Association for Information Systems
AIS Electronic Library (AISeL)

UK Academy for Information Systems Conference
Proceedings 2009

UK Academy for Information Systems

Intranet Adoption In A Construction SME: So What Actually Happened?

A S. Douglas
School of the Built Environment and School of Computing, Northumbria University, UK, a.douglas@northumbria.ac.uk

D W. Wainwright
School of the Built Environment and School of Computing, Northumbria University, UK

D J. Grrenwood
School of the Built Environment and School of Computing, Northumbria University, UK

Follow this and additional works at: http://aisel.aisnet.org/ukais2009

Recommended Citation

Intranet Adoption In A Construction SME: So What Actually Happened?

A.S. Douglas, D.W. Wainwright and D.J. Greenwood
School of the Built Environment and School of Computing, Engineering and Information Sciences, Northumbria University, Ellison Place, Newcastle-upon-Tyne, NE1 8ST, UK
Email: a.douglas@northumbria.ac.uk

Abstract

Over 90% of the firms within the UK Construction Industry are small and medium-sized enterprises (SMEs). Whilst larger organisations have recognised the benefits and competitive advantages of information and communications technology, yet struggle to come to terms with adoption barriers, the situation for SMEs appears even more daunting. However, this does not prevent some of the more innovative construction SMEs from trying. The paper reports an action research study conducted over a period of 2 years with such an organisation. The firm had decided to go beyond its former, limited use of ICT (i.e. basic email, accounting, planning software) towards adopting an intranet for the communication of all its management information. Empirical data have been derived from observation, documentary evidence (including the rigorous recording of events in the project's progress) and recorded conversations. Access was enhanced as the researcher occupied a key role in the project's implementation. Data will be analysed and interpreted using a SCOT (Social Construction of Technology) theoretical framework, and this work is currently in progress. The conclusions presented here are, therefore, tentative, but suggest that IT adoption success is very dependent on understanding complex cultural issues associated with SME owner management, the lack of ICT management knowledge and the ad-hoc and inconsistent nature of ICT vendor support.

Keywords: Construction industry, SMEs, ICT adoption, Action Research, Social Construction theory

1 Introduction

Construction SMEs are involved in many complex business processes due the nature of the industry (Udeaja et al, 2003). These characteristics comprise: multiple organisations being involved in the supply chain process with differing agendas, goals and IT systems; organisations and the key actors being geographically distributed across sites, projects and even continents; differing levels of autonomy within different project groups or business functions; variety and the many concurrent business processes within projects which may result in a high degree of planning complexity; the need for monitoring and close control of projects in terms of time, costs, quality and materials; the often cited lack of co-ordinated reporting and timely information provision; and lastly that the processes can be highly unpredictable and it can be hard to pre-specify certain tasks, plan, schedule and control many key activities.

The design, development and effective implementation of management information systems, underpinned by well planned document control systems, can be one of the most significant contributors to developing more effective operational processes. This will then provide the capability to enhance tactical and strategic decision making within Construction SMEs delivering both distinctive competencies and a competitive edge. Technological innovation in the form of web enabled intranet systems, application service providers (software as a service - SAAS) and the diffusion of mobile computing applications has enabled a low cost, practical and adaptable solution to Construction information management problems. The problem now becomes one of defining information and document requirements, automating workflow, and very fundamental ICT project management (defining requirements, identifying alternative technologies and applications, managing ICT hardware and software vendors, implementation, training, managing the change process and realising the business benefits).

This paper provides a chronological narrative of a small construction (SMEcon) company's implementation of a new Management Information and Document Control System (MIDCS) based on intranet technology. It will give a brief background of some of the preparatory work and 'vision' behind the project. The paper will then describe a key period of the project with a view to highlighting the implications of SMEcon's journey in relation to MIDCS implementation. A social construction of technology (SCOT) framework is being used as a lens to identify and analyse the company's, and individuals', attitudes and re-actions to the project. This forms the basis of a discussion concerning the real problems and issues of a 'typical' Construction SME attempting to adopt the latest intranet technology and adapt it to its current business processes, strategy and assimilate it into its organisational culture.

2   ICT Adoption in Construction SMEs

It is now an accepted fact (supported by years of international academic research, government and industry reports) that the construction industry performs poorly in its adoption, adaptation and implementation of both mature and emerging new information and communication technologies (ICTs). There are many strategic, technological, institutional, organisational and cultural reasons for this which dictates a need for more creative and lateral thinking if these historical obstacles are to be overcome. Due to the world financial crisis, the 'credit crunch', and the forecasted global recession there is a high risk or threat that any progress made to date could be either slowed down or even lost due to industry restructuring, downsizing and the impact on ICT budgets, staffing and resources.

