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**SWP 9/95 A REVIEW OF EDI RESEARCH**

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## A REVIEW OF EDI RESEARCH

*This working paper has been prepared by Andy Bytheway, who (with Juliet Webster of the University of East London) organised a EDI research forum as part of the 5th World Congress of EDI Users, in Brighton during the summer of 1994.*

*The papers referred to here are published by the EDI Association of the UK, in London, to whom further enquiries can be made:  
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### **ABSTRACT**

In the summer of 1994, researchers with a common interest in electronic data interchange came together in Brighton, England, to hear selected papers and to discuss their mutual interest in the effects of EDI on business. The papers were presented and there was a considered response by an expert discussant. There was also open discussion of their content, and the requirement for further work. This working paper touches on the key content of each of the papers presented and records aspects of the discussion.

From the sum of this research we can deduce that the critical dependency of EDI on business process management is a very important factor in success. The differences between the different sectors of business reported upon remind us that there are no absolutes in the business of EDI: the consequences of introducing EDI may well be simply to entrench further current attitudes, strengths and weaknesses. Only by stepping sufficiently far back from the detail of EDI will be able to deal with this.

Business needs to continue to seek out new tools and techniques which will make the impact of EDI and other information technologies clearer.

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## INTRODUCTION

The objectives of this working paper are to provide an overview of papers presented at the EDI Research Forum in Brighton, England during the summer of 1994, and the discussion that ensued. This working paper therefore provides an overview of research that is taking place, in Europe and elsewhere in the world<sup>1</sup>. The research forum was part of the 5th World Congress of EDI Users, organised by the EDI World Institute and the EDI Association of the United Kingdom.

## THE PAPERS

The papers, in the order in which they are introduced here, are as follows:

1. ***"Benefits and barriers to adopting EDI in the UK: A sector survey of British industries"***, Benita Cox & Sherine Ghoneim, The Management School, Imperial College, London, England
2. ***"Information technology strategy in retailing: a study of the impact of EDI on multiples and their suppliers"***, Keith Hood, David Lawrenson, Jui-Chih Chen & Bernard Williams, School of Information Systems, University of East Anglia, England
3. ***"The distribution of the benefits and drawbacks of EDI use in the European automotive industry"***, Norbert Reekers & Steve Smithson, Information Systems group, London School of Economics, London, England
4. ***"Business process redesign using EDI: an Australian success story"***, Paula Swatman & Paul Swatman, School of Computing, Curtin University of Technology, Australia
5. ***"EDI induced business redesign: a modelling approach towards improved inter-company coordination"***, René Wagenaar & Hans van der Heijden, Rotterdam School of Management, The Netherlands
6. ***"Hubs, spokes and SMEs"***, David Whiteley, Department of Computing, Manchester Metropolitan University, England
7. ***"EDI security services in international trade"***, Ivo Cathomen, Competence Centre in Electronic Markets, University of St Gallen, Switzerland
8. ***"Engineering the virtual enterprise"***, Rhodes & Carter, The Open University, Milton Keynes, England

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<sup>1</sup> Note that this working paper *excludes* consideration of EDI research at Cranfield, which is the subject of other Cranfield working papers. See for example SWP 12/94, "Seeking business improvement: a systematic approach", by the same author.

## THE STATE OF EDI

There is intense interest in how successful EDI has been. In the early days of EDI implementation the figures for take up and usage quoted by different sources varied widely, and of course the very growth of EDI led to difficulties in achieving a proper "snapshot" of the state of play.

Better therefore, to side-step the question of how many companies are doing what kind of EDI and to analyse where there are benefits, and what the barriers to implementation are in different sectors. The papers from Cox & Ghoneim, Hood *et al.*, Reekers & Smithson and Swatman & Swatman all address these questions and provide us with valuable feedback on actual experience. We do not find the usual mixture of enthusiasm and optimism, however.

### *The benefits and barriers of EDI*

The question we all want answered today is: *what are the benefits of EDI, and what barriers will we have to overcome in its implementation?* There has been little evidence of the real answers to these questions, and it is therefore good to see that Cox & Ghoneim<sup>2</sup> have produced some properly researched survey data from UK users. With a 28% response (125 organisations) there is a good chance that the reality of EDI in business can be seen more clearly, and the detail of this paper does provide interesting evidence.

The larger number of respondents were in the manufacturing, retailing and distribution sectors; a smaller number were from utilities, pharmaceuticals, government, and service industries. The differences between different sectors are marked: retailers find that there are important benefits ranging from simple efficiency to improved partnership, whereas in manufacturing there are higher level benefits but no reported improvement in efficiency; in pharmaceuticals there seem to be no benefits at all. The paper provides detailed figures for each sector under the headings of:

- operational benefits,
- efficiency benefits,
- streamlining business processes, and
- inter-organisational relationship benefits

Surprisingly, barriers to the introduction of EDI are nothing to do with technology, cost or operational difficulties. They are more concerned with higher level questions relating to the management of partnerships and the required changes to business processes.

