

# A Review of Strategic Information Systems

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## Abstract

The evolution of information technology (IT) in organizations is often achieved as following three eras—Data Processing, Management Information Systems, and Strategic Information Systems(SIS)—depending on the application of IT, each of them displaying their individual characteristics and having different objectives. While investments in IT are for both efficiency and effectiveness purposes, the SIS era is premised on management proactively seeking out opportunities for competitive advantage through IT, with approaches to information systems (IS) strategy formulation for both alignment of IS/IT investments with business strategy and its use in shaping business strategy. In this paper we try to review the basic concept of the strategic information systems and its evolution and application in the years.

**Keywords:** Strategic information systems planning; competitive advantage; Strategic planning; Information systems; information technology; Strategic Information Systems

## Introduction

Today, most organizations in all fields like industry, commerce and government are mainly dependent on their information systems (IS). Base on [Rockart's \(1988\)](#) words, 'information technology has become interweaved with business'. Indeed, in industries such as telecommunications, media, entertainment, and financial services, where the product is already or is being increasingly digitized, the existence of an organization decisively depends on the effective application of information technology (IT)([Peppard and Ward, 2004](#)). With the advent of e-commerce, the use of technology is becoming just an accepted, often expected, way of conducting business transactions—what has been referred to as the 'strategic necessity hypothesis' ([Clemons and Row, 1991](#); [Floyd and Wooldridge, 1990](#); [Powell and Dent-Miscallef, 1997](#)).

As a result firms are increasingly looking toward the innovative application of technology to obtain a competitive advantage. Even in the public sector, the push towards e-government has seen the advantage of greater technology use to deliver services ([Peppard and Ward, 2004](#)). The organizations search for opportunities to use IT for business advantage began in the late 1970s and early 1980s. Indeed, it is widely accepted that the evolution of IT in organizations to date can

be captured in three 'eras': data processing (DP), management information systems (MIS), and strategic information systems (SIS) (Somogyi and Galliers, 1987). The objectives of the DP and MIS eras are, strictly speaking, a subset of the SIS objective to improve competitiveness (Ward, Griffiths and Whitmore, 1990).

Within the SIS era, the formative writings on IS, IT and competitive advantage presented predominantly descriptive accounts of organizations that had achieved competitive advantage through the innovative application of technology and outlined the nature of that advantage (c.f. Bakos and Treacy, 1986; Cash and Konsynski, 1985; Ives and Learmount, 1984; King, 1978; McFarlan, 1984; Porter and Miller, 1985). A central prescription drawn from these early studies was that investments in IT should be formally planned for and aligned to corporate strategy (c.f. Earl, 1989; Henderson and Venkatraman, 1993; Venkatraman, 1991; Wiseman, 1985). The disruptive impact of IT on industries has also been recognized (Bower and Christensen, 1995; Christensen, 1997; Christensen and Overdorf, 2000; Sampler, 1998) and should be considered in any analysis in strategy development. Consequently, the necessity to consider both alignment and impact has become established in the process of IS/IT strategy formulation (Peppard and Ward, 2004). Models, frameworks and approaches have been developed to incorporate these aspects (e.g. Earl, 1989; Wiseman, 1985) and the success factors for this process have also been determined (Lederer and Mendelow, 1987; Teo and Ang, 2001; Wilson, 1989).

## Defining Strategic Information Systems(SIS)

The difference between strategic information systems and other Information System (IS) such as Transaction Processing System (TPS), Management Information System (MIS), Decision Support System (DSS) is that the new focus is on strategy(Min, Suh and Kim, 1999). Thus first of all the meaning of the term *strategic* must be defined. There are two distinct meanings of the strategic use of information systems (IS) (Wilkes, 1991). Firstly, IS may be *used to support strategic decision making* (Cavaye and Cragg, 1993). Examples include computer-based strategic planning methods and executive information systems, where information systems are used during the strategic decision making process(Doyle, 1991). Secondly, IS may be *used to support or shape an organization's competitive strategy* (Wiseman, 1985).

Any information system which has a strategic impact on the organisation or which provides long term competitive advantage (Eardley, Avison and Powell, 1997; Feeney, Ives, 1990).

In order for a system to be called strategic, it must significantly change business performance, the means the business employs to attain a strategic goal, the way a corporation does business, the way it competes, or the way it deals with customers or suppliers (Ernst and Chen, 1994).

IS may be used as a tool to support and implement strategy; IS may also be used to drive and formulate strategy (Chan, Huff and Barclay, 1990; Wilkes, 1991).

Some authors use the terms strategic use of IS and competitive use of IS interchangeably (Rackoff, Wiseman and Ulrich, 1985; Wiseman, 1985); other authors distinguish between the two (Huff and Beattie, 1985; Bakos and Treaty, 1986). Overlap between various strategic uses of IS causes this confusion.

Strategy may be internally oriented (aimed at improving internal operations), may be competitive (aimed at outmaneuvering other industry players) or may have a portfolio orientation (from the perspective of an outsider considering whether to and how to compete in an industry) (Bakos and Treaty, 1986).Figure 1 shows the place of a SIS.