There is now a significant opportunity for organisations that are prepared to take a more strategic approach to ICT investment in order to rethink the key business processes and adopt the power of emerging technologies and innovations to provide leaner operations, more agile response to client and customer needs, and react faster than competitors to new (and in the short term fewer) business opportunities. Effective information management, business intelligence and reporting will be the critical success factors over the next few years. Survival and business competitive success will depend on how Firms use ICTs to better advantage than their rivals – technologies are becoming ubiquitous and available to all with no other inherent advantage other than the business, technological and analytical skills that are developed to harness their potential and align them for maximum business strategic and operational impact. Innovations can be of 3 main types:

1. Radical innovations representing entirely new concepts that change business fundamentally
2. Incremental innovations that introduce new facets to existing concepts
3. User driven or user led innovations – which is bottom up and based on user defined needs

This project will focus on user-led and incremental innovation in the form of developing rapid collaborative working intranet prototypes to mirror key business processes which can deliver a range of significant business benefits with the

construction industry. The rapid development, deployment, innovation and propagation of collaborative workflow applications will be a key factor gaining business competitive advantage.

2.1   Innovation and Collaborative ICT Solutions in Construction

The construction industry in the UK is highly fragmented, with most of the organisations within it falling into the category of Small & Medium-sized Enterprises (SMEs). These organisations command around 50% of the volume of business, with the remainder being carried out by a very small number of large players. The industry is notably slow in its uptake of ICT, particularly its SMEs. The industry has other peculiarities: its activity is in general project-based; and these projects are invariably remote from the head offices of the organisations that manage them.

There are some isolated examples of the electronic transfer of high volumes of design data and management information on large, high-profile projects, but even at that level there are barriers to wider uptake; at SME-level these barriers are often prohibitive. A growing number of detailed empirical research studies (ranging from the UK and the Netherlands to Australia and the USA) are now producing very similar findings – see for example (Aranda-Mena and Stewart, 2004). These findings indicate:

1. that the Construction sector is significantly lagging behind other industries in terms of ICT adoption, Business and ICT strategic alignment, e-business and e-supply chain management. This is amplified in the most predominant industry players, namely SMEs;
2. that both generic and construction-specific adoption enablers, inhibitors and critical success factors have been identified;
3. that much more detailed empirical (action-research style) projects are needed to develop new and more innovative approaches to address the adoption and implementation issues faced by both SMEs and large construction firms.

Justification of expenditure on new innovations is always a problem – specifically on a small scale and therefore any solutions that can maximise the use of packaged, low maintenance, highly functional and usable applications will be extremely attractive.

Research is also showing that document management, workflow, business intelligence and process mapping are becoming top of the management agenda – along with the need to up-skill and increase skills and competencies of existing managers and professional staff.

2.2 Specific Construction Industry (CI) Problems

There are significant problems associated with the management, adoption, implementation and use of ICT both for internalised use and external e-business applications. These are associated with the strategic mind sets, culture, context and operational practices of small businesses and their perceived attitudes to ICT (Douglas, Wainwright & Greenwood, 2008). A fundamental paradox is apparent that despite step-changes in technological developments and capability, the opportunities afforded by innovative ICTs are not being harnessed for increased operational efficiencies or new strategic competitive advantages.

3 Methodological Approach

The present study forms part of a 3 year EPSRC Industrial CASE project whose aim is explore models for ICT adoption within Construction SMEs. The vehicle for the study is a construction company with approximately thirty employees based in the Northeast of England. The researcher had been partly based in the company for the duration of the project, and was involved with the company's attempts to adopt an electronic document control and management information system. An 'action research' approach was considered to be the most appropriate for the situation within an overall qualitative and interpretivist research-based inquiry based on an underpinning social construction of technology (SCOT) epistemology.

