CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

LEARNING AS WORK:
Teaching and Learning Processes in Contemporary Work Organisations

Cardiff School of Social Sciences, Cardiff University,
Glamorgan Building, King Edward VII Avenue, Cardiff CF10 3WT
Tel/Fax: 44(0)29 2087 0325 Email: learningaswork@cf.ac.uk

T·L·R·P TEACHING & LEARNING RESEARCH PROGRAMME

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

University of Southampton

IOE LONDON Leading education and social research
Institute of Education
University of London

Constructing Learning: Adversarial and Collaborative Working in the British Construction Industry

Dan Bishop, Alan Felstead, Alison Fuller, Nick Jewson, Konstantinos Kakavelakis & Lorna Unwin

Learning as Work Research Paper, No. 13
January 2008

Address for Correspondence:

Dan Bishop
Centre for Labour Market Studies
University of Leicester
7-9 Salisbury Road
Leicester
LE1 7QR
Tel: +44 (0)116 252 2749
Fax: +44 (0)116 252 5953
Email: dan.bishop@le.ac.uk

Alan Felstead
Cardiff School of Social Sciences
Cardiff University
Glamorgan Building
King Edward V11 Avenue
Cardiff CF10 3WT
Tel: + 44(0) 29 2087 9050
Messages: + 44(0) 29 2087 0325
Email: alanfelstead@cf.ac.uk

ABSTRACT

This paper examines two competing systems of organising the construction process and their consequences for learning. Under the adversarial system, contractors compete solely on price, risks are shifted onto those next in line and disputes are institutionalised through complicated, but inevitably incomplete, contracts. However, under collaborative working the costs and risks of the project are shared and the parties involved communicate openly and freely, often in the absence of tightly specified contracts. The move from the former to the latter – prompted and encouraged by government enquiries, large public sector clients and building regulations – represents a shift towards a climate in which problems are shared and solved regardless of where they occur in the productive system (a process conceptualised as 'knotworking' in the literature). The paper argues that such learning theories and policy pressures from above fail to take adequately into account the heavy hand of history and the importance of understanding the nature of the productive systems in which 'knotworking' is expected to occur. Both are important in understanding the fragility of collaborative working across the stages and structures of the construction production process which place limits on making 'knotworking' an habitual and commonplace activity.

CONSTRUCTING LEARNING:
ADVERSARIAL AND COLLABORATIVE WORKING IN THE BRITISH CONSTRUCTION INDUSTRY

INTRODUCTION

For the last two decades, serious concerns have been voiced about the performance of the British construction industry. These concerns culminated during the 1990s in the publication of the Latham Report (Latham, 1994) and the Egan Report (CTF, 1998), both commissioned by government. These highlighted low levels of client satisfaction, poor health and safety records, high accident rates, under-investment in R&D, large numbers of projects exceeding their budgets and timescales and a 'crisis in training' (CTF, 1998: 7). On this basis, construction was regarded as an 'under-performing' industry.

This under-performance was blamed on the ingrained patterns of work organisation that have long characterised the industry for many years. 'Adversarial' forms of contracting have dominated the sector, where it is commonplace for contractors at each point in the production process to exploit and undermine each other at every turn. This created a hostile and litigious environment that militated against more strategic and co-ordinated modes of project management. The proposed solution – then and now – is a move towards more collaborative forms of working, and associated practices such as 'partnering'. These 'new' modes of project and supply chain management, already popular in manufacturing and engineering, are focussed on forming closer relationships with clients and (some) suppliers in order to facilitate the delivery of the construction project to time, to budget and to specification. Their theoretical underpinning is provided by models of work organisation such as 'co-configuration' and 'knotworking', which rely on focussed collaborative efforts, open communication and knowledge sharing between partners (see Engeström *et al.*, 1999).

However, this paper argues that these theoretical models do not adequately take into account the historical, cultural, social and economic contexts within which such

'new' practices must operate. In the construction industry, for example, there is a recognition that the adoption of such (unfamiliar) ways of working entail a fundamental cultural and structural shift that takes time. Indeed, both Latham and Egan identified a range of skills that need to be developed and nurtured if the industry were to adopt less adversarial, more team-orientated forms of contracting and procurement. People in construction, for example, need to learn to work more closely in teams with one another and to shed the mistrustful and hostile mindset that has dogged the industry for decades. Moreover, collaborative working creates an environment that actively promotes such learning and facilitates knowledge transfer (e.g. De Vilbiss and Leonard, 2000; Cheng *et al.*, 2004); it therefore both requires and supports the acquisition and use of new skills. This has parallels with the debates surrounding high performance management systems which also focus on fostering knowledge sharing, albeit *within* rather than *across* workplaces and organisations in productive systems (see, for example, Butler *et al.*, 2004; Felstead *et al.*, 2005).

The aim of this paper is twofold. First, it explores the fundamental issues faced by the construction industry in attempting to move away from adversarial modes of operation towards a more collaborative approach. Second, it assesses the implications of such a move for learning and skills development within the industry. In doing so, it offers a constructive critique of Engeström's theory of 'knotworking' by illustrating the importance of contextualising such practices within specific – and often inhospitable – productive systems (Wilkinson, 2002).

The paper consists of five sections. The first section sets out the key theoretical principles of collaborative working through a critical discussion of Engeström's concepts of 'co-configuration' and 'knotworking'. Secondly, the methodological approach of the research is summarised, while the third section compares and contrasts the traditional, adversarial way of carrying out construction projects with 'newer' forms of working based on collaboration. Next, the paper traces the consequences these two ways of organising construction projects have for learning and skills. The fifth section of the paper discusses the obstacles to collaborative working within the British construction

industry which underlines the importance of taking the historical context and nature of the productive system into account when evaluating the prospects for 'knotworking'. The paper ends with a summary.

CONCEPTUAL BACKGROUND: CO-CONFIGURATION, 'KNOTWORKING' AND COLLABORATIVE WORKING

As we will outline, the model of collaborative working in construction has close theoretical parallels with what Engeström calls 'co-configuration' and associated practices of 'knotworking'. Co-configuration work is characterised by the creation of a complex and adaptive product, which is constructed through the collective efforts of multiple producers in collaboration with the customer (Engeström *et al.*, 1999). The various parties work closely together to share knowledge and learn from each other in order to improve the end product. This is accomplished without a central locus of control. According to Engeström, the core unit of analysis in co-configuration is the 'knot'; a temporary collective of disparate partners who come together to perform a particular task (e.g. Engeström, *et al.*, 1999; Engeström, 2000). Once the task is complete, the knot dissolves. When a new task needs to be performed, another knot forms, collaborates and dissolves, and so on. This longitudinal process is known as 'knotworking' (see also Kangasoja, 2002, and Fenwick, 2007). As Engeström *et al.* observe:

> 'Knotworking is characterized by a pulsating movement of tying, untying and retying together otherwise separate threads of activity. The tying and dissolution of a knot of collaborative work is not reducible to any specific individual or fixed organizational entity as the center of control. The center does not hold' (Engeström *et al.*, 1999: 346).

For Engeström, therefore, there is no central locus of control in 'knotworking'; no fixed point that directs and co-ordinates the activities of different strands of the knot(s). Instead, each knot is organic and essentially self-regulating in its formation, operation and dissolution. As a form of co-configuration work, 'knotworking' also generates 'mutual learning from interactions between the parties involved.' (Engeström *et al.*, 1999: 348). Through encountering and collectively overcoming 'ruptures' in the collaborative

working process, the parties learn 'expansively' (Engeström, 2001) from each other; that is, develop innovative ways of working in order to complete the task more efficiently or effectively. They move from a position of simple 'co-ordination' (i.e. working to occupational scripts with only minimal and restricted collaboration) to full 'co-operation' and open communication focussed on reconceptualising the shared problem (Engeström *et al.*, 1997)

Engeström provides empirical illustrations of 'knotworking' and co-configuration in healthcare and legal settings (see Engeström *et al.,* 1999 and 1997 respectively). Examples from other sectors are provided, for example, by Kangasoja (2002) in relation to public works design projects, and by Fenwick (2007) in the education system. In all of these cases, the authors provide clear instances of 'knots' of professional workers collaborating in a largely unregulated and improvised fashion in order to overcome an issue through collective knowledge-sharing and problem-solving. They generally encounter difficulties in the collaboration process as, for example, in the case of healthcare workers who rarely communicated effectively due to established professional divisions (see Engeström *et al.*, 1999: 370-371). Kangasoja (2002) highlights similar problems caused by occupational demarcations on large design projects. However, Engeström sees these 'ruptures' largely as functions of ingrained practices, habits and identification boundaries which inhibit attempts to move towards greater collaboration. They are, for him, apparently surmountable difficulties that can be overcome through a process of co-operation and reflection, which enables the parties to identify where the problems lie and to address them.