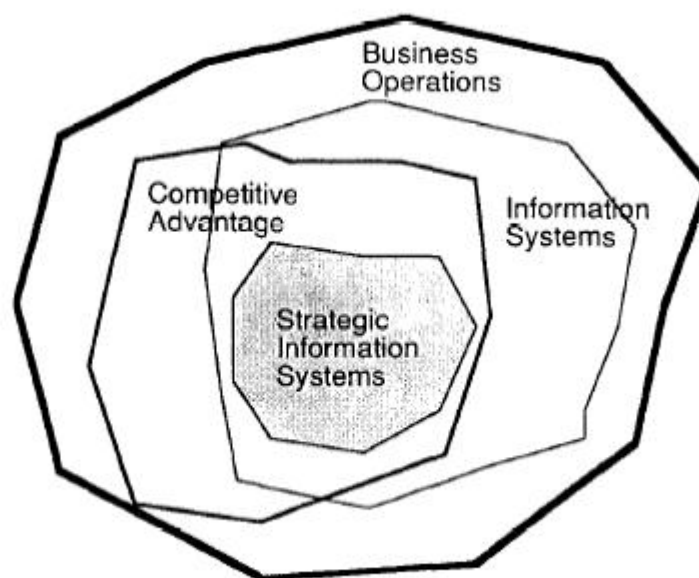
The original orientation of SIS was towards internal systems(shirazi and soroor, 2006).

Empirical studies have found that most SIS applications contribute at the internal strategy and competitive strategy level while only few SIS applications contribute at the business portfolio level (King and Sabherwal, 1992; Sabherwal and King, 1991).

An examination of 14 well-known SIS cases showed that the vast majority of SIS are initially developed in response to internal efficiency needs (Neo, 1988).

Several researchers have commented on the overlap between the internal strategic and the competitive strategic use of IS (Rockart and Scott Morton, 1984; Bakos and Treaty, 1986).

Subsequently, attention switched to cooperation among enterprises (shirazi and soroor, 2006). Consequently SIS often play both an internally strategic and a competitive strategic role in organizations.



*Figure 1. Strategic information systems*

Also some of well-known examples of using SIS are airline reservation systems and many applications of electronic data interchange (EDI).

### **Strategic information systems planning and strategic information systems**

Strategic Information Systems Planning (SISP) refers to the process of creating a portfolio for the implementation and use of IS to maximize the effectiveness and efficiency of a corporation, so that it can achieve its objectives (Min, Suh and Kim, 1999). Lederer and Sethi (1988) define it as: 'the process of deciding the objectives for organizational computing and identifying the potential computer applications which the organization should implement.' like hierarchical strategic planning (Shirazi, 2006). In the word of Min, Suh and Kim(1999) In order for a corporation to develop a strategic plan, it needs to answer the following three questions:

- What position is the corporation taking at present? (current status)
- What position does it plan to take in the future? (objective)
- What path should it take to reach the objective? (implementation)

Strategic Information Systems Planning (SISP) is the process of answering the above questions specifically in relation to IS. But Information systems planning is the process of creating a plan for the implementation and use of IS to maximize the effectiveness of corporate resources to achieve its goals.

The frameworks designed for information systems planning or information systems strategy generation emphasize the role of management and integration in strategy formulation (e.g. Galliers, 1987, 1991; Earl, 1988a,b, 1990). Consequently the emphasis has changed and information systems strategy generation is seen more and more as an interactive organizational process (Earl, 1990). From this point of view the strategic planning of information systems may be defined in the following way: strategic planning of information systems is an interactive learning process for the creation of a strategy for business process redesign and development incorporating information technology. The strategy presents plans for information systems design, implementation and operation for this purpose (Reponen, 1993). Also Reponen (1993) has said: 'an IS strategy is a plan for developing, implementing, managing, and operating information systems (Figure 2). It is a result of an interactive working process in the organization. The contents of the strategy may be different in each case, but based on the experience gained from several case studies during the past 10 years, my conclusion is that the most important decision areas in IS strategy are the following: 1.strategic use of IT 2.application development policy 3.high level architecture 4.organization of the IS function 5.investment planning.'

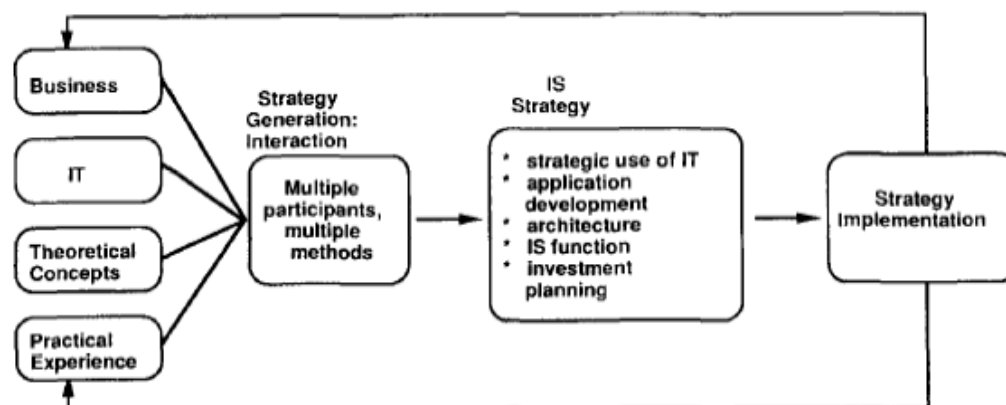


Figure 2. IS strategy process

Yet The terms “Strategic Information Systems”, “Strategic Planning for Information Systems”, and “Strategic Information Systems Planning” (Alter, 1991; O'brien, 1990) are used interchangeably.