To some extent this work confirms the anecdotal evidence, but it goes further and makes clear that if businesses are going to understand the benefits of EDI, they need to understand the contribution that is being made by different business processes, and the contribution that EDI might make *through* those processes.

Just as information technology generally can be said to amplify the existing capabilities and tendencies of an organisation (for good or ill), EDI can amplify the capabilities and tendencies of partnership arrangements within an industry. We must recognise the need to work on those capabilities and tendencies if they are going to go against our intentions and strategic ambitions.

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<sup>2</sup> "Benefits and barriers to adopting EDI in the UK: A sector survey of British industries", Benita Cox & Sherine Ghoneim, The Management School, Imperial College, London, England

## ***Manufacturing and retailing***

One of the most visible consequences of EDI has been the effect on the relationship between retailers and their suppliers. Retailers that used to offer fewer than 10,000 lines now offer more than 20,000, and the quality and availability of fresh produce is vastly improved due to better supply chain management and partnership development.

In recent history there has been much work on the economics of business, and on the optimisation of transport and logistics - traditional stuff, one might argue. Rising to the challenge, Hood *et al*<sup>3</sup> argue that there are still no real theoretical foundations for understanding the way that business interfaces work and they highlight some shortcomings in previous work. By reviewing existing practice in the UK, and by appealing to ideas about hierarchies and networks, they argue that retailers have not actually changed their strategies but have used EDI to reinforce previous attitudes. They also exercise important questions about the many-to-many relationships that exist, and how EDI might affect them.

In the old days, warehousing offered a comfortable buffer between the manufacturer and the retailer, but the scale of operations today leads to the idea of closer partnership between the large retailer and their primary suppliers. Will this actually help? What about the multiplicity of SMEs who still service the wider needs of large retailers (and will continue to do so for a long time)? Does a retailer need to recognise more clearly the different modes of operation between themselves and the different kinds of suppliers, in different trading situations? How will the benefits be shared out between the different players?

The evidence from Hood *et al* is that the retailers have been the ones to take the majority of the benefit (which supports the results from Cox and Ghoneim). Their theoretical work needs testing through a wider variety of real case studies, but it has to be acknowledged that the problem of managing multiple relationships may well be the key to future success in retailing and supply. There might yet be a surrogate for the warehouse: in the future that lies before us we must expect that this might be a virtual warehouse, based in a third-party ability to manage the storage and dissemination of *information*, not the storage and distribution of physical goods.

## ***The automotive industry***

The automotive industry is an especially fruitful sector to look at, because of the tight and highly integrated nature of the supply chain and the easily identified main players who are the entree to a real understanding. Getting in there and achieving really useful research is, as many of us know, a different issue. Reekers and Smithson<sup>4</sup> cracked this problem and studied no fewer than four car manufacturers and six suppliers, in Germany, the UK and Japan.

There are theoretical foundations for their work: transaction cost analysis, resource dependency theory and "network perspective" (a new viewpoint that they have been developing) are all used to establish a proper basis for the research design and analysis. The questions that they addressed were therefore concerned with the efficiency aspects of EDI, the resources needed for it, and the network issues arising.

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<sup>3</sup> "Information technology strategy in retailing: a study of the impact of EDI on multiples and their suppliers", Keith Hood, David Lawrenson, Jui-Chih Chen & Bernard Williams, School of Information Systems, University of East Anglia, England

<sup>4</sup> "The distribution of the benefits and drawbacks of EDI use in the European automotive industry", Norbert Reekers & Steve Smithson, Information Systems group, London School of Economics, London, England

Their paper reminds us about the forces for change in the automotive industry: customisation, outsourced manufacturing, modular sourcing, just in time and synchronised manufacturing strategies. Their research highlighted the cost to efficiency of frequent change and the value of long term relationships. They conclude that the manufacturers have gained most of the benefits; second tier suppliers have gained least.

### *An example from the steel industry*

It is helpful to see what is happening in other parts of the world, and how much further from Europe can you get than Australia? By taking a top-down approach to the introduction of EDI, embracing the concepts of business process redesign, BHP Steel achieved success and gained real benefits<sup>5</sup>. Distinct characteristics of the Australian market, which we in Europe often fail to appreciate, include the great distances in transportation, the diverse standards in use, and the many value-added network service suppliers.

The introduction by BHP steel of an EDI gateway was the solution to the problem of multiplicity of standards and sources of service. By using a very high quality approach to systems implementation, by using their own technical people led by one of their own business managers, and by organising around a steering committee, this project delivered not just electronic communications but a new way of doing business.