This is a position that has recently attracted some criticism. For example, as Young (2001) points out, Engeström tends to assume a common goal between parties; that is, he assumes that actors can be encouraged to work together because they are essentially committed to the same end or object. Any problems or 'ruptures' that occur are generally due to a lack of agreement over the means to achieve that goal or a lacuna in common understanding. However, actors may have very different aims and be committed to fundamentally different goals. What, then, are the chances of encouraging

them to work and learn collaboratively? This is a question also raised by Avis (2007), who posits that fundamental tensions that are embedded in the structural relations between actors tend to be played down in Engeström's work, as he generally views such antagonisms as positive sources of innovation and change rather than destructive conflict (cf Konzelman and Forrant, 2000). This problem may be associated with the relatively narrow empirical base on which the concept of 'knotworking' is founded. Most studies of co-configuration and 'knotworking' have focussed on work in sectors where there is a broad agreement over the fundamental goals of collaboration (e.g. healthcare, education). This is where this paper aims to make a contribution. By contextualising Engeström's work in an empirical study of collaborative working in the construction industry, we can see how 'knotworking', co-configuration and collective learning may struggle to find foothold within productive systems characterised by institutionalised conflict and incentivised hostility.

METHODOLOGY

The methodological approach used in this study was adopted with the aim of illuminating where and how learning occurs (or is inhibited) in the two different types of productive system in construction – adversarial and collaborative relations (see Felstead *et al*., 2006 and 2007). So, with work in the sector being predominantly project-based, and with the crucial involvement of (often extensive) supply chains, the construction project itself became the main unit of analysis. A large public works project was visited, and interviews conducted with representatives of the main contractor (i.e. the project management company), and subsequently with four of the subcontractors procured as part of the supply chain on that project. Such an approach allows for a 'horizontal' view of the distribution of learning across the stages involved in a single construction project and insights into the 'vertical' relations between contracting organisations. Fourteen respondents participated in this phase of the research.

Secondly, we focused on contractors and subcontractors in the mechanical and electrical (M&E) stage of the construction process. We conducted interviews with senior

managers of both large and small firms. This provided valuable insights into the organisation of work and learning across a range of projects from the perspective of a particular stage in the construction process – the fitting out of buildings, and road and bridge building work. A total of 16 organisations and 26 individuals participated at this phase of the research.

Thirdly, five 'industry-level' interviews were conducted with respondents in a range of government and non-government organisations. This was designed to set our results in a 'vertical' context. In total, 49 respondents took part in the research. In accordance with standard ethical guidelines, all respondents were assured of their anonymity and the confidential treatment of interview data, and their identity is protected in the presentation of findings through the use of pseudonyms.

ADVERSARIALISM AND COLLABORATIVE WORKING IN CONSTRUCTION: TWO PRODUCTIVE SYSTEMS

Construction work is organised around projects which can vary in length from a matter of days to several years. They can also vary enormously in terms of scale, but the principles by which they operate are essentially the same. The basic project process is well-documented (see, for example, Briscoe *et al.*, 2001: 244). First, the client decides on their requirements. Then, they appoint a designer/architect and a contractor (known as the 'main contractor') who takes overall responsibility for managing the construction process (this selection often occurs after a competitive tendering process). The main contractor (MC) then appoints major contractors to take responsibility for completing different stages of the building work such as groundwork preparation or mechanical and electrical fit-out. These may, in turn, subcontract parts of this work to smaller organisations to supply equipment such as cranes and pile drivers, install certain electrical supplies or build particular bridges. The building, road or other facility is finally commissioned and used by the client.

The realities of construction contracting are, of course, more complex. In particular, the process of appointing subcontractors – of 'procuring the supply chain' – and engaging with them once appointed is often beset with difficulties and complications that are rooted in the structure and history of the industry. For example, there has been a tendency for construction supply chains to be 'fragmented' in the UK (see, for example, Humphreys *et al.*, 2003; Matthews *et al.*, 2000). That is, main contractors generally appoint a large number of relatively small, unrelated specialist subcontractors to deliver specific goods and services to the project (as opposed to delivering those goods and services in-house, or using a smaller number of less specialised suppliers). Conventionally, these subcontractors have little contact with each other and exist in an essentially 'arm's length' relationship with the main contractor.

A commonly observed outcome of this arrangement is that there is a high degree of misarticulation between the different parts of the supply chain, and hence a considerable problem for the main contractor, whose task is to co-ordinate and manage the chain in order to deliver the project efficiently and to schedule (see Cox and Ireland, 2002). More importantly, however, with so many 'layers' in the supply chain, there are numerous opportunities for each party to enhance their own returns by driving down the fees charged by those engaged at later stages of the process or further down the structure of production (a process known by our respondents as 'subbie bashing'). As one of our respondents commented, the tendency for such opportunities to be exploited sustains an habitual atmosphere of distrust:

> 'Everyone's so scared of everybody else … every step of the way, everybody thinks that everybody's trying to shaft them, and they're probably right. So everybody spends more money protecting them from being shafted than they would do if they just got on and got the job… We just shaft each other as fast as we can. I mean obviously if you get a Quantity Surveyor, what's he employed to do? He's employed to make sure that your bill is fair. How's he going to do that? If you submit a bill for a thousand quid, he'll cut it down to 900 quid. So what do you do, you have to submit a bill for eleven hundred pounds so he can turn you down to a thousand pounds, so that he can … guarantee he's performed his job. It's nonsense … a Quantity Surveyor has to reduce your bill, because otherwise how's he going to prove to his people [that he's justified his

> fee], so ... you've got this institutionalised stupidity' (Chief Executive, large M&E specialist).

This reveals much about the prevailing culture of the construction industry. Presented with frequent opportunities to undermine and exploit – to 'shaft' – other parties (particularly subcontractors), the most common reaction is to make the most of them when they arise. As this reduces costs, there is a clear economic rationale for doing so, at least, over the short term. Furthermore, the reward structures that motivate individual behaviour within construction projects often actively support this antagonistic culture. As the engineering director of another M&E subcontractor observed, while senior managers may espouse a commitment to collaborative principles, project managers on site are actually incentivised to work quite differently:

> 'Once you get to the middle tier of the management, the operational tier of the management, they just revert to type and screw you into the ground. Because most of the time they're measured on profit. Their bonus is measured on profitability. Their success within the business, their standing within the business, is based largely on profitability ... Unless they can make some money out of you [the subcontractor], then they go somewhere else' (Engineering Director, large M&E specialist).

Thus, adversarialism is an endemic feature of the construction industry (see also, for example, Latham, 1994; CTF, 1998; Mason, 2006). The productive system of construction work effectively institutionalises hostility and foments a culture of distrust. From the inception of the project through to its completion, the different parties involved at each stage and level of the production process spend considerable time and effort in exploiting others and/or in taking legal action against them to extract a return when the terms of contract have been infringed.

Procuring each stage of the construction process on the basis of the lowest priced tender is the traditional means by which main contractors seek to extend their control in time and space; in these circumstances, the centre (i.e. the main contractors) attempts to maintain its hold over a number of links in the production process (see, for example, Greenwood, 2001). The parties collaborate only minimally and only when absolutely necessary. They restrict themselves to simple 'co-ordination' in accordance with

occupational scripts. This, on the face of it, is an environment that does little to support genuine collaboration, knowledge-sharing or the organic formation of self-organising 'knots' (Engeström *et al*., 1997).