## Uncertainty and its impact on strategic information systems

Various surveys (Galliers, 1994; Watson, 1997) reveal that the strategic uses of information systems have been a key concern for senior management for more than a decade. A major element of this concern relates to 'alignment'—ensuring that the information systems support the business direction, enabling rather than constraining. It is self-evident that an alignment of such key resources and competence-bearers with the objective of the firm is important. What is more

difficult, however, is to align these important structures with the objective(s) of the firm under the uncertainties facing any strategic planner.

These uncertainties emerge from four main sources. First, there are limitations arising from the finite application of resources to knowledge gathering about the future of the firm. Often the people best fitted to make sense of the future are those who are critical to the short-term business winning of the firm. Second, prediction itself is an inexact science and predictive methods have inherent limits to their abilities to extrapolate from present conditions. It is not difficult to predict what might happen, but it is difficult to predict what will happen. Third, firms are subject to the legitimate opposing wills of competitors. It cannot be predicted with accuracy what they will do; their pictures of the world may be from own and their value systems may be directly opposed to ours. Last, there are inherent structural reasons (Lovas and Ghoshal, 2000) why the responses of others to the world may be consciously irrational and therefore inherently unpredictable.

To the extent that these uncertainties constitute a failure of vision for the organization, their effects in terms of the SIS can be characterized under three headings (Avison, Eardley and Powell, 1998) :

- the organization's SIS development effort will be diverted or wasted
- the SIS will not support the organizations' long term business Strategy; and
- the organization's 'strategic flexibility' may be compromised and these are serious matters for the firm.

## **Models for development of Strategic Information systems**

It is known, most of the applications in strategic information systems relate to organizations in a free economy in developed countries. P. Palvia, s. Palvia and Zigli (1990) extend it to developing countries. They presented two models: a model for strategic information systems for competitive advantage (SISCA) in developing countries, and a model for strategic information systems for economic development (SISED). The former (SISCA) focuses primarily on profit, with a secondary objective to make selected domestic companies in a given nation more competitive in the world market.

The latter (SISED) is aimed at improving the economic health of a developing nation. It should be noted that SISED can also be used in developed nations.

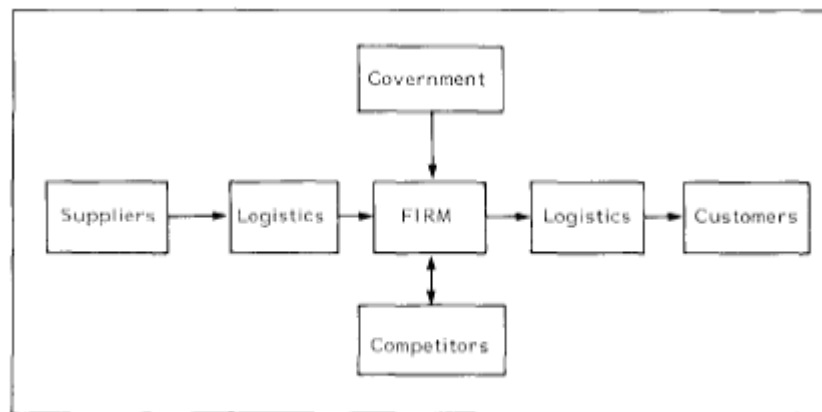
P. Palvia, s. Palvia and Zigli (1990) considered the three typical major strategic dimensions or factors : strategic target, strategic thrust and strategic mode. Each factor has several qualitative values. The targets identified are: supplier, customer, and/or competitors; the thrusts are: differentiation, cost, focus, innovation, growth, and/or alliance; and the modes are defensive or offensive.

### **strategic information systems for competitive advantage (SISCA)**

As P. Palvia, S. Palvia and Zigli (1990) have said, In the SISCA model, in addition to the three forces (strategic targets derive from the strategic forces) of suppliers, customers, and Competitors, Two additional forces have been identified in, namely the government and the logistics. Generally, the government has a significant role in developing countries.

The second new force is logistics. This force includes all of the physical systems and infrastructure required to move raw materials from suppliers to the firm and finished goods from the firm to customers. Specifically, logistics includes transportation systems, communication

systems, warehousing and distribution networks. This strategic force may not be particularly important in developed nations, but is generally very significant in developing countries. Often the logistics systems and the infrastructure in such countries are far from adequate. Figure 3. shows the forces in SISCA model for a firm in a developing country.



