Collaboration – more than the exchange of information

Dr Mark Borman and Professor Howard Williams – Department of Management Science, University of Strathclyde, Glasgow G1 1XH, UK

1. Introduction

For a number of years information and communication technologies (ICTs) have been heralded as offering an opportunity for economic transformation and the emergence of new modes of production ([1], [4], [11], [12], [16], [28]). Indeed Handy [16] and Malone and Rockart [24] have suggested that changes in the use of information may indeed call into question the very essence of an organisation.

" .. we have to wonder whether a company is, in the future, going to be anything more than a bo x of contracts ... Large parts of organisations are now made up of ad hoc miniorganizations, projects collated for a particular time and purpose, drawing their participants from both inside and outside the parent organization" [16] p4 1-42.

However, while it is increasingly accepted that it is the information that is processed and communicated by ICTs, not the technology itself, that is the facilitator of change much of the work in the area implicitly assumes that increased access to information is sufficient in itself. It is argued here that such a position is overly deterministic and that more attention needs to be given to the application of information within the organisation; both in terms of its use as a source of value added for existing processes and the extent to which it can facilitate the transformation of those processes.

By presenting the findings of recent empirical work this paper seeks to argue that while organisations are beginning to adopt ICTs they are failing to apply them effectively. One of the primary benefits held out for ICTs, and more specifically for interorganisational networks (IONs), is their potential to transform the organisation of production by allowing companies to collaborate more effectively ([1], [11]). Yet it appears that organisations are typically concerned with improving the efficiency of existing patterns of behaviour. Furthermore that 'collaboration' that is being introduced is tending to occur within a framework that takes the existing primacy of the firm as its starting point and is oriented toward buttressing that concept rather than questioning its continuing appropriateness.

The remainder of the paper is divided into four sections. The first outlines the theoretical argument that has been developed to explain how improving access to information can facilitate more efficient collaborative modes of production. The second presents the results of empirical investigation into the uptake and use of IONs and questions the contribution that they are currently making. The third presents a number of factors that companies hold are limiting their use of IONs. The final section argues that even if these constraints are overcome and the appropriate conditions for the diffusion of information put in place this will not in itself result in collaboration.

2. Information, IONs and collaboration

The rapid development and deployment of ICTs is leading to a re-evaluation of the role of information in the economy. Instead of its use being limited to directing and monitoring economic activity it is now increasingly recognised that information can function as an important source of value added ([3], [14], [15], [21], [22], [23], [27], [35]).

"An organization's ability to deliver products and services depends on how well it continues to build its knowledge, and on the data and information upon which that knowledge is based" [14] p4 1

According to Porter and Millar [36], ICTs, by facilitating the capture, manipulation and transmission of information, enable products and services to be more precisely tailored to the specific requirements of individual customers. An increasing body of literature ([20], [29], [36], [37], [38], [39]) argues that once the movement of information extends beyond the confines of a single organisation it is possible to envisage changes not only to the organisation of activities but also to their distribution. The introduction of novel and intensified flows of information between companies is held to be key to the reorganisation of production. As such the specific manifestation of computer networks of interest here is the interorganisational network (ION). Piore and Sabel [34], Malone, Yates and Benjamin [25] and Dosi et al [11] suggest that IONs are precipitating the emergence of a 'postindustrial' era of economic activity with collaboration replacing vertical integration and firms concentrating more precisely on those activities in which they have a competitive advantage.

An influential strand of economic theory ([7], [40], [41]) argues that integrated production structures initially arose because the existence of uncertainty and the consequent risk of opportunistic behaviour by trading partners made the marketplace an expensive coordinator of production. Increasing communication can reduce uncertainty and make collaboration more appropriate ([5], [37]). The facilitator in this process is held to be common knowledge. According to Cremer [8] common knowledge functions as a conduit between distinct organisational information sets. By facilitating the effective integration of routines and processes across organisations it enables the comprehensive exploitation of distinctive competencies without leakage at organisational boundaries. Historically companies have developed their own modes of working and limitations in communications media

meant that these could not adequately be shared with trading partners. Consequently the development of common knowledge was restricted to those companies that dealt frequently with one another and it was largely non transferable. The lack of any widespread standardisation of information meant that it was generally not possible for a company to apply the common knowledge it had acquired in one trading relationship to similar relationships. As such inter firm collaboration remained limited. By reducing the 'unit costs' of communication however IONs can influence the nature and availability of common knowledge and permit the development of an 'information commons'.

