

# Provisions for proficient Construction Project Extranet Protocols to facilitate Collaborative Extranet Working

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**ABSTRACT:** Construction teams within the industry are recurrently adopting Construction Project Extranet (CPE) systems to facilitate project integration and collaboration. When deciding to adopt a CPE, it is important to support their use with a clearly defined Construction Project Extranet Protocol (CPEP). Prior investigations found that the principal cause of their inefficient use was associated with missing, or poorly developed protocols. Project teams also cited the lack of a generic industry standard as the main reason for not being able to produce practicable CPEPs. This paper reports on the findings of a study, to establish the main requirements for development of a proficient CPEP and investigate the need for a generic toolkit to aid project teams. It identifies the key issues to be considered, along with the findings of a survey on current CPEPs. The paper concludes by proposing a set of recommendations for improving the way in which CPEP are produced.

## 1 INTRODUCTION

Construction teams within today's AEC industry are becoming increasingly reliant on the deployment of Construction Project Extranets to facilitate project information exchange and collaboration; whilst individual organisations endeavour to use them as a tool for generating improvements in quality, competitiveness, profitability and client satisfaction. A survey conducted in the UK by *The IT Construction Forum* (2004) affirms that the use of extranets is growing rapidly, with nearly half of all respondents indicating they had used a project extranet to collaborate online (43% of the 373 responding firms).

Within the context of this paper, the term Construction Project Extranet (CPE) refers to an extranet system, which is supplied by an Application Service Provider (ASP) and is subscribed to by a project team for a fee, either on monthly, yearly or project-to-project basis. Project members utilise the Internet and web browser technologies to securely exchange and store project information via the ASP's central repository. This is now the most commonly adopted method of implementing a CPE on a project, as systems are available 'off the shelf', can be setup within a short time frame and costs relatively little (when compared to the option of developing an ad-hoc system, which requires a great deal of expertise, resources, time and money).

The use of the web and associated technologies in such instances has now been widely acknowledged by practitioners (Nitithamyong & Skibniewski 2004) and is also described by various designations including: Project Specific Web Sites (Thorpe & Mead 2001); Project Collaborative Extranets (Hamilton 2002a); Web-enabled Project Management (Alshawi & Ingirige 2003); Online Project Management and Collaboration Tools (Unger 2003); Web-enabled Project Management Systems (Nitithamyong & Skibniewski 2004); Web-based Project Information Management (Stewart & Mohamed 2004) and Construction Project Extranets (Murphy 2001). A detailed précis on the evolution of CPEs along with an examination of their ever-increasing adoption within the USA is offered by Becerik (2004).

Within the UK, prior investigations primarily focused on understanding the impact of working with multiple CPEs within a single organisation, found that the principal cause of ineffective or inefficient use of CPEs stemmed from missing or poorly developed protocols (Yeomans et al. 2005). 20% of projects surveyed (with a total value of £342m) were found to have instigated the use of an extranet without a supporting protocol, despite many project members having to perform their duties in new ways. Additionally, although the remaining 80% of projects (with a total industry project value of £2.1 billion) had introduced some form of protocol, users reported that they were usually



ad-hoc and inadequate; as they focused exclusively on how to use the designated extranet system and provided little or no consideration of the other essential issues such as how to attain effective integration and collaboration. Project teams cited the apparent lack of both a generic industry standard along with comprehensive guidance notes on how to undertake extranet working, as the main reasons for not being able to produce practicable protocols.

The remainder of this paper aims to contribute to the growing knowledge base on the subject of CPEs by providing the key findings of additional new studies, undertaken to evaluate the importance of a protocol in facilitating efficient Collaborative Extranet Working (CEW).

## 2 RESEARCH AIMS AND OBJECTIVES

The main aims of the research were: to investigate the need to develop a generic industry recognised and accepted protocol, to aid clients and construction teams in the production of their own; and to establish which material construction teams deem most crucial for inclusion within the proposed development of a generic protocol. This was achieved through:

- Surveying 48 projects, where 22 different CPE systems were deployed.
- Examining eleven different protocols that were already employed by project teams.
- Surveying CPE administrators and users who worked by existing protocols.
- Participating in the development and review stages of five different protocols.