**Figure 3.** Strategic forces for a firm in a developing country

### **strategic information systems for economic development (SISED)**

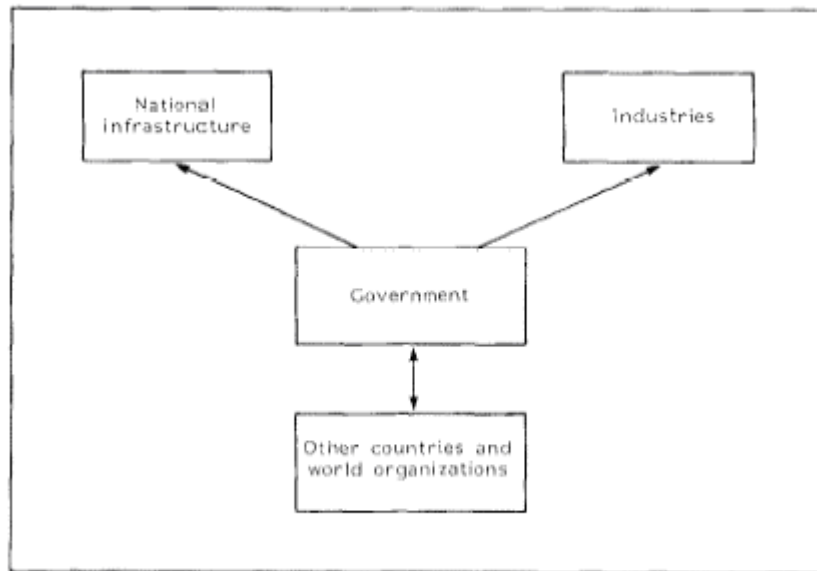
In the P. Palvia, s. Palvia and Zigli (1990) s' SISED model, there are four strategic targets: government, itself, industries, other countries and world organizations and national infrastructure. The major forces which a government may interact are shown in Figure 4. The government may use information systems to manage its own internal resources (people, money, machines) as well as to facilitate and support other strategic forces. Also Information systems may be used in creative ways to promote and support all industries. In the other hand IS technology may be used to support economic cooperation and regulatory requirements of other countries as well as world organizations and at the end the government may find it advantageous to use IS technology in developing its infrastructure. Specifically, the technology may influence the following components of the infrastructure:

(a) Utilities (b) Telecommunications (c) Educational system (d) Logistics (e) Banking/financial system (sources of capital) (f) Labour organizations.

Also there are some changes in Strategic thrust here. Strategic thrusts refer to the kind of advantage gained by doing actions. In this model, these actions are taken by government and not by competitors. Six thrusts or strategies are identified in this public sector model:

1. *Focus*: Concentration by government on a particular industry or segment of government, etc.
2. *Innovation*: A fundamental and creative change in the way a segment of government or an industry operates, etc.
3. *Growth*: Expansion of an industry, government segment, an infrastructure, etc.
4. *Alliance*: Forging partnerships with specific industries, other countries, etc.
5. *Direct support*: Providing direct support in one or more of the areas identified as the targets of government strategy. For example Financial (aid or contribution), Technological, Experts/consultants, Tax advantages.
6. *Indirect support*: Providing indirect support in one or more of the areas that follow for one or more of the targets of government like Information, Education/training programmes for industry.





**Figure 4.** Strategic forces for the government in a developing country

## Requirements for strategic information systems

P. Palvia, s. Palvia and zigli (1990) suggest to consider Some desirable conditions before developing and implementing of strategic information systems in an organization. They group these conditions into two categories: business/organizational requirements and technological requirements. Thus organizations should take further actions before deployment of SIS .

### Business/organizational requirements

1. The SIS must be patterned after the strategic vision (or corporate strategy) of a company(Cunningham,1985).First of all the organization leaders should be explicitly doing strategic planning.
2. Top management must be involved (P. Palvia, s. Palvia and zigli, 1990). SISs involve significant risk and investment, also have long-term planning horizon and a wide scope, so active participation of top management is essential.
3. Information should be considered as a resource like other resources: labour, money, materials. One way to measure this requirement is that the chief information officer (CIO) reports directly to the chief executive officer(CEO) of the company. Another way is the maturity of the organization in its use of other information systems (i.e., it must have systematically passed through transaction processing and management information systems(Morris,1987)). In terms of the Nolan(1979) stage model, the organization should be in or near the maturity stage.
4. The strategic position and nature of the firm and environmental factors may facilitate the use of IS technology for obtaining strategic advantage. Thompson and Strickland (1986) proposed four generic types of firm and five types of generic industry environment and different competitive strategies for each one of them

5. Creativity must be focused. Individual firms should promote activities and programs to improve the creativity of their human resources.
6. The commitment to change and the use of a rational process for implementing change are necessary. A rational process is the Lewin-Schein(1974)'s three-stage change process : unfreezing, moving and refreezing.

### **Technology requirements**

According to Cunningham(1985), 'In a buyer's world in which every customer becomes a market segment, it has got to be a two-way street: market-driven technology rather than technology-driven marketing'.

technological requirements for a successful SIS are:

1. The use of computer-based models. It means using acceptable software to do 'what-if' analyses in an interactive mode. Mathematical, decision support systems(DSS), expert systems(ES) and simulation models are some of these models.
2. Computer-based large databases should be accessible from remote location and include tactical data of the company's internal and external environment.
3. Telecommunications and distributed processing have a vital role because of geographical dispersal.
4. The connectivity of computers (micro and mainframe), communications and office automation provide significant innovative possibilities which make a synergism of IS technologies.

### **The process of SIS development**

The process of developing a competitive SIS can be broken down into a number of stages (Reich and Benbasat, 1990). The reason for breaking down the development process into separate stages is two-fold: Firstly, each individual stage may be completed but this does not guarantee that the organization is able to complete the subsequent stage successfully. Secondly, different factors contribute to the success of each stage(Cavaye and Cragg, 1993).

Reich and Benbasat (1990) presented a five-stage model distinguishing between idea generation, development, early adoption, longer term penetration and competitive advantage. Cavaye and Cragg (1993) combines Reich and Benbasat's early adoption and longer term penetration stages into one stage so identifying four stages and also changes the names of each stage in order to make each label as descriptive .

