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RATIONALISING THE CONSTRUCTION MATERIALS PURCHASING PROCESS

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ABSTRACT:
This paper is concerned with the process used in locating and removing inefficiency in the construction materials purchasing process. In the first part, a case study is presented showing the build-up of costs involved in purchasing materials. Potential for substantial savings is revealed. The second part of the paper gives a status report on a rationalisation pilot project currently being undertaken by the Construction Information Technology Alliance (CITA). This project aims to show how greater effectiveness and efficiency can be applied to the administration of the construction materials purchasing process by the application of information technology already used widely in other industries. The status report outlines the approach applied to-date to the project, the difficulties encountered, the solutions adopted, the current status of the project and the steps yet to be taken to bring the project to a successful conclusion.

Keywords – Construction, Purchasing, Information Technology

1. INTRODUCTION

Over recent decades, industry generally has come to recognise the inefficiencies that exist in paper-based purchasing systems. Many sectors of industry have replaced their old systems with electronic purchasing and material tracking systems. The construction sector, however, continues to retain its reliance on a paper-based system. The purpose of this paper is to identify the cost of a paper-based system, to assess the potential benefits of moving to an electronic-based system and to illustrate the issues to be faced in moving to the new information technology system.

In this paper the authors present a case study to examine the means by which the build up of costs involved in purchasing materials are identified. An account of a pilot project being undertaken by the Construction Information Technology Alliance (CITA) to investigate the potential for savings in administration costs is presented. CITA was set up in Ireland in 2001 and has grown to include over seventy members. Its diverse membership includes the leading organisations in the Irish construction industry concerned with design and construction, a representative number of materials suppliers of various sizes, representatives from the public sector including government and academia, a number of legal practices, the leading professional bodies, and a variety of technology and software providers. The aim of CITA is to harness the potential of IT in the Irish construction industry.

2. THE CASE STUDY

2.1 Purpose and Details of the Case Study

The purpose of the case study was to determine the costs arising from the administration of ordering and paying for goods, and to establish the potential savings that could be achieved in the administration system by maximising the use of currently available technology. The study was conducted with two organisations – a mid-sized building contractor and a building materials supplier. Each organisation was interviewed, in order to establish the administrative systems in use when materials were ordered by a contractor and delivered to a construction site by the supplier.

To gather the data, interviews were carried out with members of the contractor's site team, their purchasing department, their accounts department and with the supplier's sales manager. The data gathered concentrated on the administration process involved in the taking and dispatching orders, preparing and issuing invoices and collecting accounts. In order to establish costs, an average remuneration rate of €15 per hour was assumed. In reality, some of the participants in the purchasing system are paid more than this whilst some are paid less. Consequently, the cost build up, shown in Table 1, is not precise, but it does give a strong indication of the level of costs involved in the process.

Table 1: Administration costs of current materials purchasing system

	Action	*Time / Min*	*Rate/Min* *(rounded to the nearest cent)*	*Cost incurred by Supplier*	*Cost incurred by Contractor*	*Total Cost (€)*
1.	Phone call placing order	5	Min Charge - €0.0625		0.06	0.06
2.	Order given received by phone	5	0.25	1.25	1.25	2.50
3.	Order form filled out / receipt of order recorded	5	0.25	1.25	1.25	2.50
4.	Order confirmed by Fax	3	Min Charge - €0.0625		0.06	0.06
5.	Order brought to Orders Office	5	0.25	1.25	0	1.25
6.	Order given to dispatcher	2	0.25	0.50	0	0.50
7.	Order given to loader	2	0.25	0.50	0	0.50
8.	Delivery note prepared and given to driver	5	0.25	1.25	0	1.25
9.	Load checked at gate	2	0.25	0.50	0	0.50
10.	Goods checked on arrival, delivery note signed	5	0.25	0	1.25	1.25
11.	Goods received note (GRN) filled out	2	0.25	0	0.50	0.50
12.	Bring delivery note and GRN to site office	5	0.25	0	1.25	1.25
13.	Return delivery note to both Head Offices	1	0.25	0.25	0.25	0.50
14.	Delivery note given to accounts department	2	0.25	0.50	0.50	1.00
15.	Amount included in supplier's/contractor's account	2	0.25	0.50	0.50	1.00
16.	Invoice issued	5	0.25	1.25	0	1.25
17.	Invoice checked against GRN	5	0.25	0	1.25	1.25
18.	Payment authorised	2	0.25	0	0.50	0.50
19.	Cheque written and left ready for collection	2	0.25	0	0.50	0.50
20.	Collection of Cheque (10% of 1 hour call)			3.25		3.25
	(cost of collection *calculated as follows: Car costs: 10 miles @ 75c / mile + Salesman cost @ €25 / hour = €32.50 / hour.*					
21.	Cheque given to accounts dept.	2	0.25	0.50	0	0.50
22.	Cheque included on lodgement slip	2	0.25	0.50	0	0.50
23.	Cheque lodged in bank	2	0.25	0.50	0	0.50
24.	Bank charge for lodgement			0.35	0	0.35
	Total Administrative Cost			***14.10***	***9.13***	***23.23***