## 3 METHODOLOGY

This research was conducted as partial fulfilment of an Engineering Doctorate in Collaborative Working Methodologies at Loughborough University. It applied both quantitative and qualitative methods of research to facilitate a comprehensive study on understanding the main issues surrounding current development and use of protocols, whilst also determining which issues are crucial to the development of a generic industry protocol. A descriptive questionnaire was used to survey CPE managers, administrators and document controllers to facilitate collection of factual evidence on the realities of working to existing protocols. A series of project studies and observations along with meetings with senior managers, ASPs, and other CPE experts were used to accomplish investigative research into how projects currently approach the development of protocols. To aid the acquisition of subject knowledge, the Research Engineer (RE) also conducted a literature review, participated in the development of five protocols, con-

ducted collaborative extranet working trials whilst managing a CPE system (Buzzsaw Standard) with three live projects over the past 18 months. Other activities included: attending UK industry conferences *Project Extranets IV & V* (PE 2003, 2004); attending extranet vendor presentations; undertaken training on four different systems; and administrator training on two. These activities have proven invaluable as a means of attaining firsthand experience and knowledge of the issues surrounding working with extranets and developing protocols.

## 4 OBSERVATIONS ON CONSTRUCTION PROJECT EXTRANET PROTOCOLS (CPEP)

The following section provides a précis of the key issues derived from an amalgamation of literature review findings, project observations and experience gained whilst participating in the process of developing Construction Project Extranet Protocols.

### 4.1 Varying levels of complexity in CPEPs

Project teams utilise CPEs in one of three main ways (see Fig. 1), either as a simple means of transferring files between parties (Hamilton 2002b), as a comprehensive Electronic Data Management (EDM) tool, or as a means to achieve project collaboration (Hannay 2004). Yeomans et al. (2005) refers to the last of these options as Collaborative Extranet Working (CEW).

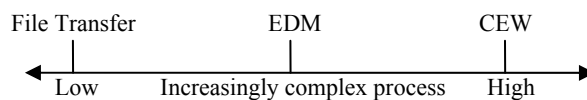


Figure 1. The three levels of CPE operation and the increase in complexity of each process (adapted from Hannay 2004).

In all cases, it is critical that an early decision is made from the outset of the project as to which electronic system is to be used and how it is to be controlled (ITCBP 2003a). Project teams should develop a set of procedures to assist workers in achieving effective use of the CPE and therefore ensure greater overall project efficiency. These procedures are often referred to as 'extranet protocol', 'protocol document' or a 'Construction Project Extranet Protocol' (CPEP). Attention to detail in the creation of procedures is vital (CPN 2001), although the scale of detail required, along with the amount of effort, resources and time expended should match the chosen level of CPE operation. Use of a CPE to conduct file transfers requires relatively simple procedures, whilst a protocol to aid EDM should be increasingly more detailed. A protocol for CEW will need to be substantially more detailed, as collaboration involves a high level of complexity (Austin et al. 2001) and is still not so fully developed that proper implementation planning