The four stages are :

*Opportunity identification.* No system can be developed without the original idea so an SIS opportunity must be identified and evaluated.

*Design and build.* To use an opportunity, a system must be designed and built.

*Implementation.* After development, the SIS must be implemented and adopted by the intended users. Since these users are often outside the sponsoring organization such adoption may be voluntary.

*Competitive impact.* After implementation, some firms derive a competitive advantage from their SIS.

### **Identification of SIS opportunities**



The identification of an SIS opportunity is the start of the SIS development process. Alternatively, organizations can proactively search for opportunities using one of the many frameworks designed for this purpose (Cavaye and Cragg, 1993). Cavaye and Cragg (1993) proposed forces encourage SIS development: Internal need, competitive pressure, opportunities and threats facing an industry, information intensity.

*Internal need.* Neo's (1988) analysis of 14 well-known SIS suggests that most organizations develop SIS initially in response to an internal need. Processes and products with a high information content are automated to enhance internal efficiency (Lindsey et al., 1990). Businesses with high transaction volumes develop systems to improve internal operations (Johnston and Carrico, 1988).

*Competitive pressure.* A competitive industrial environment is conducive to the development of SIS (King and Sabherwal, 1992). Organizations that are first to develop and introduce an SIS often have a competitive orientation and show a strong desire to be number one (Reich and Benbasat, 1990). In other cases SIS are developed in response to increased competition in the industry (Johnston and Carrico, 1988; King, Grover and Hufnagel, 1989). Increased competitive pressure may arise from a growing number of competitors (increased foreign competition or entry of competitors from another industry) or from a successful SIS initiative by a competitor (Cavaye and Cragg, 1993).

*Opportunities and threats facing an industry.* Opportunities or threats can act as a catalyst for SIS development (Johnston and Carrico, 1988; Neo, 1988).

*Information intensity.* Development of SIS is often related to the relative information intensity of products and processes (Cavaye and Cragg, 1993). Products that have a large information content, and processes which involve a high degree of information processing, provide opportunities for exploiting IS (Huff and Beattie, 1985). In some industries, IS are critical for the functioning and survival of firms (finance, publishing, distribution); in other industries IS plays a cost-effective, but distinctly supporting role (manufacturing) (Cavaye and Cragg, 1993). SIS applications are therefore often associated with information intensive industries (Johnston and Carrico, 1988).

## Framework for identifying SIS opportunities

A significant part of the early SIS literature is allotted to the identification and description of opportunities for SIS. Typically frameworks are proposed, based on either Porter's models or on the value-added chain model (Cavaye and Cragg, 1993).

Porter (1980, 1985) in his books presented the enterprise's value chain can be used as a framework for identifying opportunities for competitive advantage. A firm's value activities fall into two broad categories: primary and support (shirazi and soroor, 2006). Primary activities are related to the physical creation of the product, its marketing and delivery and also its support and servicing after sale. Support activities provide the infrastructure for the primary activities to take place. These are linked together to form the enterprise's value chain. Competitive advantage in either cost or differentiation is a function of this chain (shirazi and soroor, 2006).

Parsons (1983) proposed an expanded list of potential strategic application impacts; he groups the impacts into three levels: the industry, the firm, and the company's strategy. Ives and Learmonth (1984) presented a customer resource life cycle model to clarify what opportunities exist for strategic applications. Ives and Vitale (1988) apply the model to the after sale phase to identify strategic application opportunities.

Benjamin and Scott Morton (1988) focused on the integration chain to show the impact of strategic applications. Benjamin et al. (1984) presented a strategic opportunities matrix for IT opportunities identification. They suggested that IT can be used for strategic purposes both in the marketplace and in internal operations. Porter and Millar (1985) proposed using an information intensity matrix to assess IT's role. The matrix evaluates the information intensity of the value

chain against that of the product (shirazi and soroor, 2006). They suggested that IT will play a strategic role in industries which is described by high information intensity in both the value chain and the product.

Wiseman (1988) broadened the scope of Porter's model (shirazi and soroor, 2006). According to shirazi and soroor (2006) Wiseman combined his generic strategies with Chandler's growth strategies to produce a 'strategic thrusts' framework intended as a means of identifying strategic IS. Strategic thrusts are major competitive moves made by a firm. Five postulated thrusts are: differentiation, cost, innovation, growth and alliance. They are targeted at suppliers, customers and/or competitors. IT can be used to support or shape the enterprise's competitive strategy by supporting or shaping competitive thrusts.

Many frameworks are based on one or both of Porter's models of competitive forces and competitive strategies (Porter, 1979, 1980). These include frameworks by Benjamin et al. (1984), Ives and Learmonth (1984), Johnston and Vitale (1988), McFarlan (1984), Parsons (1983), Rackoff, Wiseman and Ulrich (1985), Wiseman (1985) and Wiseman and MacMillan (1984). They describe and give examples of ways in which firms can exploit IS to produce low-cost goods and services, to reduce lead-time, to customize products, to enhance levels of customer service, and to identify specialized markets (Cavaye and Cragg, 1993).

