Fitting in innovation and information systems – connecting two different worlds

Reima Suomi

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There seem to be two driving forces in systems development. Systems can be developed based on either tradition or on innovation. Whereas tradition often has much to offer in planning information systems of an operational character, SIS's clearly necessitate new ways of thinking, i.e. innovation. Therefore, rigid methods initially designed for the development of operative information systems are not suitable for the development of strategic systems. Such methods, based on a technical view of information systems, also ignore the social dimensions of computing, whereas innovative uses of computers create new and socially acceptable ways to use computers.

In order to clarify the ideas in the introduction we shall first discuss the difference between operational and SIS's. Then we will take up the factors allowing and at the same time demanding innovation. We establish division between different kinds of innovative approaches. Finally, we look at some concrete ways to create an innovative atmosphere.

Reima Suomi, DrSc (econ), professor, Turku School of Economics and Business Administration

1 INTRODUCTION

The strategic importance of information systems is now a well established concept. Various theories of competitive advantage strategic information systems afford have been developed (Benjamin et al 1984, Cash & Konsynski 1985, Earl 1988, Ives & Learmonth 1984, McFarlan 1984, McFarlan & McKenney 1983, McFarlan & McKenney — Pyburn 1983, Parsons 1983, Porter & Millar 1985, Runge 1985, Wiseman 1986). On the theoretical level, there exists a consensus of the importance of the topic, and managers and IT-professionals are urged to develop strategic information systems. They are also provided with several tools for accomplishing this task.

However, there seems to exist a gap between theory and practice. Several problems in the process of developing strategic information systems have been found. Among the most common are:

1 The lack of interest in the side of top management.
Lederer & Sethi (1988) found in their study that over half of the companies in their study had difficulties in securing top management commitment for information technology plans. The problem is more deeply discussed in Lederer & Mendelow (1988). Earl (1986) reports that top managers too fail to provide IT executives with proper business plans.

2 On the other hand, the exclusion of IT managers from strategic planning.
In their study, Hershey & Eatman (1990) found, that even 35% of IS Executives felt truly uninvolved in corporate planning. Only 28% found themselves to be very involved or involved.

3 Despite of rich supply of methodologies, sticking to ad hoc -approaches.
One of the major findings in the study of Galliers (1987) on U.K. and Australian system development methodologies.

4 The total absence of clear plans.
A survey of European companies by De Long (1983) proved, that only 17% of the companies studied had a long-term strategy for information technology in place. An American survey by Diebold (1982) proved, for example, that only 25% of fortune 500 companies had a telecommunications strategy.

5 The lack of clearness of the plans.
46% of respondents in the Lederer & Sethi study.

6 Sticking too much to solely technical problems.
Discussed for example in Angell & Smithson (1990) study.

It is argued here that many of the problems mentioned above result from a wrong approach to the planning of strategic information systems. They can't be developed in the same way as purely operational information systems. However, planning methodologies pay little attention to the type of the system to be developed. Here, especially, we pay attention to the fact that rigid methods do not provide planners and designers of strategic information systems with enough room for innovation, which would anyway be badly needed.

2 STRATEGIC VERSUS OPERATIONAL INFORMATION SYSTEMS

A key for the successful planning of information systems with strategic characters is the understanding of different system types. Here, we distinguish between strategic (SIS) and operational information systems (OIS) in terms of system development. The differences of these two system types are discussed in this section.

In the early days of computing, technical problems were the number one headache of all information system planners. Much system development has now become routine, and usually better technology is available than users have the resources to acquire. Still, technical problems exist where demanding applications are developed. As technical problems fade into the background and usage of information systems spreads in organizations and society, social problems begin to dominate. Many authors have documented this trend (Hirscheim — Klein 1986a, 1986b, 1987, Nurminen 1985). We are suggesting that this same development will recur : as information technology's social problems are eventually solved[1] what remains is a set of vital managerial problems connected with information systems. This seems to be one of the main distinctions between OIS and SIS: in the case of OIS's, technical and social problems are still topical, with SIS managerial issues are the key problems.