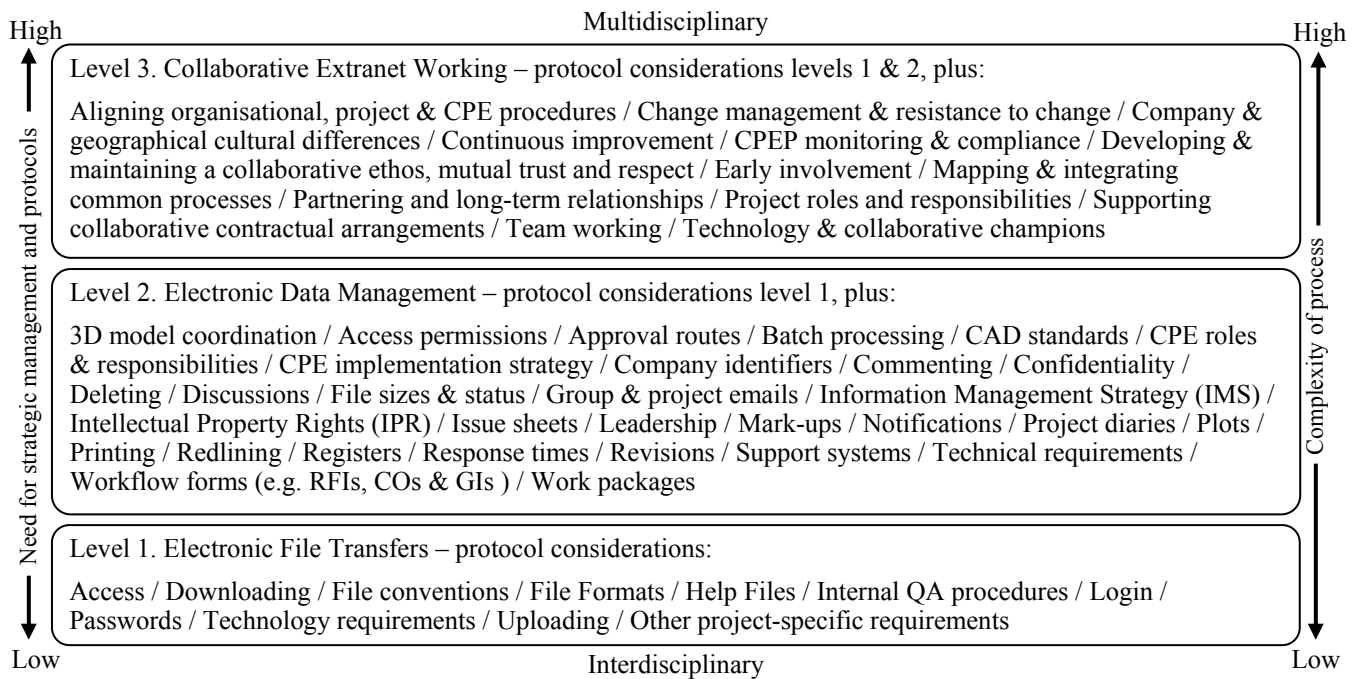


Figure 2. The levels of CPE operation and their respective protocol considerations

can be ignored; strategic support through the process is still required (CPN 2001).

#### 4.2 Main requirements of CPEPs

In order to determine the main requirements of a generic protocol, as well as formulate a questionnaire about their availability in current CPEPs, the RE conducted a review of existing literature in addition to surveying 11 project protocols.

A considerable difference was noted between the contents of operational protocols, which concentrated on the 'nuts and bolts' of how to use the designated CPE system, and recommendations made by experts (CPN 2001, 2004a, 2004b, 2004c) along with issues raised by experienced CPE users (Yeomans et al. 2005). Issues include: monitoring protocol compliance, overcoming resistance to change, process management, continuous improvement, organisational cultural management, teamworking, collaboration, interoperability, data ownership, resource management, contractual arrangements and Quality Assurance (QA).

Figure 2, provides a comprehensive list of those items and issues a proficient CPEP should consider, whilst categorising them in accordance to the levels of operation for a CPE. In the case of CEW, all three levels would need to be taken into account. Examination of the working protocols and experience gained from the development process found all CPEPs to include the majority of the items listed in levels 1 and/or 2, but none of those contained in level 3 (see Fig. 2). Therefore, it is appropriate to argue that CPEPs are not proficiently developed to foster true project integration and CEW; despite clients and project teams indicating

these as reasons for adopting the use of a CPE. To enable understanding of the reasons why protocols were not being adeptly formed, it was necessary to examine the role of ASPs in the initial stages of CPE adoption.