Researchers (Rockart and Scott Morton, 1984; Porter and Millar, 1985; Ives and Vitale, 1988; Johnston and Carrico, 1988) have also utilized value-added chain analysis to put forward approaches to identify competitive IS opportunities. Frameworks to identify SIS opportunities proliferate; more than 15 separate models have been identified (Earl, 1989). Some researchers have questioned the relative usefulness of these models (Doyle, 1991; Galliers, 1991). Others have pointed out weaknesses and limitations of existing frameworks (Chan, Huff and Barclay, 1990). Organizations that wish to use a framework for identifying SIS opportunities face the difficulty of selecting an appropriate framework (Cavaye and Cragg, 1993).

In a study to compare the relative usefulness of two main frameworks, Bergeron, Buteau and Raymond (1991) compared Porter's value chain model (Porter and Millar, 1985) and the Wiseman strategic thrust model (Rackoff, Wiseman and Ulrich, 1985). The conclusion was that both models were relevant and helped identify strategic opportunities.

The study concluded that value chain models tend to be more applicable to organizations in stable environments aiming to improve internal processes but The strategic thrust model seems more relevant for organizations that seek an improved competitive position (Cavaye and Cragg, 1993).

## **Design and build an SIS**

Researchers used a number of methods to identify factors for designing and building of SIS. Most research has been case study based and authors have generalized from a single case in a single industry [e.g. the TELCOT system in the cotton industry (Lindsey *et al.*, 1990)] or look for commonalities in a number of cases in a single industry [e.g. reservations systems in the airline industry (Copeland and McKenney, 1988)] or a number of cases in several industries [e.g. customer oriented systems (Reich and Benbasat, 1990)] (Cavaye and Cragg, 1993). Other studies have surveyed IS professionals to elicit practitioners' perceptions of factors impacting on the SIS development process (e.g. Johnston and Carrico, 1988) (Cavaye and Cragg, 1993). There are therefore opportunities for systematic investigation of various success factors (Neo, 1988). Here are the Factors contributing to the successful designing and building of SIS which proposed by Cavaye and Cragg (1993).

*Application sponsor.* Runge (1985) first recognized a indicative positive correlation between the existence of an application sponsor and SIS development success. Studies since then have shown that an application sponsor is indeed often associated with an SIS development (Kim and Michelman, 1990; Lindsey *et al.*, 1990; Reich and Benbasat, 1990; Wightman, 1990). A centralized environment is conducive to the effective sponsorship of systems by a high-level executive (King and Sabherwal, 1992).

*Top management support.* An SIS development is often a large project and needs a major commitment in terms of time, people and financial resources, thus top management must support it. Successful SIS projects are accorded high priority in the organization (Neo, 1988; Reich and Benbasat, 1990). A lack of top management support is a major inhibitor in the development of SIS (King, Grover and Hufnagel, 1989) even if the IS function itself is willing and enthusiastic (Johnston and Carrico, 1988).

*Resources.* Management has to be willing to invest substantial resources in order to develop an SIS as most SIS require an abundance of resources (Reich and Benbasat, 1990). A strong financial position of the firm has therefore been identified as a major enabling factor for the development of SIS, while budgeting

constraints act as an inhibitor (King, Grover and Hufnagel, 1989). However, there may be risks attached to not investing (Clemons, 1991). Case studies show that an organization may have to invest in a major project in order to keep up with competitors (Copeland and McKenney, 1988) or to remain in business (Lindsey *et al.*, 1990).

*Build on an existing system.* It is more desirable if organizations have prior experience with IS. Many successful SIS evolve from transaction processing systems already operational in the organization (Copeland and McKenney, 1988; Johnston and Carrico, 1988). Existing systems may become an SIS through integration of separate internal systems (Benjamin and Scott Morton, 1988) or by extending the systems beyond company boundaries (Cash and Konsynski, 1985).

*IS experience.* If not using an existing system, organizations may use the experience gained in one system to build a new, improved SIS (Reich and Benbasat, 1990). King, Grover and Hufnagel(1989) found a strong internal, technical ability to be a major enabler for SIS development. High levels of competence amongst IS staff (Reich and Benbasat, 1990) and a mature IS function (King and Sabherwal, 1992) enable an organization to design and build an SIS(Cavaye and Cragg, 1993).

*Existing IS capacity.* As well as having expertise, organizations must have the capacity to develop a system(Cavaye and Cragg, 1993). A large existing processing capacity enables an organization to design and build an SIS (Copeland and McKenney, 1988).

Some researchers (Krcmar and lucas, 1991) proposed other key factors in developing strategic information systems.

These factors are :

1. Recognizing and seizing an opportunity.
2. Dealing with a lack of cost justification.
3. The need for a systems's sponsor.
4. Marketing an application.
5. Building on an infrastructure.
6. Taking a customer-oriented point of view.

## **Implementation of SIS**

Few studies of SIS distinguish between, on the one hand, the designing and building of an application and, on the other hand, the implementation of that application (Cavaye and Cragg, 1993). Successful implementation depends on acceptance and adoption by users (Cavaye and Cragg, 1993). Though there have been many studies of IS implementation, only two studies refer specifically to factors impacting on the implementation or adoption of SIS (Runge, 1985; Reich and Benbasat, 1990). Cavaye and Cragg (1993) s' factors which determine the relative success of the implementation/adoption of an SIS, are:

*Fulfilling a user need.* The system may have been built to satisfy known needs:

intended users may have expressed dissatisfaction with an existing system or they may have expressed the desire for a new service (Cavaye and Cragg, 1993). Reich and Benbasat (1990) discovered systems built in reaction to needs expressed by customers were adopted faster and better than systems built in the absence of an expressed need.