3.1 Action Research Method

Action Research (AR) as an approach, attempts to find ways of eliminating the gap between theory and practice (see, for example, NcNiff, 1988, pp ix). Coghlan (2003: p. 452) states that AR is a method based upon 'a collaborative problem-solving relationship between researcher and client, which aims at both solving a problem and generating new knowledge.' This emphasises the strong relationship between the researcher and the practitioner. It is fundamentally different from, as an extreme,

laboratory research, where the interaction between researcher and researched is rigorously minimised by careful design. AR involves the community throughout the project and is often driven by an issue from the community itself. It is a method that can be driven by a group of people requiring change whilst working with a researcher to focus on a solution to the problem. Indeed, it actually 'favours consensual and participatory procedures that enable people (a) to investigate systematically their problems and issues, (b) to formulate powerful and sophisticated accounts of their situations, and (c) to devise plans to deal with the problems at hand'(Curry, 2005: p.2). Somewhat confusingly, practitioners may use different terms to describe it: AR is also referred to as Participatory Action Research, Participatory Research, Participatory Evaluation, Emancipatory Action Research, Action Science, Action Learning, Action Inquiry, Mutual Inquiry and Empowerment Evaluation. (Whitehead et al., 2003: p.7). However, within these definitions, there are four basic themes: empowerment of participants; collaboration through participation; acquisition of knowledge; and social/ organisational change.

3.2   Theoretical Underpinning.

The Social Construction of Technology, SCOT, as proposed by Pinch and Bijker (1984) views technology as a force in social changes as well as actual technological innovation. It has three core concepts; Interpretative Flexibility, Relevant Social Groups and Design Flexibility.

Interpretative Flexibility is the idea that each technological artefact has different meanings and interpretations to various groups. Relevant Social Groups tackled the issue of stakeholders to the artefact. The two basic groups are said to be the users and the producers. However, many subgroups can be identified, such as users with differing socioeconomic statuses, competing producers, etc. There may be groups who are neither users nor producers of the artefact e.g. journalists, politicians, etc. Pinch and Bijker (1984) state that the groups may be distinguishable based upon their shared or diverging interpretations of the artefact in question. The third core concept is that of Design Flexibility. Pinch and Bijker (1984) state that, just as technologies have different meanings in different social groups, there are multiple ways of constructing technologies. They propose that a design is only one point in the total field of technical possibilities, all reflecting the interpretations of certain relevant groups.

The SCOT methodology has three main stages. The first is to restructure the alternative interpretations of the artefact, analyse the problems and conflicts from these interpretations, then tie them to the design features of the said artefacts. The second stage is closure. This is a time dependant variable and it is stated that there are two types of closure mechanism: Rhetorical Closure and the Redefinition of the Problem. The former is defined as the point in time when social groups see the problem as being solved thereby the need for alternative designs diminishes. The latter is where the artefact becomes part of a new problem. However, the closure may not be permanent. New social groups may form and reintroduce interpretative flexibility thus causing a new round of debate or conflict about an artefact. Overall, this stage of the SCOT methodology is about how closure is achieved. The third and final proposed stage attempts to relate the content of the artefact to the wider socio-political environment. This stage positions the artefact within the overall human environment within which it will operate.

4 The Case Study Background

The name SMEcon has been adopted to retain the anonymity of the construction company involved in the research project whilst SMEsup1 represents the original ICT support company, SMEsup2 is the replacement ICT support company and SMEweb is the company contracted to create the Intranet and Internet system. Extracts from all of the company's former and current websites remain unreferenced for the same reason.

At the beginning of the research project, the construction company, SMEcon, had thirty employees (this varied slightly, depending upon projects) with its head office in an industrial estate in the Northeast of England. The company provide 'professional services to the construction and property industries … [and works] …. with individuals, companies and organisations, providing a complete service' [original website]. They originally conceived the 'Property Cycle' as being split into five sections; Develop, Design, Build, Maintain and Manage, and each of these 'divisions' can stand alone as a service or be combined in a manner that suits the client. The three owner-directors of the company each has around 20 years' experience in the industry and they formerly operated as the regional management team of a major national construction and property company. They describe themselves as having 'a wealth of

experience in managing a successful regional business for a major multi-national organisation.' However, 'the team decided to rid itself of the shackles of the plc to concentrate on using its skills and experience for the direct benefit for the people who really matter – employees and customers!' [original website]. Their feeling was that large companies can't change quickly enough to suit client demands and other industry developments due to bureaucracy, complex reporting mechanisms and a 'lack of direct contact' with the clients, suppliers and other stakeholders [Interview with Commercial Director, 19/03/07].

