

CITB-ConstructionSkills action learning project – supply chain integration, logistics and e-trading

Report into the potential applications for e-trading between construction supply chain members



Research project on electronic trading, final report

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Initial objectives

The statement below summarises the initial objectives of CITE's (Construction Industry Trading Electronically) involvement with the project partners and their supply chain.

'To identify the supply chain needs of the project partners, which include the requirements for successful electronic trading and, incorporated into this aspect, was the necessity for true interoperability between *all* project partners. The aim for each partner was therefore to identify their specific requirements in order to collaborate efficiently with their clients and suppliers.'

CITE's project manager for this work, Sue Langley, met with the project partners, sixteen members of their supply chains and six service providers. They discussed what business improvement possibilities were open to them and the conclusion from these exploratory meetings was that the following topics should be explored.

Summary of agreed research topics

1. The electronic transmission of business documents such as orders, invoices and dispatch notes between trading partners, using appropriate document information exchange standards.
2. Use of a dispatch note bar-coding system to record goods sent and received by scanning bar-codes, as an aid to automate and improve the efficiencies of the proof of delivery process for both supplier and customer.
3. The merits of using biometric/electronic signature capture to automate business processes such as subcontractor payment certificates.
4. The benefits of using purchase cards for obtaining low value items required on project sites.
5. Using a customer-defined bar-coding system and appropriate hand-held technology as a means of tracking the manufacture, shipping, receipt and installation of a product on a project site.
6. How component tagging using RFID (Radio Frequency Identification) could aid distribution to construction sites, as well as improving tracking and recording activities remotely by using hand-held computers.
7. How delivery drivers could use hand-held computers to aid the supplier's proof of delivery procedures by remotely recording all aspects of the delivery process electronically, capturing customer's signatures and electronically transmitting captured data to both supplier and customer.
8. The merits of bar-coding and/or tagging systems, when used with hand-held computers to automate the recording of maintenance to equipment such as boilers and gas fires.
9. Development of standards that will provide the potential for seamless data exchange and information sharing for the design, construction, procurement and operation of buildings in relation to building components ("objects").

Summary of results, barriers and issues

Whilst many useful learning points emerged, each of the above activities encountered barriers which prevented them moving to a fully successful conclusion. To a greater or lesser extent, the following issues contributed to this.

1. The current profusion of information exchange standards is a major barrier to the exchange of business information between the disparate computer systems found in the typical supply chain.
2. A construction company, when using e-trading, is not always the largest organisation. Taylor Woodrow for example is smaller than many of its suppliers and the average construction SME will be relatively tiny. In the retail sector, the large companies state the rules by which their supply chain trades with them. However in the construction industry it is likely to be the reverse with the suppliers developing the e-trading mechanism. A contractor may be able to successfully exchange trading messages with Travis Perkins - but only if he fully understands their bespoke systems. Other builders' merchants may have different systems with which he cannot exchange data.
3. When adopting mobile IT, there is a huge investment of both time and money to set up a secure environment so that mobile devices can be integrated into a company's network/telecoms systems. One of the project partners took almost a year to do this.
4. An organisation in a construction supply chain cannot 'do mobile IT' alone, it has to be a joint commitment with most or all of those in the project supply chain setting themselves up to take part. This is where the stumbling block occurs – getting total commitment all the way down the line.
5. Supply chain members are cautious when considering changes to their business processes. They need to be convinced that changes will produce cost and time savings which outweigh the cost and upheaval of implementing change. The implications for their business, both internal and external need to be clearly understood with risks identified and managed. Although this was a two year project, the lead time given to the partners was insufficient for them to take up these initiatives because of the impact on their wider business operations. The Denne logistics project identified that process efficiency can limit flexibility and responsiveness – this sub-project seems to confirm that view.

The following points were some of the reasons given by the partners for their reluctance to take part in full e-trading pilots.

