INTEGRATING EDI INTO THE ORGANISATION’S SYSTEMS:
A MODEL OF THE STAGES OF INTEGRATION

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Abstract

The growing importance of Electronic Data Interchange for the rapid transmission of intra- and inter-organisational communications is becoming widely recognised. EDI itself is little more than a faster mail service: it is the opportunity to integrate EDI with internal application systems and organisational functions which separates it from other forms of electronic telecommunications - and makes EDI a truly strategic application, offering comparative advantage at the organisational, national and international levels.

This paper discusses the results of a series of case studies of Australian organisations involved with EDI, undertaken to determine whether integration with internal application systems can be defined as a series of comparatively standard and recurring stages. The results of the analysis indicate that while such integration does, indeed, occur in a relatively standard manner for a large class of EDI-using organisations, there are also three other classes of organisation for each of which a different model is appropriate. Although these additional classes are small in terms of the number of organisations of which they are composed, they are significant in terms of their importance and influence on industry in general and on EDI penetration in particular.

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INTRODUCTION

EDI - a Cooperative Inter-Organisational System

"An examination of the strategic use of information systems technology by business organisations shows that the most dramatic and influential contemporary uses involve systems that transcend company boundaries" (Cash 1985, p. 200).

The concept of multi-organisational information systems is not a new one: corporate cash management systems have been used daily by large (and increasingly by small) companies for a number of years now, while on-line reservation systems have been so successful as to provoke a number of crises in the U.S. airline industry. Despite the popularity of such special cases, inter-organisational information systems have only recently begun to attract wide-spread general interest, in some degree due to the dramatic growth of that particular type of inter-organisational system known as Electronic Data Interchange (EDI).

EDI, "the standards-based computer-to-computer exchange of intercompany business documents and information" (Coathup 1988), gains its attractiveness from the promise of major cost savings in inter-company transaction costs and greatly increased productivity. EDI is already seen as an essential prerequisite for Just-in-Time/Quick Response inventory and production systems (Robinson and Stanton 1987; Sadhwani and Sarhan 1987; Knill 1989; Skagen 1989). Inter-connections are now being urged between EDI and other types of information systems, such as electronic funds transfer (EFT) systems (Canright 1988; Cafiero 1989) and corporate application systems (Svinicki 1988; Wilmot 1988), to provide additional organisational efficiency.

In 1982 the Society for Information Management, together with the University of Arizona, funded research on inter-organisational systems (IOS). The study was undertaken by Barrett and Konsynski (1982) and the original material further developed in papers by Cash and Konsynski (1985) and Cash (1985). These authors suggest potential strategic uses of such systems (overall cost leadership, product differentiation and special market focus) and point to the influence on industry structure which may be exerted by inter-organisational systems - such as, for example, to change the balance of power in buyer-seller relationships, or to enable a group of organisations to unite within a common set of standards/protocols which may result in the establishment of barriers to entry or exit within a particular market-place (see also Porter and Millar 1985; Copeland and McKenney 1988; Reich and Benbasat 1990; and Wiseman 1989).

EDI is merely a special type of IOS, dealing with the transfer of standard-format business documents. McNurlin (1987), however, also suggests that EDI is the definitive example of a cooperative IOS (seen in EDI’s adoption by such fiercely competitive market sectors as the automotive and pharmaceutical industries) and concludes that organisations view EDI as a factor in their industry’s survival, rather than a competitive weapon. Short-term competitive advantage from EDI is possible for an organisation which is the first in its market sector to link in suppliers - but only until a competitor follows suit: "EDI applications, rather than being a competitive weapon, are increasingly a necessary way of doing business" (Benjamin, De Long and Scott Morton 1990, p. 29).
Integration with Internal Application Systems

The long-term strategic importance of EDI lies in the potential comparative advantage to be gained from its use: "those who do gain significant competitive advantage from EDI will do so by learning how to integrate the technology effectively into their organisations in such a way that they can continually add valuable new capabilities to the system, while deriving cost savings from increased productivity and decreased overhead made possible by EDI" (Benjamin, De Long and Scott Morton 1990, p. 39).

EDI in its simplest form (as a replacement for paper-based document flows) is little more than a rapid electronic mail service. Significant changes only occur with the integration of EDI into internal application systems, allowing a seamless connection to functions such as purchasing, order entry, shipping, inventory management and accounts payable and receivable (Boucher 1989).

Figure 1 shows that EDI software performs two quite disparate tasks - and thus can be subdivided into two separate categories:

- in-house interface software, which translates outgoing information from unstructured, company-specific formats into structured EDI formats (such as ANSI X12 or EDIFACT) and places these structured documents in an electronic "out-tray" (and, of course, deals with incoming structured documents in an analogous manner); and
- network communications software, which transmits the now structured message to its recipient (using data communications standards such as OSI). For an extended discussion of this topic, see Swatman, Swatman and Duke (1991).
While many prospective EDI-purchasing organisations concentrate their attention on the communications software (which is generally provided by third-party network suppliers in any case), it is in the domain of the in-house interface software that the greatest potential for strategic benefit in the form of comparative advantage may be found.

Linking EDI messages with in-house systems can improve an organisation’s internal operations - reducing or eliminating administrative overheads such as overtime premiums, overnight courier charges, late/incorrect shipments from suppliers, excess inventories, poor forecasting, disruptive production schedules and incorrect order entry (Skagen 1989).