Inter-organizational information systems are among the most discussed themes in the field of MIS (Barrett — Konsynski 1982, Cash 1985, Cash — Konsynski 1985, Clemons — McFarlan 1986, Jonston — Vitale 1988, Kaufman 1966, Malone — Yates — Benjamin 1987, Runge 1985, Runge — Earl 1988, Stern — Sturdivant 1987). The emergence of this topic in the last few years is no coincidence: new SIS's are usually designed around telecommunication components. This is another distinguishing factor: OIS's are intra-organizational, SIS's usually inter-organizational.

This inter-organizational orientation has led to a situation where users of a SIS's are usually customers of the organization that owns or runs the system. Strategic information systems are heavily used by non-employees of the organization responsible the system, a phenomenon we do not see with operative systems. The new role of users being "customers" instead of "employees" has helped ameliorate SIS's social problems. If the users are not satisfied with the information system, they just freely pick up another system.

The key point that we tackle here is that OIS's can be developed by following strict structured methods. Strategic use of information technology, on the other hand, requires more innovation and freedom from structured techniques. By following strict guidelines, OIS's can be built within fast schedule, whereas SIS's require time to mature: they tread an evolutionary path of growing strategic importance.

One can calculate the costs and benefits of an operational information system usually quite accurately since the desired benefits are operational and thus quantitative. With SIS's, we are looking for strategic advantages, which by nature and definition are more variable and vague than operational benefits. The justification of costs of a SIS is a much tougher task than that of an OIS.

SIS's and OIS's give rise to different risks. As early as 1983, McFarlan & McKenney identified three factors causing risk in the development and use of information systems: the size of the system, the structure of the system,[2] and the difficulty of the technique to be used. The concept of structure is important in the case of SIS's: it is extremely difficult to estimate beforehand whether the extra-organizational users will consider the system usable and good or not. The risks in SIS's are therefore much higher than in OIS's.

OIS's usually formalize previous ill-structured and manual tasks. The tasks and work-flows to be automated are derived from past traditions. As far as SIS's are concerned, they are based more on innovative thinking. An organization gains competitive advantage only by doing something better and in a different way than its competitors.

The purpose of this discussion was to establish the difference between OIS's and SIS's. This difference should also be reflected in the ways systems are developed. This is our main issue to be addressed here.

The primary differences between SIS's and OIS's are summarized in Table 1:

Table 1. Main differences between strategic and operational information systems.

Characteristics	Strategic IS	Operational IS
nature of problems	mainly managerial	mainly technical or social
system scope	usually inter-organizational	in one organization
main users	customers, other third parties	clerical staff
method of development	logical incrementalism[3]	systematic planning
costs and benefits	unpredictable	predictable
cost of failure	huge	variable
"driving force"	innovation	tradition

3 NEW NEEDS AND POSSIBILITIES FOR INNOVATION

Information technology and the environment in which it is used — organizations and the society as a whole — is undergoing great changes which make it possible to use information technology in innovative ways. These changes as seen from the viewpoint of innovation are discussed here under the headings of organizational, technical, and economical changes.

Organizational Changes

1 The growing need for information processing.
The introduction of computers at the individual level, both at work and in the home — will raise the total volume of information processing to a new unprecedented level. Traditionally, only organizations have made use of information technology.
2 Liberalization of the information technology industry especially in data communications.
At the moment, telecommunications seems to be the field of most activity in innovative information technology use. This is very much a result of the liberalization of this industry branch.
3 The saturation of traditional information processing practices in organizations.
So far, innovative resources have been exploited in the development of basic operational systems. Now as development begins to level off the field is looking at new, more innovative uses of information technology.
4 The new breed of innovative small companies.
It is a well known fact that innovations are not tolerated in big, bureaucratic organizations. Large, well-known enterprises and companies have to establish small independent units when innovation is looked for, as documented for example in Elder (1989), Grossi (1990) and Yamanouchi (1989). History has shown that small companies are responsible for most innovations, especially in the field of information technology, which has witnessed a boom of new enterprises offering various services.

