

E-SYSTEMS DESIGN THROUGH THE STUDY OF AUTHENTIC WORK PRACTICE

social activity theory and the case of University - Industry collaboration

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Abstract: E-commerce systems involve collaborative systems that support and enable trading partners to work together as members of communities of practice. Eliciting the information requirements necessary to design, develop and run these systems requires understanding of what practitioners do in practice, as well as what policy directives impose as practice. A practice-centric approach is proposed for identification of elements of practice, a brief summary is made of some tools and concepts from Social Activity Theory and their relevance for further analysis of collaborative system information requirements is assessed.

1 INTRODUCTION

E-business removes the need for physical contact between trading partners or agents. Teams of practitioners, which are dispersed geographically, organisationally and culturally, need to operate as a form of community in order to enable the trading system to work effectively through its technical infrastructure. The traditional face-to-face approach to developing mutual trust and a shared understanding of the trading system is rarely available to them. Instead they develop practice within a technical system overlaid with socio-cultural rules. This is what we refer to here as a collaborative system.

Communities using these systems are highly dependent upon sharing knowledge that enables them to be effective practitioners. This reciprocal dependency between practice and knowledge maintains the criticality of communication, co-ordination and co-operation (Bafoutzou and Mentzas 2002) in collaborative systems that perform satisfactorily. Sharing of knowledge is, in turn, highly dependant upon the establishment of trust within practitioner communities and allows the community knowledge to be accessed and contributed to by its members.

In previous work, a socio-technical view of developing collaborative systems between trading

partners has been examined (e.g. Dingley & Perkins, 2000). This paper proposes an approach to identify the information requirements of such systems, exploring the relationship between policy and collaborative practice.

Problems with the development and management of systems that attempt to enable collaboration arise as a result of building the systems on cardinal, or espoused requirements of practice projected from policy requirements. We propose that in contrast, the actual practice that often results from individual practitioners 'working around' policy directives to achieve finite results in a situation where time and other operational resources are rationed (Lipsky 1980) should form the basis for determining the information requirements.

Computer supported co-operative practice research has recognised this problem of identifying actual as opposed to cardinal practice, but it remains a difficult problem (Sachs 1995). By the nature of the encultured and embodied knowledge that enables expertise, it is highly tacit and often not recognisable in an explicit form even by the practitioner who employs it in practice activity. An approach to develop information systems that more effectively enables collaborative activity needs to be situated within the study of practice activity itself.

This paper introduces some recent approaches known collectively as Social Activity Theory

developed in the social sciences as a means of identifying authentic practice with a view to analysing its information system requirements.

1.1 Approach

This paper aims to propose an approach to investigate the information needs of groups of collaborating practitioners. It provides a context for the critical appreciation of some recent theory. Collaboration in practice is explored both between industrial partners and between a UK University and an industrial organisation. The study is principally aimed at individual practitioners and the groups, or communities that they form in the conduct of their practice.

The following section explores the subject of collaboration to clarify its meaning and practice. A taxonomy of academic-industry collaboration is then proposed as it pertains to a computing school in a UK University in order to develop information systems based on practitioner needs. The paper will identify some of the policy developments that provide explicit influence upon institutional frameworks. It concludes by identifying means by which collaborative activity might be examined more closely to reveal the authentic patterns of practice of e-trading practitioners

2 EXPLORING COLLABORATION

In the UK Higher Education sector there are considerable pressures upon academic staff to collaborate with their colleagues inside their institution, with their colleagues at co-operating institutions and with commercial and industrial partners. The rationale for this collaboration may be positioned at a number of different organisational levels and orientations. It might be situated at the level of technical rationality with resource efficiency and effectiveness as the primary criteria. Alternatively it might be at the level of academic research or teaching practice as a means of more effectively situating learning through immersion in practice. Yet another situation might involve collaboration as a tool for social engineering, especially with a view to redistributing educational resources.

