MBA
Information Systems

Strategic Information Systems

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1. INTRODUCTION

The success rate of strategic information systems during the previous decades has been so low that the term "productivity paradox" was coined in the 1980's to describe this phenomenon. The paradox was that no link was found between the ever-increasing investments in information technology (IT) and perceived improvements in productivity.[1] The problem persisted into the 1990's; in 1996, the British Computer Society reported that 90% of investments in information technology (IT) did not reach the goals set for them,[2] and a study[3] in 1997 reported that 50% of IT projects cost over twice their budgeted amounts. Since then the success rate has improved somewhat, although it has yet to reach acceptable levels. For example, in 2003 it was reported[4] that 25% of information systems projects had succeeded, 25% had failed, and the remaining 50% had been "challenged" (i.e. implemented but with cost overruns, delays, etc.).

Why is the success rate improving (albeit marginally)? To help answer this question it is useful to look at the reasons to which the failures are attributed. The above cited study by the British Computer Society attributes the dismal success rate principally to dominance of technological factors over all other considerations combined with a lack of attention to human and organizational factors. Of all the "human" factors involved, user satisfaction is repeatedly found to have a dominant influence over the outcome of an information systems project.[5] For example, as early as 1989 Davis et al. report that[6]

> "End-users are often unwilling to use available computer systems that, if used, would generate significant performance gains".

Obviously if end-users do not use the system, the best technology is rendered utterly useless. Other researchers[7] concur, citing user involvement and alignment of information management strategy with overall organizational strategy as key issues affecting the success of information system implementation. Still others[8] report findings that

> "Show the primacy of the managerial and organizational issues, compared to the technological issues as major barriers to the effective implementation and use of systems"

Thus the research indicates that two general areas that are determinant for the success rate of information systems:

1) user satisfaction, and
2) meshing of information systems strategy with organizational strategy.

For the simple reason that without end-users, no information system can function, we consider user satisfaction to be the most important factor to investigate in regards to both explaining the recent increase in the success rate of strategic information systems, and to exploring ways of ensuring to the degree possible the success of future information system projects. We will discuss these topics in the next section.

In the following section, we address the second point listed above. Specifically, we discuss the effects of organizational behavior and management strategy on the past and future success rate of information systems.

2. USER SATISFACTION

2.1 HAS THE CHANGE IN THE USER AFFECTED THE SUCCESS RATE OF INFORMATION SYSTEMS?

Historically, the "user-designer communications gap"[9] is credited with creating a barrier that prevents effective involvement of the end-user in the design phases of information systems. Without involving the user, the system design and interface inevitably will not reflect their needs, and they will not be eager to embrace it.

A significant body of research supports this conclusion. It has been shown, for example, that a "significant and positive correlation exists between user involvement in the definition, design, and implementation of a system, and system use", [10] and that "user involvement leads to an increase in both user satisfaction and system usage".[11] On the other hand, the same study indicates that lack of user involvement in the design phase leads to user resistance and under-utilization of the system.

Over the last decade the user-designer communications gap has narrowed due to the fact that general computer literacy has risen dramatically. A layperson now is much more likely to be familiar with terms such as megabytes, networks, email, drop-down menus, dialogue boxes, etc. In employment, education, leisure, shopping, traveling, banking, entertainment – just about all phases of daily life people in the developed world are confront and use information technology. An indication of the primacy of computer literacy is given by a current article on a job-hunting web site that states: "no matter where you find employment, there is a good chance a computer will be a basic tool you will have to use".[12] Educational institutions also have evolved to the point where "a wide variety of computer skills are useful and, in some cases required, as an essential part of college learning and employment for most individuals". [13]

More evidence of this trend towards generalized computer literacy can be seen in statistics provided by government agencies. For example, Figure 1 shows that the majority of U.S. homes now have computers, [14] whereas in 1984 fewer than one in ten U.S. homes possessed computers. As of 2001, 50.4% of U.S. households have internet access, whereas in 1989 the word "internet" is not even mentioned in the U.S. Bureau of the Census report on Computer use in the U.S.[15], nor even in the entire webspace for computer use in the U.S. The rise in computer literacty is not limited to the United States; in countries belonging to the Organization for Economic Cooperation and Development (OECD) internet access has grown by an average of 13% annually from 1995 to 1999.[16] Many more statistics can be cited, but all point to the same conclusion: use of information technology is now much more common than in decades past.