2.2 The potential for Cost Savings

To determine the potential for cost savings it was now necessary to examine the effect of eliminating certain steps in the system by adopting a new process that makes them unnecessary, and possibly amalgamating further steps. The result of this examination would reveal the savings that were theoretically possible without significant change to the existing administration system. Further savings would require significant change to the remaining steps.

Faxing the order directly to the dispatcher would eliminate the need for steps 1, 2, 3, 5, and 6. From Table 1, this elimination gives a potential cost saving of €6.76. Steps 19 – 22 could be eliminated if 23 were replaced by making an Electronic Funds Transfer (EFT) directly to the supplier's bank. It is worth noting that the principle of EFT is now well established amongst the leading contractors but is yet to be adopted by the small and mid-sized contractors. Assuming that the bank charge for lodgement is the same as that for EFT, this reveals a further potential cost saving of €4.75. The total potential cost saving through elimination of the steps made unnecessary amounts to €11.51 per order, representing 50% of the original cost.

To locate further potential savings, it is necessary to examine the remaining steps in the system. The majority of these steps involve the movement of information, usually done by a person physically carrying the information in hard copy from one place to another. Advances in information technology (IT) now make it possible to capture the information electronically at an early stage in the process. This information could then be accessed and verified at subsequent stages thereby eliminating the need for paper and the time taken in reconciling the information presented on the different documents. Laage-Hellman and Gaade (1996) contend that such a system could remove 90% of the administration costs. Such a reduction against the costs shown in Table 1 would reduce the cost per invoice from €23.23 to €2.32.

These potential savings that may be obtained are only part of the benefits of using an electronic administration system (Adcock, 1996). Developing new inter-organisation systems provides for greater accuracy, greater communication, improved business relationships, reduced administration, greater use of just-in-time deliveries, lower storage costs, greater flexibility and an up-to date information base for use across the company. Indeed improvement in any of these factors would be possible in the case of the two organisations involved in the initial case study, as the atmosphere between them was noted as being profoundly adversarial as evidenced by the following comments:

> "We let the Supplier worry about his own costs. It's nothing to do with us" *(Site Manager's comment during the introductions to a site interview)*
>
> "Regardless of what you do with the results you find (during the study), it won't change the attitude of the contractors. If they can get something for a penny less down the road, you won't see them for dust!" *(Supplier's comment during the supplier interview).*

Value is often perceived as being equal to the price paid for the materials. The possibility of using the supplier's expertise in relation to material availability, handling, etc., is not often examined in Ireland. Such involvement can lead to a 10% reduction in construction times (Agapiou, Flanagan, Norman and Notman, 1998) and is now widely accepted in other countries such as Denmark, Sweden and Japan (Day, Dandy and Townsend, 1996).

2.3 Conclusions from the Case Study

The case study demonstrated that there is significant potential for cost savings resulting from an examination of the administration of construction materials purchasing systems.

