

Strategic information systems planning: deriving comparative advantage from EDI

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In this paper we argue that electronic data interchange (EDI) should not be viewed simply as a technological infrastructure, but as a technology which may enable an organization taking a strategic view to derive comparative advantage from utilizing it as part of a process of business re-engineering – in other words, as a sociotechnical entity. We suggest that strategic information systems planning (SISP) is a suitable superstructure within which EDI implementation may be considered from an appropriate strategic, as opposed to tactical, perspective. Finally we describe the theory and current practice of SISP and present guidelines for its application in relation to EDI.

Introduction

To many of the business practitioners and managers facing the decision to become involved in electronic data interchange (EDI), the technological issues are those which appear to have the greatest weight (Rochester, 1989; Skagen, 1989; Swatman 1993; Van Brussel, 1992). Despite the wide circulation of academic and commercial material over the past 4–5 years which analyses the importance of a business focus for EDI (see, for example, Ali, 1992; Borthick and Roth, 1993; Sheombar and Wagenaar, 1991; Swatman *et al.*, 1994), there are still many working in this field who see only the technological obstacles. For example, ‘new edi’ – an approach to defining EDI messages which its creators believe will substantially simplify the process of EDI document creation – has been a major topic of interest within the internet discussion group (listserv) EDI-L during 1994/1995. Despite the ‘newness’ of the concept, however, its creator frequently states in his messages to the group that: ‘EDI is not about business – it is about technology’. This statement has polarized opinion among contributors to the discussion to quite a large extent, with participants taking strong positions for and against the argument, although no resolution of the debate is yet in sight. It would thus appear that the argument concerning EDI’s status as an enabler of business, rather than as a technological tool, is far from being over.

This view of EDI as a technical problem which must

be solved anew for each scheme is reflected in the approach often taken when implementing new EDI schemes – that of handing the problem to the IT department to solve (West, 1994). Organizations contemplating EDI tend to perceive each implementation as unique, primarily because each company involved in a particular market segment transacts its business slightly differently from its competitors. This is not a new problem for the software industry – the conviction that because a company’s methods of doing business are unique, the software to support those methods must also be unique has been a major contributor to the development of today’s wide range of software variations on universal requirements such as payroll or general ledger (Dearden, 1987; Swatman *et al.*, 1990).

Case studies of organizations which have based a successful redesign of business processes upon the common technological infrastructure provided by EDI, however (see, for example, the case studies of Levi Strauss in the United States, Tesco in Britain, or BHP Steel in Australia cited in Baker, 1991; DuBois, 1990; Harris *et al.*, 1992; INS, 1991; Rochester, 1989; Swatman, 1994), all point to the need for a top-down, strategic planning process within which the business re-engineering may occur.

Without denying the importance of senior management support for major organizational change, the strategic information systems planning (SISP) literature also recommends a multiple or eclectic approach (Earl, 1989; Sullivan, 1985) in order to gain comparative

advantage from information technology (IT). In other words, the utilization of IT for strategic purposes should not simply depend on existing objectives and assumptions, or on improving the efficiency of existing processes (Hammer, 1990; Morrow and Hazell, 1992). It should also incorporate radical, creative thinking which could lead to radically changed relationships with, for example, suppliers and customers; and a reorientation of the very nature of the business itself.

This paper discusses the relationship between SISP and EDI and suggests that SISP offers an appropriate framework for organizations wishing to take a strategic approach to the implementation of EDI and to the subsequent use of EDI as an infrastructure for business process redesign. The practice of SISP is examined and the difficulties encountered by practitioners are shown to be similar to those encountered by the more advanced EDI-implementing organizations. Finally, we suggest an approach to the practical implementation of EDI based on the practice of SISP enhanced by insights drawn from the SISP literature.

Strategic information systems planning

The theory and, to some extent, the practice of strategic information systems planning has developed over the past two decades. The focus of interest has shifted from technological and methodological issues towards a creative approach to the definition of business directions and organizational (re)design (Galliers, 1993a).