Yet moving towards a more co-configured, collaborative way of working, based on extensive co-operation, is exactly what policy-makers have advocated for over a decade. Collaborative working and 'partnering', as presented in the Latham and Egan reports, undoubtedly hold the promise of a fundamental shift in working patterns in construction. They also present the possibility of a productive system that relies on and cultivates increased levels of skill and knowledge through collective efforts. Yet these are still concepts that lack an exact and widely-accepted definition. As Bresnen and Marshall observe, for example, the term 'partnering' is used:

> 'to refer to situations ranging from vague claims of collaborative intent, to much more systematically structured relationships, involving charters, team-building and the like' (2001: 338)

In general, the terms 'collaborative working' and 'partnering' are used interchangeably to describe a particular mindset or style of project management. For example, Bresnen and Marshall describe it as 'a determination to move away from adversarialism and litigation and to resolve problems jointly and informally through more effective forms of inter-firm collaboration' (2000: 230). Comparable definitions have referred to 'an informal relationship for the purpose of accomplishing mutually agreed goals and objectives' (Cheng and Li, 2001: 294). In a similar vein, our respondents tended to see collaborative working as:

> 'Where you operate with a mutual benefit both for partners … It's a matching of culture and objectives' (Engineering Director, Large M&E specialist).

The emphasis in these definitions tends to fall upon the active involvement and joint, concerted effort of construction clients, contractors and subcontractors to effect the efficient accomplishment of the (supposedly) shared object; the completed construction project, within time and to budget. Moving towards an acceptance of this shared object,

as opposed to the pursuit of individualised and conflicting goals (i.e. profiteering at the expense of others) is generally taken to be the key characteristic of collaborative working. This is underpinned by a shift away from lump-sum contracts with recourse to remeasure, if the conditions of the contract change, to target price contacts in which contractors share with clients the pain and gain of budget overshoots and undershoots.

Collaborative approaches have several benefits over traditional, adversarial modes of operation. These include a higher level of integration and communication between the various parties, and the early involvement of (some) subcontractors which in turn improves articulation between the various stages of the project (see, for example, Constructing Excellence, 2004; Larson, 1997). Other commonly cited benefits of this approach include the increased capacity to develop trust between organisations (Matthews *et al.*, 2000) and the potential for inter-organisational (and inter-project) knowledge transfer and collective learning (Constructing Excellence, 2003; CTF, 1998).

The parallels between such ideal-type models of collaborative working, on the one hand, and co-configuration and 'knotworking', on the other, are clear to see. For example, both involve a complex product, requiring the collective contribution of a range of normally unrelated actors as well as input from the customer/end-user. In construction, teams of individuals from different trades and professions (e.g. carpenters, plumbers, scaffolders, electricians, architects, design consultants, clients, project managers and so on) coalesce around particular activities and problems over the course of the project and, once the activity is complete and the problem solved, they go their separate ways. During their collaboration, the diverse actors converge in ephemeral groups, cross occupational and professional boundaries, share knowledge and engage in mutual learning – at least in theory. Furthermore, where collaborative working is extended to include multi-project partnering arrangements between contractors, there is a ready framework to support the repetition of 'knots' through the continuation of collaborative inter-organisational teams (see, for example, Bennett and Peace, 2006).

This, in essence, is the theory behind collaborative working. How closely does it match the reality of construction work? To date, empirical studies of co-configuration and 'knotworking' have tended to focus upon work in sectors that are very different to construction (e.g. Engeström *et al.*, 1997, 1999; Fenwick, 2007), where fragmented supply chains and long-established relations of exploitation do not normally characterise the productive system (although Kangasoja's study of 'knotworking' on large design projects does provide a comparable setting to construction). How useful are these concepts in understanding the adoption of collaborative working in construction? Can they take root in an industry where there are powerful incentives drive actors apart rather than together?

ADVERSARIALISM AND COLLABORATIVE WORKING: THE CONSEQUENCES FOR LEARNING

As the previous section illustrates, the structure of the construction industry promotes distrust, antagonism and a pervasive spirit of adversarialism. This is an environment that does not encourage collective learning and knowledge-sharing between parties. With each contractor having their own goals and keen to maximise their gains at the expense of others, knowledge becomes a weapon to be hoarded, kept from others and used to 'shaft' others.

An example of this is the way in which contractors make frequent use of 're-measure' clauses within standard-form construction contracts issued by professional bodies such as the Institute of Civil Engineers. These clauses allow contractors to claim that unexpected developments during the course of the project have resulted in increased costs and are therefore used as justification for raising their charges above the tender price. Many respondents commented that it is common practice among contractors to abuse this provision by deliberately underestimating their costs in the bid for tender (thus appearing an attractive option to clients), safe in the knowledge that they can recoup any shortcomings later using the re-measure clause. Those in the industry have become highly adept at this practice, using prior knowledge of the circumstances of each construction

project and the potential problems to make 'loss leader' quotations profitable. As one respondent commented, this practice has become a 'game' to be played, with some players becoming skilled in keeping the 'real' cost of a project hidden from clients:

> 'The client would produce a bill of quantities and it would be re-measured under the [terms of the contract]. So when the job was finished the quantity surveyor would go round with the resident engineer and re-measure the length of pipes you put in, re-measure the kerbs, and then you reapply the actual quantities delivered on the project to the prices which, when you add it all up, was what you got paid at the end. So you could play tunes on that, if what you tendered on [was a price] you knew it wasn't going to end up at in order to make your job cheaper… You'd adjust the rates [in your tender] to make it more advantageous, so that when you put the tender in it would come out at a cheap price knowing that when the job was remeasured you actually got what you needed. And so it was clever mechanisms like that which everybody played' (Project Manager, large construction contractor).

Other respondents made similar comments about how contracts with remeasure clauses raised final prices, made delays more likely, and prompted claims and counter-claims:

> 'You assume everything was going to be best case because if you assume worst case, you were the smartest person that didn't have the job … you would assume the best ground conditions and you'd say that doing the pile [pilings for road bridges as part of a road extension] was £10 a linear metre because you were told it was going to be sand and you were told it was going to be very, very loose sand, so piling was going to be very, very easy. But when you came along, the sand was a bit harder than you thought, so rather than £10 a linear metre, we want £15 a linear metre because we didn't price for this … similarly timescales – you programmed on what you knew. So, if you thought it was soft sand and you were told it was soft sand, you programmed for it … anything else and you're going to be there longer' (Project Manager, large construction contractor).

Thus, under adversarialism, knowledge becomes an important resource to be hoarded, kept from others and used to further one's own goals while undermining others. Contractors learn to become adept in using knowledge in this way. This is at odds with the suggestion that knowledge is best used when it is shared between parties. Without a common object or goal to work collectively towards, such a suggestion can have little impact, hence a 'restrictive learning environment' is formed (Fuller and Unwin, 2004). There is no impetus to communicate or share knowledge across organisational or even

functional boundaries, and 'skill', 'learning' and 'training' are determined by occupational rather than project requirements.

In contrast, it is often argued, collaborative working promotes an 'expansive' learning environment. It encourages collective learning and knowledge-sharing by advancing a set of cultural values and beliefs that support trust, allow discretion and experimentation, and creates a collective ethos within which individuals feel comfortable collaborating and sharing knowledge with each other (see, for example, Thomas and Thomas, 2005; Davey *et al.*, 2001; Barlow and Jahaspara, 1998). Such benefits may be even greater within multi-project or 'strategic' collaborative arrangements, where the same team of clients and contractors (and, perhaps, subcontractors) work on a series of projects together. As Prencipe and Tell (2001) observe, the capacity to transfer knowledge and lessons learned is often under-developed in situations where teams are typically disbanded after each project; much of their accumulated collective knowledge and experience is lost. However, as Bennett and Peace (2006) argue, strategic, long-term partnering may offer a solution to this problem. As the Egan Report points out, retaining the same team over a number of projects potentially enables:

> 'teams of designers, constructors and suppliers [to] work together … continuously developing the product and the supply chain; eliminating waste in the delivery process, innovating and learning from experience' (CTF, 1998: 19).

