

## INFORMATION SYSTEMS INNOVATION: DIFFUSION AND IMPLEMENTATION ISSUES

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### ABSTRACT

*The implementation of information technology innovation is much more complex and process-oriented than the creation of the innovation itself. Proper implementation involves a tremendous amount of organizational cooperation and support in order for the innovation to be used to its maximum or target potential.*

*How can innovators and information technology systems work together to get the most out of innovation? There are several salient features to remember when working with and implementing innovation. It is important to understand that each organization is a different, cognitive entity, capable of interpreting and understanding its own reasons for existence. By the same token, one should understand that in most cases, the business knows what is best for itself. Proper organization of a business entity can cause an increase in innovation within the organization.*

*The information systems department plays an integral role in organizational innovation. The diffusion of innovation information is also paramount in providing for the successful implementation of innovation. An example of the implementation of Activity Based Costing is presented in the paper. This example provides a six-step process to implementing information technology innovation. These steps are initiation, adoption, adaptation, acceptance, routinization, and infusion. This paper also presents the idea that innovation and information technology is highly correlated and discusses the role of top management in successful implementation of innovative ideas.*

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## **INFORMATION SYSTEM INNOVATION: DIFFUSION AND IMPLEMENTATION ISSUES**

In organizational settings, the most commonly used definition of an innovation is "a new idea, which may be a recombination of old ideas, a scheme that challenges the present order, a formula, or unique approach which is perceived as new by the individuals involved" (Larsen, 1993). According to this definition, any idea, whether it pertains to products, production processes, administrative procedures, or information technology may be regarded as an innovation as long as people, on an individual basis, are of the opinion that it is something new to them.

There is a difference between innovation and change. Change activities are actions taken to improve an individual job situation. Innovation, on the other hand, will be used by more than one person, and have an impact beyond the department or function of the originator (Larsen, 1993).

Innovative ideas are not scarce in business, especially in research and development. New ideas pertaining to information systems technology are perhaps the most common and therefore most competitive type of innovation. For example, AT&T's development sub-company, Lucent Technologies boasts a "three innovations per day" standard. California's Silicon Valley sees more innovations than cars on a highway during rush hour. Innovation, although it seems like a "novel" idea, is something that takes pure genius to develop, implement, and make successful. If one innovative idea fails, there will be countless other that sprout up to compete to take its place.

Coming up with a new idea may be the easiest step in making an innovation a success. Perhaps some of the greatest difficulty lies in the proper development, implementation, and utilization of new information technology. How can information systems developers and designers successfully bring about a change in processing or programming due to innovative ideas?

Finding an unfulfilled need, creating the "perfect" product or service to fill that need,

taking advantage of the "first mover" status, and sustaining that advantage by continuous customer-driven motivation is all necessary in being a successful innovator. Whether or not these ideas seem like pure marketing, they are all essential to the business of innovation.

### **PROBLEM STATEMENT**

During the past decade, many organizations have recognized the advantages of many new innovative theories such as Total Quality Management (TQM) and Just in Time (JIT) inventory strategies, but have not always found them easy to implement. Likewise, many information technology innovations are seeing the same difficulty in implementation. During the era of creating the lean and mean company, many information technology innovations have been used to improve decision making and support reengineering activities; however, many organizations come across many barriers to implementing IT innovations. These barriers reflect technical, organizational, political, and behavioral factors that can prevent organizations from obtaining all of the innovation's potential benefits.

So, the basic research question is; How can innovators and information technology systems work together to get the most out of innovation?

A review and synthesis of the appropriate literature and a practitioner conference is presented next followed by a discussion that helps address the above question.

### **EVIDENCE SUGGESTS THAT . . .**

#### **Understanding Itself ? Business Knows Best**

In a recent information technology conference "Organizing for Innovation: Technology and Intelligent Capacities," co-sponsor and author of "The Intelligence Advantage: Organizing for Complexity", Mike McMaster along with presenters from the Santa Fe Institute, executives involved in innovation, and consultants developing applications of approaches of complex systems in the business environment explored ideas and themes associated with the conference subject. The central idea that integrates all themes

presented is that of the organization as a cognitive or intelligent entity in its own right.

Business is a cognitive activity, according to some of the presenters at the conference. That is, it is an activity of interpreting, understanding, and making sense. Each corporation makes sense of its environment in unique ways that are guided by the reason for being in business. This approach was explored under the related topics of complexity, technology, organization, and innovation. These four themes are being treated as interactive, co-emergent, and mutually influencing. By shifting focus between these four themes, and without losing sight of their mutual influence, clarity begins to develop which provides design principles and guides action.