#### 4.3 Influence of ASPs on CPEP development

Only one out of the eleven protocol documents reviewed, was not primarily developed and supplied by an ASP. In this case, the project team decided to develop an ad-hoc, in-house extranet solution, which meant no ASP was present in the process. All remaining CPEPs originated from generic documents produced by an ASP. This was attributed to project teams inexperience of CEW, their lack of understanding as to the requirements and the relationship between the adopters of the CPE and the ASP. The way in which relationships are formed depends largely on one of the following sets of circumstances happening:

1. A client has previous experience of working with CPEs and specifies use.
2. A client (who has no previous experience of CPEs, but is knowledgeable about the benefits) requests that the project team investigates and recommends a suitable system.
3. An individual team member has experience of, or understands the benefits of CPEs and suggests/persuades the rest of the project team to adopt the use of a CPE.
4. The Main Constructor (MC), who has an arrangement with a particular ASP to service all of their projects, specifies use as part of their contractual arrangements.

As those within the first three instances were found to have relatively little or no long-term exposure to working with CPEs and lacked the necessary experience and expertise to understand how to implement and utilise a CPE to best suit their project needs, they would:

- Rely heavily on ASPs to provide the necessary expertise to setup and manage use of the system; due to their expertise in the use of the respective systems.
- Allow ASP administrators to provide generic protocol templates (formulated from use of their own system on past projects) and supervise project teams whilst revising them to suit current project needs.
- Believe that adopting a CPE and allowing the ASP to support the implementation of the system would naturally result in effective use of the CPE and lead to collaborative working (as the ASPs are selling tools to foster collaboration).

In the fourth instance, the main contractor has usually developed more experience both of working with extranets and with ASPs, due to the nature of the long-term arrangement between the two parties. As a result, protocols on these projects were more detailed and had considered a wider spectrum of issues; although they still did not include those specified for CEW (level 3, Fig. 2). Additionally, they were still based upon generic templates developed in the first instance by ASPs. It is therefore proffered that in cases where a rented CPE solution has been sought, ASPs are required to become the main drivers and facilitators of the CPEP development process; although in all

probability that they are no more suited to delivering a proficient protocol. ASPs are adept at delivering protocols to assist users work on their particular systems, as they are experts in developing electronic systems. However, they are not experts in delivering efficient collaborative working based upon a collaborative contract and continuous improvement. This argument is corroborated by Berckerik (2004) who found systems to be very document-orientated; which has led the industry to move towards shuffling electronic paper rather than electronic collaboration.

#### 4.4 Development and implementation of CPEPs

The following describes the archetypal approach to development and implementation of a CPEP on large construction projects. It is by no means indicative of all cases.

Parties responsible for purchasing a CPE will normally work with the ASP (as shown by the options 1, 2 & 3 Fig. 3) to further develop the ASP's generic template into an appropriate form for the current project. This may be completed through a series of meetings, workshops or 'postings' (placing the document on the extranet for review). Once the main members' issues and project requirements have been addressed, those responsible for developing the CPEP may follow one of two courses of action. Either invite all other parties (currently contracted to the project) to read and comment on the proposed protocol; notifying the document administrator of any issues or specific needs e.g. exclusive folder for photos. Or, conversely, publish the guide without consultation and request all other parties to work to

#### KEY:

ASP = Application Service provider	CPE = Construction Project Extranet	DC = Document Controller
ASPA = ASP Administrator	CEA = Company Extranet Administrator	E = Employee
FM = Facilities Management	QS = Quantity Surveyors	PM = Project Manager