Initially, SISP was considered to be primarily concerned with the identification of a portfolio of information systems applications and the necessary technology to support these. Although much current practice still reflects this view (Galliers, 1987a, 1991a, 1994) there is now some evidence that organizations are seeking to provide, via SISP:

- (1) new or better products/services (Wilson, 1990);
- (2) an environment which provides a platform for flexibility and change (Oxford, 1990); and
- (3) a means by which business processes may be re-engineered in line with opportunities afforded by new information technology (IT) and by changed business imperatives (Scott Morton, 1991).

During this period of evolution of SISP thinking there has been a striking trend towards an increasingly dynamic process. In the early days, it was not uncommon for SISP studies to take 6–9 months while more recent evidence points to process durations measured in weeks or even days (Lincoln, 1990). Similarly, the time horizons studied have dropped from as much as 10 years in early studies to today's 2–3 year durations. It has been suggested that this is a consequence of rapid technologi-

cal change and volatile markets but, in any event, the keynote is flexibility (Galliers, 1993b).

Most organizations undertaking SISP appear to be reasonably satisfied with the results of their efforts. Both Galliers (1987a) and Wilson (1989) report that more than 70% of organizations participating in their studies profess some level of success (although both note that this is likely to be an overestimate of success). Nonetheless, the key factors which influence the success of SISP initiatives are often missing:

- (1) quality of management involvement in and commitment to SISP;
- (2) consideration of a number of alternative futures on which to base SISP with a tendency to focus on a single view of the future;
- (3) appropriateness of the SISP in terms of feasibility as well as desirability;
- (4) careful consideration of the choice/style of the SISP approach to be adopted;
- (5) assessment of the benefits/impacts of SISP (in business terms); and
- (6) integration of SISP considerations into business strategy and business re-engineering.

Lederer and Sethi (1992) suggest that satisfaction with SISP planning does not necessarily lead to a successful implementation. They note particularly that between finalization of the plan and its implementation, changes in the planning firm's external environment may mean that the plan is no longer so appropriate, or business priorities may alter because of political change within the organization itself. Galliers (1991a, 1993b, 1994) goes further by arguing for a continuous process of evaluation and review and the consideration of implementation issues as a key component of SISP formulations (see also Baker, 1995).

This discrepancy between plan and implementation is also apparent in EDI. Those describing the possibilities which EDI offers point to an efficient and integrated future, in which data flows are replaced with information and where organizations can restructure in the most effective manner (DuBois, 1990; Knoppers, 1992; Payne and Anderson, 1991; Swatman and Swatman, 1992). Yet many of these opportunities are lost because of sub-optimal EDI implementation. Van Kirk (1993) summarizes the pitfalls succinctly:

- (1) failure to conform to agreed standards or to move to more recent versions of agreed standards means that many companies must install complex and ever-changing translation software (see also Swatman and Swatman, 1994 and, for a quite different perspective on the problem of EDI standards, Webster, 1994);
- (2) the difficulties of integrating EDI messages with internal application software, particularly for

small-to-medium sized enterprises (SMES) which cannot afford gateway conversion software, or for organizations with many legacy systems (although this problem is now starting to be addressed in a more formal way – for example Fowler *et al.*, 1993, 1994a, 1994b). Lloyd (1992) believes that the absence of such links not only impedes information flow, but also inhibits management's attempts to engage in business restructure;

- (3) the problems of updating databases with information contained in EDI messages (see Swatman (1994) for a discussion of the way in which BHP Steel has integrated EDI and databases to provide seamless corporate access); and
- (4) the emerging issue of LAN-based EDI with its associated notification problems, given that EDI is essentially a centralized application (but see Seymour (1993) for potential solutions to this problem).