The stop-start nature of project work and therefore the difficulties of carrying lessons from project to project was widely recognised by respondents:

> 'every time we do a job, we're setting up a new company, so it's not like manufacturing baked beans … you can tweak things, but by the time we've tweaked things, we've finished' (Project Manager, large construction company).

By establishing a long-term framework that supports the ongoing formation and operation of innovative 'knots', collaborative working promotes collective learning. In addition to creating a climate in which learning can flourish, participants are also required to learn a range of skills and acquire the requisite knowledge. For example, Thomas and

Thomas (2005) claim that, given the adversarial, low-trust environment that has dominated the construction sector for many years, a considerable amount of correction is required if the correct 'win-win', high trust, teamworking mindset is to take hold. Humphreys *et al.* (2003) also highlight the need for a concerted effort to change prevailing attitudes through a programme of cultural education.

Similarly, Briscoe *et al.* (2001) emphasise the need for a process of learning throughout the industry in order to engender the skills that support effective partnering and teamworking. They observe that '[t]hese skills are of a generic nature, rather than narrower vocational skills' (2001: 244), and point in particular to communication skills, systems awareness, problem-solving and empathy with suppliers and customers (2001: 246-248). This resonates with Fenwick's assessment that effective 'knotworking' relies on skills and abilities such as 'spanning boundaries among discursive communities and generally becoming attuned to shifting discursive patterns that emerge in negotiations among different constituents' (2007: 151).

As such accounts indicate, it has become popular to commend the benefits of partnering and collaboration in terms of the increased capacity for learning it enables and requires. However, some writers have urged caution in this regard, suggesting that not only is genuine collaborative working extremely difficult to achieve and rarely observed in construction (e.g. Cheng and Li, 2001), but that the benefits achieved in terms of learning and knowledge transfer are often exaggerated. What benefits, we might ask, in terms of learning and skills does collaborative working actually promote over more conventional forms of work? Is the rhetoric of collaborative working, and its purported promotion of learning, borne out in reality? What barriers are there to collaborative working, learning and knowledge sharing in construction?

Our findings indicate that, where implemented in practice, collaborative working has the potential to promote learning and knowledge transfer in a number of ways. Many respondents, for example, spoke of the benefits brought by long-term, multi-project collaborative relationships with customers. These relationships had proven consistent and

reliable sources of work over time, and were of considerable value in lending greater transparency to business planning; knowing that work was guaranteed (or at least probable) over the next year or so afforded the opportunity to make investment in capacity. As one respondent commented:

> 'You can start making plans on the basis that you know you're going to get return. If you're at risk people don't commit. If you tell somebody [they're] going to make bridges from now to kingdom come and they're going to get a return of even 3% or 4% on it they'll set up a factory and bring on new staff, increase their skills … It's long term. It allows investment. It allows training' (Commercial Manager, large construction contractor).

Another participant expressed the same view in a different way:

> 'You can slaughter a cow and eat it once or you can milk it every day' (Managing Director, small M&E specialist).

This highlights the potential benefits of long-term, continuous collaborative working, as opposed to the more conventional, hostile, single-project relationships that have traditionally been prevalent in construction. As most participants pointed out, there are potentially considerable one-off profits to be made through adversarial modes of contracting, as money can be extracted from other parties to a project through aggressive exploitation of the supply chain ('subbie bashing') or through litigation against other contractors. However, in 'slaughtering the cow' in this way, bridges are burned in terms of repeat business and closer co-operation between organisations, as the hostile contractor develops a reputation for being difficult to work with. The result is a business cycle characterised by extreme peaks and troughs, making long-term investments difficult. 'Milking' the cow, on the other hand (i.e. accepting potentially lower but more sustained profit margins by pursuing closer and more durable 'knotworking' relationships with partners), enables greater strategic investment in skills and employee development.

It was not just in terms of a more stable business environment that collaborative working approaches promoted increased levels of learning. Some respondents observed that 'true' collaborative working inevitably entails a much closer relationship between

partners over a longer period, relative to more traditional modes of contracting. Communication becomes more rapid and extensive between organisations and information systems become increasingly entwined. This, in turn, lays the ground for knowledge sharing and collective learning between collaborating firms:

> 'True partnering to me would be … true sharing of … some relationships. So in other words sharing IT systems ... It's systems. It's supply chain. It's intellect. It's all sorts of things. It's learning. It's education. It's everything' (Procurement & Supply Chain Manager, Large Construction Contractor).

In the majority of cases, this integration between collaborating firms was not particularly formalised, tending instead to be left to individuals at the point of contact on site; these were spontaneous relationships where interactions, in true 'knotworking' style, did not hinge on a central locus of control. As a result, collective learning and knowledge-sharing occurred in a largely informal, ad-hoc fashion such as that described in the following extract:

> [When working collaboratively with another contractor] we might see a working practice that they have as well that we'll think that's a good idea … from the health and safety it tends to be more formal, you know, there's a clause in the contract, your guys must have done this, must be qualified to do that. In terms of the actual procedures, that's more on a site base isn't it. Have you tried this kind of fixing. Even with technology, receiving emails and drawings from A. N. Other, you might see something that's been done on the computer and think 'bloody hell, what's that?', and that'll link you into finding out how that's been done and next thing we're using that same method in here' (Contracts Manager and MD, small M&E specialist).

Knowledge transfer tends to occur in a relatively informal manner under collaborative, co-configured modes of working. Most firms, therefore, had no formal mechanism for capturing and retaining any 'new' knowledge that emerged or was shared as a product of these relationships. However, in a few instances, attempts were made to achieve just this – effectively to establish some kind of centre to the collective learning that occurred within the knots. In the following extract, for example, the respondents explain the role of a facility within their organisation that is dedicated to the development of new products in collaboration with suppliers:

> ‘We’ve invested heavily in that over the last three years, four years ... we are looking at products, we are looking at hand tools, we’re looking at systems and calling suppliers who are part of our supply chain to say look how can we do this differently, can we design instead of just for the cable tray, we have the cable tray, the cable ties, the supports that go with it, and buy it as a module … A number of [our suppliers] see it as an adjunct to their R&D department ... [also, it] is literally used as a kind of training centre for a lot of our kind of manual workers to come in and, you know, if they’re going on to a new job or we’ve got a new system, that’s where they’ll come in and have a look at it. So, there’s a fairly steady flow of good experienced workers going in there and looking at these new products and, you know, they’ll often say well if you did that and that, then it would be really worthwhile having. So there’s this kind of informal feedback’ (Commercial and HR Directors, large construction contractor).

Not only does this illustrate an example of an organisation striving to capture the knowledge transfer that can happen between partners under collaborative working, it also represents an instance of ‘knotworking’ (albeit ‘knotworking’ with a ‘centre’). That is, groups of relatively disparate actors working together, temporarily and across functional boundaries to solve a particular problem or effect a particular performance improvement. While this was relatively unusual, it was not a wholly isolated example either. Another respondent described the functioning of a ‘labour improvement team’ within his nation-wide organisation, which had a roaming brief to ensure that lessons were learned and captured from each project and transferred to others, not simply hoarded at one isolated point within the organisation. It also engaged with subcontractors by asking them how they could help:

> ‘What can [we] do, what would help them, and listening to them, you know, if they’ve got a white van travelling round all the time delivering a box of screws, it’s not efficient, but if they say right, you have these stores on site, we’ll take that box of screws and we’ll automatically just feed this system for you, so whenever your guy goes there, he’s got the box of screws, and instead of us delivering ten times a day to you, we deliver once a week in a planned method. So they benefit from not having a white van sat around, and we benefit from, you know, a logistics saving’ (Chief Executive, large M&E specialist).