Approximately 50% of the cost of the current systems could be eliminated without significant changes to the process. However, such change would not eliminate all of the inefficiencies in the administrative system for materials purchasing. It is evident that IT could be used as an enabler for process change, the result of which could result in further radical reduction in costs. By the end of this case study, it was obvious that a pilot project was necessary to test the potential for savings that would be available through the use of such technology.

3. THE PILOT PROJECT

3.1 The CITA Materials Procurement Study

CITA promotes a number of Special Interest Groups (SIGs). The objective of one of these groups, SIG 1- Materials Procurement, is to '..use existing technology to minimise cost of administration of ordering, delivery and invoicing of construction materials'. In setting up this group, representation was drawn from suppliers, contractors, and the technology sector. In order to achieve its objective, the members of SIG 1 set up a pilot project to investigate the use of a new electronic based system administration for materials purchasing and payment. The approach adopted for the pilot project was to use the Generic Change Model shown in Figure 1 (Gunnigan, 1999).

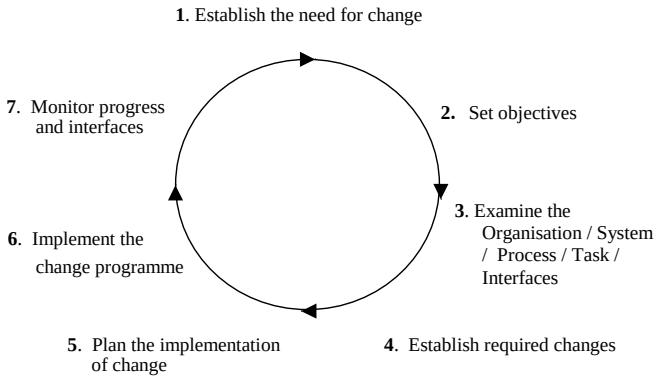

Figure 1 Generic Change Model

3.2 Progress to Date

The group recognised that the current administration system for materials purchasing, which consists of a large number of processes, was not cost efficient. The processes in this system generate an enormous amount of paperwork and tie up a significant amount of staff carrying out repetitive, boring tasks. Making significant cost savings in the current system would generate competitive advantage. The group set itself the objective of finding a more effective and cost efficient system for the administration of purchasing and payment of building materials, using currently available information technology. The proposed system should be practical and user-friendly and should only involve a small number of processes. It should be designed in a manner that will allow it to be tested while being used alongside the current system.

In examining the current system, the scope of this project was limited to those processes that involve the contractor, the supplier and/or the haulier. The actual payment for the materials was not within the scope of the project, as it would involve a number of financial

institutions and could potentially concentrate the project on the issue of security rather than on general administration of the purchasing system. Table 2 outlines the involvement of each of the parties in each process and the potential weaknesses that currently exists within each process.