Economic Changes

1 The increased value of information in organizations.
So far innovations have been focused on other functions of organizations than information technology. In industrial history, we can distingulsh two periods: one of production innovations (mass production time) and one of marketing innovations (differentiated production). The time is ripe for innovations based on information technology, since information is now established as a valuable company resource.
2 The falling prices of technology.
Because of technological advances, but also because of the break up of regulated industries and other monopolies or cartels, the costs of information technology and its usage are falling on nearly all fronts. This allows for innovative uses of information technology, since price is not so often an prohibiting factor any more.

3 The rising prices of the traditional workflows.
Normal daily routine is becoming more and more expensive in all organizations. The work force is expensive, and new ways to exploit computers to assist employees are desperately needed.

Technological Changes

1 Better hardware makes new innovative uses of information technology possible.
The advent of better hardware is a well-known trend that needs no explanation here. Among the most important trends in technology for innovations are:
— introduction of portable computers
— new user-interface devices
— new technologies in telecommunications allowing more fluent communication, both intra-organizational (LAN's) and inter-organizational
2 Better software
The advent of software is even more viable than the advent of hardware because of:
— knowledge-based systems
— new user interface possibilities
— idea processors
— multimedia systems allowing for the integration of different kind of structured and unstructured information.
3 The establishment of standards and protocols.
Standards may appear to counteract innovation. On the other hand, standardization of certain basic functions allows for even greater flexibility in other areas. Without basic telecommunication standards, for example, any kind of communication between different computer installations would be difficult.

4 DIFFERENT VIEWPOINTS ON INNOVATION

There are several dimensions along which to classify innovations. Here we want to make a separation between

1 Process and product innovations.
2 Technical, social and application innovations.
3 Innovations originated either by customers, employees, management or information technology professionals.

What is argued here is that SIS planning needs more process innovation than OIS planning, SIS is more a matter of social and application innovation than technical innovation, and that SIS innovations are more likely to stem from customers and management than from IT professionals or employee-users.

One main line of demarcation goes between process and product innovations. When talking of information systems development, we consider process innovations to be connected with the ways information systems are developed. System development has witnessed many process innovations, some examples are:

— the life-cycle view on information systems
— structured methodologies
— automated methodologies (case-tools).

Our main point of argument here is that the field of SIS planning lacks real **process innovations**. The methods developed for the purpose are basically copied directly from methods of OIS planning. The rigid phases and tasks to be done are maybe needed to achieve effectiveness and efficiency in OIS planning, but SIS planning needs more innovation and freedom. What is needed is a completely new way of thinking.

Product innovations are connected with the product — the information system — itself. Both SIS and OIS need product innovations, but again the need for innovative thinking is more acute in the field of SIS. Safe standard solutions are good for OIS, but competitive advantage can't be based on standards. Competitive advantage must be based on unique features of information systems.

Another way to classify different innovations is to differentiate between technical, social and application innovations.

Technical innovations have to do with the different design options of the information system and serve as a basis for other innovations. Multimedia systems, for example, have been a major technical breakthrough paving the way for much innovation both in social and application spheres. There are many examples of situations where technical innovations have not been enough. The social and application-related prerequisites for system development have been lacking. The literature concentrating purely on the failures of information technology is immense, but even more failures are recited within success stories as examples of wrong

actions. A good summary of the problem area can be found in Hirscheim (1984).

A **social innovation** uses computers in a new way to alleviate social pressures. We often see electronic mail given as an example of how a system can make organizational communication less bureaucratic and more fluent. A worker at even the lowest level of an organization has an easy means to communicate, even with top managers. Resulting improved communication alleviates social pressures, but on the other hand may produce a burden for management as well illustrated in Chuckburn (1989). Arnbrak, in his article concerning innovation in telecommunications (1988), shows how two telecommunication techniques (The Nordic NMT-network and facsimile) have succeeded mainly because of their social innovations, aside from the technical benefits they offer.