The company's structure is based upon a framework that was introduced to the team in the late 1990s. This framework, along with their individual and group experiences, gave them a clear goal as to the direction the company would go along with a clear method of accomplishing this. They are committed to the 'change agendas' of Latham (1994) and Egan (1998), as well as other more recent developments, to adopt a new way of working within the construction industry. They feel that this should give them a real competitive advantage in the industry. [Interview with Commercial Director, 19/03/07]. These changes include the implementation of a co-ordinated project information system, quality-based tendering, committed leadership, a focus on the customer, integrated processes / teams, a quality driven agenda and commitment to people. The company policy is described as providing 'maximum value for money to customers by combining a relaxed, friendly and flexible approach with a wealth of experience, expertise and professionalism. Our approach is to work closely with our customers to fully understand their requirements, aspirations and priorities. Information is openly shared and we encourage customers to pass responsibility to us to manage their property and construction projects, using our in-house experience and expertise.' [original website]. The company's use of technology has been limited to date. When the study began, they used the ubiquitous laptops/desktops with Microsoft operating and Office systems and a few specialist software packages: Asta PowerProject, AutoCAD and Sage Accounts. There had been little or no formal training in any of these systems.

4.1 Timeline

To aid the understanding of this paper, the timeline of events must be established.

Time span	Description	Key decisions
September 2006 – October 2007	This work entailed the design of the MIS structure in paper form. A paper, ICT Systems and Construction SMEs – a case study of issues related to adoption by A.S Douglas, D.W Wainwright and D.J Greenwood highlighted some of the issues encountered during this period.	• Information Structure • Ideas for the 'Golden Rules' for information storage
November 2007	SMEcon's director decided to change IT support companies.	• Decision to leave SMEsup1
December 2007	This month consisted of an independent report on the existing computer (hardware and software) in operation @ SMEcon. Meetings with SMEsup2 and SMEint	• Decision to employ SMEsup2 • Decision to employ SMEint
January 2008	SMEsup2 audit SMEcon's IT systems	•
February 2008	IT back-up issue – total failure of SMEcon director's computer resulting in catastrophic loss of information	• Policy on Back-ups of all systems and computers.
March 2008	Work done on Version 2 of paperwork, to allow for Intranet-based Document Repository	• Keeping documents in Office 2003.
April 2008	Continuation of March 2008's work	• Structure of Intranet finalised.
May 2008	Continuation of March 2008's work. Website redesign	• SMEint's account manager announces he's leaving SMEint
June 2008	Website Launch	• New account manager at SMEint. • Structure and wording of website confirmed
July 2008	Intranet redesign and Launch	• New 'structure' in intranet system. • Phased launch of new system onto new SMEcon projects beginning from 7th
August 2008	Holiday period in SMEcon. Monitoring of launch	
September 2008	Major Intranet redesign due to user issues	• Decision to re-launch Intranet ASAP
October 2008	Work done on Version 3 of paperwork, to allow for Intranet-based Document Repository.	• Switch all document types from Office 2003 to Office 2007.
November 2008	Continuation of October 2008 work.	• Switch all users' computer browsers due to unforeseen technical issues.
December 2008	Re-launch of Intranet	• Trial of user manual
January 2009	Training of site operatives and Handover of SMEcon's work to another researcher	• Handover of SMEcon information

Table 1.   **Basic timeline of SMEcon events.**

4.2   2006-7 Pre-SMEcon observations

At the start of this study (September, 2006) SMEcon already used laptops with Microsoft Office suite products generally available, along with a few more specialised software systems. These included Sage Accounting and Asta PowerProject. Both of these systems incur an annual support and licence fee.

More adventurous ICT implementation was driven by the needs of SMEcon's finance function. Through purchasing the Sage package, mechanisms for data capture and reporting were required and the creation of *purchase requisitions*, *business mileage forms*, and similar reports were expedited. These data-capturing forms (MS Word and Excel-based) were initially based upon previously recognised layouts and enhanced to match the data necessary to drive the Sage software. These forms created the basis for operational and statutory data recording; from *new starter* forms to *customer questionnaires*. There is little or no automation in the company apart from one or two MS Excel spreadsheets which only work independently. They do not provide separate reports or feed information to other documents. Indeed, the majority of software used creates forms to be manually filled-in (hand-written) or emails to geographically separate stakeholders. The purchase of the Asta PowerProject software was based upon the directors' previous exposure to it.

The company also has a web presence which had not been updated since the site's initial launch in 2006. It acts as a brochure, mainly giving snippets of information about the origins and ethos of the company as well as contact details. It has undergone a major redesign as part of the overall MIS implementation and is discussed later.
As with most SMEs, one person is the driving force behind the overall project and he had the idea of bringing in a researcher to aid the project and take an academic view of actual processes. It has also been observed that this person does not have a deep IT understanding and does not have the knowledge or experience to deal with some of the more technical issues that arise in such a project.

4.3   Nov 2007

Immediately prior to this research project, the companies ICT-based systems were 'being looked after' by a small ICT consultancy, SMEsup1. However, this ICT consultant had become dilatory, and appeared to have reached the limit of support that

it could offer SMEcon. Not long after the start of the research, another ICT consultant, SMEsup2 was appointed. The choice was based upon personal recommendation, ironically from the former ICT support company.