3. From theory to practice

Despite the compelling nature of the above explanation of how and why IONs and the information flows they support can facilitate the emergence of more collaborative modes of production the argument remains at the theoretical level unsubstantiated by empirical evidence. Indeed a criticism that has been levelled at much of the work in the field of ICTs ([6], [10]) is that it is building castles in the air; many of the proposed visions remaining unsupported by empirical work. Furthermore where investigation does take place, it is often firmly wedded to the case study approach [2]. While this is valuable in that it highlights what can be achieved a major failing is the implicit message that any findings are widely applicable; yet the same examples – such as the Prato region of Northern Italy and American Airlines – are consistently referred to. A need to more fully establish whether the theoretical propositions being developed are supported by the actions of companies in the economy can therefore be seen to exist. To this end a survey of the Scottish electronics industry was conducted to chart the uptake and use of a broad spectrum of IONs in what is generally described as a pivotal sector of the economy ([30], [32]). In addition a number of interviews were carried out with electronics companies and 'industry watchers' to try and identify what factors were shaping or constraining the use of IONs. For the survey a random sample of 74 sites, representing over 15% of the population, as defined by the Scottish Enterprise Electronics and Support Companies in Scotland directory, was selected. Fifty of these subsequently participated in a telephone survey during March 1993. The interviews focused upon companies who appeared from the survey to be advanced users of IONs and those actors in the economy who it was felt could have a significant influence on the adoption of IONs or who were in a position to gauge companies attitudes towards the technology. The specific organisations chosen were:

Computer Co. – a worldwide company, providing a full range of desktop, client/server, production and mainframe systems for multivendor computing environments.

Camera Co. – a supplier a variety of products in the instant image recording field with an annual revenue in excess of $2bn.

Systems Co. – a small, independent Scottish company based South of Edinburgh that designs and manufactures hardware and software peripheral equipment.

Telecoms Co. – the dominant telecommunications company in the UK with 87% of the business market for telephone calls in 1993.

Network Co. – an enhanced service provider based in Inverness providing a range of online and 'host' computer services.

Enterprise Co. – an agency established with an annual budget of approximately 450m to promote economic development in Scotland on behalf of the Government.

Training Co. – a training company specialising in the provision of short 'post experience' courses in the technical and organisational aspects of information technology.

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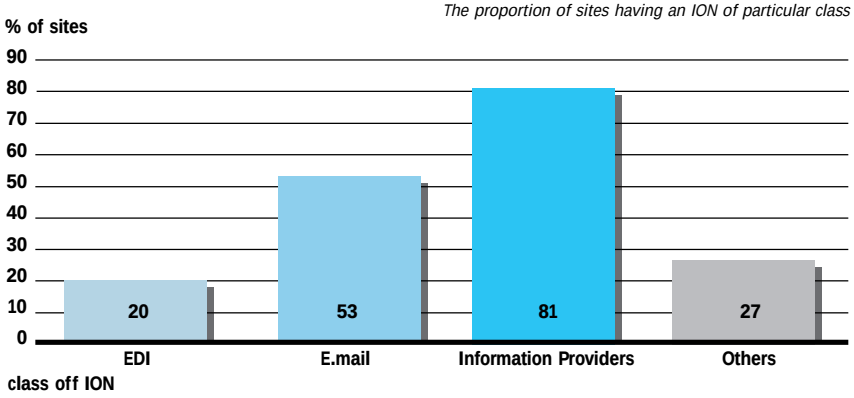
Trade Assn. – a trade association promoting the electronics industry's interests; particularly in the area of distribution. The 64 member companies represent 70% of the sector's employment.

If IONs are to form the basis for increased collaboration in the economy organisations not only have to install the necessary technical infrastructure they also have to recognise that information has a central role in their business. At a *prima facie* level it appears that both conditions are being met. Of the companies surveyed, 32% had an ION of some description (see Fig. 1) and 18% had two or more different types; the most popular combination being e.mail and access to online information services. These findings are interesting in two respects. Firstly, given that the survey covers the full range of companies in the industry, they show a relatively high uptake of the technology. Since over 75% of the companies with IONs have fewer than 50 employees IONs would seem not to be confined to just the largest firms. Secondly companies appear to appreciate that a single class of link can only play a limited role and are installing multiple types of IONs to support different business processes. It is also apparent that the primary objective is not to improve the efficiency of existing information processing activities. Rather there is a recognition of the value added that information can contribute to the business. Only 27% of companies highlighted reduced cost as a very important consideration when installing an ION while 86% were motivated by the potential to access greater quantities of better quality information. Indeed *every* company considered the ability of IONs to supply more information *or* improve the quality of that information already communicated to be a very important influence on their decision to introduce them. In the Scottish electronics industry at least, companies seem to be focusing on information as a resource rather than an administrative by–product whose burden on the company should be reduced as much as possible. Furthermore, evidence suggests that electronic communications are moving beyond the narrow confines of supporting the exchange of goods and companies are becoming genuinely *informatised* . IONs are allowing the intertwining of information with specific products and relationships to be loosened; sources of information are becoming more varied and new patterns of exchange are emerging. Bulletin boards are a case in point. Typically a *collaborative milieu* exists. Expertise is pooled and while participants expect the benefits they receive to compensate for the effort they exert there is no expectation of direct transactional symmetry. One company, for example, described the technical conferences maintained on Cix as an 'experience system' which enables expertise from outside the company to be tapped in response to particular problems that are encountered.