6. It is very difficult to run a pilot R&D project on existing working systems because such software applications/systems are very difficult/expensive to change as they are likely to have been implemented for the specific needs of a company's processes.
7. Even if trading messages are being used there are problems:
 - a) Bespoke XML messages are being used so only software that understands such messages will work. Thus, these communications will be just system and/or company and software application specific.
 - b) If standard trading messages are being used (BASDA e-Build or CITE for example) then there can still be problems. Certain optional fields in a message can be used in different ways - so a receiving system may not be able to interpret the meaning if it does not know the 'rules'. This is where Message Implementation Guidelines are important and should be read alongside the technical specification or XML Schema for example.

c) Getting deeper into the data in a message - there is a need for the standardisation/mapping of product codes. It is clear from the pilots that everyone uses different product codes for the same item! The use of mapping systems is proposed as a solution.

Actions required

CITE and similar organisations need to be fully aware of the problems the supply chain is facing with regards to interoperability standards. Lead contractors must decide and clearly communicate their requirements for e-trading and a construction industry strategy is required to move e-trading forward.

When developing software solutions, service providers need to incorporate interfaces to “open” data exchange standards within their software products. Where there is no available standard for a particular data exchange, rather than developing their own proprietary standard they should consider making a request for a new, or a change to an existing, standard to the appropriate standards organisation.

It appears that there is currently a lack of coordination and integration between IT systems and the business procedures and policies in place. This is starting to impede upon e-trading. The e-business and technological world is moving rapidly and it may be that people in the construction industry are finding it difficult to absorb new technologies.

To counteract this it is important that organisations such as CITE provide information through seminars and case studies (of those who have successfully done it), and point people in the direction of other organisations where similar information can be found. In many cases the construction industry is reinventing the wheel in trying to prove a supposed ‘new concept’ that may have already been proven to work in practice.

Mobile technology, flexible business processes, and seamless networks are all seen as fundamental to the advance of project efficiency and it is thought that they would deliver considerable improvements to the construction industry.

Research topics in more detail

Topic 1. The electronic transmission of business documents (such as orders, invoices and dispatch notes) between trading partners, using appropriate document information exchange standards

Individual organisations generally understood and appreciated the benefits of electronic ways of working, however, organisations within the supply chain seemed unable to work together electronically, and it appeared that part of this is due to the lack of interoperability between supply chain partners.

In some cases there was reluctance to change, and many firms are not looking at e-business as a top priority within their organisation.

1.1 Electronic purchase orders

Product coding

One barrier in particular was that transmitting electronic purchase orders to suppliers was proving difficult due to the various structures of product coding systems used.

There is an issue surrounding the use of supplier/manufacture product codes, whereby the contractor may purchase the same products from several sources with each source using a different product code structure. Solutions to overcome these issues are provided by companies which offer mapping services.

One such product is an information database for mechanical engineering products, providing product and price information to the building services industry by referring to a unique code for each product. The database currently contains some 750,000 products, and each code can cross-reference to the product code that may be supplied by several suppliers of the same item. The potential user can licence access to this database, which can be downloaded onto their system.

There is also the potential for a link from this database directly to the Voltium database, which maintains a large volume of technical information that has been obtained from manufacturers.

For products that do not fall into the category of mechanical engineering, another supplier offers a simple data mapping solution and service that is not reliant upon any other system. This can be used for all products that may be purchased and might be a more cost-effective solution for smaller organisations. Again, the potential user can licence access to this mapping software.

A data mapping process can revolve around building maps from transfers of purchase orders, delivery notes or invoices, but in the first instance this database will evolve from the supplier's invoice/dispatch note.

Action required

It was agreed that an organisation such as CITE should act as catalyst in any attempt to resolve issues facing those choosing to use electronic data, if their respective software systems are not be capable of coping with what is required.

Transmission of purchase orders

At the time the overall project came to an end, the project partners had just begun evaluating the purchase ordering module of their software product. In the first instance they intend to generate paper purchase orders, which they will send to suppliers by post and then look into sending them by fax, email and in XML (Extendable Mark-up Language) format, all through the Software Systems eXchange system.

A positive outcome of the discussions was that supplier Travis Perkins made a commercial decision to enhance their service to customers by developing an online order tracking service with XML confirmation.