This type of recommendation, although highly likely to occur in large organisations, would almost certainly not have been taken up as quickly, or without other 'sign-offs' from senior management and budget holders. Therein lies a major perceived benefit of SMEs; the people doing the work, pay for the work. Bureaucracy, tendering, procurement 'rules' etc, are not the blocks to decisions often found in large companies or public organisations. However, the procurement issues in particular, may allow large organisation to truly receive the best provider of service if they use a measured competitive tendering process, whereas an SME's approach may be more 'ad-hoc' and personal, increasing the risk of sub-optimal technology choice and lock-in.

4.4   Dec 2007

This month saw the independent investigation and report that accelerated the overall project's development. Up to this point, SMEcon had struggled to move the project on technically, due to SMEsup1's inability/unwillingness to communicate at a greater level in order to facilitate the project. The report highlighted technical issues with the existing infrastructure as well as making recommendations about upgrades and even a suggestion of which document management system may suit SMEcon.

The reports started by describing the technical architecture. "Windows Server 2003 (Small Business Server) is the operating and network system with Windows Microsoft Exchange Server 2003 used for email and folder/file sharing. The company website is externally hosted and a mixture of MS Windows Office 2003 and 2007 are used on individual laptops. MS SQL Server is only partially installed (Check this for operation with Sharepoint) and MS Sharepoint WSS2.0 is installed as standard and is accessible internally and externally." (Internal consultancy report, 2007). The report then described the cabling and networking structure before giving more specific details on the incumbent document repository system that form part of the MS Server 2003 system.

Requirements for Sharepoint Initiation and Configuration	
Item	Description
1	Need access to SMEcon network (can add to mobile users group?)
2	The researcher now has access
3	url and external ip address exist (ask what the server external domain name is from SP at SCL)
4	Sharepoint has been configured for existing users – can access this through Site Administration. Initial work has been performed to set up Shared Filing System based on the SMEcon Categorisation System (as defined by SMEcon director and updated with subsequent work).
5	The researcher now has log in access and can demonstrate what has been configured so far. He can now use site administration to set up users and configure permissions and security levels etc.
6	The initial Sharepoint system has been configured with existing folders and file structures. This can now be extended and used on a pilot level with a selected number of users. Warning – these are duplicates and kept separate. Can Sharepoint access and link to the Network shared folders (on shared drive)?
7	Sharepoint, as currently configured, does not seem to have a full SQL Server installation. Question – how will this impact on development of the system?
8	Currently, the SMEcon project team are set up within the Sharepoint Administrators group. These have full privileges for systems administration.

<div align="center">Table 2.   MS Sharepoint System.</div>

The remaining section of the report gave suggestions for additional systems requirements, along with rough potential costs, suppliers of such systems and a summary of necessary actions.

Additional Systems Requirements	
Item	Description
1	Need for Discussion and Agreement regarding an annual IT Budget. Split into Capital expenditure and Revenue (recurring maintenance, applications support and development, and training).
2	Purchase of new Dell Server? (Intel core 2 duo processor, 4 Gbyte RAM, 2 * 300 Gigabyte storage in a RAID array (fault tolerant) = LCD 17" monitor ?- £1500? + Replacement support package – Tower System + 24 hour on-site repair/replacement warranty (DELL).
3	Or Possible second 300 Gigabyte Drive for data – archive separation
4	Possible full installation of SQL Server (alongside Small Business Server) for full operation and capability for WSS2.0 Sharepoint. Cost TBA
5	SBS Windows Server 2003 – need to ensure the requisite number of licences (CALs?) also for Office 2003/2007 and Sharepoint WSS2.0
6	Determine upgrade and migration path from MS Office 2003 to 2007. Cost TBA
7	Determine policy regarding upgrading or (staying with) from MS Windows XP to MS Windows Vista (for laptops and workstations client machines across Koru)
8	Determine possibility of upgrading from WSS2.0 to MS Sharepoint WSS3.0 that runs on Windows Server 2003? TBA and cost TBA
9	Keep watching brief on need to upgrade to Windows SBS 2008 ?
10	Cost – MS Sharepoint Training (for up to 5 users – initially the researcher plus TBA) – from Site Administration to Site and Document creation, management and customisation.
Short List of Possible Preferred Suppliers (Sharepoint Services and/or ICT maintenance and support)	
Item	Description
11	A local Sharepoint and intranet local software company – circa 40 employees
12	A local ERP and intranet development company – circa 50 employees
13	A local IT company specialising in construction project management software