Just as with SISP, the complexities of EDI implementation may be sufficiently daunting to deter potential adopters, particularly in the case of SMEs where the technological costs may not be offset by the organizational or strategic benefits – although evidence is beginning to emerge that even this group can benefit substantially from a strategic approach to EDI. A case in point is the Australian company Bisalloy which, while using exclusively PC-based systems decreased data handling errors, improved timeliness of inventory information (reducing inward goods delays from 36 to 12 hours) and substantially improved the productivity of both supplier and customer order processing by integrating EDI messages with internal system information (Croll, 1992) – suggesting that even comparatively small companies can take advantage of the benefits available from EDI-based business process redesign.

The major obstacle to a strategic view of EDI, of course, is the fact that many users are effectively forced into using the technology by their customers or suppliers (the 'desourcing' or 'delisting' argument made famous by the US automotive manufacturers – 'do business with EDI or don't do business with us'). Under these circumstances, few small companies are able or willing to take a strategic (and planned) view of their use of new technology. Yet SISP and EDI have the capacity to improve the day-to-day operations of any organization (whether large or small) and can be seen as strategic weapons in an increasingly competitive marketplace.

SISP and EDI

There are interesting parallels between the key factors which influence the respective successes of SISP and

EDI implementation – if we are to judge the success of EDI implementation by its ability to generate comparative advantage. We define comparative advantage, in line with the term's conventional usage within the economics literature, as sustainable competitive advantage, while the headings for the following analysis are taken from Galliers' (1992) review of SISP.

Management involvement and commitment

It has been argued that one reason for the slower than anticipated acceptance of EDI can be found in implementing organizations' tendency to devolve the responsibility for EDI to the IS department (Swatman and Swatman, 1991a; West, 1994). This devolution of control (and, often, of interest) has led to EDI being considered by many organizations as a primarily technical rather than organizational issue. In the case of small businesses, of course, it is the technical issues which are most apparent – an organization under pressure from its major customer to implement EDI will generally buy the recommended software package and run it on a PC without consideration of any longer-term issues. In such cases, even the selection of an EDI network provider may be beyond the company's influence (see Webster (1995) for a discussion of the Ford case study, in which automotive suppliers had little or no influence over ways in which EDI was implemented and administered).

Larger organizations, however, have considerably more ability to control the way in which they implement EDI and, in those cases where senior management have taken an active interest in designing the company's approach from the top down, the results have been uniformly satisfactory. The classic cases include Levi Strauss in the US (Rochester, 1989; Dubois, 1990; Baker, 1991), Tesco in Britain (INS, 1991; Harris *et al.*, 1992) and BHP Steel in Australia (Swatman, 1994).

Those large organizations which have actively supported their smaller trading partners in the acquisition of EDI by training programmes and the provision of help desk facilities have found that a much longer-term view of the use of EDI often results. While we are unaware of any formal research on this topic, a number of recent case studies (Fowler *et al.*, 1993; Iacovou *et al.*, 1995; Reekers and Smithson, 1994; Swatman, 1994) have touched on this finding in passing. Management involvement, both within the implementing company and from large trading partners, appears to be a major success factor for those organizations which have made the transition to strategic use of EDI.

The extent of management involvement in SISP is a less pressing problem than it was in the early days, but there is still concern over the quality of the involvement and the lack of senior management commitment shown in taking responsibility for the implementation of change

(Galliers, 1987b, 1991a; Grindley, 1990). Too much of SISP, even today, is concerned with technological issues with less attention being paid to topics such as: the impact of IT on business processes; organizational arrangements for IS services; and the skills necessary (on the part of both users and IS professionals) to implement chosen strategies (Galliers, 1991a, 1994).

A single view of the future

Despite the volatility of the business and technological environments in which most organizations operate, management perspectives on EDI are too often based on a single set of assumptions about the way in which business will be conducted in the 'foreseeable' future. The set of assumptions is often unquestioned – indeed, it is too rarely acknowledged that such a set of assumptions exists. EDI, then, is often considered in isolation both from other technological innovations and from changes in business practice (Parker and Swatman, 1995a, 1995b; Swatman and Clarke, 1991; Swatman and Swatman, 1991b).