According to some respondents, a few major contractors and construction clients had adopted similar knowledge-sharing systems on project-wide bases, incorporating all

collaborating organisations. For example, on one very high-value private sector project, the client had instituted a central training facility that provided short and long courses for all contractors and subcontractors on site. These courses ranged from brief health and safety workshops through 'toolbox' talks (essentially, lectures on specific items of equipment) to full apprenticeships.

Even beyond the confines of the individual project, some major contractors act as a permanent 'training hub' for suppliers and subcontractors with whom they work collaboratively on a regular basis. At present, for example, large contractors often demand specific standards from their suppliers in terms of quality of product or service and, in some instances, provide training to help them attain the capacity to meet those standards:

> 'We involve [our suppliers and subcontractors] in our training both at site level and off site level. If we are running awareness courses we will involve them in those. We don't take over their training. We still leave them with some responsibility and duty to do the statutory parts of it, but in terms of enhancing their ability and making their ability more akin to what we would do ourselves there's this cross fertilisation' (Commercial Manager, large construction contractor).

Such examples highlight the significant potential for learning-intensive working arrangements under collaborative approaches. They also emphasise the fact that some organisations are not content to leave learning to the ad hoc, improvised interactions that occur within 'knots'. Instead, they seek to formalise and standardise this process by providing a focal point for learning and development that it activates.

Yet collaborative working does not just have the capacity to promote learning, it may also *require* it. Most respondents were of the firm conviction that effective collaboration and partnering is reliant on each party possessing certain 'hard' and 'soft' skills. For example, working closely with design consultants in a partnership arrangement is made easier if the contractor possesses a high level of technical design skill:

> 'So a lot of the work has been not only about being selective in the kind of type of work we're chasing in the business development, but also in

> focusing on how we market and project the skills we have within the business ... The traditional route is that the client would employ an M&E consultant to carry out the full design duties. We encourage, actively encourage the M&E consultant being used to develop the concept design, we will do the detailed design and we will work alongside that M&E consultant in developing that design to ensure that it meets the concept ... So there's added merits there for us to be involved, it gets us involved much earlier as well, but ... Yes we've invested strongly in our central engineering department which is a team of specialist designers that do nothing else but design' (Commercial Director, large construction contractor).

'Soft' skills are also important in making collaborative approaches successful. Under such approaches, there is an increasing requirement for many engineers and project managers to have a broader range of, for example, communication, client-facing and teamwork skills ('briefcase' skills, as one respondent put it). Several individuals emphasised that negotiation and 'influencing' skills are crucial in terms of making the most of early collaborative involvement:

> 'What I find is that there is a growing involvement of us at the earlier stage than perhaps in more traditional contracts. Our ability to influence the design, the build-ability etc. comes to the fore because we're able to do that. We're a bit more proactive and less reactive. So in terms of the skills that engineers would have on [larger partnered projects] that approach [developing 'briefcase' skills] is well developed' (HR Director, large construction contractor).

Client relations and relationship-building skills – at all levels, not just management – were also viewed as crucial to effective collaboration. This is seen by the following respondents as something that the human resource function within organisations can develop to support collaborative working:

> 'It's people that provide the service to the client in the construction sense and what we find is that people with good client skills form relationships with the contractors who want to work with them again. And that's what we're developing and continuing … If you were to look at our organisation, engineering quantity surveyors side of it on site, wherever you are in that, be it the project manager to the CAD guy you will have a relationship with your counterpart and those relationships are then important to then transfer across (Commercial Manager and HR Director, large construction contractor).

This echoes Fenwick's (2007) assertion that 'knotworking' relies on individuals possessing skills that allow them to span discursive boundaries and communicate with a wide range of partners. However, while communication and teamworking skills seem particularly important in a partnering context, some respondents emphasised the need to switch back and forth between different discursive mindsets in order to cope with the more traditional, commercial-style projects:

> 'Sometimes you need them to be the opposite. So, they'll be on one job where everybody is putting their arms around one another and, yes, you're doing really well and the next job they'll take the chair away so you'll fall over just to get some sort of competitive advantage. So, we don't want everybody in love with one another. There are jobs where you've got to stand your corner … Some days they'll have one hat on and the next day they'll have another hat on. You might get a senior project manager one day having to rant and rave to get something done, but the next day he might be out trying to build a relationship with another client (Engineering Director and HR Manager, large M&E specialist).

This extract raises an obvious yet crucial point; that shifting from a productive system based on adversarialism to one based on collaboration is not an easy or instantaneous process. While most respondents claimed that the proportion of collaborative work on their books was increasing, they also emphasised that more traditional modes of contracting – commercial, exploitative and often hostile – were still important and in many cases central to their income. The picture emerging from the interviews suggests that some of the rhetoric surrounding collaborative approaches in construction may hide a slightly less favourable reality. Respondents raised questions about the actual extent of genuinely collaborative relationships within the industry, particularly in terms of relations between the larger contractors and their supply chains. They also hinted at structural disincentives to collaborative working within the sector, and furthermore, some individuals identified intractable barriers to knowledge transfer between organisations, even within collaborative relationships. Within such a context, what are the prospects for 'knotworking' and collective learning? It is to such issues that we now turn.

BARRIERS TO THE MOVEMENT AWAY FROM ADVERSARIALISM AND TOWARDS COLLABORATIVE WORKING

While our findings paint a positive picture of the impact of collaborative working and 'knotworking' in construction, this section adds a strong note of caution. After all, the institutional framework of the construction industry does little to encourage collaboration and the sharing of knowledge and information between organisational actors. In fact, its ingrained practices, institutional arrangements and incentive systems are at odds with such a mode of working and instead institutionalises adversarialism (Cox and Ireland, 2002; Hughes and Maeda, 2002; Ng *et al.*, 2002). Models of collaborative and co-configured working assume a shared goal or object between the different actors. However, the prevailing tendency in construction is for the various parties to be committed to very different objects focused around particular stages of production they are contracted to deliver such as ground work, ductwork, heating and ventilation, and concrete and steel framing.

Furthermore, Wood (2005) and Beach *et al.* (2005) highlight the deeply embedded power inequalities that persist within the industry, the culture of self-protection and distrust, and the cynical exploitation of market power by some construction clients and large contractors. All of these factors militate against attempts at collaboration. Thus, the established productive system of the industry actually undermines collaboration and makes co-operative 'knotworking' economically irrational. It is against the background of this generally unfavourable environment that Engeström's concept of 'knotworking', and the adoption of collaborative working and learning practices must be understood. Such an approach emphasises the importance of context and history, issues which have hitherto been neglected by 'knotworking' scholars.

A major barrier to collaborative working identified by most respondents lies at the very start of the productive process, namely the attitude of clients. On all construction projects the client wields considerable power through setting and letting of contracts. Consequently, a persistent theme in the interviews was that for collaborative working to

function properly on a project basis the client must be able and willing to encourage and incentivise this way of working. However, many respondents observed that, on the whole, clients were at best lukewarm towards a genuine collaborative approach. Most still worked on the principle that the 'best' (that is, the cheapest) strategy is to adopt a more conventional, arm's length, commercial relationship with contractors and subcontractors, which can drive down costs through the competitive bidding process. Often, it seems, clients use 'partnering' as little more than a rhetorical tool, which (as they see it) allows them to avoid some of their more onerous responsibilities:

> 'I think some clients see it as an easy option because if you partner with somebody generally you get an easier ride as a client because you've been taken on knowing… what the cost parameters are. What the profit parameters are. It's sort of ring fenced and there's an element of comfort in the relationship. So therefore clients are, especially in the public sector, they think if we get into this I can sit back and I can go home a bit earlier because I've got a partner here. I haven't got somebody that I've got to keep an eye on all the time. He's a partner' (Engineering Director, large M&E specialist).

While some respondents were more optimistic in their assessment of clients' attitudes towards collaborative working, most cited the client as one of the greatest obstacles to the expansion of collaborative practices. While the majority of clients still continue to pursue 'traditional' modes of procurement that are purely designed to reduce costs (i.e. through competitive bidding processes based mostly or completely on price criteria), attempts by contractors, suppliers or external agencies to seek collaborative relations are unlikely to be successful. Any project that begins with, and is dominated by, an obsession with reducing costs inevitably encourages a system of incentives that actively undermines a collaborative approach at all levels. As highlighted above, for example, middle managers/project managers who are judged and assessed from the outset solely on the basis of cost and profitability are not incentivised to work in a collaborative manner, even where there is rhetorical commitment to do so from those above them in the vertical chain.