14	Possible independent contractor
Actions	
Item	Description
15	Suggest meeting with SMEsup1 with prepared set of questions:
16	His availability, timescales and costs for IT support and maintenance (General infrastructure) – to include MS Server, MS Office upgrades (2003-2007) and SBS 2008, installation of new Server hardware etc. Is there a Service Level agreement.
17	If cannot commit – or offer appropriate SLA – then source from alternative Supplier. Get quotes from preferred supplier list.
18	Technical questions over Windows Sharepoint Server upgrade from WSS2.0 to WSS3.0.
19	Technical question over role of SQL Server and installation. + costs
20	If SQL server – do you need separate processor/Box (due to intensive data access)
21	Technical question over whether standard shared folders on shared network drive can be attached to Sharepoint (as opposed to duplicating everything).
22	Technical question over current number of licences (MS office, XP, Vista, SBS, Exchange and Sharepoint)
23	Costs of upgrading or increasing number of licences (also types? CAL)
24	Cost Training for Sharepoint – suggest 3 delegates, local Sharepoint Development Company?

Table 5.   Report Recommendations.

Shortly after this report, SMEcon signed a six month contract with SMEsup2. The agreement was for SMEsup2 to upgrade the existing infrastructure and maintain the system thereon. They would also be responsible for any other hardware and 'off-the-shelf' non-specialised software solutions, such as MS office products, etc. From this appointment, the researcher was included in a meeting with SMEsup2 and SMEcon where discussions took place regarding potential Intranet solutions. SMEsup2 informed us that they did not have that type of capability but could recommend a firm local to them (along the corridor) that provided such solutions. SMEcon's director contacted this firm, met them and the researcher, and signed them as the Internet/Intranet supplier, SMEnet. This led to more technical meetings, where the researcher was given the responsibility of leading this part of the project, based upon his exposure to similar systems and experience within computer system implementation.

4.5   Jan 2008

SMEsup2 undertook a full system and infrastructure check, including upgrade of server memory as advised by the previously mentioned report. As well as this development, SMEint required a lot of information pertaining to SMEcon's ideas of what the intranet and internet should do.

The internet was relatively simple to go through, as there was an existing example in place. This meant that the SMEcon director had some experience with what the design process involved. However, his experience was not a positive one, as the previous internet designers contracted had not been flexible with the overall design, leading him to doubt what may be possible, regarding editability and updating of the site. This lead onto discussions about what the intranet would require in way of look, structure, functionality, etc. Most of these questions were new and had not been thought of by SMEcon. The director had a clear 'vision' of what a paper-based system should do, but, due to lack of experience, did not appreciate the complexity now involved with and electronic version such as details such as user access, document types, search facilities and filing requirements.

4.5.1 February 2008

This month began with a major problem. The main instigator of the whole project lost over three years of information during his laptop replacement. The cause of the physical loss is uncertain in spite of investigations by SMEsup2 but highlighted the need for a robust policy on document storage i.e. back-ups. The full effect of this data loss had not been realised at this time.

The researcher and SMEcon's director were also involved in more requirement and design meetings with SMEint. It was at this time, the director asked the researcher to take the lead in this process. The director and the researcher were to discuss 'company' requirements, then the researcher was to discuss these with SMEint. This was mainly due to 'language difficulties. The two companies had very different terminologies and understanding of each other's operations, whereas the researcher had experience in the computerisation of processes in other built environment-based organisations.

4.6 March 2008

The effects of the information loss from last month's IT disaster did not affect the researcher's work as far as can be determined. This is due to the researcher recently having received all documents tied to the project. However, there may be other collateral damage that may impinge upon the project later.

One interesting side-effect is the apparent damage to the business relationship between SMEcon and SMEsup2. There seems to be a lot of 'bad mouthing' of SMEsup2 from other SMEcon staff members. This means that the situation has been a point of conversation or gossip. This has lead to a negative view of SMEsup2's abilities to function to SMEcon's requirements.

The researcher and SMEcon's director held meetings to finalise the structure required for the documentations system, from a company viewpoint. The system will be in two main parts – company and projects. Company information access is to be held at director level only, whereas Project information must be accessed by project 'relevant' employees.

This section is the subdivided into five main sections – Develop, Design, Build, Maintain and Manage – reflecting the company structure. Manage, however, is to be split into two, one for Property Management and the other for Project Management, which reflects the vision of the director and the subtle differences of these management processes. The structures within each section should be based upon the Build Structure, as this is the main activity of the company at this time.