Figure 1
The proportion of sites having an ION of particular class



However while it appears that there is some substance behind the rhetoric on ICTs, IONs and new eras of production once one looks in more detail at how companies are using the technology it becomes apparent that it is to support existing patterns of activity and organisation. Companies appear thus far to have focused attention on improving *access* to information and to have neglected considering how to innovatively apply that information to improve their business. For example, one company was cited by Training Co. as operating a computerised maintenance system whereby engineers receive help from an expert system when trying to ascertain the cause of particular technical problems. Information in the system is updated automatically as the details of each problem incurred are incorporated into the base database. But this is all the information is used for. The system is not used to alert the company to consistent failings i.e. whether there are patterns showing possible generic problems, for example in the supply of a component. Furthermore design teams do not have access to the database when designing new, or related, products. Problems that have arisen with previous products and which could be avoided are thus not highlighted. Organisations still essentially associate a given piece of information with a particular task. There is only limited realisation that as well as such standard usage the same information reanalysed, or reformatted, might be of value elsewhere in the organisation. At the extreme organisations are even divesting themselves of the responsibility for making better use of information. It is trading partners that are expected to realise its potential. All the organisation itself wants are the tangible benefits, such as a faster turnaround of orders, that result. In the short term such a strategy may help maintain a company's competitive position. In the long term, though, there is a danger that if the company fails to evolve and informatise its own operations it will find itself disadvantaged. An ex-

ample is provided by Computer Co. Here there is a *unidirectional* flow of information *out* of the company. Information is passed to suppliers to help them in their production and planning activities but there is no reciprocal flow of information into the company.

While companies have lofty ambitions few appear to be making a determined effort to realise them. For example, the survey revealed that there is a general acceptance that collaboration supported by an increase in the exchange of information is beneficial. And indeed 69% of the surveyed companies suggested that the introduction of IONs had facilitated closer working relations with trading partners. Yet while it might be expected that such collaboration would result in changed trading patterns this has not occurred and 71% of companies have the same number of trading partners as before the ION was introduced. Few companies are employing IONs as the basis for introducing significant changes in their business practices or relationships and it would appear that IONs still make a rather peripheral contribution. For example for 25% of the companies less than 20% of their business is supported in any way by IONs and only 13% use IONs to support more than 80%. Furthermore the contribution that IONs could, or do, make is not well understood and 56% of companies in fact *did not know* how much of their business was supported by IONs. All of the companies also suggested that the linkages, were effectively being used to support *established* business, by for example, operating as an extra service, rather than to help the company generate *new* business opportunities.

At a fundamental level even the assumption that the introduction of IONs is leading to enriched communications can be questioned. The majority of survey respondents were of the opinion that IONs are principally suited to the communication of hard or factual information. Electronic communication, for example, is typically bereft of many of the *contextual* clues that attend more personal communications. One might therefore expect that if organisations' are introducing IONs because they recognise that the communication of information is *central* to their business the use of complementary media might also increase. Individual companies did report that the introduction of IONs was serving as the catalyst behind a general reassessment of the role of communications

"Once communications are made more effective a greater reliance is placed upon them"

However nearly 50% of companies have substantially reduced their use of more traditional communications media such as the postal service and telephony following the introduction of IONs. Only 13% have increased their use of such media. And of these several have moved to a position of duplicating rather than extending communication; whereby an e.mail, for example, is used to confirm a telephone conversation. It may even be the case not only that the total level of communication is not being increased but that with IONs being used wholesale organisations are increasingly using inappropriate media for communication.

4. Why IONs are not delivering

If, as appears to be the case, companies are not using IONs to their full potential why is this the case? Interviewees identified two limiting factors:

Problems with the technology

While the ICT industry marketing machine and academic visionaries churn out visions of future societies transformed by ubiquitous information and cheap communications organisations are left with the reality of struggling to manage unreliable, proprietary systems. ICTs are not a stable and well understood technology but one that is continuously being developed and refined. Organisations not only face the difficulty of implementing applications whose future functionality and perceived organisational role is

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clouded with uncertainty. They also have to integrate these applications with *pre–existing* systems designed under different conditions to meet different needs.