**Integration with Overall Business Practice**

The benefits offered by internal systems integration are significant in themselves, but still more significant long-term benefits will be built upon the technical foundation provided by system integration. These strategic gains arise through changes in the organisation’s structure and functions, so that EDI provides the spring-board for re-designed, efficient work and production practices. Such beneficial integration is consistent with Benson and Parker’s (1985) Enterprise-wide Information Management (EwIM) model.

This view is supported by the existing European experience: "I suggest you look particularly hard at *intra*-company activity, and look beyond purely paperless trading for the early international paybacks ... the most successful users of EDI don’t mind joining industry clubs and sharing the benefits of intercompany EDI, because they have usually got massive organisational restructuring and internal information systems plans to exploit the situation competitively" (Wilmot 1988, p. 17).

As a particular example, the need for total integration is well recognised in the retail industry, where Quick Response (QR) systems depend for their success on connectivity. "Every stage in the retail chain, from production to sales, must be able to link in to achieve the turnaround and productivity improvements sought ... To get maximum benefit from EDI, an order must flow right through a vendor’s system, right to the distribution centre, without being re-entered or manipulated manually" (Spriggs 1989, p. 28).

**EDI INTEGRATION IN PRACTICE - THE STUDY**

**The Background to the Study**

The major problems associated with involvement in EDI are not primarily technical in nature, but may rather be the result of inefficiencies in corporate information systems analysis and design - or, alternatively, might result from a lack of top-level management support (Swatman and Clarke 1991; and further developed in Swatman and Swatman 1991a). This, in turn, implies that the broad organisational integration and re-evaluation of structure and function which Benjamin, De Long and Scott Morton (1990) and Wilmot (1988) regard as essential for strategic gains may also be affected.

It has now become almost an article of faith within the EDI community to claim that "EDI is 90% business and 10% technology". A wide variety of writers within both the trade and
academic sectors provide support for the view that EDI should be regarded as a strategic issue, rather than as a technical problem (see, for example, Sadwani and Sarhan 1987; Robinson and Stanton 1987; Patrick 1988; Lyttle 1988; Skagen 1989; Rochester 1989; Emmelhainz 1990; Swatman and Watman 1991a; 1991b; 1991c).

The failure to validate this view is largely due to the difficulties of separating EDI’s technical aspects from the organisational issues of implementation and integration. Prospective users of EDI have tended to view both aspects of the total EDI system as falling within the domain of their own I.S. department and, since the creation of an EDI communications system is unquestionably a complex and difficult task, it is not surprising that they have recoiled from contemplation of the issues.

Several approaches to establishing the relative importance of the organisational and technical aspects of EDI implementation have been undertaken. One involves the development of both informal and formal models of an EDI communications system, enabling the isolation of in-house EDI interface software from the networking issues. This research project (reported in Swatman, Swatman and Duke 1991) is being further examined by means of the detailed formal specification of a complete EDI system.

Another research approach which seemed to offer real possibilities was to determine the significance of integration with internal application systems, so that this aspect might be separated from the broader question of organisational restructure. A multi-phase research programme has been developed, attempting to isolate the various aspects of this question. Phase I of the research involved a survey (conducted in August 1989) of all 131 members of the EDI Council of Australia (the EDI “users group”), which established the size and rate of growth of the EDI market-place in Australia (Swatman and Everett 1991). 62% of organisations approached responded to the survey and the results obtained indicate that EDI was showing significant growth, with larger organisations being more likely to be involved in EDI than small to medium ones.

The study was based in Australia for a number of reasons, among the most important of which was an attempt to understand the likely impact upon small, non-aligned trading nations of the growing number of major trading blocs (such as Europe’s Single Unified Market). The movement towards electronic links within such blocs is twofold - the formation of the bloc requires the implementation of communication links for its day-to-day operation, while the greater movement of trade and information within the bloc itself tends to encourage former rivals to regard one another in a more favourable light. The self-reinforcing aspects of trading bloc formation may, however, tend to obscure the need for continued links with smaller trading partners (Swatman and Watman 1991b). A survey instrument is currently in preparation for issue internationally in an attempt to confirm the generality of application of the results of the current study.

The survey of Australia’s EDI population provided the necessary information for Phase II of the research programme, reported here. The hypothesis investigated during this phase was: there is a series of comparatively standard and recurring stages in the integration of EDI into internal applications systems. On this basis we developed, as a secondary hypothesis, a model of the stages of integration against which actual data were compared:
1. In the first stage, we anticipated that there would be a PC with EDI software (translation and communication), requiring:
   • a member of staff to key in outgoing EDIFACT/X12 messages;
   • the printing of incoming EDIFACT/X12 messages.

2. The second stage would be composed of two alternate paths, either:
   2a files created by the mainframe/mini application systems down-loaded to a PC having the EDI translation and communications software (with, of course, analogous facilities for incoming EDI messages). This replaces the keying-in and printing-out of messages with flat files, speeding up the process and making incoming messages (in particular) more useful, since they do not require rekeying prior to use by another system.
   2b the EDI software is itself based on a mainframe/mini computer. This is similar to the process described in 2a, save that the physical uploading/downloading is also eliminated.

2a and 2b are essentially the same stage of integration, since the physical location of the EDI translation/communication software is of little importance. The difference between these sub-stages is therefore merely technical in nature (rather than organisational). We had originally anticipated that some organisations, seeing EDI integration as primarily a technical issue, would choose to pass through both stages 2a and 2b.

3. Seamless integration between EDI transactions and production applications such as purchasing, order entry, production scheduling, inventory management, accounts receivable/payable, shipping and so on.

Our initial, anticipated model of EDI integration is summarised in figure 2. This diagram includes both the stages of integration and the anticipated organisational entry-points to the integration process.