4.7   May 2008

This month, a huge amount of communication regarding website design – specifically editing and control, and the implementation of the flash movie, was undertaken. This involved electronic mock-ups, implications of web-page formatting requirements, security and content. The director, once given some suggestions and recommendations on how web-pages look on screens, created the wording and picked photographs that would suit the company's marketing needs. The project was then hit with the following announcement.

"I wanted to get in touch with you both to give you some news as it will have a bearing on the below. I've been presented with a new opportunity that means I'll be leaving SMEint in the next few weeks. My colleague ...will be handling our Newcastle business from that point; she's actually working with me from the office here for a couple of days each week until I leave on 13 June. Obviously this means that I can't

make the presentation on 18th, but she has already put that in her diary – you'll be in safe hands!

In terms of launching the website next week I don't see any issues with that at all: we've changed the wording in the Flash movie and the formatting works for us – could you please check that you're happy before sending live.

I'm just waiting for confirmation that we have the control we need on the domain name in order to set the changes so the site is live next week. Ideally we'll sort that all out this week so it's ready & live for you come Monday." SMEint contact

This announcement initially caused consternation, especially with the researcher who was mainly dealing with SMEint. A change of personnel at this stage of the project's development would be difficult to manage.

5   Discussion and Conclusions

When reading through the timeline of events at SMEcon, certain themes begin to come to prominence whilst others may be hidden in the dialogue of the case. Building on the original work of Aranda-Mena and Stewart (2004), Douglas, Wainwright & Greenwood (2008) highlighted some critical factors involved in ICT implementations. These were then interpreted and highlighted with respect to a re-interpretation of the SMEcon case:

- Availability of internal IT skills
- Top management support (owner manager relationships)
- Centralised decision making versus employee participation
- High reliance on external IT vendors – low rates – trusted relationships
- Small IT budget – not formalised – and very ad hoc IT purchase
- Lack of trained staff – IT and business applications/analysis
- Security, backup and recovery of data
- Sensitivity of data for owner managers/directors
- Risk of employee turnover and loss of sensitive data
- Fragmented IT architectures (Office 2003, XP, Vista, 2007)
- IT industry insensitive to 'small firm' cultures (after the bigger sales)
- Variable levels and amounts of Government support for SMEs and IT

For discussion purposes, some have been selected and are reflected upon in line with the timing of actual events at SMEcon.

The initial point of the project began with senior management questioning if the current 'way of working' i.e., the quality and reliability of current infrastructure, was suitable. The feeling was that employees were just doing what they know, based upon other experiences from other organisations. There were no absolute systems in place in which the management could garner operational results. They only knew how the business was doing in a financial basis. They wanted management information and this required some policies and procedures as to how SMEcon should and would operate. This was the management commitment to the project where top management support (owner manager relationships) are hugely influential in SMEs

It was also partially driven by the security issues in the early summer of 2007. Security, backup and recovery of data as well as the sensitivity of data for owner managers/directors were listed as important but one action in particular created the impetuous for change; the risk of employee turnover and loss of sensitive data. Fraud was implied and the use of a system to implement some form of user authentication and control was deemed to be a way of managing such issues. To create this management information, business processes needed to be investigated and changed from the ad-hoc approach being taken at the time. However, due to the lack of trained staff in IT and business applications/analysis, the process was difficult and depended greatly upon external IT vendors.

This caused SMEcon's management a large amount of uncertainty. No-one knew how IS systems worked. They all had experience of using some types of systems, but purely from an end-user viewpoint. As managers wanting to change the way the company worked, questions of benefits and value and system and user performance were paramount. The whole project would involve a cultural change within SMEcon.

The contracts on the new system had been chosen on two criteria; timing of the beginning of the contract and the IT skills and literacy of the managers on the site. In July, at the first launch, the contrast between the contracts loaded onto the new system compared to those on the paper-based one, was startling. People stopped filing the forms on the system altogether, as issues arose from the actual usability of the system, specifically connection speeds and technical performance, as well as the need for

greater flexibility of the system itself due to management changes. The centralised decision making versus employee participation issue began to appear and the need for meetings and face to face communication became vital, as the new users were beginning to lose any confidence and trust in the system, before it had even been rolled out throughout the company.

A few, non-time dependant issues that became apparent involved IT budgeting and the fragmented IT architectures (Office 2003, XP, Vista, 2007). These had never been formalised, with the result that all decisions were very ad hoc, especially the IT purchase! This is not only due to SMEcon's approach to such implementations. The IT industry itself appears to be insensitive to 'small firm' cultures as the big revenue streams can be collected from larger organisations. The variable levels and amounts of Government support for SMEs and IT can also add to the 'bit-part' approach to an overall system implementation.