Application innovations find new applications for old techniques. A good example of a major application innovation is the use of bar-code readers. Whereas these bar-codes were once used only for identification of goods, we now see the same equipment and codes used in other connections. One example is the processing of direct marketing replies in an insurance company. Instead of keying in all the replies to a marketing campaign, the campaign reply can now be processed by using the bar-codes printed in the reply-forms sent to customers. Both the customer identification data and her/his reply can be read from the bar-code. A well known framework of (application) opportunities is that of Benjamin et al. (1984), who differentiate between four types of opportunities:

Innovation can stem from various sources. Innovativeness is boosted in OIS planning by the co-operation of employees and IT-professionals. Employees should contribute the application innovations, whereas information technology professional master the side of technical innovations.

In SIS application, as noted before, customers are many times the dominant user group. The management of the organization running the SIS should constantly monitor the behavior of customers and modify the system according to their needs. IT professionals lack the channels to monitor customer behavior, and so management must act as a link between customer needs and information technology specialists providing the services. In addition, the huge risks and investments connected with SIS's alone necessitate the active role of management.

There is anyway reason to stress to the importance of users, are they either employees or customers, as the primary motor for innovations. Pure technical facilities are not enough, the application of information systems, both OIS and SIS, depends on the attitude of the users. An early document on the importance of users as a source of innovation can be seen in von Hippel (1978). The study of Baroudi et al. (1986) too proves that user involvement in the planning and design of information systems leads to better system usage and user satisfaction. The same trend was found out in the study of Hirscheim (1985).

Based on the discussion above, a tentative classification of different innovation types is provided in Figure 2.

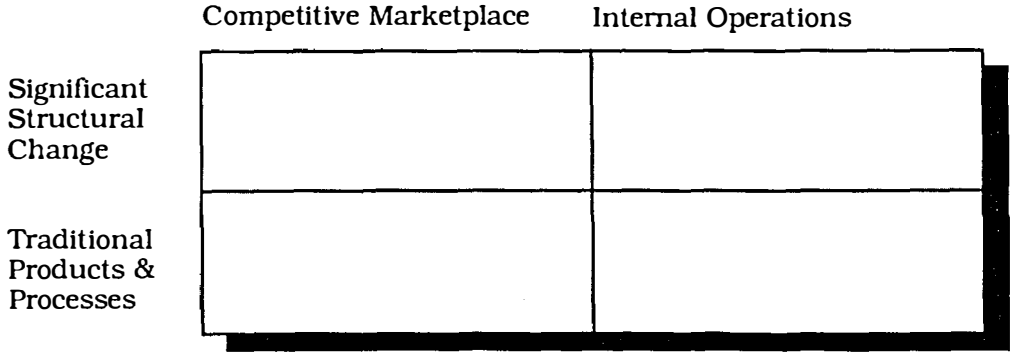

Figure 1. Strategic Opportunities Framework as in Benjamin et al. (1984, 7).