With this spread of information technology into every aspect of our lives, and with the aid of fourth-generation tools, users are "assuming more of a leadership role in articulating the adoption, development, and implementation of information technology innovations".[17]

Thus we attribute the reduction of the user-designer communications gap to society's heavy use of information technology. Furthermore, it is this improved communication between end-user and designer that is seen as the principle reason behind the recent improvement in the success rate for strategic information systems.

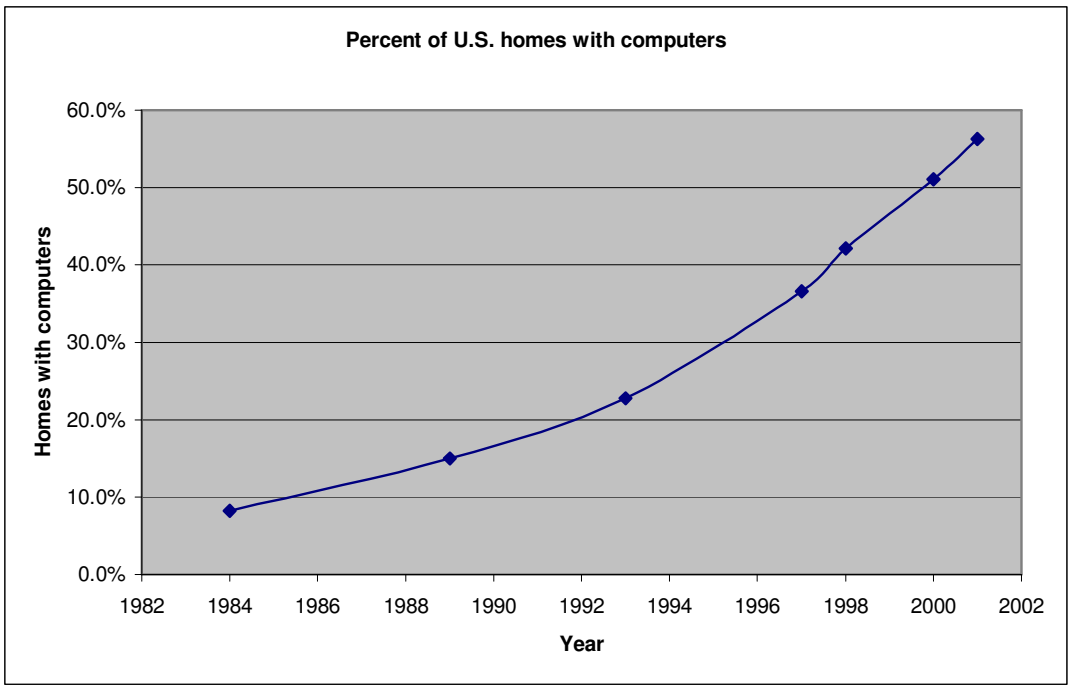

FIGURE 1 THE PERCENT OF U.S. HOUSEHOLDS WITH COMPUTERS FROM 1984 TO 2001. SOURCE: U.S. BUREAU FOR THE CENSUS.

2.2 WHAT MANAGERIAL TECHNIQUES ARE ADVISED FOR OPTIMIZING USER SATISFACTION?

2.2.1 User involvement

As a senior manager introducing a strategic information system in an organization, one cannot ignore the importance of user involvement in the process. [a] What guidelines are available to allow managers to maximize user involvement in the design and implementation of a strategic information system?

2.2.2 Obstacles to user involvement

Before addressing this question, it is useful to note things that inhibit user involvement, since these may undermine any positive actions taken to enhance user involvement. A primary factor that is repeatedly found in the literature is the behavior of senior management.[18,19] What is desired, of course, is full support from senior management. This means, for example, a willingness to spend the funds necessary, a feeling of ownership of the project and/or an involvement in the project's design and implementation. Another important factor is the organizational culture and internal politics of the organization. This factor will be strongly affected by the attitude of senior management towards the project, but for organizations that do not embrace a culture of change, this may not be enough. More will be said about this issue in the following section when we discuss change management. Finally, there are the users themselves. Their background and personalities will strongly influence how they perceive the new system. For example, younger people will normally be more open to change compared to older people, and will normally have a higher level of computer literacy as well.

[a] Laudon et al. designate four key factors in determining implementation success or failure. The first among these four factors is "user involvement and influence".