How it works

- A Travis Perkins customer can view information about orders placed by accessing the Travis Perkins website.
- To receive XML order confirmations the customer will first need to contact the Travis Perkins Helpdesk on 0800 093 4233, quoting their account number, together with the email address they wish the document to be sent to, or indicate the software package being used (such as Ramesys' eXchange system or Causeway's Tradex system).

1.2 Electronic dispatch notes

Project partners cannot receive electronic dispatch notes as the software systems did not have this functionality and the developers had no immediate plans to provide it. However, the group was informed of a GUI (Graphical User Interface) product and it was agreed that perhaps this could be used to view the required dispatch note information directly from the supplier's website.

A further positive outcome of the discussions was that Travis Perkins agreed to extend their service of order confirmation to enable customers to track their dispatch notes through the website.

How it works

- First the customer needs to register using one of the Travis Perkins websites. This can be achieved by using one of their brand sites (www.travisperkins.co.uk, www.keyline.co.uk, or one of the Travis Perkins generic sites such as www.trademate.co.uk) and registering online.
- Once registered the customer can access information via clicking on Account Details then on Order Tracker.

1.3 Electronic invoices

Electronic invoicing is already used by many organisations, and suppliers can generate information using a BASDA e-build XML invoice which can be transmitted to customers through systems such as Ramesys' eXchange and Causeway's Tradex.

The project partner required an upgrade to receive BASDA XML invoices from the suppliers so that the standard programs used by them would be able to retrieve invoices from the eXchange system, matching them against orders and thence to standard routine for payments. After due consideration, the project partner chose not to pilot the receipt of electronic invoices at this time.

Potential barriers

Although it is possible for Travis Perkins to use the Ramesys eXchange system to transmit and receive electronic information, it was pointed out that the current cost of around 20–30p per transaction is a prohibiting factor to its use. The Tradex system, which is a secure hosted service supporting the electronic exchange of trading documents between buyers and sellers, also charges for services but in a different way. This charge is based upon an ongoing annual service fee that relates to the size of the company and potential usage.

Action required

One of the prohibiting factors to the use of e-trading is that software products currently being used may not provide appropriate functionality to perform the desired EDI (Electronic Data Interchange). Information exchange standards require further development to fully support efficient e-trading.

It is necessary for CITE to raise this issue and discuss the problems of interoperability with its industry partners, and it is essential that lead contractors clearly communicate their requirements for e-trading to the software industry.

An industry e-trading strategy needs to be agreed upon after thoroughly researching any activity currently underway in the international arena where valuable lessons may be learnt.

Topic 2. Using a supplier's bar-coding system, together with the customer using hand-held technology to record goods received, as an aid to automate and improve the efficiencies of the proof of delivery process for both supplier and customer

Lost delivery notes and payment delays caused by proof of delivery disputes are just two reasons for automating the exchange of delivery information. The ideas discussed provide a solution to this problem while supporting a range of operational practices that can then be implemented to suit specific business requirements.

The ideas utilise structured data exchange alongside traditional processes and hand-held technology to provide information that supports the receipt and recording of deliveries by the contractor. The proposal would use bar-coding to provide flexible options for capturing delivery details. By interfacing with an EDI system, links to purchase orders and invoices can also be incorporated to extend the benefits of this system.

For the purpose of the trials Travis Perkins enhanced their system and provided space for a bar-code on their EPOS (Electronic Point-Of-Sale) dispatch ticket print, and all dispatch tickets received by the companies taking part in the pilot will display an appropriate bar-code.

The bar-code conveys:

- the Travis Perkins company registration number
- a brand identifier
- a ticket number.

By simply scanning the bar-code on the delivery ticket using a hand-held device linked to an appropriate software system, the contractor can use this at the time of receipt to automatically record that the goods have been received. This information is then immediately transmitted to the computer system of all interested parties, in this instance the supplier and the contractor. It was also thought to have its use further extended if a third party was involved in the delivery process. For example, if a manufacturer was supplying materials direct to the customer and on behalf Travis Perkins, then the computer system of that manufacturer could also be provided with the delivery information, which is seen by them to be a significant benefit.