This short-sighted attitude can clearly be seen from the fact that organizations contemplating EDI tend to perceive each implementation as unique, despite the obvious similarities existing within a single market sector. The responses to two surveys of Australian EDI-using organizations conducted in 1989 and 1992 (Swatman, 1993) show that companies in virtually identical markets (particularly within the retail industry) frequently created entirely new EDI schemes, often using different EDI network providers, in preference to joining existing EDI schemes. There are encouraging exceptions to this pattern, such as the Australian automotive industry scheme (Hill, 1988; Holland, 1989; Mackay, 1992) which connects the automotive manufacturers' industry association with the automotive parts suppliers' association, but the myth of the 'competitive' EDI scheme still has considerable force for many sectors of the business community.

This approach to EDI is largely representative of the way in which organizations still approach strategic IS planning – while business strategies may arise from an analysis of a range of future scenarios, such a wide-ranging consideration does not appear to have been translated into SISP in practice (Galliers, 1991b).

Feasibility and desirability

Many parts of the EDI community (in common with the IS community more generally) have been criticized for developing information systems which effectively perpetuate the status quo – that is, EDI implementations (in

common with information systems more generally) too often automate existing processes without consideration of their continuing optimality.

By contrast, SISP practice, the more 'advanced' EDI implementors and many academics seem much more focused on a future vision. The role of top management support, for example, appears to be a consistent theme in the writings of most researchers in the field of competitive, strategic and inter-organizational systems (Galliers and Baker, 1994) – possibly because integration is itself an issue which touches on all aspects of an organization's world-view (Rockart and Short, 1989). In the case of such a diffuse and deceptively simple technology as EDI, it is rare to find examples of successful strategic integration and process restructure except in the case of organizations which have had a senior EDI champion.

There is a danger here, however, that the current state of IS within any particular organization may not be considered (Galliers and Sutherland, 1991). In SISP, this has led to the development of desirable but unfeasible plans and in the case of EDI this contributes to the phenomenon of the 'perpetual pilot'. Such an outcome often results from the implementation of single-application-oriented EDI schemes within smaller organizations – possibly those based on a personal computer, where there is no incentive to consider the possibility of a future which includes multiple application systems. Such systems may be beneficial to the creating organization, but may well work to the detriment of the smaller suppliers forced to take part in a value-chain over which they have no control (Lyttle, 1988; Webster, 1995).

Although there is no single framework which accounts for all the issues relevant to both the current status of IS and the feasibility of SISP, the 7Ss framework (Pascale and Athos, 1981) is an example of a mechanism which does take into account a wide range of issues. It can therefore be used to assess, in broad terms, the current IS status within an organization, and hence the feasibility of an EDI implementation – and, more generally, a strategic IS plan (Galliers and Sutherland, 1991).

Assessment of benefits

It is commonly acknowledged within the EDI community that one of the most significant difficulties faced by a prospective adopter of EDI is the lack of a mechanism by which the costs, and more importantly, the benefits of EDI may be assessed prior to implementation. While the cost justification of EDI may be assessed after implementation and compared against the original situation, it is difficult to ask 'what if' questions and to assess accurately the potential relativity of costs/benefits in advance (largely due to the importance of intangible factors such as trading partner relationships). Anecdotal evidence indicates that there is considerable

interest in the development of cost justification metrics for EDI, although research in this area is still in its infancy (Tengende (1993) describes the development of a single-case EDI cost-benefit project). Consequently an iterative, contingency-based approach to planning a strategy for EDI implementation (where the plan itself evolves with reference to the continuing experience of applying the implementation plan) is rarely applied.

The assessment of benefits is also considered to be a key barrier to successful SISP formulation (Wilson, 1989). Interestingly, while 80% of organizations which apply SISP claim that formal plan reviews take place, only 10% report that a formal assessment of benefits is attempted (Galliers, 1987a). Without such assessments it is difficult to see how SISP can be undertaken in an on-going manner. Consequently, organizations are unable to take advantage of the knowledge which could be obtained, were they to do so. No wonder, then, that mistakes are all too often repeated (Baker, 1995).