A further barrier to collaborative 'knotworking' in construction is the type of work that is currently available in the industry. For example, the number of clients able to

offer regular work that supports multi-project partnering arrangements is limited. As one respondent pointed out, the prevailing structure of demand will condition the ability to pursue a long-term partnering approach:

> 'It all depends on the individual demand profiles of the clients. Some don't have regular demands' (Procurement and Supply Chain Manager, large construction contractor).

Some clients are regarded as more building savvy than others having regularly commissioned projects in the past and for whom the completion of the work is an end in itself. However, other clients 'want the buildings built for a second purpose' since buildings 'aren't what they're about'. These clients lack building expertise and are unlikely to develop a long-term relationship with those in the construction industry.

Furthermore, the volume and type of work available at any one time is not entirely stable, but is instead prone to market fluctuation. These macro-level economic circumstances are crucial in generating an environment that either supports or discourages the pursuit of collective endeavours or the formation of co-operative 'knots'. Several respondents observed that the economic cycle and prevailing market conditions have an important impact upon the feasibility of a collaborative approach. Some were concerned that, if the recessionary conditions of the early 1990s were repeated, there would be a reversion to more adversarial contracting:

> 'We went through a cycle then in the '80s, late '80s and '90's, where it was highly competitive onerous terms and conditions and we now see it going back towards this collaborative working… but I think if a recession bites, that's the time that people then strike harder bargains and my people will then chase turnover, taking on jobs that perhaps they shouldn't have done on onerous terms and conditions' (Commercial Director, large construction contractor).

This echoes Ng *et al.*'s (2002) observation that collaborative working is often a fair-weather activity; when profit margins tighten, clients and contractors revert to the more conventional practice of squeezing value from each stage and structure of the production process.

Yet perhaps the most frequently cited barrier to collaborative working was the general and pervasive culture of distrust that characterises the construction industry. With hostile and adversarial modes of working having persisted for so long, this is perhaps no surprise. Contractors have, over decades and centuries, developed ingrained practices and habits based on the assumption that, even if they do not exploit and undermine others in the earlier or later in the horizontal chain of production, they are unlikely to be treated in similar manner by others. This history weighs heavy in the sector, and casts a long shadow over attempts to establish co-operation or the spontaneous emergence of 'knots'. Opportunism at the expense of others is rife, and indeed is the means on which some firms rely for much of their income. While this adversarial culture – which clearly does nothing to support collaboration – may be changing slowly, it is clear that its effects are still felt throughout the industry. For example, as one respondent observed:

> 'The difficulty with construction is that we are a bit "Neanderthal". There's too much testosterone in construction … Construction is almost universally a male dominated sector and because it's a male dominated sector it reacts like kids do in the playground. It reacts to bullying. It reacts to those sorts of things and it's even got a little bit more sophisticated in that we let someone in called lawyers who say well yes you can be bullied and by the way you'll sign to say you can be bullied' (Managing Director, small M&E specialist).

The persistent adversarial culture, which institutionalises conflict and naked exploitation was seen by many individuals to be strengthened and perpetuated by the common use of cost consultants, quantity surveyors and consultant engineers by clients. This means that more parties are having to justify their fees by driving down costs in other parts of the productive system. As such, the basic structure of the industry once again creates an incentive system that does very little to support collaborative working and collective learning. As illustrated previously, contractors are often simply too afraid to risk working or sharing knowledge with others, since the knowledge they gain is often used to 'shaft' others. Within such a context, collaborative 'knots' rarely have a chance to form, let alone to operate effectively or generate 'expansive' learning (i.e. learning that occurs collectively and which generates innovative ways of approaching shared problems, Engeström, 2001).

For smaller subcontractors in particular, being 'shafted' by those higher up – what our respondents called – 'the food chain' was a common experience (i.e. by their customers in the vertical structure of production). For these firms working on a project or with a customer in a genuinely collaborative manner was the exception rather than the rule (a trend also observed by Greenwood, 2001; Mason, 2006). Most were used to being treated poorly and also to being kept in the dark by those higher up the supply chain – they are excluded from the 'knot'. This is illustrated in the following extract:

> 'It was on a project in [the north of England] and the builder wasn't pulling his weight, what he wasn't doing was forming the holes for us in the walls… to enable our installation… The builder promised that these holes would be cut and they weren't… Our client [the mechanical contractor] was pressurising us to finish because the job was behind. The builder was pressurising our client to finish because the job was behind, but the builder wasn't performing. We ended up taking the bull by the horns as it were and cut our own holes out. We put in [an additional fee to the mechanical contractor] for cutting the holes cos it's not part of our contract and… their attitude was well you shouldn't have cut the holes because it's builders' work, why would you do that… So we didn't get paid for it and the attitude from our client at that time was don't do it again' (Contracts Manager, small M&E specialist).

Such encounters made subcontractors sceptical of concepts such as 'partnering', which they tended to see as an empty rhetorical device employed by clients and those close to them (i.e. main contractors). For some, it meant:

> 'Sod all to anybody [laughs] basically ... Down in London there are one or two companies that it actually means something to ... but a bit beyond that, it's a come on from the main contractors to come into my [web], you know, kind of spider beckoning you on, it's all partnering, it's all fantastic, it's all wonderful, it's all friendly, and now we're going to stitch you up' (Chief Executive, large M&E specialist).

Such poor experiences of partnering – which were commonly reported – and the persisting lack of trust clearly do little to promote collaboration. Moreover, it became increasingly clear that, while many large contractors profess to 'partner the supply chain', the reality is that only a few select suppliers and subcontractors are accorded this privilege. For example, one of the larger contractors interviewed claimed to engage in supply chain partnering, but, when probed, revealed that:

> ‘It’s being selective ... We’re going to look for the [subcontractors] that we can operate best with and share benefits with rather than having a scatter gun approach that will never lead to any relationships’ (Supply Chain & Procurement Manager, large construction contractor).

This highlights the crucial point that, from the perspective of construction clients and main contractors, there is more incentive to collaborate with certain types of supplier and subcontractor such as those who deliver a highly specialised product or service or account for a significant part of the project. In these circumstances, there is a clear incentive for those earlier in the chain to co-ordinate and communicate with those who supply work or come on site later in the process:

> ‘When you look at the content of our work in a building, it ranges between 25%, or 20% and 40% of the value of that project. So, that means we are the biggest single subcontractor in any construction project. And that means, by necessity, a level of cooperation and collaboration, it’s not possible for a building to be built without that kind of relationship’ (Marketing Manager, large M&E specialist).

‘Partnering the supply chain’ (as extolled in the Egan Report of 1998) is therefore a more complex issue than is sometimes assumed. The benefits of working collaboratively with some suppliers are likely to be different or simply greater than with others. Moreover, some will be more willing and/or able to work collaboratively than others. As a consequence, any benefits in terms of collective learning will be restricted to certain parts of the supply chain. For example, specialist sub-contractors are more likely to be involved in designing and planning the build, but this rarely extends to general sub-contractors typified by the ‘white vans’ often seen on sites:

> ‘If, for example, you know, there’s a specialist control system, it’s helpful to have them onboard early … we need to make sure that we have all the messages he wishes to deliver at the right time, so that we design it and develop the working drawings once and once only … However, there’s a law of diminishing returns and, in some cases, no return [in partnering the supply chain] beyond the key players’ (Business Development Director, large M&E contractor).

As this section has illustrated, the barriers to collaborative forms of working in construction are considerable. Co-configured modes of organisation, such as

'knotworking' and partnering, are undermined by long-established habits, practices, cultures and incentives, all of which have a long history which promotes exploitation and conflict. More specifically, there may be further implications of this environment for learning and knowledge sharing. As outlined in earlier sections, collaborative approaches do indeed have the potential to create an environment in which learning flourishes and knowledge is shared freely between partners. However, given that the construction industry has a long history of distrust, information hoarding and poor communication between the different parties, it may be easier said than done to institute relationships that facilitate collective learning and inter-organisational knowledge transfer.