Owing to lack of appropriate functionality of the contractors' software systems (highlighted in 1.3 action required) this sub-project was unable to prove or disprove the benefits of this method of recording receipts.

Topic 3. The merits of using biometric/electronic signature capture to automate business processes such as subcontractor payment certificates

The ideas behind this pilot project included the following aspects:

1. Using specialised signature capture software to authenticate the document when the monthly payment certificate is prepared on site.
2. Using email to direct the prepared and electronically signed payment certificate to others for further authentication as required.
3. Forwarding the fully authenticated payment certificate to the Accounts Department to process payment to the subcontractor.

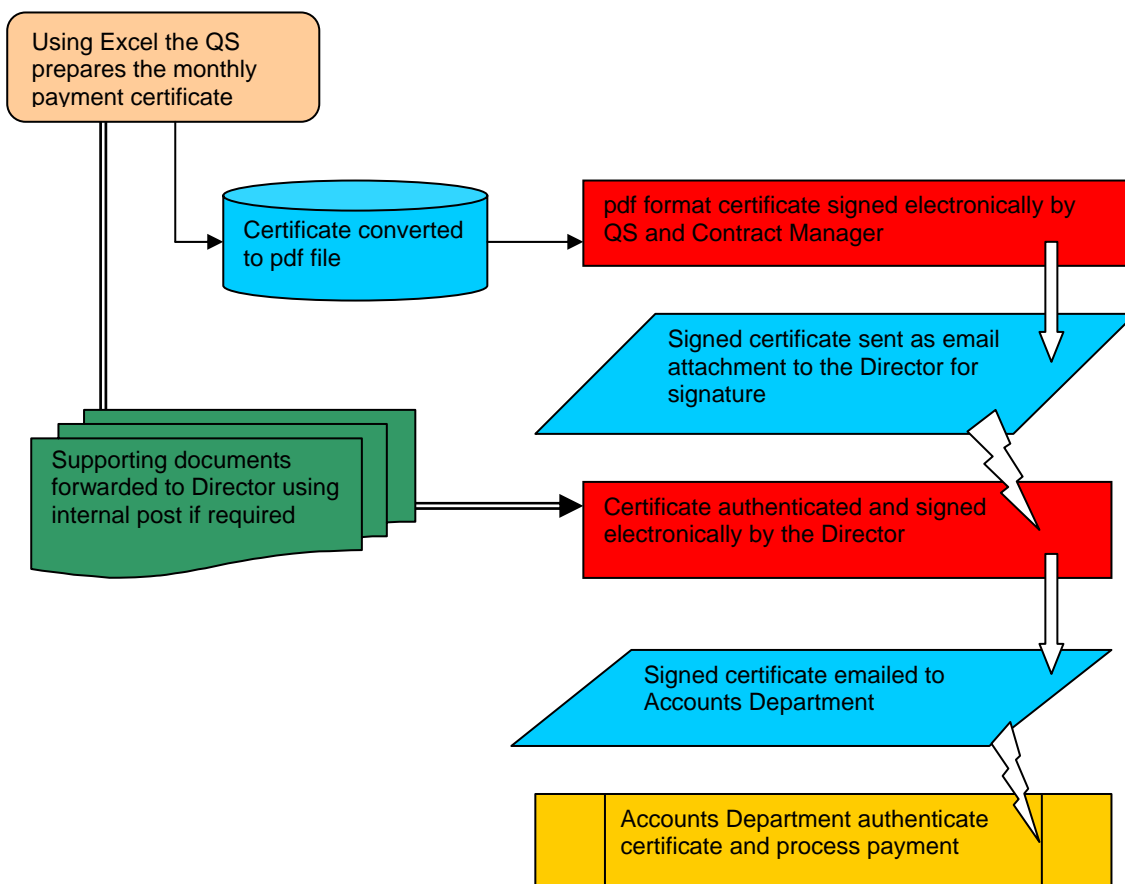
Following demonstrations and discussions on this topic the management decided that now was not the right time to move forwards with a pilot project to evaluate the use of biometric signatures.