Frequently the collaborations that academics become involved with are entered into in relative ignorance of the issues and criteria that surround the immediate task. The integration of these activities is ostensibly integrated under the umbrella of University policies that dictate strategy and lend guidance to practice (UCE 2002). However policy

frequently falls short of providing adequate and appropriate direction to the individual or group engaged in practice involving collaborative work. The practice that results is likely to reflect the behaviour referred to as that of the 'street-level bureaucrat' (Lipsky 1980). This refers to behaviour where the discretion arising from job ambiguity is used to develop new practices to control the behaviour of clients and introduce the rationing of scarce resources. This may give rise to institutional uncertainty and doubt that changes the nature of collaborative activity. Alternatively it may provide sufficient ambiguity of objectives to collaborating practitioners that they feel enfranchised to take on board further powers of discretion in their roles. The problem appears to be of mapping espoused policy to roles and practice. The determination of the conceptual foundations of collaboration and in particular, academic-industrial collaborative practice, may provide a means to address this problem of activity specification.

2.1 Generic Concepts of Collaboration

The notion of collaboration is a broad one. A dictionary definition gives two meanings: the first is 'to work together, especially in a joint intellectual effort'. The second is 'to cooperate treasonably, as with an enemy occupation force in one's country' (www.yourdictionary.com). This indicates at least two factors. Firstly, the meaning of the term is historically and socially situated. It implies that the partners' 'joint-ness' is equal and that the partners in collaboration share common goals, enjoy equal benefits and wield equal power. These initial assumptions about the nature of collaboration appear to be contested by much literature on observed practice in collaborative work situations (Tett 2003, Booher and Innes 2002). Secondly, collaboration has not always occupied high moral ground. Collaboration frequently appears to contain a strong competitive element. The notion that collaboration can go too far and become tantamount to 'fraternisation with the enemy' is another common feature of reports on collaborative practice (Loan-Clarke and Preston 2002). Power and status within the partnerships undergoing collaboration also appear to be potentially interesting issues to guide an investigation into its conceptual foundations.

2.2 Collaboration Policy within the Industrial Sector

The nature of interaction between suppliers, customers and fellow competitors in a market driven capitalist system such as that in the UK remains reasonably well represented by the original ideas of Adam Smith (2001) developed 250 years ago. The introduction of concepts of relative power between competing participants within competitive marketplaces was developed further during the early 1980's when free market economy was developing as the dominant contemporary paradigm in the USA and UK (Porter 1980) when the principal motivation of survival within a competitive marketplace was extended into a concern with strategic alliances used to gain competitive advantage. The concept of value chains and value networks were used to provide metaphors capturing and objectifying this dialogue (Porter 1985). Many management approaches followed in an attempt to develop competitiveness (Alvesson 2002).

The development of Information and Communication Technology (ICT) from the 1990s was perceived as a significant weapon for securing advantage complete advantage for industry and commerce (Synnot 1987). The development of the Internet and the introduction of the world-wide web in the early 1990s brought about some profound changes in the way that technology might mediate traditional ways of competing (Gates 1996).

Within the UK retail sector, for instance, major supermarkets all established electronic trading networks. In some research conducted over a four-year action research programme into a collaborative e-commerce system in the retail sector, suppliers to these monolithic organisations were effectively compelled to change their systems of trading to comply with the technical and operational requirements of these systems (Perkins and Dingley 2001). The structure of the collaborative systems that resulted imposed considerable differences in the amount of power that the collaborating partners could bring to bear on other partners (Perkins et al 2003), however, suppliers willingly assented to become part of the collaborative trading system as they considered that their position in the supply chain produced by the collaboration increased their chances of survival within the market as a whole (Perkins and Dingley 2001).

2.3 Collaboration Policy within the University Context

Cycles of mutual dependency and antipathy have long existed between the UK government and the University sector. These have been responsible for a series of legislation and supporting policy that is well documented (Trowler 2003, Kogan and Hanney 1999 and Henkel 1999). New expectations of education/industrial collaboration by the UK government and its agencies through legislation date back to at least 1994 with the White Papers on competitiveness (DTI 1994) and Foresight (DTI 1997). This launched the debate on public-private interests in research and provided a means of scanning the environment for determining social, economic and market trends and deciding upon appropriately responsive research policy as a result. The Dearing Report (Dearing 1997) contained explicit recommendations that UK universities should collaborate rather than compete. It also recommended that institutions of higher learning should be represented on Regional Development Boards, establishing a participatory role for universities in local economic development. Tett sees the concept of collaboration as integral to the current UK government ideology:

'These themes of collaboration and partnership, sometimes referred to by the shorthand term 'joined-up government', are at the centre of New Labour's vision of the welfare state' (Tett et al 2003).