Table 2. Current Administration System for Materials Purchasing and Payment

Process		***Involvement of***			***Weakness of Current*** *Process*
		Contractor	***Supplier***	***Haulier***	
1.	Order placed by phone	Contractor makes phone call			Order can be imprecise
2.	Order given received by phone	Contractor verbally transmits order	Supplier interprets Contractor's requirements		Order can be misinterpreted
3.	Order form filled out / receipt of order recorded		Transcription of verbal order		Potential for transcription errors
4.	Order confirmed by Fax	Fax can come from site or purchasing department			
5.	Order brought to Orders Office		Order physically carried		
6.	Order given to dispatcher		Order is received and sent to dispatch area		Order may not include all of the information required for dispatch
7.	Order given to loader / materials loaded		Loader checks stock levels and notifies orders office if levels are too low to fulfil full order		Full order may not be in stock. Delivery may consist of part of the order
8.	Delivery docket prepared and given to Haulier		Issues delivery docket to haulier	Haulier verifies that delivery docket corresponds with material loaded	Material order re input – potential transcription errors
9.	Load checked at gate		Check that material is dispatched	Signs that material is leaving the Supplier's premises	
10.	Goods checked on arrival, delivery docket signed	Contractor signs the delivery docket, verifying that the material received corresponds with the delivery note		Haulier gives copy of signed delivery docket back to contractor	Haulier sometimes has difficulty in finding the person authorised to accept deliveries. Goods delivered may not match the original order
11.	Bring delivery docket to site office	Docket physically carried to site office			Delivery dockets sometimes get mislaid
12.	Goods received note (GRN) filled out	Contractors have a variety of ways means by which this is achieved			Potential transcription errors
13.	Return delivery docket and GRN to contractor's accounts department	Dockets sent to head office with other site returns			Dockets and GRN can get mislaid causing major delays to the system at invoice matching
14.	Return delivery note to supplier's accounts department		Some suppliers have developed systems to ensure that all dockets are accounted for	Haulier has responsibility for returning docket	Dockets can get mislaid causing delays in issue of invoice
15.	Amount included in supplier's/contractor's account		Normally typed		
16.	Invoice issued		Normally sent to contractor in hard copy		Can be delayed if delivery docket is not returned on time
17.	Invoice checked against GRN	Normally done manually. Can be difficult if dealing with part orders or multiple orders			Very time consuming and labour intensive
18.	Payment authorised	Payment approved for matched invoices			
19.	Cheque written and left ready for collection	Cheque printed and signed			
20.	Payment collected		Supplier's sales rep collects payment		
21.	Payment brought to supplier's accounts dept.	Not included in the scope of this project			
22.	Payment lodged in bank				

There are two different types of process in the system: those that are totally contained within one organisation and those that involve the interaction of two or more organisations. Whilst there are a considerable number of weaknesses in the system, it is a system that is standard across the industry and has evolved over a long period of time. At a number of stages in the system, a verification of some type is required. It is these verification stages, illustrated by the shaded boxes in Figure 2, which ensures that the participants have confidence that their interests are protected.