Listed below are some of the benefits realised by other organisations who have piloted the system.

- Speeds up the payment process.
- Less paperwork.
- Quicker flow of payment certificates when used correctly.
- Payment time is controlled by Treasury and not by internal postal delays.
- Saves time overall.

The case study can be found on the CITE website at www.cite.co.uk

Typical process using electronic signature software



Topic 4. The benefits of using Purchase Cards for obtaining low value items required on project sites

After seeing demonstrations given by HSBC bank it was decided not to pilot the use of Purchase Cards at this time. The system demonstrated allowed cards to be used at any participating builders merchant and in this case there was a need to specify exactly where the cards could be used.

However, other organisations such as Shepherd Construction and Taylor Woodrow have successfully used the cards for some time and realised many benefits.

Purchase Cards streamline the buying of low value goods and services in a way that substantially reduces the time spent and costs involved in making such purchases.

- You decide who within your business has the authority to make purchases on a card.
- You agree a maximum spending limit for each card issued.
- Your suppliers will be paid in full within three to four days.
- The bank will send you and each cardholder a monthly statement showing details of all purchases made. The balance on *all* statements is settled with a single payment.
- Your suppliers benefit from improved cash flow.
- Cards can be used to purchase a wide range of goods and services.

Control

- Costs – you know how much is being spent and when.
- Suppliers – you will be dealing with suppliers that you know and trust.
- Policy guidelines – your employee will know who they can deal with and how much they can spend.

Efficiency and time

The bank will supply all relevant management information to allow a comparison of costs and to possibly allow renegotiation of discounts with suppliers. All VAT information is supplied in line with HMR&C regulations.

Creditworthiness

A Visa card is recognised throughout the world as a leading payment card.

Monitoring

Credit cards allow you to keep a constant check on expenditure being incurred by yourself or your employees and on general expenditure within your company.

Flexibility

The bank can tailor a purchasing process that is designed to match the needs of your organisation.

More detailed information on the use of Purchase Cards can be found on the CITE website:
www.cite.co.uk

Topic 5. Using a customer-defined bar-coding system and appropriate hand-held technology as a means of tracking the manufacture, shipping, receipt and installation of a product on a project site

Linked to this report, there are two flow diagrams. The first explains how [bar-codes](#) can be used to record the various stages of manufacture and delivery. The second details how [information flow](#) between the various parties involved might be addressed.

Topic 6. How component tagging, (using RFID) could aid distribution from a holding store containing predefined packs of supplies to building sites, as well as tracking and recording activities remotely using hand-held computers

Brief overview of issues to be addressed

1. It was decided that a forecasting system is necessary in order to manage the material packs required to fulfil build programmes. It is hoped that this system would trigger when building packs need to be dispatched from the holding stores for the various stages of work conducted on each building site.

2. Given the limited resources available at the holding stores it is preferable if packs can be assembled in advance and stored until the actual dispatch date. There are enough resources to assemble 600 building packs per week, but holding stores are often required to assemble 300 one week and 800 the next. Therefore, if they can pack in advance and stock to full capacity there is every possibility of reducing the number of packers required.

The holding store dispatch 120–170 packs per day on seven to eight trailers.

3. A stock management system is required and there may also be a requirement for an internal bar-coding/product-coding system to improve the efficiency of the stock control and issue procedures. However, any chosen system needs to link into existing software systems.

4. Around nine per cent of the value of stock is lost, misused or stolen, but this may be reduced if packs were managed more efficiently with the aid of new technology to record pack content and exactly where materials are required to be used on site.