There are fundamental problems, for example, with EDI relating to reliability and managing the diversity of incompatible standards and networks. Computer Co., for example, has numerous suppliers connected to different third party EDI networks. Yet as the situation stands there is limited interconnection between the different networks and issues relating to message audit trails and the allocation of responsibility for 'lost' messages remain unresolved. Turning to reliability, while EDI is viewed as being of primary value to support moves to more efficient 'pull driven manufacturing systems' such as Just In Time (JIT) and MRP its implementation has been largely restricted to peripheral areas such as the processing of financial transactions. Considering Computer Co. once more, there is at the present time no genuine EDI in operation supporting manufacturing; messages are invariably pulled of the machine and manually checked. There is insufficient trust in the technical capabilities of EDI to allow the data to be directly input into production schedules or Computer Numerically Controlled (CNC) machines. Furthermore a vicious circle is operating to inhibit the introduction of EDI. The lack of trust in the technology means there is little prospect of introducing EDI in areas where there is a possibility for transforming business processes and contributing a significant level of value added. On the other hand the use of EDI in peripheral areas results in low payback on the initial investment making it hard to justify.

The historical development of ICTs has progressed through a number of stages. In the past many companies focused primarily on implementing systems that exploited the technology's data processing capabilities. The current emphasis on the *communications* potential of ICTs is a relatively recent phenomena. Design and development approaches that were appropriate for systems that essentially functioned in a stand alone capacity are having to be overhauled now that integration is a priority. Past actions however have often resulted in a plethora of idiosyncratic systems that are difficult to integrate at the internal level let a lone with external systems. An example given was of a company that established a ratings database for international carriage. The system is held to be of immense value internally and has been extended over time; for example migrating from manual to electronic input. Yet it was developed in an unstructured manner with the various analysts and programmers who 'visited' the project essentially 'doing their own thing'. Consequently there is not intention of allowing outsiders access to it; the argument being that the cost of bringing it up to the required standard would be prohibitive. Companies though cannot afford to 'abandon' their old systems, according to Trade Assn., because they have sunk large amounts of capital into them.

A misguided view of what is required

Communication fulfils many varied roles each of which is likely to make different demands of an ION. Numerous interviewees though expressed concern that the telecommunications infrastructure upon which the majority of IONs depend is being constructed in an inflexible fashion. The main concern raised related to the emphasis being placed on the provision of 'global solutions'. The belief that a single, or very small number of services will be able to meet the needs of all users; that just as all subscribers have fundamentally the same requirements for voice telephony so the same will be true for data communications. Interviewees remarked that all data service users do not have the same needs and that they will also vary for a *single* subscriber depending upon the type of data or application being used. There will be differences in, among other things, the length of connection, the degree of security and the bandwidth required. The example of ISDN

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was raised repeatedly. For a number of years ISDN has been touted as a communications panacea ([9], [17], [26]). It was suggested, actually by Telecoms Co., though that such an emphasis on a single solution may be deleterious: "companies need access to a variety of capabilities so that the most *appropriate* can be used for a given task". ISDN is best suited to 'bursty' traffic where a link is established as, and when, required and dropped at other times. A number of interviewees also argued that the development of ISDN had been driven by the technology not led by the market. It was not designed to meet perceived needs rather to make use of the output of research laboratories. As such despite it having been available for a number of years it is only relatively recently that widespread uptake has begun as people have started to identify uses for it and produce applications that exploit its functionality.

5. Making collaboration work

The empirical evidence suggests that the introduction of IONs is not leading to the emergence of more collaborative modes of production. Furthermore interviewees have highlighted a number of factors, such as an inappropriate communications infrastructure and applications that are proving difficult to integrate, as the principle obstacles to change. However it is argued here that even if such issues are resolved collaboration will not necessarily result. Successful collaboration requires much more than the exchange of information ([16], [18], [19]). Perhaps more important than managing the complexity of collaboration on a day to day basis though is establishing conditions appropriate to its *formation* . According to Giddens [13], North [31] and Perez [33] economic activity needs to be considered within an institutional context. The political, economic and judicial institutions of a society function as a web of interconnected formal rules and informal constraints that define the incentive structure within which organisations operate; the so called 'rules of the game'. Over time an institutional framework evolves to support and promote particular production structures. Occasionally however innovations such as ICTs challenge the very basis of that relationship and the existing framework has to be fundamentally overhauled.