*User participation in design.* Applications which rely on voluntary adoption must take into account the views of the intended user (Krcmar and Lucas, 1991). User participation is positively correlated with rapid adoption of SIS (Runge, 1985). System development which does not involve user participation has mixed adoption rates (Reich and Benbasat, 1990).

*Financial cost to user.* Empirical evidence suggests that passing on a high cost of the SIS to the user leads to slow adoption, while low or nominal cost is associated with fast adoption of SIS (Reich and Benbasat, 1990).

*Marketing of SIS.* Since SIS often involve users outside the organization, adoption may depend on the relative effectiveness of marketing the system (Cavaye and Cragg, 1993). Empirical evidence suggests that superior marketing programmes have an enabling effect on system adoption (Runge, 1985). Disappointing marketing efforts, on the other hand, are associated with slow adoption of SIS (Reich and Benbasat, 1990).

## **Competitive impact of SIS**

King and Sabherwal's (1992) study of 81 SIS shows SIS are successful and can provide differentiation and cost advantages (Cavaye and Cragg, 1993).

However, there are few reported instances of sustained competitive advantages based on SIS (Cavaye and Cragg, 1993).

*Temporary competitive edge.* A competitive edge based on IT may only be temporary (Clemons and Kimbrough, 1986). A firm can maintain a competitive edge while it has the time to reap benefits from its SIS (Clemons, 1987). Competitors may not be aware of the source of the leader's competitive success; they may not realize the importance of the new IT application; they may not be able to imitate because of costs or lack of access to technology (Clemons and Kimbrough, 1987).

*Strategic necessity.* SIS may have such an impact on the industry that it changes the rules of the business (Cavaye and Cragg, 1993). It may become clear to competitors that the SIS application is a strategic necessity: something that a firm must have in order to compete (Clemons and Kimbrough, 1987). By not investing in and not imitating the SIS, firms may no longer be able to compete effectively (or at all). In order to overcome first mover advantages, competitors may have to leapfrog the capabilities of the original system or entice users away from the original system by offering greater incentives (Johnston and Carrico, 1988). When an SIS becomes a strategic necessity and competitors copy the first mover in an effort to regain their competitive position, the cost structure of the industry changes (Clemons and Kimbrough, 1987). As the

industry stabilizes and all competitors use the application, the cost of industry participation has increased and entry barriers have been raised - but no single firm is able to gain or maintain a competitive advantage based on the SIS (Cavaye and Cragg, 1993). IT applications classed as strategic necessities are not always easy to obtain as acquisition costs may be high, implementation may be difficult and development time may be lengthy (Clemons and Kimbrough, 1987). Such constraints may lead to the development of cooperative systems (e.g. joint ATM networks in the banking industry) or to industry concentration through mergers, acquisitions and firms leaving the industry (e.g. the drug distribution or airline industry) (Cavaye and Cragg, 1993).

*Sustained competitive advantage.* A competitive advantage is sustainable only if competitors cannot easily copy the first mover (Cavaye and Cragg, 1993). Firms that want to sustain their competitive advantage rely on a capability gap (Cavaye and Cragg, 1993). This differentiation in capability may be based on firm-specific strengths (Coyne, 1986) or on the ability to create barriers to entry (Porter, 1980) or on the continuous updating and improvement of the strategic tool (Grindley, 1991).

*Firm-specific strengths.* Exploiting IS to support activities, skills and routines that are unique to the organization and thus exploiting the information component of IS may enable firms to sustain a competitive advantage (King, Grover and Hufnagel, 1989).

*Creating barriers to imitation.* Many SIS are inter-organizational systems and their major defence against competitor imitation relies on switching costs (Cavaye and Cragg, 1993). When adoption of the system has been rapid and switching costs are substantial, a first mover is likely to reap lasting benefits from the system (Clemons and Kimbrough, 1986).

*Exploiting continuing opportunities.* According to Cavaye and Cragg (1993), firms that have gained a competitive edge with an SIS may be able to sustain that advantage by continually enhancing and improving the system, thus remaining one step ahead of their competitors. Empirical evidence supports the notion that continued exploitation of SIS underlies a sustainable competitive advantage (Copeland and McKenney, 1988; Reich and Benbasat, 1990). Cavaye and Cragg (1993) expose Many SIS research findings are the result of exploratory and descriptive studies based on small sample sizes and Method limitations concern problems with measurement of variables, and the generalizability of findings which are out of this report scope.

## **Significant barriers to successful development of SIS**

From the business press review and from interviews with leaders in the SISs area, it appears that the potential pitfalls faced when working with SISs can be classified into three steps of the SIS creation process (Kemerer and Sosa, 1991). These are:

- *Definition phase:* identification of feasible opportunities for strategic advantage is difficult.
- *Implementation phase:* given an idea, strategic systems are often difficult to implement.
- *Maintenance phase:* even if implementation is successful and the system is strategic, continued success can be costly.
- *Definition phase:* Feasible opportunities identification is difficult

To identify a feasible opportunity to obtain strategic advantage through SISs, the following minimum criteria should be satisfied (Kemerer and Sosa, 1991). Systems must: 1. be conceived

2. be technically feasible 3. be fundable by the organization 4. have a market

- *Implementation phase:* SISs are complex to Implement



Achieving a fundable, technically feasible, and marketable SIS concept moves an organization only partly towards success (Kemerer and Sosa, 1991). The examination of the literature on successful SISs suggests that systems often involve one or more of the following attributes:

1. telecommunications
2. reliance on multiple vendors
3. inter-organizational cooperation
4. 'bleeding edge' technology

These areas, either separately or combined, can provide sufficient difficulty during the development and implementation process to make an SIS idea unsuccessful (Kemerer and Sosa, 1991). Unfortunately the explanation of them is out of this paper.