5. The benefits of using any type of new technology must show a reduction in the pack cost.

Comment

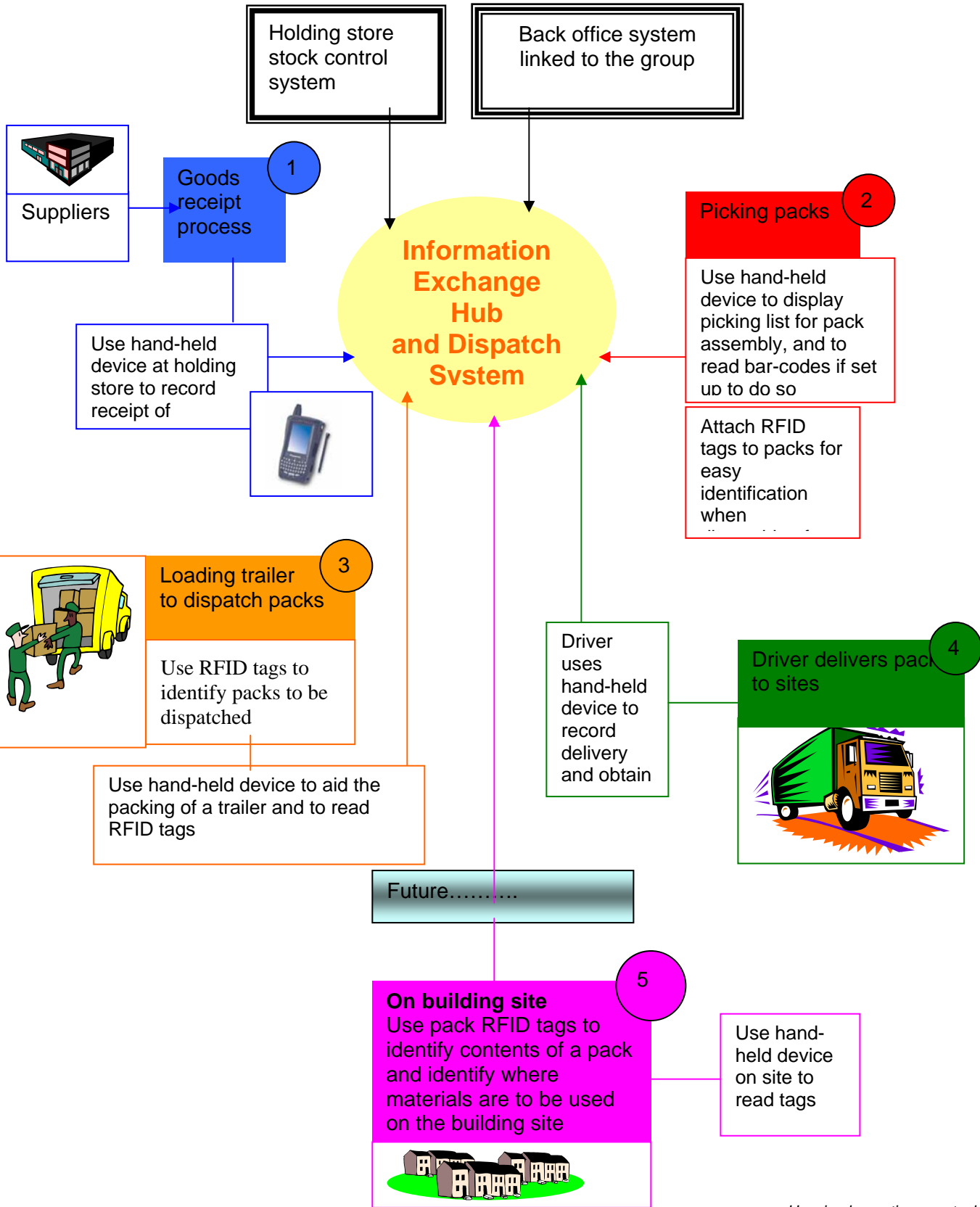
Several ideas were looked at in some detail but because the store was due to be relocated in the near future, the pilot was not put into operation. However, it could be envisaged that such a system could improve overall efficiency but there might be an issue when linking any new system into existing systems used and this needed careful consideration before any development takes place.

Using new technology to overcome some of the issues

A software company gave a clear overview of how their dispatch system and information exchange hub could address many of the requirements, but it was agreed that the forecasting issues should be addressed internally and within the existing software system.