Special considerations need to be made if one is dealing with a population that is neither inclined to accept nor prepared to operate a new information system. Examples of some such considerations will be pointed out in the following discussion.

With these factors noted, we are prepared to address the question of user involvement directly.

2.2.3 Strategies to enhance user involvement

Let us first discuss who should be involved. This will of course be affected by the type of system begin designed and by the organizational culture. As a general rule one can say that input should be solicited from all affected users[b] to the degree possible.

For large organizations, consultative or representative techniques will likely prove valuable. An example of a consultative technique would be gathering input throughout the different departments affected through group meetings. The desires of each group are then communicated to the project team. A representative technique would be to have groups chose a representative to attend central meetings where their input will be solicited. The representatives may even join the project team and become wholly integrated into the project design and implementation.

Smaller organizations may find a consensus technique more valuable, where all affected users are involved directly in the process of system design and implementation.

Another subtlety regarding user involvement is the question of at what stage(s) in the project should one seek user involvement? Research shows that an iterative approach to systems development should be preferred over a cascade approach.[20] This means that one should not strive for a single design phase followed by a single implementation phase then by a verification phase, but rather should structure the project so that the phases are part of an iterative loop. The users should be solicited to provide feedback between each phase (in addition to before the initial design phase).

Techniques appropriate for soliciting input from users can be taken from the field of action research. An approach that is particularly interesting is Cooperative Inquiry that is appealing because it has an iterative nature and hence meshes well with the proposed iterative approach to project development. Cooperative Inquiry involves a cycle of action and reflection and may be implemented using the following four-step method:

1. Participants agree on a area of inquiry and identify research areas;
2. Actions and goals are agreed upon;
3. All participants are involved in executing the actions (this will normally lead to new insights);
4. The results of the actions are compared to the goals, and the goals are evaluated in light of the new insights obtained in 3. If satisfaction is not obtained the process may start again at step 1.

Cooperative Inquiry aims to expose privileged and expert opinions through a critical approach akin to that exposed by Critical Social Theory.[21] The essence of this theory is the denial of rigid scientific principles that have hitherto dominated research of most any kind. Instead, reality as defined by the assumptions people have is initially accepted. These assumptions are then critically examined to establish their reliability. The aim of the process is to make people understand what is called their "false consciousness", and in so doing free them from it. Put into the framework of Cooperative Inquiry, critical Social Theory amounts to questioning the a priori assumptions of all participants, so

[b] Note that included in "all affected users" are operational users (the people actually operating and using the system daily) as well as managerial users (users who may not operate the system directly but exploit the information provided by the system).

that a robust picture of reality that applies to all participants may be constructed. This technique may be particularly helpful in an environment that is resistant to change (i.e. a group of people who feel threatened by the new system because they do not feel technically prepared to use it or do not perceive its value). By aligning the design and implementation of the information system to the reality that emerges from the approach of Critical Social Theory, the system should prove more useful for all the participants.

Another point that supports the use of Cooperative Inquiry is that pointed out by Davis et al.[22] using the Theory of Reasoned Action and the Technology Acceptance Model. They find the following determinants of utilization of information systems:

1. People's computer use can be predicted reasonably well from their intentions;
2. Perceived usefulness is a major determinant of people's intention to use computers;
3. Perceived ease-of-use is a significant secondary determinant of people's intention to use computers

These results show the importance of *perceived* usefulness in determining the level of use of an information system. Thus we can see that Cooperative Inquiry has an additional advantage, which is that by aligning user's expectations with reality it nurtures user's perception of the system's usefulness.

3. STRATEGIC INFORMATION SYSTEMS AND ORGANIZATIONAL STRATEGY

We will now discuss the second main reason for the dismal success rate that strategic information systems have historically experienced, namely the difficulty in blending strategic information systems into organizations without damaging one, the other, or both. A fundamental outcome of this recipe is *change* – the organization will operate differently due to the introduction of the strategic information system. These changes may include, for example, modifications in the decision-making process, job-content, or in communication patterns.