- Maintenance phase: Maintaining and adapting SISs requires constant management

Even after an SIS idea has been created, and the system has been successfully developed and implemented, the success of the system can be costly for the organization (Vitale, 1986). According to Kemerer and Sosa (1991) Strategic systems can:

1. be copied by competitors
2. create oversubscription
3. be expensive to maintain and/or enhance
4. create high exit barriers from the industry

## Sources of SIS

According to Radford (1987) strategic information divide into four categories:

- (a) which is freely and openly available,
- (b) information which is deliberately provided by a participant,
- (c) information which is held confidential by a participant, and
- (d) information on one's own organization which is held confidential. The greatest proportion of strategic information is provided by open sources. Observation of the activities of others and of trends in the environment by an informed individual is the most useful method of gathering this kind of information. A study of managers working in organizations showed that they rely heavily on personal contacts and networks of communication for gathering strategic information (Aguilar, 1967). The two most important sources of information about the external environment are customers and those having no regular relationship with the organization. Also the study showed only about half of the strategic information used by managers was directly inquired by them. The remainder was presented unsolicited by persons who knew of the recipient's interests and had some incentive to satisfy his needs (Radford, 1987). Radford (1987) believes because there are few formally organized systems, managers did not obtain strategic information from them.

In any case, the reluctance or willingness of managers to share sensitive information are the main factors in determining the success of the strategic component of an organizational information system.

## Essential function of SIS

Radford (1987) proposed four essential functions for strategic information systems:

- (a) Acquisition
  - (b) Interpretation,
  - (c) Storage and retrieval, and
  - (d) Presentation.
- (a) The acquisition function

There are a numerous sources of strategic information, Also the volume of information and the subjects to which the information refers are very great. Thus many organizations may want to gather all subjects in all areas but it is impossible in practice because there are some limitation on time and resources. Of course Shirazi and Soroor (2006) proposed intelligent/ mobile data miner agents for strategic organizational environmental scan. However, there are some modes by which the acquisition of strategic information is carried out. Three of these modes are:



*General scanning*, which includes considerable and non-specific search procedure based on predetermined pattern. It is the most economic method but its output may not be sufficiently specific to a particular problem.

*Directed scanning*, is concentrated on a specific area of the environment. It is more concentrated but the number of subjects it covers is limited.

*Active search*, is to seek information on a particular subject. It is the most effective method of gathering information in specific issues but it is also most costly.

(b) The interpretation function

The purpose of this function in a strategic information system is to assess the importance of information which is obtained. Interpretation of strategic information might not be separated from its acquisition. Also managers involved in decision processes are often the best interpreters and the best result is achieved when there is a close and continuous cooperation between managers and their colleagues in interpretation function of strategic information system. Such cooperation also provides some safeguard against distortion and misperception of the meaning of strategic information that may arise from a number of behavioral and group interactive phenomena (Janis, 1972; Stoessinger, 1974).

(c) The storage and retrieval function

The purpose of this function is to make the retention of information and its later retrieval effortless. The three components of this facility are:

1. A group of storage locations which information is stored in diverse forms
2. A system communication with the storage media for updating and assessing the contents
3. A system for storing information to retrieve effectively and efficiently.

The main keys in effective and efficient storage and retrieval system are accuracy, consistency and exact descriptions of the information. If the content of the information is better structured, a subject index or catalogue can be brought forward. Also cross references and linkages between the items which are stored is another way to classification information named thesaurus.

(d) The presentation function

Its function is to provide information which is related to managers' work and others who are responsible in making decisions. The way in which the detailed information is presented should attract them and also respond to their needs with the least deviation in the main subject. One of the best methods of presentation is using comprehensive directories and catalogues to provide immediate assistance to users. But to gain this objective these directories and catalogues should be up to date continuously. Another method is establishing information in a display room located in the organization. By using the display techniques which integrate different fields of information and provide facility to concentrate on one issue in particular, the relevant information would be available in an interesting way rapidly. In this method updating the information should be considered too.

## Conclusion

Within the competitive global environment, information has become a key resource for increasing a corporation's competitiveness by changing the nature or conduct of business. The important issue is that investment in IT should be planned for and aligned to corporate strategy. A message from the research literature is that IT alone is not a source of sustainable competitive advantage and the business value derives from IT investment. This report focuses on one of the applications of IT in organizations named Strategic Information Systems (SIS). It is tried to have a review on SIS literature. SIS has been introduced and definition of SIS from different researchers has been brought. The process of SIS development, requirements for this developing and its barriers, besides of SIS risk evaluation has been proposed too. But survey of more than 80 papers in this subject shows some issues need more study;

- How to align SIS with objectives of an organization better.
- Using an Intelligent agent-based architecture for SIS applications.
- Applying Information security policy in SIS.
- Presenting a mechanisms to achieve sustained value from SIS.

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