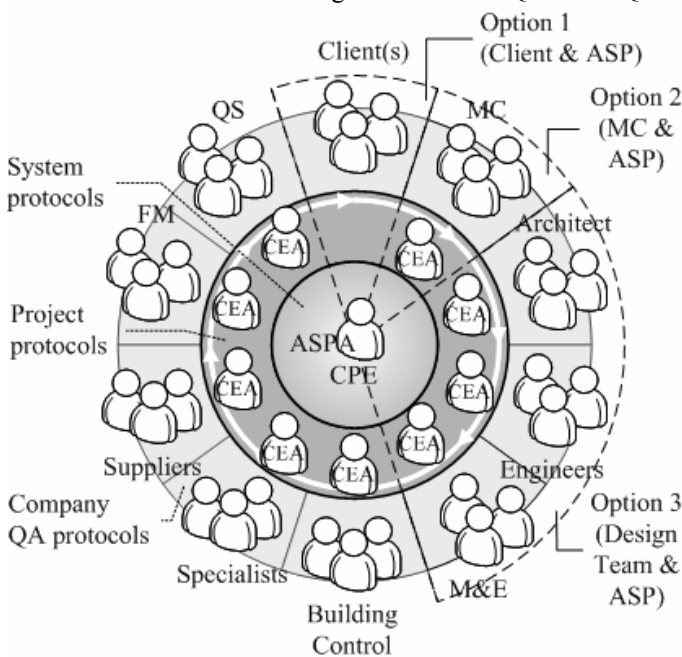


Figure 3. CPEP development and implementation options

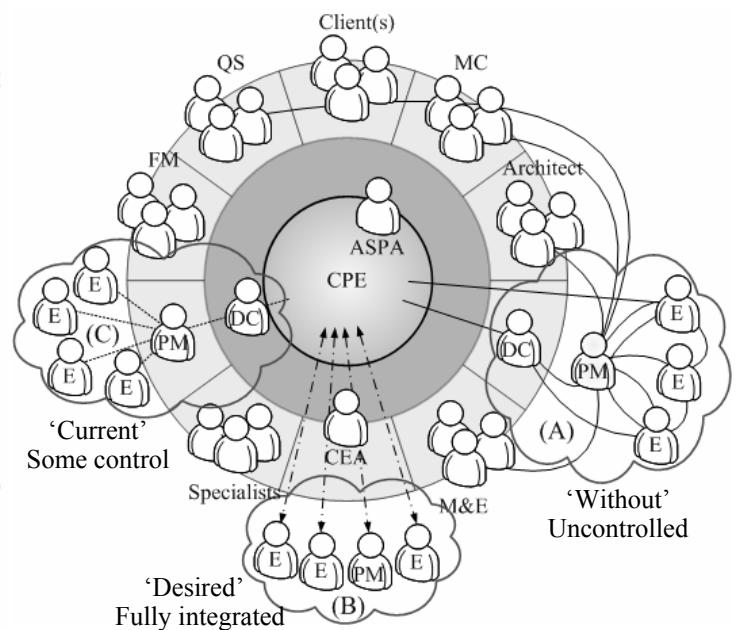


Figure 4. Realities of working with or without current CPEPs

the procedures. The ITCBP (2003b) stipulates protocols must be agreed from the beginning by all - it is a partnering process.

The ASP maintains an active role throughout, mainly to provide advice, setup the system and deliver training. Nevertheless, they will also ensure that procedures being included within the CPEP document are consistent with their systems abilities and protocols (e.g. inherent electronic workflow procedures). Perhaps the most difficult task facing any protocol development team is deriving a solution that satisfies each members project requirements, whilst still being acceptable to all others. This was never achieved on a single one of the projects surveyed, as a large number of the parties who were to work on the CPE, were not represented at the development stage, and therefore their needs were not accounted for.

A good protocol must also provide equal consideration of individual company QA procedures, project procedures and the inherent protocols of the specified extranet system (as shown in Fig. 3). At present, this does not happen and company procedures are usually sacrificed at the expense of the other two. As a result, many organisations struggle to understand the benefits of working on a CPE due to them having to duplicate work in order to satisfy both in-house procedures and those of the project. This sometimes created resentment, both towards the CPE and those championing its use. It also led to various organisations:

- Refusing to adopt the CPEP and reverting to old methods of working e.g. company email and issuing paper copies (option A, Fig 4);
- Wrongly interpreting the CPEP and developing and/or adopting inefficient modes of working; or
- Bypassing the CPE's audit system by using a single person to interface with the CPE (option C, Fig. 4).

If any of the above problems transpire, the CPEP should be determined as failing in its primary objective, to have everyone working in the same, integrated and efficient manner (option B, Fig. 4).