What does this have to do with innovation? During the conference, several presenters touched on innovation. John Holland and Stu Kauffman presented innovation from the perspective of complex adaptive systems, while John Chambers and Hatim Tyabji presented innovation from an organizational perspective. They can be seen in complementary ways, stated McMaster. Holland showed how innovation is the result of constructing strategies with a few simple but key elements, which are constantly in experimentation yet produce predictable results. Kauffman provided a model for innovation by comparing it to the formation of life and related that to the formation of business opportunities. The term he suggested throughout his presentation is "the adjacent possible." That implies that the next strategic move a business may make is most likely going to be where there is a new combination of existing elements where only one piece is missing that would create a new source of innovation. That is, by redefining or redesigning processes or products, innovation can be more easily achieved through the formation of new combinations within the processes or products. Chambers and Tyabji showed how the design and practice of organization could be accomplished to provide a base for constant innovation. These are created from the cognitive step of realizing that innovation is a matter of organization. Designing implies the requirements are met by

the operation of the system itself rather than by any special effort "against" the system.

The requirements of organization design for innovation and cognitive effectiveness (presented by Howard Sherman and McMaster) are that a few basic design principles be made explicit. Various models are created from which endless variations can be drawn to match the intentions with the business environment. These basic principles are:

- Distribute accountability ? give the employees autonomy and ownership of the work they do
- Increase connections ?make the organizational network stronger by encouraging increased communication
- Generate understanding ? communicate new ideas, events, etc. in order to gain organization support
- Engage and enroll ? implement and support

In essence, the presenters at this conference were attempting to demonstrate the importance of a company's cognition and sense of organization on the cultivating of innovation (McMaster, 1997).

## INFORMATION SYSTEMS? ROLE IN ORGANIZATIONAL INNOVATION

In another article discussing the importance and integration of innovation, Swanson (1994) states that innovation in its employment among organizations is crucial to competitive survival and success. The Information Systems (IS) unit within the business is largely responsible for meeting this challenge. Yet, current theory explains little about IS innovation and its role in organizational innovation in general. Swanson says that there are three types of IS innovations. Type 1 innovations are confined to the IS task. Type 2 innovations support the business and administration functions. Type 3 innovations are those that are imbedded in the core technology of the business. Each of these types of innovations is also critical to the success of an organization, and therefore must be implemented properly.

## INFORMATION DIFFUSION

Another aspect of innovation is information diffusion. The newness of an idea, taking on a form of uncertainty in the minds of the potential users, gives the innovation diffusion process a unique character. Information diffusion theory can be used to examine the problematic implementation of a sophisticated client management system by a large firm. The firm's efforts to sell the new system to its users may not be strong enough, and support for its use may be insufficient. When introducing a new system to a workforce, it is imperative to remember the following (Huff and McNaughton, 1991):

- The benefits of using the system
- The firm should provide for an easy transitioning process from one system to the next
- Ongoing training and support is critical
- Monitoring results is paramount

## THE ACTIVITY BASED COSTING EXAMPLE

Another case involving innovation and its implementation is that of the conception and utilization of Activity Based Costing (ABC). ABC is a recent innovation that has encountered many barriers. Krumwiede and Roth (1997), explain the various stages of the implementation process using ABC as an example. They also elaborate on how organizational issues can affect the various stages of information technology implementation and how these issues can be addressed.

The five stages of ABC are as follows:

- Identify the object for costing, such as a product, customer, or service
- Identify the major activities involved in the production of each object and determine the costs for each
- Choose an appropriate cost driver for each activity cost pool
- Compute the rate per unit of cost driver for each activity

- Assign costs based on the driver rate

In addition to product costing, ABC can provide valuable information for performance measurement, cost control, and strategic decisions. Many companies viewed ABC as a technological innovation. Perhaps it should be implemented as an Information Technology (IT) innovation. IT innovations are those that provide managers with better information for decision-making (Krumwiede and Roth, 1997).