Numerous parties have a role in defining the institutional framework. The single largest influence though is probably the government. Public policy makers have largely accepted that technological excellence is not necessarily beneficial in itself and recognised the need to promote the use of new innovations *vis* initiatives such as VANGUARD[1] and Technology Foresight[2] While such policies may encourage and facilitate the extension of current patterns of 'collaboration' by operating within an institutional framework that emphasises the central position of the firm opportunities for radical new forms of collaboration are likely to remain unrealised. Part of the problem is that while *the firm* was only invented because it was perceived to be a useful 'tool' in the economy [12] it is now considered to have inherent value. The challenge is to change that perception; to recognise that too much emphasis is being placed on the importance of the *individual* firm. Enterprise Co., for example, argue that the norm is for companies to see *their* future as being dependent upon *their* actions. The possibility that trading partners could help build that future is largely ignored. Where companies claim that they are collaborating more often than not this is a euphemism for wanting suppliers to be more responsive to their needs; cutting costs, not designing more effective relationships. Companies are so preoccupied with supporting their individual businesses that they are failing to recognise that often the best way to achieve this would be to work to increase the effectiveness of the entire value chain. While Computer Co., for example, espouse collaboration and view their business as changing from the supply of hardware to being a service provider. Yet relationships with their own suppliers remain essentially transaction based. Product design

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[1]Intended to improve awareness and use of value added and data services (VADS) by highlighting best practice and identifying communities of common interest that might benefit from being linked by VADS.)

[2]Seeks to encourage frequent informal contacts between science and industry which the government hopes will forge new working partnerships and promote increased awareness of new emerging key technologies.)

and manufacturing decisions for example still appear to be taken within Computer Co. with little or no outside consultation. All that is wanted is a finished product; there is little interest in tapping the suppliers' expertise to see if the effectiveness of that product could be improved. There has been no qualitative change in the nature of the information exchanged and there is little prospect of joint business development. Suppliers are still clearly responding to the demands of Computer Co. rather than helping to define them. In a slightly different vein companies even appear unwilling to collaborate in areas which might be considered to be *pre* competitive. Where generally applicable competencies or resources could be built up together more effectively or less expensively than individually. Take for example the provision of basic training or education which is then further refined and differentiated within the specific context of particular companies. Training Co. deliver such courses. They are usually narrowly focused and directly relevant perhaps to only a single person per organisation. As such when trainees return to their organisation typically there is not a pool of internal resources that can be drawn upon when problems arise. Training Co. thus feel that the best form of post course support would be workshops, where problems could be shared and advice received from people who have experienced similar difficulties. And yet companies tend to prefer the provision of one–to–one mentoring or consultancy.

Where companies have been willing to work together experience suggests that the commitment is superficial rather than deeply rooted. Ultimately separation rather than togetherness is the order of the day. Trade Assn., for example, brought a group of companies together to take a collective look at their supply chain processes to see how EDI could make them more effective. The group however would only cooperate up to the point of defining what they felt should be done and how to implement it and then insisted on going it alone. The argument being that they were all at different points on the path to EDI and a common timetable would be restrictive.

"some companies, for instance, had desource they could command for EDI while major internal reorganisations were going on" (Trade Assn.)

What the companies failed to understand is that a crucial requirement of EDI is the establishment of a critical mass of users. Only then should they have started to think about their own individual situations and how to secure a competitive advantage.

6. Conclusion

It is possible at this stage to draw a number of tentative conclusions. It would appear that while organisations are beginning to introduce IONs the technology is so far having little influence on the organisation of economic activity. Companies appear willing to pay lipservice to the concept of collaboration so long as it does not call into question the underlying basis of their business. And yet that essentially is what collaboration should do. The emergence of collaboration though would appear to be dependent upon more than the provision of an appropriate technical infrastructure that supports the development of common knowledge. It will require a conducive institutional framework and an acceptance that the structure and role of the firm or organisation in the economy today is likely to be subject to radical change. It is however also questionable whether organisations have genuinely recognised the contribution that information can make to their business. While communication *may* have increased following the introduction of IONs patterns of information use appear the same; only the medium has changed. Information is still typically associated with a predefined application and seen as a static, stand alone asset. The *potential* for change is present though. For example Camera Co. is currently introducing computer–aided design (CAD) for the electronic transfer of drawings. At the moment *finished* designs are shipped from Camera Co. to its suppliers. This hard copy system often leads to delays if amendments or alterations are necessary because of tooling constraints. While CAD is initially being introduced simply to speed up the transfer process the interviewee thought that in the medium term suppliers will take a more active role in the design process.

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