In contrast with the situation in the industrial sector, and with the exception of the sort of collegiate research collaboration described by Smith (2001), collaboration within UK universities is not as well established. At the corporate level, universities are frequently involved in collaboration in research joint ventures as a result of encouragement by government policy (FEFC 1997). Also there is considerable incentive to collaborate with overseas institutions of learning as a means of increasing income independently of government funding. Both types of initiative may be seen to be parallel to the needs within the industrial sector to create and be protected by the synergy resulting from monolithic networks of trading influence.

In general however, within UK universities it appears that tangible collaboration at the level of individual academic practitioners has been normative, localised and often ad-hoc. Specific examples of policy directives on how collaboration should be achieved are rare. Research collaboration is encouraged in principle, but the effects of a structural devolution of power to specialised faculties and departments tends to become a serious barrier to managing cross-faculty or cross-

institutional projects that require resources (Smith 2001).

2.4 Collaboration policy between Universities and Industry

The present UK government has made a strategic commitment to securing collaboration between the two sectors but there is evidence that academic-industrial collaboration meets with problems arising from a lack of common goals and a lack of mutual benefits (DTI 2000).

Many of the goals that are held in common between industrial and academic institutions exist primarily at the top levels of corporate University management. The financial management of organisations in both industrial and academic sectors share common concerns about securing income, managing costs and optimising cash flow. They are also both constrained by government policy that seeks to position research grants and other major funded projects in elite teams situated within elite institutions, both industrial and academic (Jarvis 2000). At middle levels of management as well as at the level of active practitioners in both academic and industrial organisations there appears to be a much lower incidence of common goals. Work by Willmott (1998) identified differing attributes of practitioners in a sample of industrial organisations compared to a sample of academic practitioners. Loan-Clarke and Preston (2002) focus on research practice but identify areas of tension and power their case study hybrid practitioner. These include:

- theory as opposed to practice orientation
- rigour against relevance
- insider against outsider orientation
- academic (research) role against practice (management) role.

Academic-industrial collaboration can be interpreted as potentially beneficial from one of a number of standpoints. Firstly, and seen from the viewpoint of national policy, it appears to provide a cost-effective means of embedding government policy into the Higher Education sector. Secondly, seen from the viewpoint of those sponsoring research for the purpose of increasing national wealth and academic prestige, it provides a framework for developing elite research partnerships. UK government policy is to encourage the structural embedding of collaboration between industry and the Universities. However, at the level of academic and industrial practice there appear to be some generic problems. Short-term common goals that are valued by both academic and industrial partners are difficult to identify (Jones 2002). Government research funding programmes

frequently address this with explicit performance measurement requirements. However, the implicit interpersonal relationships that provide the more tacit components of collaboration, such as mutual trust, are not so frequently assessed in such frameworks.

Overall, academic-industrial collaboration appears to have lacked the drive from survival or competitive pressures that typically lead industry to collaborate. In general, and with the possible exception of some practitioner-led research programmes (Smith 2001), there has been an absence of bottom-up initiatives for academic-industrial collaboration. Government policy requirements have insisted that such collaboration will take place and this has led to enforced top-down collaboration in Universities when they bid for major research and other significant projects. But top-down pressure for collaboration tends not to be effective (Smith 2001).

This reflection on the impact of policy on how e-commerce practitioners interact in collaborative systems has been examined at a strategic level up to this point. This is useful for identifying macro influences on e-commerce systems but is remote from the operational practice that enabling e-commerce systems are intended to operate. In order to identify information requirements it is necessary to resolve specific activities where practice exists. This will be the subject of the next part of this paper.

3 A TAXONOMY OF COLLABORATION

A variety of tasks are called collaboration. Collaboration comprises many different practices and policy will impact upon them in different ways. The taxonomy proposed here will provide a means of refocusing upon this interaction. The notion of collaborative practice is distributed over all shades and varieties of practice. Smith (2001) identifies categories specifically for the research area of higher education, and this has a usefully simple, if not fully explanatory function for collaborative practice in general. His categories comprise:

- Corporate partnerships
- Team collaboration
- Inter-personal collaboration

This scheme maps well to the notion of practice at the macro (national/organisational), meso (local community of practice) and micro (individual and small group) levels. The macro level addresses the areas of strategic consideration of overall policy

within the operation of educational schemes. The micro level addresses the activity of individual tactical educational practice. Finally, the meso level bridges the gap between these two end points of the practice continuum. It does this by considering the activities of closely co-operating groups, or communities of practice that interact dynamically with other communities. This model appears to be a useful way to structure discussion on how these categories of collaborative practice act and interact. Smith bases his work on academic research practice in Universities. This model may be further qualified in terms of the universal, reformist and radical approaches to practice identified by Martin (1987) in his study of community education. This uses an alternative characterisation of approaches described as:

- Universal
- Reformist
- Radical

Under the universal model, it is assumed that there are shared values and a working consensus with a basic harmony of interests. In this view the community educator's role is to make universal non-selective provision for all ages and groups. Under the reformist model, it is assumed that there is a plurality of interests with inter-group competition for resources. Here, selective intervention is made by the community educator to assist disadvantaged people and socially excluded areas. Under the radical model, it is assumed that interests are in conflict because existing structures create inequality and powerlessness. In this model, the community educator's intervention is based on 'developing with local people political education and social action focused on concrete issues and concerns in the community' (Martin 1987: 25).

Another viewpoint comes from the management literature. Bush (1995) identifies five distinct types of educational management orientations through which collaborative activity might be viewed. These are:

- Formal
- Democratic
- Political
- Subjective
- Ambiguity

These categories are by no means an elegant mapping of approaches to the problem of addressing the multiple dimensions of collaborative practice. Each of them assumes that only one archetypal category is consistently dominant throughout the

course of an element of practice. However, any area where 'everything depends on everything else' may benefit from the sacrifice of some precision in definition in order to gain a small breakthrough in discerning patterns of collaborative practice (Fullan 1999).

A simple taxonomy of practice was developed from two interviews conducted with an academic partner and an industrial partner to a joint project (Dingley and Perkins 1999). This data was triangulated with data taken from observation of collaboration between academic and industrial institutions. This provides a complementary way of integrating parts of these three models in order to look at specific examples of what is meant by collaborative practice. The taxonomy is built upon a scale where one end is occupied by practice that is predominantly controlled, or influenced by academic institutions (for example, teaching and learning practice) and the other end by industrial influence (for instance, applied research and development projects).

At the **educationally oriented** end of the practice continuum this taxonomy comprises:

Micro level	A1	Industrial practitioners from industry - guest lectures from industry- relation of categorical information.
	A2	Industrial practitioners as guest lectures relating case studies for problem solving
	A3	Industrial practitioners acting as team members in academic workshops
Meso Level	A4	Groups of industrial practitioners giving access and information to academic staff and/or students
	A5	Groups of industrial practitioners providing access to research by academic staff/students
	A6	Groups of academic staff sharing resources and research outcomes
Macro Level	A7	Industrial institutions providing access to academic institutional staff and students for placements, workshop activities
	A8	Industrial institutions providing access and facilities to academic institutional for educational projects
	A9	Industrial institutions sharing resources and research outcomes (joint venture).

At the **industrially oriented** end of the practice continuum this taxonomy comprises:

Micro level	B1	Academic practitioners act as trainers/advisors for the relation of categorical information
	B2	Academic practitioners act as guest lecturers relating case studies for problem solving.
	B3	Academic practitioners acting as team members in industrial projects
Meso Level	B4	Groups of academic practitioners give access and information to industrial staff and/or students
	B5	Groups of academic practitioners provide access to research by industrial staff
	B6	Groups of academic staff share resources and research outcomes with industrial staff
Macro Level	B7	Academic institutions provide access to industrial institutional staff for personal development and training
	B8	Academic institutions provide access and facilities to industrial institutional for educational projects
	B9	Academic institutions share resources and research outcomes (joint venture).

This simple categorisation provides a rudimentary taxonomy of this example of collaborative practice observed between an academic and an industrial institution, its groups and its individuals. The development from initial types of collaborative practices to more mature forms is characterised by the taxonomy proposed above. Increasingly intensive forms of collaboration, such as that from A1 to A3, or B7 to B9, involve more developed levels of collaborative ability, motivation and cultural affinity to collaborative action. Development of the collaborative practice in this way is accompanied by a concurrent development of a number of attributes of the developed collaborative system. These include time invested in the collaborative arrangement, by a higher level of trust amongst the participating practitioners, by an ability to identify benefits accruing from the partnership, by holding some goals in common and by having begun to institutionalise, or 'tempered' the relationship in a way in which interpersonal tensions are released sufficiently to enable participants to be able to perform in the joint practice that emerges from the collaborative work system (Dingley and Perkins 1999).