## 5 CPEP QUESTIONNAIRE SURVEY RESULTS

A electronic questionnaire was sent to 159 individual CPE managers and administrators throughout the industry to question them about current CPEPs, to:

- Determine those issues currently being included within the protocol document;
- Gauge opinions on the success rates of CPEPs;
- Ascertain if additional issues were required for inclusion;
- Assess reaction to the planned development of a generic industry protocol and best practice guide.

23 people responded to the survey, providing a response rate of 14%. CPE managers (seven) and administrators (seven) were the largest responding groups, followed by CPE document controllers (five). Between all of the respondents, they had gained experience of working on 211 different projects where a CPE was used. 123 (59%) of these had developed and implemented some form of CPEP.

### 5.1 Findings on Current CPEPs

Table 1, demonstrates that current CPEPs focus most often on the use of the system and its tools, and sometimes covers issues such as EDM and electronic workflow. The majority of respondents also indicated that other crucial issues were not likely to be included; substantiating arguments made in section 4.2.

Table 1. Frequency of procedures within current CPEPs.

Procedures required for effective CEW	How often (No. of people)			
	Never	Seldom	Often	Always
Use CPE tools and system		6	11 <sup>x</sup>	6
Conducting EDM	4	12 <sup>x</sup>	6	1
3D model coordination	18 <sup>x</sup>	5		
Conducting collaboration	13 <sup>x</sup>	7	1	2
Managing online relationships	11 <sup>x</sup>	8	4	
Collaborative contract duties	15 <sup>x</sup>	7	1	
Align QA & project procedures	16 <sup>x</sup>	4	3	
Managing online workflow	6	13 <sup>x</sup>	3	1
Continuous improvement	16 <sup>x</sup>	5	2	
Change Management	16 <sup>x</sup>	4	3	
Data and software compatibility	8	10 <sup>x</sup>	4	1
CPEP compliance monitoring	12 <sup>x</sup>	9	2	
CPEP strategy	13 <sup>x</sup>	10		

\* x used to facilitate easy identification of largest response.

When questioned about the ability of current CPEPs to helping project members work more efficiently on project extranets, and therefore bring about savings in time and project costs through effective CEW, nine people indicated that they felt protocols had been partly unsuccessful, eight people felt they had been partially successful, whilst 6 people felt they were very unsuccessful. Overall, the mean score found that CPEPs have been unsuccessful.

Respondents were also asked to specify how important it is to include information on the procedures outlined in section 4.2. None were determined as unimportant (Table 2), which signifies they all must be considered when developing a CPEP. Two additional items were also gained from a question asking if there were any additional items that should be addressed. These were:

- What to do when the CPE is unavailable and information requires publishing.
- Highlighting the impact of failing to follow protocols.

Table 2. Respondents' views on the importance of containing various procedures within a CPEP.

Procedures	How important (No. of people)		
	1	2	3
Use CPE tools and system	16 <sup>x</sup>	7	
Conducting EDM	17 <sup>x</sup>	6	
3D model coordination	10 <sup>x</sup>	8	5
Conducting collaboration	15 <sup>x</sup>	7	1
Managing online relationships	11 <sup>x</sup>	10	2
Collaborative contract duties	9	11 <sup>x</sup>	3
Align QA & project procedures	6	15 <sup>x</sup>	2
Managing online workflow	10 <sup>x</sup>	13	
Continuous improvement	4	15 <sup>x</sup>	4
Change Management	9	9	5
Data and software compatibility	11 <sup>x</sup>	11 <sup>x</sup>	1
CPEP compliance monitoring	6	15 <sup>x</sup>	2
CPEP strategy	7	16	
Strategy for CPE use	14 <sup>x</sup>	8	1
Project roles & responsibilities	14 <sup>x</sup>	9	
CPE roles & responsibilities	18 <sup>x</sup>	5	
Training provisions	13 <sup>x</sup>	9	1
Flow charts for procedures	6	13 <sup>x</sup>	4
Technical requirements	10	11 <sup>x</sup>	2
Technical support	10	10 <sup>x</sup>	3
Intellectual property rights (IPR)	12 <sup>x</sup>	11	

\* <sup>x</sup> used to facilitate easy identification of largest response.