The recognition of this aspect of the problem has come relatively recently. For example, a quick perusal through a 1991 review book on the management impacts of information technology yielded a citation of an article[23] published in1986 on the social and organizational impacts of computers in the workplace that concluded: "There is a pressing need for further research" because the current research was inconclusive. Another chapter of the book laments the lack of research into the impact of computer technology at the individual level.[24]

In the last decade a great deal of research was carried out which focused on the social impacts of information systems. This shift can be seen in 1997 in the work of Clarke and Lehaney who state: [25]

> "Both IS and IT have historically been largely informed from the functionalist roots of natural science, but in recent years the relevance of social theory to the study of IS has been gaining ground"

3.1 CHANGE MANAGEMENT

This evolution has included the application of techniques from the field of change management to the problem of designing and implementing information systems.[26,27] The literature now stresses that successful system development requires careful change management.[28] An example of this is described in an article relating the heavy investment in change management made by Cisco Systems

for the upgrade of its operating system in over 34,000 computer systems in 117 countries. The result was a smooth changeover process and a generous payoff for the IT investment.[29] We conclude that viewing a strategic information system as an *agent of change* is one of the principle reasons for the recent improvement in the success rate of strategic information systems.

Thus as a manger responsible for introducing a strategic information system into an organization, one would be well advised to include the "soft" view (i.e. social theories, including change management). Note however, that several authors caution against excluding the "hard" view (i.e. technological), and espouse instead a complimentary approach where both views are included.[30,31]

To understand how best to mix the hard and soft approach, it is useful to understand the different types of failure for information systems, and for which type of organization each failure is likely to threaten. Lyytinen and Hirschheim propose the following 4 categories of failure for an information system:

1. Correspondence failure – this is when the system does not meet the stated requirements;
2. Process failure – when the system cannot be produced on time and on budget;
3. Interaction failure – when the system does not gain the usage level anticipated;
4. Expectation failure – when the system does not meet the expectations of the users.

The table below is taken from the work of Mintzberg.[32] It shows, for various organizational forms, which type of failure is more likely to occur. The organizational forms are defined as follows:

1. Machine: Mass production or mass service organizations where efficiency is paramount (automobile companies, retail banks…). Also included are organizations with an overriding need for control, such as nuclear power stations.
2. Entrepreneurial: Organizations where CEO must provide vision for firm, where the direction of organization is dominant force (startups, turnarounds…).
3. Professional: Organizations where proficiency is the dominant force and the drive to perfect existing skills is dominant (hospitals, engineering or accounting firms…).
4. Adhocratic: Organizations where innovation is an overriding need. Similar to professional form except that experts in the adhocratic form are driven to create novel products and skills. Collaborative structures with informal communication patterns dominate.
5. Diversified: Organizations that diversify then divisionalize. Each division concentrates on distinct product lines subject to controls imposed by relatively small central headquarters.

Table 1 **Organizational forms and systems failure (The failures marked with a double asterix are more probable, or relevant, than those marked with a single asterix).**

Organizational form	*Correspondence failure*	*Process failure*	*Interaction failure*	*Expectation failure*
Machine	**	*		
Entrepreneurial		*	*	*
Professional			**	**
Adhocratic			**	**
Diversified		**		*

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Armed with this knowledge, the people responsible for introducing a strategic information system may chose to emphasize different areas. For example, if one is dealing with a machine organization, it is critically important to ensure that the system corresponds to the specifications stated. For a professional or adhocratic organization, one should spend more effort ensuring that the system is aligned with user expectations and that the intentions of the users are nurtured towards acceptance of the system (as discussed in the preceding section).

With this basic understanding of the organization with which we are dealing, one can proceed to apply techniques from the field of change management for introducing strategic information systems. There are numerous texts available on the subject.[33,34] Some of the techniques, for example defining your desired outcome or encouraging commitment to change, parallel the strategies advised for encouraging users to embrace a new information system. Other techniques, such as how to lead change or how to choose people for a change team, are complimentary to strategies discussed thus far.

4. CONCLUSION

By reviewing the relevant research, we have confirmed that currently the two main reasons for failure of strategic information systems are:

1. Rejection by the users and,
2. Conflict between the information system strategy and the organizational strategy.

We have also proposed two principle reasons to explain the recent upswing in the success rate of information systems. The first reason is the reduction of the user-designer communication gap over the last decade, which in turn is linked to the overall rise in general computer literacy. The second reason is the acceptance of the view of information systems as social systems, and in particular as agents of change. This shift has brought the techniques of change management to bear on the problems of developing information systems.

We also discuss techniques and strategies that managers may use to avoid the pitfalls associated with user rejection and organizational conflict. These are grouped into strategies for soliciting maximum user involvement in system development and into ways to align system development with organizational type and to facilitate organizational change.

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