Furthermore, the plethora of specialist crafts and trades that has developed over the years provides a series of occupational boundaries that militate against the pooling of expertise and cross-functional knowledge-sharing. As one respondent commented:

> 'Some trades, ductwork people, they're not interested, you could put them all in a room, they'd kill each other… as an industry they're not, insulation guys, and I presume one of the main contractors, probably a few ground workers, plasterers, there's certain trades that just aren't there yet… most of them, you could put ten in a room and say, you know, there's a knife, the first one to kill the rest of you gets the job, and they'd just kill each other, there'd be none left' (Chief Executive, large M&E specialist).

Such illustrations of the persistent functional barriers within construction resonate with Kangasoja's observations of 'knotworking' in design projects, where 'traditional rules, divisions of labour and power positions' continually undermined attempts at collaboration and collective learning (2002: 203).

CONCLUSION

The findings presented here go some way towards confirming that 'new' forms of collaborative ('co-configured') work organisation can enhance the quantity and quality of learning in construction, relative to more traditional, adversarial ways of working. By enabling greater strategic investment in capacity, promoting a more co-operative ethos, and demanding an expanded set of skills from co-operating parties, collaborative

approaches potentially enable and require an increased level of skill and knowledge sharing. As such, there is some support for Engeström's theory of 'knotworking' as a mode of organisation that promotes and relies on knowledge-sharing and collective learning.

However, the evidence presented here also demonstrates the need to add empirical weight to Engeström's work, and emphasises that models of 'knotworking' and collaborative working more broadly need to be contextualised within specific historical and institutional settings. In reality, the fabric of the productive system in construction militates against collaboration and undermines collective learning. Decades of conflict and mistrust, alongside a reward structure that in many cases encourages cynicism and exploitation, and the persistence of demarcated occupational boundaries with associated knowledge silos all contribute to an unfavourable environment for co-operation and knowledge sharing. It is therefore perhaps no surprise that, while some collaboration and partnering does occur in parts of the industry and indeed in some cases has apparently been instrumental in raising levels of skill (Love, 1997), the evidence continues to suggest that relatively little has changed in recent years (see, for example, Mason, 2006, and Greenwood, 2001).

Beyond the specifics of the construction industry, the findings of the paper emphasise the importance of understanding 'new', supposedly learning-intensive models of work organisation, within the context of specific and established productive systems. With the best will (and skill) in the world, attempts to move towards collaborative working and 'knotworking' may struggle in construction, due to the culture and structure of the industry, and the fact that there are still tangible rewards for working against rather than with other parties. It is also questionable whether an environment 'which is frequently characterised by one-off contracts and short-term gain is capable of supporting a concept which is based on mutual trust and long-term collaboration' (Beach *et al*., 2005: 612). This is the reality of work in a competitive capitalist productive system dominated by exploitative relations. Yet this is the environment in which moves towards 'new' collaborative, co-configured models of work organisation and collective learning

must be contextualised. Until the structure of work and the nature of incentives change considerably, collaborative working will face an uphill struggle. The prospects of this occurring appear small, though perhaps not negligible. More than one respondent observed, for example, that the introduction of recent environmental regulations had forced alterations to the design of some products, which in turn required closer collaboration with parts of their supply chain. More regulations of this sort will be required if collaborative working – and its skills enhancing potential – is to achieve a secure foothold in an otherwise inhospitable learning environment.

ACKNOWLEDGEMENTS

This research forms part of a larger project which investigates the links between workplace learning, the organization of work and performance in a range of economic sectors (see http://learningaswork.cf.ac.uk). It is funded under the Economic and Social Research Council's Teaching and Learning Research Programme (RES-139-25-0110A).

BIBLIOGRAPHY

Avis, J. (2007) 'Engeström's version of Activity Theory: a conservative praxis?' *Journal of Education and Work*, 20(3): 161-177.

Barlow, J. and Jahaspara, A. (1998) 'Organisational learning and inter-firm "partnering" in the UK construction industry', *The Learning Organization*, 5 (2): 86-98.

Beach, R. Webster, M. and Campbell, K. (2005) 'An evaluation of partnership development in the construction industry', *International Journal of Project Management*, 23: 611-621.

Bennett, J. and Peace, S. (2006) *Partnering in the Construction Industry: A Code of Practice for Strategic Collaborative Working*, Oxford: Butterworth-Heinemann.

Bresnen, M. and Marshall, N. (2000) 'Partnering in construction: a critical review of issues, problems and dilemmas', *Construction Management and Economics*, 18: 229-237.

Bresnen, M. and Marshall, N. (2001) 'Understanding the diffusion and application of new management ideas in construction', *Engineering, Construction and Architectural Management*, 5(6): 335-345.

Briscoe, G., Dainty, A. R. J., and Millett, S. (2001) 'Construction supply chain partnerships: skills, knowledge and attitudinal requirements', *European Journal of Purchasing and Supply Management*, 7: 243-255.

Butler, P., Felstead, A., Ashton, D., Lee, T., Unwin, L. and Walters, S. (2004) 'High Performance Management: a literature review'. *Learning as Work Research Paper No. 1*, Leicester: Centre for Labour Market Studies, University of Leicester.

Cheng, E. and Li, H. (2001) 'Development of a conceptual model of construction partnering', *Engineering, Construction and Architectural Management*, 8(4): 292-303.

Cheng, E., Li, H., Love, P. and Irani, Z. (2004) 'A learning culture for strategic partnering in construction', *Construction Innovation*, 4: 53-65.

Constructing Excellence (2003) *Partnering in Practice*, London: Constructing Excellence.

Constructing Excellence (2004) *Supply Chain Partnering*, London: Constructing Excellence.

Construction Skills (2004) *Altogether Stronger: Skills Needs Analysis for Construction* (executive summary), Bircham Newton: CITB-Construction Skills.

Cox, A. and Ireland, P. (2002) 'Managing construction supply chains: the common sense approach', *Engineering, Construction and Architectural Management,* 9(5/6): 409-418.

CTF (Construction Task Force) (1998) *Rethinking Construction: The Report of the Construction Task Force* (The Egan Report), London: DTI.

Davey, C., Lowe D. and Duff, A. (2001) 'Generating opportunities for SMEs to develop partnerships and improve performance' *Building Research and Information*, 29(1): 1-11.

De Vilbiss, C. E. and Leonard, P. (2000) 'Partnering is the foundation of a learning organization', *Journal of Management in Engineering*, July / August: 47-57.

DTI (Department of Trade and Industry) (2004) *Construction Statistics Annual 2004*, London: TSO.

Engeström, Y. (2000) 'Activity Theory as a framework for analyzing and redesigning work', *Ergonomics*, 43(7): 960-974.

Engeström, Y. (2001) 'Expansive learning at work: toward an activity theoretical conceptualization', *Journal of Education and Work*, 14(1): 133-156.

Engeström, Y., Brown, K., Carol Christopher, L. and Gregory, J. (1997) 'Co-ordination, co-operation and communication in the courts: expansive transitions in legal work', in Cole, M., Engeström, Y. and Vasquez, O. (ed.) *Mind, Culture and Activity: Seminal papers from the laboratory of comparative human cognition*, Cambridge: Cambridge University Press, 369-385.

Engeström, Y., Engeström, R. and Vähäaho, T. (1999) 'When the center does not hold: the importance of knotworking', in Chaiklin, S., Hedegaard, M. and Jensen, U. J. (ed.) *Activity Theory and Social Practice*, Aarhus: Aarhus University Press, 345-374.

Felstead, A., Fuller, A., Jewson, N., Kakavelakis, K., and Unwin, L. (2007) 'Grooving to the same tunes? Learning, training and productive systems in the aerobics studio', *Work, Employment and Society*, 21(2): 189-208.