In addition to the new dispatch system on offer for trial, a pallet tagging system could be bolted onto the front end of this system to perform several functions to improve efficiency in the systems used in both the holding store and at the building sites.

Below is an overview flow diagram covering five examples in which implementing new technology could be of immense benefit to the total operation.



How implementing new technology can benefit operations

Topic 7. How delivery drivers could use hand-held computers to aid the supplier's proof of delivery process by remotely recording all aspects of the process electronically, capturing customers' signatures and electronically transmitting captured data to both supplier and customer

Listed below are just some of the reasons why one of the suppliers of materials on this project is considering changing the current method of working.

- Paper POD (Proof of Delivery) documents are currently used.
- Mobile phone communication is already in operation.
- Little pro-active delivery reporting
- No remote load quality monitoring.
- Effects of transport policies and other pressures on road distribution.

The supplier perceived the benefits of change from a number of angles.

Financial point of view

- Provision of electronic POD and accurate records of waiting time and day work.
- Revenue protection for multi-drop vehicles.
- The ability for multi-drop vehicles to print paperwork in-cab.
- Reduced administration effort in managing POD and other invoice queries.
- Better customer service without the input of sales/back office staff.

Customer services improvement

- Ability to accurately pre-advise customers and units of vehicle arrival.
- Automatic communication to the customer of delays through default reporting.
- On-screen 'real-time' vehicle locating, providing improved response to customer enquiries.
- Reduced delays through the ability to guide drivers to customer locations.
- Monitoring of product quality on vehicle during delivery.
- Reduce paperwork via electronic POD.

Fleet management

- Precise and immediate real-time vehicle locating.
- Improved vehicle utilisation.
- Increased security.
- Management reporting of vehicle and driver activity.
- Immediate notice of vehicle availability after tipping.
- Improved vehicle turnaround times at units due to automated pre-advise of vehicle arrival.
- Mileage queries eliminated.

Improved operations management

- Ability to give production units notice of imminent vehicle arrival.
- Reduced delays at weighbridges and health and safety risk.
- Ability to plan unit breaks around vehicle arrival.

Benefit to vehicle operators

- Increased earning potential through quicker allocation of the next job.
- Improved vehicle security and reduced insurance costs.
- Reduced costs through the replacement of mobile phones with Hanson in-cab text units.
- Easier recovery of payments for waiting time and mileage queries.

Action taken by the supplier

The supplier invited software providers with appropriate technology to give presentations and demonstrations of their products and provide outline proposals on how the recoding of deliveries might be improved by using remote data capture software and hardware. At the time it was suggested that a trial, probably beginning early in 2005 using 12 vehicles be put in place.

Outcome of the discussions

Due to major changes within the supplier's organisation in which existing systems were being reviewed, a decision was made to postpone any work-related to processes involving delivery drivers and hand-held computers until at least 2006.

However, after realising what the various software providers could offer, it was agreed that it is essential that this aspect of the business realise the benefits of using hand-held computer technology.

Potential benefits of introducing e-trading

Tangible benefits

- Reduction in POD data entry time
- Fewer administrative staff required
- Reduction in phone calls
- Time saved generating manual reports
- Accurate billing of waiting time
- Hours saved getting copy dockets
- Improved cash flow as no disputed dockets
- Elimination of document costs such as printing and scanning
- Faster vehicle turnaround and loading
- Increased number of deliveries per day

Intangible benefits

- Time saved chasing payments withheld owing to missing dockets
- Accurate calculation of driver/contractor payments
- Single view of the business as all systems work on the same data
- Improved stock control and visibility
- Faster response to customer queries
- Increased visibility of all mobile activity
- Ability to give customers better information on deliveries
- More efficient scheduling

Topic 8. The merits of bar-coding and/or tagging systems, when used with hand-held computers to automate recording the maintenance of equipment such as boilers and gas fires

As with other potential projects, the supplier to one of the project partners believed that adopting a system to fully automate the scheduling and recording of maintenance programmes could benefit the organisation. Before our approach the supplier had been looking into such systems but there was no budget readily available to put a pilot in place at this time.