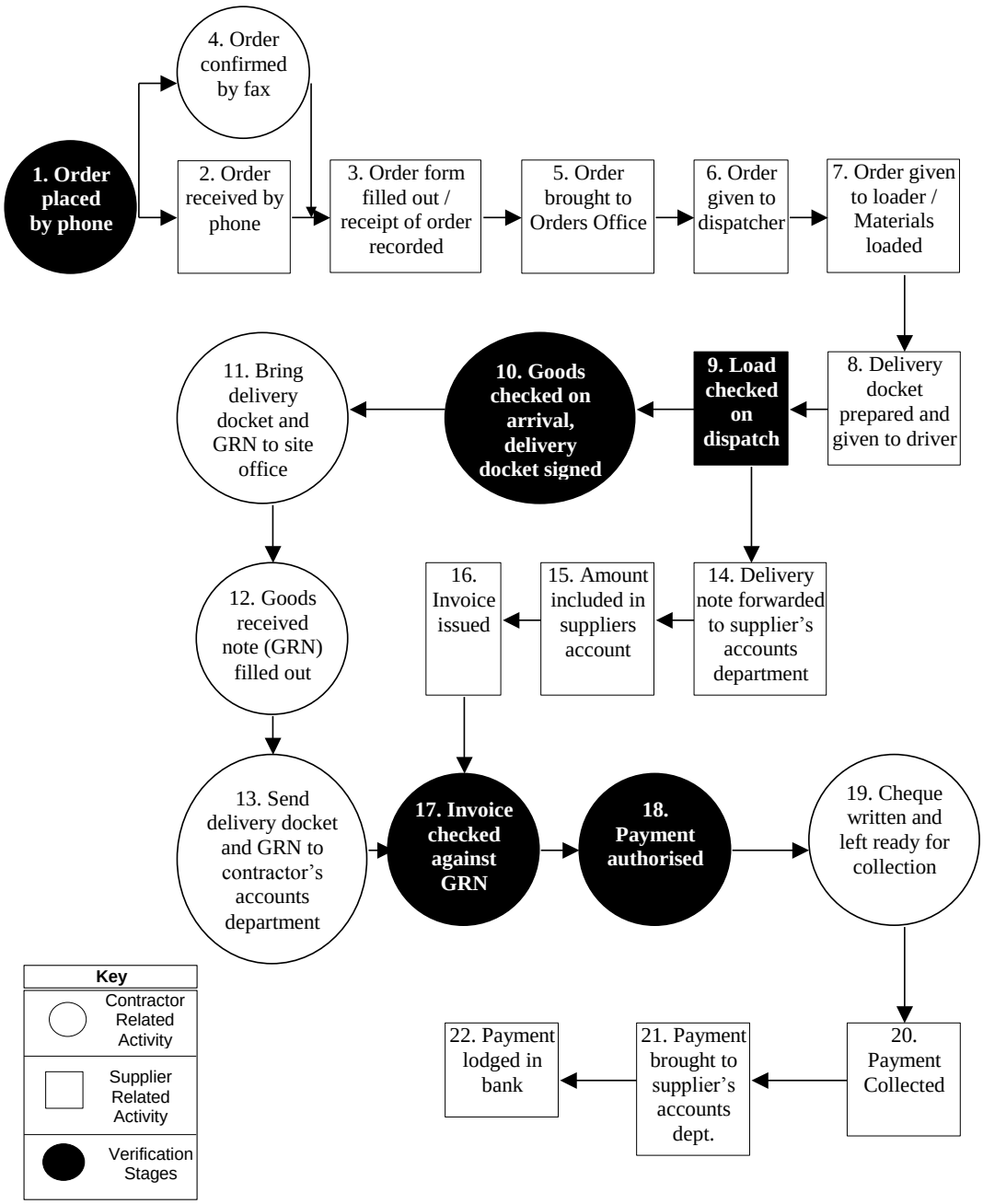

Figure 2 Verification Stages

Whilst it would be impractical to expect the group to propose a total re-engineering of the current administration system, nonetheless the group considered it important to remove the weaknesses from the system whilst keeping the verification stages. Such stages would

include processes such as proof of dispatch, proof of delivery and any process where new information is entered into the system. Once the weaknesses and the verification stages are identified it is then possible to design a new administration system.

3.3 The Pilot Project

Having established weaknesses and verification stages in the current system, the group decided to set up a pilot project through which the new system could be implemented and monitored. The group examined a number of instances from other industries where paper-based purchasing systems were replaced with electronic based systems. O_2, the technology partner in the group, gave an account of the changes that had been effected in the retail sector with the introduction of electronic purchasing systems and from this produced a scoping document that outlined the available options to the group. A variety of existing technologies were investigated, including bar-coding, text messaging (SMS), combined use of mobile phones and a personal digital assistant (PDA), infrared transfer of data using PDA, smart cards and voice recognition.

With the aim of the project being to find a practical, user-friendly, effective and cost efficient system for the administration of purchasing and payment of building materials, using currently available technology, O_2 proposed the adaptation of a system already adopted by an organisation called Sentrio in a project that they had carried out with Roadstone Ltd. (outline available online at http://www.sentrio.com/casestudies/roadstn.pdf). This system could be adapted, as illustrated in Figure 3, so as to remove the weaknesses in the current administration system for materials purchasing whilst retaining the verification stages.