Trade is now driven by information not by documents; information in databases is made available through the gateway, and there is internal as well as external use of EDI for information interchange. The information involved is not just the usual gamut of orders, invoices and payments, but also certificates of quality for batches of steel. The extended use of bar coding has enhanced relationships with customers.

This project recognised and demonstrated that it is easier to change software than it is to change the business: it demonstrates the way in which EDI can be used to make a good business better. Even more exciting, it also showed how partners - even small ones - can be stimulated to improve, leading to even greater mutual benefits overall. This is a complete contrast to some of the experiences of retailer's suppliers in the UK.

## **SEEKING NEW FOUNDATIONS FOR UNDERSTANDING**

In contrast to the papers which surveyed early experiences with EDI and current practice, there were others which set about finding new models and mechanisms to understand what might happen in the future. Wagenaar & van der Heijden, Whiteley, Cathomen and Rhodes & Carter all take a more forward looking viewpoint, but from different angles and perspectives.

### *Understanding the interaction between businesses*

The question of the business process comes through again almost immediately. Wagenaar & van der Heijden<sup>6</sup> argue that the quality of communication and coordination between different businesses is key in achieving successful redesign of processes at the business interface. They look at the degree of

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<sup>5</sup> "Business process redesign using EDI: an Australian success story", Paula Swatman & Paul Swatman, School of Computing, Curtin University of Technology, Australia

<sup>6</sup> "EDI induced business redesign: a modelling approach towards improved inter-company coordination", René Wagenaar & Hans van der Heijden, Rotterdam School of Management, The Netherlands

interaction between businesses and the degree of structure within them, and use this as the basis of a model which allows assessment of the correspondence between the two.

With little "substance" in the interaction and a high level of structure, EDI is a natural vehicle with which to implement inter-company communications. However, where there is a substantial, rich interaction and where there is a lower level of structure in the exchange, there is a need for much more richness in the medium of communication. EDI as we have it today would be totally inadequate to service the needs of the second case. In this way we can begin to resolve the differences that may exist between organisations, and more effectively manage the connection between EDI capabilities and business needs.

The Rotterdam work has looked at the impact on business at different levels: geography, concurrency of operations, and disintermediation (the case where an intermediary business is eliminated from the supply chain, perhaps because its only role was to broker information, which can now be done directly using EDI and appropriate information systems within the other players). As with other research, Wagenaar & van der Heijden use the idea of business processes - singularly and in combination - to get above the level of EDI technology and into business strategy. They have developed guidelines for business process management, based on the elimination of redundancy in data collection and the reduction of uncertainty but identifying the sources of uncertainty and dealing with them.

### *Home working and the smaller enterprise*

Whiteley<sup>7</sup> finds a completely different aspect of EDI to look at: the question of SMEs, and teleworking as something that might benefit from the introduction of EDI ideas and techniques, especially electronic mail. This leads to the question of whether EDI and email are in any sense comparable. Some would argue that we must have the rigour and discipline that comes from standards (ie EDI), and others would argue that we need flexibility and freedom that comes with electronic mail. Wagenaar & van der Heijden have already given us a clue as to how this might be dealt with.

In the discussion at Brighton the case of P&O was quoted, where a tracking system used electronic mail initially but reverted to EDIFACT standards in order to achieve the required level of structure and certainty. Such services as CompuServe (which now has about 3 million users and includes an international trading forum) were quoted as another illustration; this kind of value added service might just show that the more open and flexible approach is just what is needed in some trading situations. Whether the Internet will ever provide the same level of facility remains to be seen - it is a much wider facility of course, being a network of networks, with little or no value adding and the constant risk that security might be breached.

Although there are isolated examples of teleworking that have frequently been studied and reported over the last twenty years, the contribution of EDI - by any interpretation - remains an area for further investigation.

### *A fresh look at the nature of trade*

A perennial question is the role of the banks in the development of EDI. Initial EDI-based payment services have *not* found a ready market, and despite some limited successes the banks must be wondering just what they have to do to engage the interest of the wider business community. The

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<sup>7</sup> "Hubs, spokes and SMEs", David Whiteley, Department of Computing, Manchester Metropolitan University, England

business community would argue that the banks need to understand more clearly what is *really* needed. Progressive businesses need much more than simple payment services which, to a large extent, are already available at low cost.

Others would argue that the banks should remind themselves of the role of the trusted third party in the execution of trade, and that they should seek out truly value adding services for their corporate customers in this specific area. Cathomen<sup>8</sup> presented an interesting paper which zeroed in on the ways in which we might secure trade arrangements in international trade, with electronic services in mind.