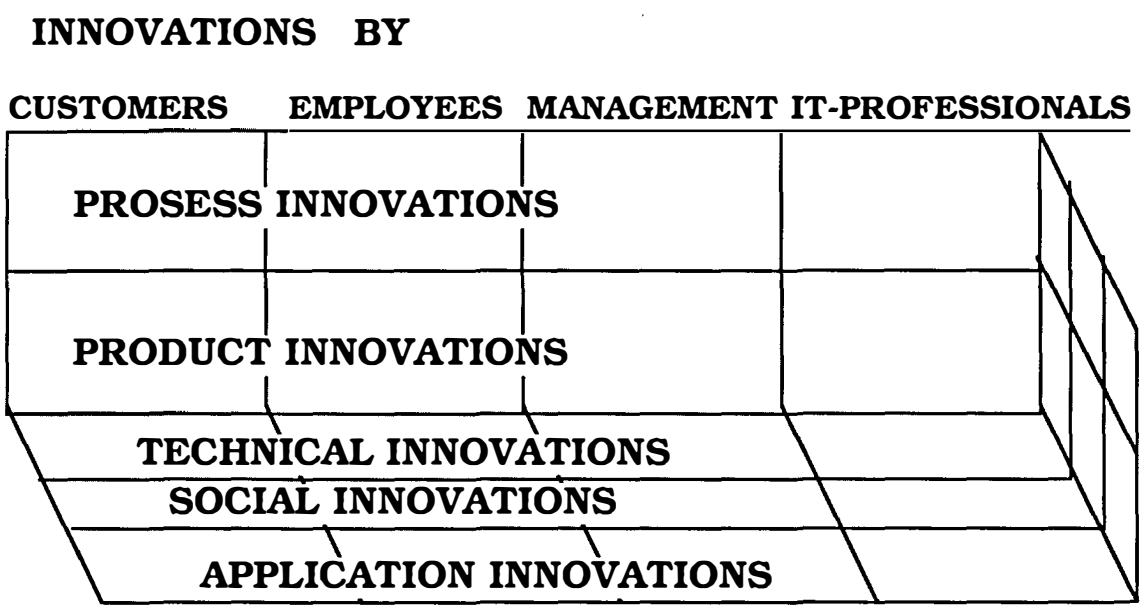

Figure 2. A tentative classification of innovations.

5 WAYS TO ENCOURAGE INNOVATION

Innovation does not arrive by itself but must be constantly sought. Innovation is a way of life more than a distant event. There is no patent on how to accomplish innovation, but the following thoughts are surely of importance.

Keeping critical eye on old, established ways of doing things is essential. Established traditions must be questioned, but of course not abandoned without reason. In his article discussing the new innovativeness of Japanese enterprises, Crister Karlsson (1989) introduces the term "unlearning". Old and unsuccessful knowledge and methods must be actively unlearnt. We all know that, for example, in our personal activities we many times stick to old inefficient habits, which are difficult to abandon. These habits should anyway be abandoned, as Japanese examples show.

Group-work and co-operation are the basic ingredients of innovative behavior. The increasing use of computers as communication media in group-work has had a positive effect on innovation. This is clearly presented in Bell (1979), to whom new communication techniques are actually the key to the new post-industrial society which is characterized by a high level of innovation.

Identifying new opportunities demands new frameworks and theories through which we view the world around us. Michael Earl (1988) has introduced the term "opportunity frameworks" for those instruments that open our eyes to new possibilities.

An opportunistic lifestyle is a requisite for innovations. One must be constantly on the lookout for new possibilities and ways of using computers. Organizational learning is a process of matching problems and solutions. When an opportunity comes along, one must seize it. A prime example of missed opportunity, presented in Elder (1989) is how Xerox failed to exploit an invention on user interface, one that Apple later pounced on and made a commercial success out of.

6 CONCLUSIONS

We have attempted to establish the need for innovative thinking in practical system development. In practice, new innovative uses of computers are spreading.

The scientific community must also pay attention to innovation and innovation studies. The scientific system with its "social control" and its tendency to stick to tradition has been

a major inhibitor of innovative thinking. New research approaches that are not in line with the leading paradigm have been difficult to take hold of. Luckily, information technology is not the worst of the lot, as there is no single leading paradigm in this field.

Innovation should always be allowed, but it is especially important in SIS's, whether they be developed or studied. Strategic use implies the exploitation of unique, unforeseen possibilities, which one rarely finds by employing rigid methods or by sticking to tradition. Thus new methods based on, and allowing for, innovation must be developed and used in the strategic planning of information systems.

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NOTES

1 There is already evidence that practices contributing to the solution of social problems of computing are well developed: end-user computing, participative system development, personal information systems, etc.
2 This term is the vaguest of the three factors: a system is unstructured if one finds it difficult to agree whether it has fulfilled its requirements or not.
3 The term introduce by Quinn (1989)