## STAGES OF INFORMATION TECHNOLOGY INNOVATION IMPLEMENTATION

While many firms have tried to implement ABC, an increasing number of organizations that have adopted ABC have reported difficulty in achieving the successful integration or infusion they expected. Why is this? Many companies have treated ABC as a purely technological innovation, but it should be implemented as an IT innovation. To successfully implement IT innovations, managers need a good understanding of the implementation process. A model refined by R.B. Cooper and R.W. Zmud describes the stages of implementing any IT innovation. The six stages are as follows (Krumwiede and Roth, 1997):

- Initiation
- Adoption
- Adaptation
- Acceptance
- Routinization
- Infusion

An example of ABC implementation is Chemco, a division of a large corporation that produces materials from chemicals for use by textile manufacturers. In 1990, the company grew concerned that larger customers would begin producing their own materials. In order to remain a supplier, Chemco had to provide materials at a lower cost that textile manufacturers could not match. In 1991, the president of the division responded by initiating an ABC project to identify possible

cost reductions in manufacturing (Krumweide and Roth, 1997).

Initially, the ABC analysis went as planned. The implementation team formulated a set of cost pools and drivers that seemed to work. As more plants were added, the process began to get bogged down and unforeseen obstacles began to appear. Employees and managers began to envision budget cuts and staff reductions. Another obstacle occurred because ABC was implemented as an individual system, separate from the existing cost information system used for performance evaluation and budgeting. Implementation stalled even further in the acceptance stage. While top managers found the ABC information interesting, they felt it was too complex to be practical.

The Chemco experience shows that more than just technical or system issues need to be considered. The degree of innovation change is an important issue. Change can be radically extreme or subtly incremental. Fully implementing ABC can be considered a radical change because it not only results in a different way of assigning costs but also requires a focus on activities that might lead to new issues for management relating to strategy, performance evaluation, and resource allocation (Krumweide and Roth, 1997).

The boundaries between the stages of implementing IT innovation are not always distinct, because it is an ongoing process. A general understanding of the process that most IT innovations pass through is important because the factors affecting progression differ from stage to stage. A more detailed description of each stage is given below.

#### *Initiation*

The initiation process begins when there is pressure to change an existing function or system and involves analyzing organizational problems and possible solutions. Generally, someone from upper management drives the change because of a belief that an information need is not being met. The initiation may also come from someone lower in the organization more familiar with system limitations or possible solutions. Assuming there are good reasons for a firm to desire a better system, there must also

be a sense of urgency to go through the expense of making a change.

Chemco, for example, began its ABC implementation only after management became fearful of losing business. When that threat faded, so did the motivation for implementing ABC. In order for an innovation to be implemented successfully, there must first be a need that does not subside with changing business trends.

#### *Adoption*

When agreement is reached that a new process or system (in this case, ABC) is a possible solution for a company's needs, the next step is getting approval and the resources for implementing the system. In this stage, the proponents of ABC campaign for the resources needed to implement the change. This stage requires a strong advocate in top management, someone with significant budgetary and organizational clout who will push the project and get the necessary funding and cooperation. If such an advocate does not exist, it is highly unlikely that the project will proceed.

#### *Analysis*

When the resources are approved, project implementation enters the analysis stage. In this stage (still using ABC as an example), the implementation team studies the resource costs and links them to activities and then to cost objects i.e. products, customers, etc. The team's focus is on identifying the root causes, or drivers for overhead costs. TQM principles of teamwork, customer satisfaction, and process analyses are useful at this stage. Here, the organization should be developed into self-managed teams consisting of both information users and providers for a given process. Team members should be given the time and training necessary to document, measure, and improve upon the process of being addressed. A barrier in the analysis stage is the complexity of many business processes, especially those involving production. A recent study found evidence that the ability of an existing information system to provide the operating data needed for the ABC model is a significant factor for implementation success. Several companies said they needed the information ABC would provide, but that they must first implement new integrated

information systems. In general, implementing ABC is easier if the information system has good subsystem integration, user friendly query capability, and data going back for an extended period of time, and real time updates of data. ABC, like other cost reduction and process reengineering strategic initiatives should be done in full partnership with the information systems department.

### *Acceptance*

The goal of the acceptance stage is getting key decision-makers to agree that ABC information should be used in their decisions. Acceptance is unlikely if they don't understand or agree with the ABC information. The barriers surface because many managers feel a fear that more accurate information will adversely affect their position in the organizations. If modeled properly, ABC will probably uncover product lines, customers, or processes that are less profitable than realized. Managers of these divisions may fear losing budget money, power, or worse, their jobs.