An automated planned maintenance system could realise the following benefits

Efficiency

- Real-time dispatch of jobs to engineers resulting in faster response times.
- Increase in the number of calls per engineer.
- Online history of repairs available to the engineer to aid diagnosis.
- Tracking of all unproductive activity.
- Increased visibility and control of activity in the field.
- Tracking time and materials used per job.
- Fewer mistakes – no more illegible writing and transcription errors.

- Back office system updated in real-time.

Customer service

- Gets jobs to the engineer faster and improves response time.
- Measure KPI's and monitor service level agreements.
- Provide customers with accurate information on what is happening in the field.
- Increase billing accuracy with a reduction in billing disputes.
- Customer reports could be made available for all work completed.

Cost savings

- Ensure all jobs are billed correctly.
- Eliminate administration and data entry that doesn't add value to a project.
- Reduce stock shrinkage and improve stocktaking process.
- Ensure that all parts are charged to the customer.
- Minimise disruption to the business.
- Short implementation cycle.

Linked to this report there is a flow diagram showing the potential [communication mechanism](#) between a service supplier and a client servicing residential and industrial properties using a hand-held device and web access link interface.

Topic 9. Development of standards that will provide the potential for seamless data exchange and information sharing for the design, construction, procurement and operation of buildings in relation to building components (“objects”).

Background information

The work of CITE has primarily been the development of information exchange standards for the traditional business documents such as invoices and orders etc., which can provide the potential for seamless data exchange between trading partners. CITE works in alliance with BuildingSMART, formerly the IAI UK Chapter (International Alliance for Interoperability), which has been developing other standards to provide the potential for seamless data exchange and information sharing for the design, construction, procurement and operation of buildings in relation to building components (“objects”). These standards are known as IFC's (Industry Foundation Classes) and have been developed because the industry uses hundreds of applications that cannot share data owing to different formats being used.

Exchanging and sharing information between different disciplines and work processes can significantly reduce cost, save time and increase quality of building projects. Building information modelling is one example of technologies that are now being used by the industry to achieve new efficiencies in design and construction.

The largest gap in the chain of building information occurs between the design/construction of a building and the handover to those who will be responsible for operation and maintenance. Taylor Woodrow recently led a DTI (Department of Trade and Industry) sponsored project (the ifc-mBomb Project) that has shown how the information chasm can be bridged. The project brought together representatives of construction and IT in a programme that developed an information process framework, test cases and complex software interfaces that can dramatically reduce the time to populate Facilities Management systems and improve the accuracy of information being transferred. Instead of taking months to populate an FM system by hand the job can now be done in a matter of days.

The innovation is to use IFC-compliant software applications and an object model server that holds the building model and enables software applications to share the information.

The latest developments in IFCs are made for housing developers and their supply chains, with opportunities to speed up planning, improve marketing and take out time and cost in design and building. There is now an opportunity for housing developers and design and

construction companies to look at new approaches to configuration and layout using 'state of the art' software and to consider how information sharing can improve business processes.

Ongoing development in data exchange standards

CITE works at a European level through the European Committee for Standardization (CEN) and at an international level through the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) on developing and defining new open data exchange standards. The new standards differ from previous ones in that they are not based on 'documents' alone, e.g. invoice, enquiry etc, but on the individual pieces or sets of information, e.g. address and contact information that might be exchanged at a stage in a process. Consequently the definitions can be reused and put together in different ways to define new message structures relatively easily. References are included in the definitions to recognised code lists to improve data quality and meaning. The standards development work also focuses on process as well as data, as the two are linked in defining a complete data exchange or messaging standard. Invariably, mapping the business processes also highlights areas where data exchange between parties and systems can be improved.

CITE's new data exchange standards, based on the CEN and UN/CEFACT work, will be "open" and available to all interested parties. Software providers will be encouraged to use them in their software products and make suggestions for improvements in the standards.