1 = very important, 2 = important and 3 = not important.

Both are important issues, and although they were not originally identified by the author as requiring individual recognition, it is recommended they form an integral part of any CPE strategy.

Finally, CPE users were asked how important is a good protocol to the successful application of an extranet system on a project. Fifteen (65%) responded by ticking 'very important'. All but one of the remaining group said that it was 'important', with the single individual stating they were 'neutral'.

### 5.2 Developing CPEPs

Ten respondents had been involved in the course of helping project teams form a CPEP. All indicated that undertaking the task for the first time proved to be either a difficult or very difficult process. Two common themes were apparent throughout all of the reasons (provided in supporting statements) why respondents had encountered such an experience. Firstly, that the most problematic part of the process was *trying to get people to agree and work together*, (collaborate). The second was *not enough guidance and a lack of expertise* (best practice experience).

When asked to rank four given barriers to the successful creation of an extranet protocol, they were positioned in the following order:

1. A lack of best practice guidance, generic templates and guidance notes.
2. Relying on the extranet system vendor to facilitate the process.
3. Adapting an ad-hoc template from another project.
4. A lack of necessary expertise to call upon.

When asked to rank four known issues that hamper efforts to create a successful CPEP, respondents placed them in the following order:

1. A lack of expertise and experience within those responsible for development.
2. Not having all project team members involved in the process.
3. Having to rush the process as the CPE was already being used.
4. A lack of commitment to the process from project team members.

Responses to this section suggest that there is a lack of participation in the process from professionals who are well versed at the 'art of collaboration'. Furthermore, projects teams wanted to seek additional assistance or expertise, but were not sure what was available or where to obtain it.

### 5.3 Requirements for a CPEP toolkit

To appreciate what assistance project teams require in developing a CPEP, they were asked to indicate in which one of four services they would most likely use, if they were available. These were, in order:

1. A best practice guidance document (explaining how to develop an extranet protocol).
2. A generic extranet protocol (template document that can be adapted to individual projects)
3. Specialist designated software (step-by-step guide with input boxes to complete).
4. Professional extranet coordination services (employing consultants to facilitate the process)

The survey then asked which format would respondents most like to see a CPEP toolkit presented in. Sixteen (70%) people chose a web-based guide with generic document that could be completed online.

### 5.4 Respondents opinions to key research findings

The final section of the electronic survey asked respondents to indicate their reactions to five statements, formulated from key findings of the overall research project. The statements were:

1. The use of poorly developed extranet protocols, or non use of them, leads to the ineffective and inefficient use of construction project extranets
2. Current extranet protocols are ad-hoc, project-specific and inadequate, as they focus on how to use the designated extranet system but provided little or no consideration of other critical issues such as integration and collaboration.
3. The lack of an industry generic extranet protocol and guidance documentation, make it difficult for project teams to develop practicable extranet protocols.



4. Project teams would benefit greatly from the availability of an industry approved, generic extranet protocol toolkit.
5. The availability of a generic industry extranet protocol would facilitate more efficient collaborative extranet working.

Table 3. Reactions to five key statements formulated from key research findings.

Statement	Response (number of people)				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	8	14	1		
2	7	11	4	1	
3	5	11	3	4	
4	6	11	4	2	
5	5	15	1	2	

As shown in Table 3, the majority of respondents agreed, or strongly agreed with all five statements. Whilst the low survey response means these statistics cannot be used to demonstrate an industry wide opinion, a strong grouping of responses to the five statements can be seen to validate the findings of the research.