The key to overcoming these barriers is to educate managers and employees about the value of the ABC system. Specific data should be provided to upper management and key users to show that the system meets the original objectives. The focus should be on:

- Explaining why the traditional method was inadequate
- Discussing how ABC cost information is collected and reported
- Explaining why the ABC model is better than the old cost allocation methods and
- Highlighting how ABC information will lead to better decisions

### *Action (or Routinization)*

Once acceptance of the ABC project is reached, the next stage of action occurs and ABC starts making an impact in an organization. The cost model is accepted by at least a few key decision-makers who consider it a normal part of the organization's management information system. The biggest barrier in reaching this stage is gaining acceptance, but once this is achieved, there are still more roadblocks to overcome. Problems

such as information overload can occur. One way to deal with this is to work with users to identify and eliminate old performance measures and reports that are no longer important. This will reduce information overload and free up people's time for using and/or maintaining the ABC information.

### *Infusion*

Most information technology innovations end at the routinization stage, if they even make it that far. Once in a while, a system or process comes along that has a tremendous impact on the organization's effectiveness. Instead of doing the old level of work more efficiently or faster, higher levels are achieved as the new system is used in an integrated and comprehensive manner. When this stage is reached, the innovation is infused in the organization. This is also referred to as activity based management (ABM). ABM may be the most difficult stage to reach because it strikes at the very heart of the strategic focus of top management. The factors that slow strategic change, such as turf change, and communication issues are in full force here. Reaching ABM or infusion requires a truly integrated, cross-functional effort to analyze the basic processes of an organization. Management should overcome these barriers by linking ABC implementation to major competitive strategies.

## **ROLE OF TOP MANAGEMENT IN INNOVATION IMPLEMENTATION**

When top executives decide to adopt an IT innovation, like ABC, they should recognize that it takes much more than vocal support. Most implementation success stories show at least one high level proponent involved in securing cross-functional support and even ownership of an idea. Executives should ensure that information technology proposals meet the rational needs of the firm. Information technology initiatives should also satisfy a decision usefulness criterion.

## **DISCUSSION**

The connection between innovation and information technology is real. In its CIO 100

list for 1990, CIO Magazine's subject was the relationship between information technology and innovation. A poll of leading experts, consultants, journalists, and government officials worldwide revealed that there is a strong link between the two. In almost all of the 100 companies, information technology has become an integral part of the organization's way of life. The majority of the CIO's from the Fortune 100 companies agreed that information technology contributes most to innovation by:

- Enabling communication
- Helping organizations better understand and serve their customers and
- Helping organizations to continually improve their internal processes

Again, there is a lot of evidence suggesting that IT innovation is a key factor in the success of any company.

Creating innovative organizations is a complex process. Within the field of management information systems, researchers have used various approaches to investigate the role information technology may play in creating business change. An investigation was conducted to see whether implemented IT innovation could best be explained by a general tendency among middle managers to create implemented business innovation or by experience with information technology. The results indicated that middle managers responsible for implemented business innovation also generated IT innovation while managers' practical use of information technology was shown to result in more implemented IT innovation.

Middle managers who actively used support functions for help and discussion of information technology-related issues created and implemented a greater amount of IT innovation. The variables of attitude toward change and peer recognition for their implemented innovations were related to the implemented business and IT innovations but not to the internal and external networking. Furthermore, peers recognized their fellow managers for their implemented business innovation, but not for their information technology related achievements (Alter, 1990).

Finally, the concept of leveraging a company's intellectual capital is being approached with the development of knowledge management practices. A formula for quantifying the intellectual benefits of this movement may not exist, but perceptive leadership skills do exist for recognizing real pay-off even with implementation of this type of policy (Nasseri, 1996). In fact, much of the day-to-day strategic decision-making involves strong consideration of just this asset. The list would include: incentives and corporate culture decisions, establishing company-wide relationships with external providers and contacts, what R & D programs are right for this organization, how to safeguard existing intellectual capital, and what learning systems are needed for the environment and for human capital renewal. In order to transform intellectual assets into business value, firms need to exploit their knowledge by a strong collaboration with the internal and external community since knowledge is dispersed throughout the organization. Organizations need to develop a supportive atmosphere of openness and trust in order to effectively leverage their worker's knowledge for competitive advantage and develop business processes that can take advantage of the information technology architecture.

## CONCLUSION

There is no doubt that information technology is vital to innovation in an organization. It is also obvious that the implementation of any innovation is a complex and easily miscalculated process. Without the support of the necessary individuals, many innovations will not see themselves become a reality. Likewise, the support of a good information technology and/or information systems team is essential to the implementation of nearly any innovation.

If a business is organized effectively and promotes a philosophy of welcoming change, the implementation of innovation can be a somewhat smooth process. It is important for not only the various functional levels of an organization to work together, but to work for the common goal of increasing efficiency, increasing customer satisfaction, and promoting innovation and corporate creativity.

After all, it is usually the "new and improved idea" that generates success.

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