Felstead, A., Bishop, D., Fuller, A., Jewson, N., Lee, T. and Unwin, L. (2006) 'Moving to the music: learning processes, training and productive systems – the case of exercise to music instruction', *Learning as Work Research Paper No 6,* Cardiff: Cardiff School of Social Sciences, Cardiff University.

Felstead, A., Fuller, A., Unwin, L., Ashton, D., Butler, P. and Lee, T. (2005) 'Surveying the scene: learning metaphors, survey design and the workplace context', *Journal of Education and Work*, 18(4): 359-383.

Fenwick, T. (2007) 'Organisational learning in the "knots": discursive capacities emerging in a school-university collaboration' *Journal of Educational Administration*, 45(2): 138-153.

Fuller, A. and Unwin, L. (2004) 'Expansive learning environments: integrating organizational and personal development', in Rainbird, H., Fuller, A. and Munro, A. (Ed.) *Workplace Learning in Context*, London: Routledge.

Greenwood, D. (2001) 'Subcontract procurement: are relationships changing?', *Construction Management and Economics*, 19: 5-7.

Hughes, W. and Maeda, Y. (2002) 'Construction contract policy: do we mean what we say?', *Research Papers of the Royal Institute of Chartered Surveyors Foundation*, 4(12).

Humphreys, P., Matthews J. and Kuraswamy, M. (2003) 'Pre-construction partnering: from adversarial to collaborative partnerships', *Supply Chain Management*, 8(2): 166-178.

Kangasoja, J. (2002) 'Complex design problems: An impetus for learning and knotworking' in Bell, P., Stevens, R. and Satwicz, T. (Ed.) *Keeping Learning Complex: the proceedings of the fifth international conference on learning societies*, Mahwah (NJ): Erlbaum, 199-205.

Konzelman, S. and Forrant, R. (2000) 'Creative work systems in destructive markets', *ESRC Centre for Business Research Working Paper No. 187*, Cambridge: University of Cambridge.

Larson, E. (1997) 'Partnering on construction projects: a study of the relationship between partnering activities and project success', *IEEE Transactions on Engineering Management*, 44(2): 188-195.

Latham, M. (1994) *Constructing the Team: Final Report of the Government / Industry Review of Procurement and Contractual Arrangements in the UK Construction Industry* (The Latham Report), London: HMSO.

Love, S. (1997) 'Subcontractor partnering: I'll believe it when I see it' *Journal of Management in Engineering*, Sept / Oct: 29-31.

Mason, J. (2006) *The Views and Experiences of Specialist Contractors on Partnering*, paper presented to RICS conference, 2006.

Matthews, J., Pellow, L., Phua, F. and Rowlinson, S. (2000) 'Quality relationships: partnering in the construction supply chain', *International Journal of Quality and Reliability Management*, 17(4/5): 493-510.

Ng, S. T., Rose, T. M., Mak, M. and Chen, S. E. (2002) 'Problematic issues associated with project partnering: the contractor perspective', *International Journal of Project Management*, 20: 437-449.

Prencipe, A. and Tell, F. (2001) 'Inter-project learning: processes and outcomes of knowledge codification in project-based firms', *Research Policy*, 30: 1373-1394.

Thomas, G. and Thomas, M. (2005) *Construction Partnering and Integrated Teamworking*, Oxford: Blackwell.

Wilkinson, F. (2002) *Productive Systems and the Structuring Role of Economic and Social Theories*, ESRC Centre for Business Research, University of Cambrdige, Working Paper No. 225.

Wood, G. (2005) 'Partnering practice in the relationship between clients and main contractors' *RICS Research Paper Series*, 5(2), April.

Young, M. (2001) 'Contextualising a new approach to learning: some comments on Yrjo Engeström's theory of expansive learning', *Journal of Education and Work*, 14(1): 157-161.

Learning as Work Research Papers

Bishop, D, Felstead, A, Fuller, A, Jewson, N, Kakavelakis, K and Unwin, L (2008) 'Constructing learning: adversarial and collaborative working in the British construction industry' *Learning as Work Research Paper No 13*, Cardiff: Cardiff School of Social Sciences, Cardiff University.

Fuller, A, Kakavelakis, K, Felstead, A, Jewson, N and Unwin, L (2008) 'Learning, knowing and controlling "the stock": the changing nature of employee discretion in a supermarket chain' *Learning as Work Research Paper No 12*, Cardiff: Cardiff School of Social Sciences, Cardiff University.

Kakavelakis, K, Felstead, A, Fuller, A, Jewson, N and Unwin, L (2007) '"I am a genuine person": sales training and the limits of moulding instrumentality' *Learning as Work Research Paper No 11*, Cardiff: Cardiff School of Social Sciences, Cardiff University.

Jewson, N, Felstead, A, Fuller, A, Kakavelakis and Unwin, L (2007) 'Transforming knowledge and skills: reconfiguring the productive system of a local authority', *Learning as Work Research Paper No 10*, Cardiff: Cardiff School of Social Sciences, Cardiff University.

Felstead, A, Bishop, D, Fuller, A, Jewson, N, Unwin, L and Kakavelakis, K (2007) 'Performing identities at work: evidence from contrasting sectors', *Learning as Work Research Paper No 9*, Cardiff: Cardiff School of Social Sciences, Cardiff University.

Lee, T, Jewson, N, Bishop, D, Felstead, A, Fuller, A, Kakavelakis, K and Unwin, L (2007) 'There's a lot more to it than just cutting hair, you know: managerial controls, work practices and identity narratives among hair stylists', *Learning as Work Research Paper No 8*, Cardiff: Cardiff School of Social Sciences, Cardiff University.

Fuller, A, Unwin, L, Bishop, D, Felstead, A, Jewson, N, Kakavelakis, K and Lee, T (2006) 'Continuity, change and conflict: the role of knowing in different productive systems', *Learning as Work Research Paper No 7*, Cardiff: Cardiff School of Social Sciences, Cardiff University.

Felstead, A, Bishop, D, Fuller, A, Jewson, N, Lee, T and Unwin, L (2006) 'Moving to the music: learning processes, training and productive systems – the case of exercise to music instruction', *Learning as Work Research Paper No 6*, Cardiff: Cardiff School of Social Sciences, Cardiff University.

Bishop, D, Felstead, A, Fuller, A, Jewson, N, Lee, T and Unwin, L (2006) 'Connecting culture and learning in organisations: a review of current themes', *Learning as Work Research Paper No 5*, Cardiff: Cardiff School of Social Sciences, Cardiff University.

Unwin, L, Felstead, A, Fuller, A, Lee, T, Butler, P and Ashton, D (2005) 'Worlds within worlds: the relationship between context and pedagogy in the workplace', *Learning as*

Work Research Paper No 4, Leicester: Centre for Labour Market Studies, University of Leicester.

Felstead, A, Fuller, A, Unwin, L, Ashton, D, Butler, P, Lee, T and Walters, S (2004) 'Applying the survey method to learning at work: a recent UK experiment', *Learning as Work Research Paper No 3*, Leicester: Centre for Labour Market Studies, University of Leicester.

Lee, T, Fuller, A, Ashton, D, Butler, P, Felstead, A, Unwin, L and Walters, S (2004) 'Workplace learning: main themes and perspectives', *Learning as Work Research Paper No 2*, Leicester: Centre for Labour Market Studies, University of Leicester.

Butler, P, Felstead, A, Ashton, D, Fuller, A, Lee, T, Unwin, L and Walters, S (2004) 'High performance management: a literature review', *Learning as Work Research Paper No 1*, Leicester: Centre for Labour Market Studies, University of Leicester.

All above available from:

Suzanne Beazer
Project Administrator
Cardiff School of Social Sciences
Cardiff University
Glamorgan Building
King Edward VII Avenue
Cardiff. CF10 3WT
Tel: + 44 (0)29 2087 0325
Email: suzannebeazer@cardiff.ac.uk

Or alternatively the Research Papers can be downloaded from our website:
http://learningaswork.cf.ac.uk/outputs.html