3.1 Refining and Using the Taxonomy

An example of collaborative practice between an academic member of staff from UCE and a major industrial manufacturer of soft drinks was used to test the proposed taxonomy. The investigation involved an interview with a member of UCE staff involved in an extended collaborative project and an interview with a senior member of a business organisation involved in the same exercise. Observation of the practice that took place in some of these activity groupings was done concurrently through a programme of action research over a period of four years.

The taxonomy can be used as a basis for identifying degrees of departure from cardinal practice, that is practice that ostensibly 'should' happen if accepted policy is interpreted literally by practitioners. This can be compared with authentic practice, which is about what really happens when practitioners use 'work arounds' that cope with the work-based pragmatics of managing limited time and resource availability.

Let us take as an example practice B6 – 'groups of academic staff share resources with industrial staff'. The cardinal practice set by policy in this area of activity might dictate that e-commerce systems must enable groups of practitioners from both industry and academia to access research outcomes in a particular area. Design activity to carry this out might result in common data being made available through a web-based portal and with this technical infrastructure in place, the policy need is ostensibly satisfied. In observed practice however the case study identified differences of preferences for information presentation between academic and industrial partners. Summarising the observations briefly, academic partners expected emerging research data to be presented and discussed in some forum. Industrial partners expected a summary of best practice principles to emerge from the data that might inform tactical decision making for current practice. The information was strongly mediated by its coding and presentation. Frequently the knowledge of practice that the collaborative system information was expected to support was of a category that could not be coded in any explicit form.

The study of authentic practice within communities of practitioners is necessary to determine the cultural rules that underpin routine practice and provide a process of authentic information requirements determination. An approach that is currently emerging from the social sciences and organization studies that offers some valuable advice is that of Social Activity Theory.

3.2 The Role of Social Activity Theory

This developing area sets as its main focus the study of organisational culture through the medium of the work practices that comprise and result from it. It comprises an eclectic body of research and provides useful tools for the analysis of work practice identified through the taxonomy developed above.

Blackler's taxonomy of knowledge is a significant move away from the traditional concept of knowledge as abstract, disembodied, individual and formal (Blackler 1995). Instead a model of knowledge as embodied, embedded, embrained, encultured and encoded is proposed. Rather than studying knowledge as something individuals or organizations supposedly possess, the attribute of 'knowing' is seen as something that they do. This is used to analyse the dynamics of the systems through which knowing is accomplished. With this reorientation of approach,

'..knowing in all its forms is analysed as a phenomenon which is: (a) manifest in systems of language, technology, collaboration and control (i.e. it is mediated); (b) located in time and space and specific to particular contexts (i.e. it is situated); (c) constructed and constantly developing (i.e. it is provisional); and (d) purposive and object-oriented (i.e. it is pragmatic).'

(Blackler 1995)

Blackler uses Activity Theory (Engestrom 2001) to identify this knowledge situated within communities of practice. Engestrom's model of socially distributed activity systems explores the dynamics between agents, such as the users of collaborative systems, objects of activity, such as trading processes, and the community that this trading takes place within. The way that these elements are mediated by implicit or explicit rules, by roles and divisions of labour and by instruments and technology such as their information systems are then analysed.

Michael Eraut introduces processes of distributed learning and distributed 'knowing' about how practice should be conducted (Eraut 2000). Recent research from psychology and education into memory structures and knowledge acquisition pathways are presented to allow a deeper understanding of some of the cognitive processes taking place within the activities analysed.

4 CONCLUSIONS

Collaborative systems are important to successful e-commerce systems, which are in turn a vital

component of modern business. But the nature of collaboration is not clear. This is problematical because:

practices can turn out to be different from their ostensible policy specification,

the community in which those practices are understood to be actioned can reject them

the knowledge that drives work practices can be located in places or media inaccessible to the information systems supposedly enabling them.

An approach to improving the ability of collaborative information systems to support authentic work practice is proposed. This begins with the development of taxonomies of practice for the specific work situation under examination. It moves on to using participant surveys and observation to refine the nature of individual practice. Conceptual tools from Social Activity Theory are then identified in order to better determine the information requirements of systems to support the collaborative practice.

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