Figure 4: Dynamics of business and IT growth

A frequently asked question is what is the cost of implementing an integrated research methodology. This often depends on the company culture and its vision. If an organization is value-based where it considers the tangible and intangible values are assets then following this methodology helps them becoming more futuristic and technology aware. For example, with handheld, the constant connectivity to data provides an intangible comfort to the customer, also a high degree of situation awareness, say the available quantities of a product in a given warehouse. The salesperson can commit more strongly to the customer and the service level goes up tangibly. Our methodology, especially, the sub-methodology "Researching New Technology", thus tries to consider these types of balances between a tangible and intangible business value. Additionally the methodology ensures that the technologies investigated with more details are the technologies that will return the most value back to the business. Thus the cost of investigation is optimized using a standard method which is repeatable and consistent.

CONCLUSION

As the business or technology changes, the approach that IT takes should change in order to balance the current and future business requirements. With the current dynamics of technology, it becomes very difficult for an organization to focus on the right technologies that will be value adding to the business in the future. Our proposed methodology here helps to standardize the technology research and thereby a proper standard, product or vendor alignment. Additionally reviewing of the business and technology mapping keeps the IT infrastructure and competency updated to the current and future business demand and thus make IT more effective.

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