In summary, the systemisation of SMEcon's management information systems and the subsequent attempts to automate them, have involved a huge learning curve and the divisions and gaps within organisational information flow are only now being highlighted.

Future research work will utilise a SCOT framework as a theoretical lens to frame the data derived from the action research. This should provide a more rigorous interpretive analysis of the data aimed at informing our theoretical knowledge of ICT adoption processes in Construction SMEs and also the development of a potential model for SMEs to follow when undertaking such important ventures.

6 References

Aranda-Mena, G. and Stewart, P. (2004) E-Business Adoption in Construction: International Review on Impediments, Research Report 2003-003-A, 2004 Icon.Net Pty Ltd.

Atkinson, C. J. and Brooks, L. (2005) *In the Age of the Humanchine*, In Proceedings of International Conference on Information Systems (ICIS), AIS, Las Vegas, USA.

Bryant, C. G. A. and Jary, D. (1991) Giddens' theory of structuration : a critical appreciation, Routledge, London.

Callon, M. and Latour, B. (1981) *Unscrewing the Big Leviathan: how actors macrostructure reality and how sociologists help them to do so,* In Advances in Social Theory and Methodology: Toward an Integration of Micro- and Macro-Sociologies.(Eds, Knorr-Cetina, K. D. and Cicoure, A. V.) Routledge and Kegan Paul, Boston, Mass, pp. 277-303.

Constant II, E. W. (1984) *The Social Locus of Technological Practice: Community, System or Organisation?* In The Social Construction of Technological Systems – New Directions in the Sociology and History of Technology, (Eds, Bijker, W. E., Hughes, T. P. and Pinch, T. J.) MIT Press, Mass, pp.223-242

Coghlan, D. (2003) Practitioner Research for Organisational Knowledge, Mechanistic- and Organistic-oriented Approaches to Insider Action Research, Management Learning, 34 (4), pp. 451-463.

Curry, A. (2005) Action Research in Action: Involving Students and Professionals, World Library and Information Congress: 71st IFLA General Conference and Council. Oslo 14-18/08/05. Oslo: ILFA.

Douglas, A.S, Wainwright, D.W, and Greenwood, D.J. (2008) *ICT Systems and Construction SMEs – a case study of issues related to adoption*, in Proceedings of the 13th UKAIS Annual Conference, "the Scope of Information Systems: Perspectives from Academia and Practice, Bournemouth University, 10-11th April, 2008

Egan, J. (1998), *Rethinking Construction*, Report from the Construction Task Force, Department of the Environment, Transport and Regions, UK.

Kemmis, S., (2001) "*Chapter Eight Exploring The Relevance Of Critical Theory For Action Research: Emancipatory Action Research In The Footsteps Of Jürgen Habermas*" in Reason, P., and Bradbury, H., (Eds.) "*Hand Book Of Action Research Participative Inquiry & Practice*", Sage Publications, London, pp. 91 – 102.

Latham, M (1994) *Constructing the Team*, Final Report of the joint Government/Industry Review of Procurement and Contractual Arrangements in the United Kingdom Construction Industry, HMSO.

Lofgren, A. (2007) Mobility in Site: Implementing Mobile Computing in a Construction Enterprise, Communications of the Association for Information Systems, Vol. 20, pp. 594-604.

McNiff, J. (1988) Action Research, Principles and Practice. 1st edn. London: Routledge.

McNiff, J. & Whitehead, J. (2006) All You Need To Know About Action Research. London: Sage Publications Ltd.

Penston, J. (2007) *Patients' preferences shed light on the murky world of guideline-based medicine,* Journal of Evaluation in Clinical Practice*,* 13 154-159.

Pinch, T. J. And Bijker, W. E. (1984) *The Social Construction of Facts and Artifacts: Or How the Sociology of Technology Might Benefit Each Other,* In The Social Construction of Technological Systems – New Directions in the Sociology and History of Technology, (Eds, Bijker, W. E., Hughes, T. P. and Pinch, T. J.) MIT Press, Mass, pp.17-50

Udeaja, C.E., Tah, J.H., Ndumu, D.T. (2003) *Construction material supply chain integration using multi-agent systems technology: a conceptual framework*, International Journal of IT in Architecture, Engineering and Construction, January, pp. 67-83.

Whitehead, D., Taket, A. & Smith, P. (2003) *Action research in health promotion*, Health Education Journal, 62 (1), pp. 5-22.