Integration with business strategy and business process redesign

The prevailing orientations of practice in both EDI and SISP present obstacles to their closer integration with business strategy formulation. The view that both EDI and SISP are primarily technological issues has led to difficulties in implementation and in reaping the potential from new technology in terms of a revolutionary change in the way business is conducted (Ali, 1992; Borthick and Roth, 1993; Swatman *et al.*, 1994).

While many organizations gain short-term, localized advantage from the application of EDI and, more generally, information technology (Scott Morton, 1991) fewer have been able to use EDI's potential as an enabler of business process redesign for improved business efficiency and effectiveness and fewer still have gained major improvements in inter-organizational collaboration.

Research into EDI must, therefore, place less emphasis on the 'communications' issues associated with this topic and instead concentrate on the educational, organizational, social, managerial and strategic issues which still remain largely incomplete. See Parker and Swatman (1995a, 1995b) for discussions of innovative, simulation-based approaches to educating EDI users.

Researchers have for some years now referred to EDI's ability to provide an infrastructure for the development of strategic, inter-organizational links. For example, Davenport and Short (1990) point to EDI's ability to support inter-organizational processes forming part of a multi-organizational value chain as part of business process redesign: 'buyers and sellers have used EDI largely to speed up routine purchasing transactions, such as invoices or bills of materials. Few companies have

attempted to redesign the broader procurement process – from the awareness that a product is needed, to the development of approved vendor lists, or even to the delivery and use of the purchased product' (Davenport and Short, 1990, p. 18).

These authors, in common with many other researchers who are concentrating on the issues involved in business re-engineering rather than on EDI, have tended to view EDI merely as a way of transmitting formatted data across organizational boundaries. While it is certainly an accurate description of EDI's function, the technology's longer-term, enabling infrastructure offers far wider strategic opportunities than these. There are two major opportunities available to organizations willing and able to see EDI's full potential:

- (1) the benefits of linking intra-organizational systems effectively and on the basis of the necessary underlying information – rather than being constrained by traditional paper-based document flows; and
- (2) the benefits of linking trading partners in truly effective long-term relationships (a basis of comparative advantage, after all) – once again on the basis of the information flows upon which each partner depends (Rockart and Short, 1989).

With the increasing moves to third-party software development and to the outsourcing of both core and peripheral business, the need to link disparate software will continue to grow. EDI's consistent infrastructure allows networked organizations to ignore the details of software design and to exchange information rather than data, using whatever means of communication is most effective.

Discussion

EDI is an open and essentially cooperative technological infrastructure (McNurlin, 1987; Rochester, 1989; Swatman *et al.*, 1994). While it is possible to gain short-term competitive advantage from embracing EDI ahead of competing organizations, it is now generally accepted that there is no scope within the inter-organizational system for the kinds of barriers to competition suggested by the work of Porter and others (see, for example, Cash and Konsynski, 1985; McFarlan, 1984; Porter, 1980, 1985; Porter and Millar, 1985). Consequently, there is no potential for sustainable competitive (comparative) advantage (Clemons, 1986). It has been argued in the literature (Benjamin *et al.*, 1990; Sheombar and Wageenaar, 1991; Swatman *et al.*, 1992; Wilmot, 1988) and it is now widely accepted that EDI's potential to generate comparative advantage (exemplified by the success of companies such as Levi Strauss, Tesco and Australia's

BHP Steel) results from the integration of EDI with processes and information systems within the organization. Put another way, an organization will gain comparative advantage in line with its ability to redesign its internal business structure and processes to take advantage of the opportunities for increased effectiveness offered by EDI.