## 6 CONCLUSION

Application Service Providers (ASP) lease-based Construction Project Extranet (CPE) systems are increasingly deployed on construction projects as a means to facilitate project information exchange, integration and collaboration. However, existing research shows that clients and project teams are failing to realise the full potential of such systems (in terms of project cost savings) due to missing or poorly developed Construction Project Extranet Protocols (CPEP). Additional research conducted by the authors on the subject of CPEPs, their importance in assisting Collaborative Extranet Working (CEW), and the proposed subsequent development of a generic CPEP toolkit reached the following conclusions.

There are three levels of CPE operation, simple file transfers, Electronic Data Management (EDM) or CEW. Regardless of the level chosen, the project team will need to develop a set of procedures (a CPEP) to help workers achieve effective use of the system; therefore ensuring greater overall project efficiency. The CPEP must also be tailored to suit the chosen level of operation. As the need increases for the CPE to facilitate collaborative working, so to does the need for greater strategic management and a more proficient CPEP; to ensure successful application of the system. The issues that an adept protocol should consider, in accordance with the CPEs level of operation, has been compiled and included within Figure 2 (page 3). The relevance of these issues along with the importance of their

inclusion within a CPEP was authenticated by the survey response.

All protocols must provide equal reflection of company, project and extranet system procedures. At present, company procedures are usually sacrificed at the expense of the others.

The most difficult task facing a team trying to develop a CPEP is ascertainment of a document that satisfies the individual's requirements, whilst still being acceptable to all others. Respondents who had participated in the protocol development process substantiated this. All indicated that undertaking the task for the first time proved to be difficult and most supporting statements mentioned the main issues were: *trying to get people to agree and work together* (collaborate), and the *lack of available guidance*.

Current protocols were found to partially unsuccessful at achieving effective working and delivering savings in project costs. They include the majority of items identified for undertaking EDM, but none of those listed for achieving CEW. Therefore, they are not sufficiently developed to foster true collaboration. This was attributed to the teams lack of experience in understanding what was required, along with their subsequent reliance on ASPs to manage the process.

ASPs deliver protocols that mainly assist users to work with their particular systems, but lack consideration of other crucial issues. This has seen them contribute to the industry's move towards shuffling electronic paper rather than helping to achieve electronic collaboration.

Whilst a detailed listing of the main barriers, that hamper creation and implementation of a successful, can be found in Section 5.2, the two main issues identified by the survey were:

- A lack of expertise and experience within those responsible for development; and
- A lack of best practice guidance, generic templates and guidance notes.

When questioned about how project teams felt they could best be assisted in the process of developing a CPEP, the majority (16) stated that they would want a best practice guidance document (explaining how to develop an extranet protocol). They also indicated that a web-based guide with generic documents that could be completed online, would be the most desirable form of media.

The general consensus between those CPE managers, administrators and document controllers (who responded to the survey) agreed with the following statements formulated from the research:

- Poor CPEPs lead to inefficient use of CPEs.
- Current CPEPs are inadequate.
- The lack of a generic template and guidance documentation makes it difficult to develop practicable extranet protocols.



- Projects would benefit greatly from the availability of an industry approved, generic CPEP.
- The availability of such a document would lead to more efficient CEW.

## 7 RECOMMENDATIONS

Based upon the above findings, the following recommendations are submitted for consideration by the construction industry and where applicable, future work:

- Clients, project teams and ASPs must develop and implement CPEP on all projects, where a CPE is to be used.
- Appropriate time and effort should be expended in the development of CPEPs, and at the earliest feasible time. Doing so will encourage greater successful adoption of the system.
- Teams responsible for developing a CPEP should identify which of the three levels of operation is required and ensure consideration of the appropriate items (as outlined in Fig. 2).
- Protocols must provide equal reflection of companies, projects and extranet system procedures and not sacrifice one at the expense of the others.
- Clients and project teams would benefit from adopting external expert assistance on how to ascertain efficient collaborative working.
- ASPs should provide greater consideration of other critical issues surrounding the use of the system on a project, not just efficient use of their system. When selling a collaborative solution, it should ‘do exactly what it says on the tin’.
- The need exists to develop a best practice toolkit, which aids development and implementation of practicable CPEPs on projects. This should be presented to the industry in the form of a web-accessible application.

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