Research at St Gallen has been looking at new forms of settlement that might evolve in the new circumstances for global trade. A key focus is risk. If we can assess the credit risk as we negotiate business and cover it more effectively, then we will ease considerably the difficulties of doing business in distant markets. Cathomen presented a model of the life cycle of a trade, and discussed different approaches to dealing with it, for example:

- the idea of the *trusted third party* which could assure buyers and sellers of the level of risk, and help them to deal with it;
- the idea of *fair exchange of value*, where the release of information is carefully geared to the progression of the trade.

In developing and implementing new ideas about trade there is a risk that legal requirements and constraints get in the way. The international trading community recognises this, of course, and even governments are discussing new ways of encouraging rather than regulating trade. The work at St Gallen is very relevant to the "trade point" idea being discussed internationally as a way of easing and facilitating international trade, especially for smaller enterprises. It also goes well with the idea of "open EDI", where trade is more easily executed without lengthy prior negotiations - possibly no prior negotiation at all.

One of the most interesting questions that came out of the discussion of Cathomen's paper is: who will be the trusted third parties in the future, if the banks fail to respond to the challenge that has been set them? We shall have to wait and see.

### ***The virtual enterprise***

In seeking to develop an understanding of the "virtual enterprise", the Open University<sup>9</sup> went to the US to find examples of best practice. There they found that the real concern is with quick response and the contribution that EDI might make to it. The concept of lean production requires a very tight understanding of the factors affecting demand and supply, and in a sector such as textiles there is a critical need for accurate forecasting. Practical experience with quick response indicates the need to unify the supply chain and it follows (as others have found) that implementing change can be very difficult.

EDI is just one element within business and we are reminded by Rhodes and Carter that the broader processes of supply in the US and elsewhere do not necessarily match with the arrangements in the UK, which some argue are unique.

Looking more to the future, the trend to strategic partnership in the US leads to tighter integration, and a clearer vision of the virtual enterprise. We could define the virtual enterprise as: *the*

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<sup>8</sup> "EDI security services in international trade", Ivo Cathomen, Competence Centre in Electronic Markets, University of St Gallen, Switzerland

<sup>9</sup> "Engineering the virtual enterprise", Rhodes & Carter, The Open University, Milton Keynes, England



*combination of activities in different organisations that services a single supply requirement*<sup>10</sup>. These virtual enterprises are evident in progressive businesses, but they have no legal status and they are autonomous in their operations. Who knows what problems this might cause with regulatory requirements?

Nor are these virtual enterprises necessarily short term affairs. In the case of denim manufacture, the traditional very long manufacturing runs are threatened by varying short term requirements in smaller, more frequent orders, but this does not mean short term business arrangements. The virtual enterprise is able to transcend these variations by finding the basis for long term arrangements. Despite variation in short term demands, the timescale for the life span of a virtual enterprise could be ten years.

Although the virtual enterprise may embrace the activities of many organisations, it is bound together by shared interests, for example the point of sale data generated at the retail level, which gives all participants key information about the level of demand and short-term production requirements. In cases of best practice (such as Marks & Spencer in the United Kingdom) stock turns as high as 9 times per annum can be achieved.

Key issues in dealing with virtual enterprises include the question of:

- **Culture:** can a virtual enterprise survive the differences in culture between Europe, North America and the far east?
- **SMEs:** can the role of the smaller enterprise be defined well enough that they can survive, or even flourish, in a virtual enterprise?
- **Entrepreneurial spirit:** every business needs a vision and a degree of adventurism, especially in the early days; how will this be engendered and preserved in a virtual enterprise?

It is interesting to contrast the work of Rhodes & Carter on the virtual enterprise - which is essentially something new - with other work (such as that of Hood *et al*) which looks at shifting and leveraging power in the supply chain. One could postulate that there is a threshold below which we have competition amongst discreet enterprises, and above which we have true partnership in what has become a virtual enterprise. We need to undertake further work on the criteria which would put an enterprise (or a combination of enterprises) in one side or the other of this threshold.

## SUMMARY

These papers make a clear case for taking a broader rather than a narrower view of EDI in business. The critical dependency on business processes is very clear, and the differences between the different sectors remind us that there are no absolutes in the business of EDI: the consequences of introducing EDI may well be simply to entrench further current attitudes, strengths and weaknesses. Only by stepping sufficiently far back from the detail of EDI will be able to deal with this.

Business therefore needs to continue to seek out new tools and techniques which will make the impact of EDI and other information technologies clearer, and how better to do this than to support the work of academic researchers? Those researchers themselves need to be careful not to lose touch with reality, whilst allowing a degree of constructive tension between the academic and business viewpoints. We believe that the papers presented here precisely illustrate this point, and make a useful contribution to our understanding of the opportunity that presents itself.

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<sup>10</sup> (my definition, not Rhodes & Carters' - Andy Bytheway)