Swatman (1994) has argued strongly that the full potential benefits of EDI may only be achieved by organizations which are mature in the sense of, say, the MIT 90s model (Scott Morton, 1991). Galliers and Sutherland (Galliers and Sutherland, 1991; Sutherland and Galliers, 1989) refer to these as Stage VI organizations, characterized by:

- (1) at the strategy level
 - (i) focus on maintaining/increasing comparative advantage
 - (ii) monitoring futures
 - (iii) interactive planning
- (2) at the structure level, centrally coordinated coalitions leading to concurrent corporate and strategic business unit (SBU) views
- (3) at the information systems level
 - (i) inter-organizational systems
 - (ii) new IS-based products
 - (iii) external/internal data integration.

In essence, then, an organization may gain comparative advantage from EDI by effective business re-engineering. This in turn is dependent on a mature organization, a strategic and holistic perspective and senior management-led integration of SISP into business strategy planning – triggered by an opportunist view of EDI as an enabling information technology.

If we view EDI from the perspective of the SIS Planner, we identify the following key issues. Management involvement is essential – but that involvement must extend beyond a simple monitoring of costs. Senior management must drive the process which determines the extent and direction of business re-engineering and take responsibility for the implementation of the plan.

Additionally, the organization must look at a range of possible futures and conduct ‘what if’ analyses when considering the various alternative approaches to implementing EDI. The plan must, of course, be feasible. Identification of the current state of the organization and the capability of the organization to change that state must be established before any plan may be meaningfully evaluated.

We have pointed out above that it is inadequate simply to report that the organization must move from state A to state B – we must also define the transition. This is an organizational/social engineering issue much more than a technical IS one.

The (partially) re-engineered organization must be the

constant focus of review and analysis to ensure that redesigned processes remain optimal.

Conclusion

EDI offers an exceptional opportunity for an organization to gain comparative advantage through business re-engineering which takes advantage of the relaxed constraints of the new inter-organizational information system. This was clearly seen by senior management at BHP Steel where, in a document reporting the results of preliminary investigations into the need for such a project, the author pointed out that: ‘Traditionally EDI has been driven by customers down to their suppliers, but BHP Steel has seen a unique opportunity to be pro-active and initiate EDI with our customers. By taking this initiative we can create business benefits to both BHP Steel and our customers (the partnership approach) as well as achieving extensive savings in administration’s costs, stock holding, error reduction, manufacturing efficiencies . . . flowing from this was the realisation that BHP Steel need to develop an EDI strategy to cover all the elements of electronic links with our customers and how such links could be converted into value-added servicing that can give BHP Steel a competitive edge’ (BHP Steel, 1989, p. 4).

Such opportunities are primarily the responsibility of the senior executives and business strategists, not the technologists. Too often, the potential benefits of EDI fail to arise because EDI is considered from a narrow IT perspective, or because politics or a desire to dominate suppliers is allowed to stand in the way of inter-organizational partnerships (Webster, 1995).

In this paper, we have discussed SISP in theory and in practice and have shown how lessons from the past two decades in this field can be applied to the world of EDI by presenting guidelines for the improved practice of SISP as an aspect of business strategy planning, incorporating EDI (which, despite the enormous amount of discussion it engenders, is still to realize its full potential as an enabler of organizational restructuring). We have argued that organizations considering EDI implementation – or those which have failed to capitalize on EDI by gaining comparative advantage – should adopt a business strategy-based approach.

EDI implementation need not be considered in a theoretical vacuum – the broader SISP literature is both relevant and potentially helpful to organizations implementing EDI today, if they are to gain the comparative advantage they seek from this investment. Case studies and analyses (see, for example, Parker and Swatman 1995a, 1995b; Swatman, 1994; Webster, 1995) continue to point out that implementation of EDI without due consideration of the longer-term strategic

implications will result in little more benefit than could have been obtained by the purchase of a fax machine. Above all, EDI should not be seen in an isolated, purely technical way. For maximum effect, its implementation must be viewed as but one aspect of SISP, business re-engineering and business strategy.

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