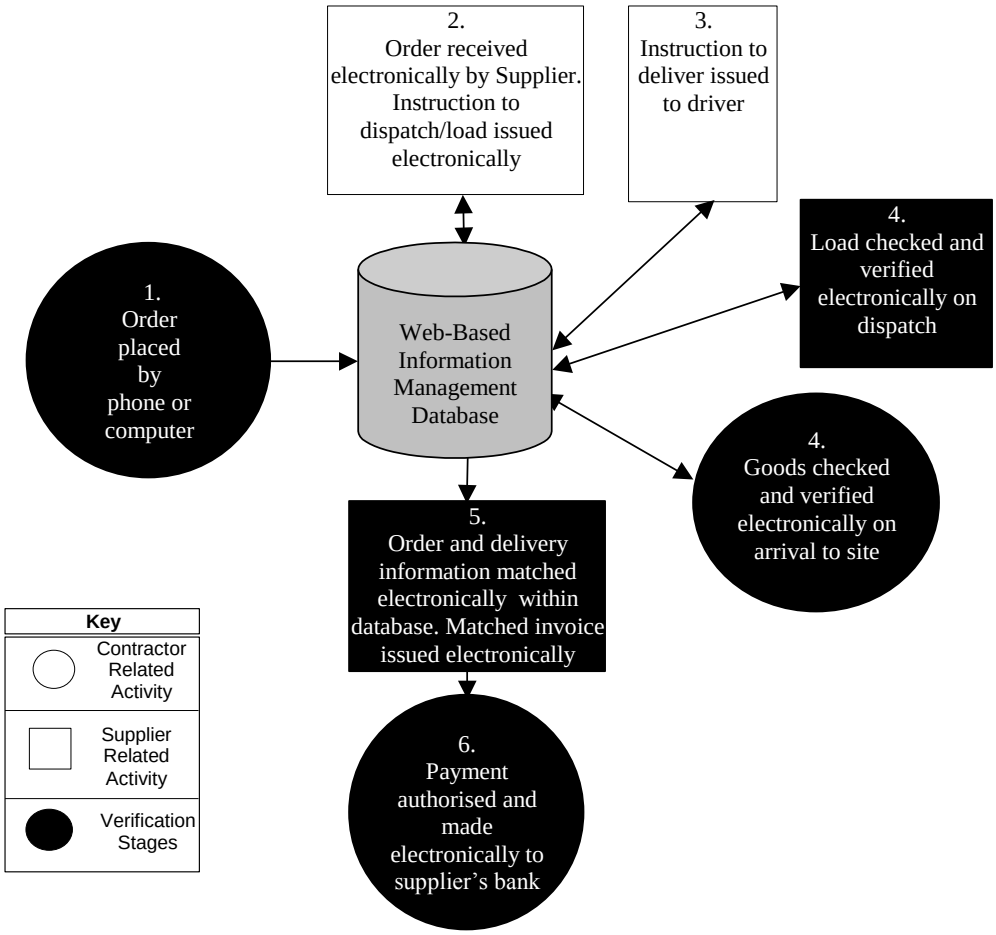

Figure 3 Proposed CITA system

Using this system, capture of ordering information occurs at the initial input stage. This ordering information is then moved electronically throughout the system, being used and reused, with potential changes being approved at the verification stages. This system retains the necessary levels of confidence in the current system, whilst eliminating the processes that had contributed to cost inefficiencies.

Using the data previously gathered in the case study, the notional administration costs involved in the proposed new system are presented in Table 3. These would amount to €2.99 per transaction, a potential saving of over 87% compared to the administration cost incurred using the current system. This level of potential saving tends to show that Laage-Hellman and Gaade's (1996) estimate of 90% savings could be realistic. Obviously, there will be other costs to be considered such as the cost of web hosting, etc. The precise nature of such costs and the rate per transaction are yet to be ascertained.

Table 3: Notional operating costs, per order, of proposed new administration system for materials purchasing

	Action	*Time/Min*	*Rate/Min* *(rounded to the nearest cent)*	*Cost incurred by Supplier*	*Cost incurred by Contractor*	*Total Cost (€)*
1.	Order placed electronically (plus network dial up charge)	5	0.25	0	1.25 0.06	1.31
2.	Order sent electronically to dispatcher/Loader	0		0	0	0
3.	Load verified on dispatch	2	0.25	0.50	0	0.50
4.	Goods checked on arrival, delivery verified (plus network dial up charge)	2	0.25	0.50 0.06	0.50	1.06
5.	Invoice issued/matched electronically (including network dial up charge)	0		0.06	0	0.06
6.	Payment authorised/delivered electronically (including network dial up charge)	2		0	0.06	0.06
	Total Administrative Cost			***1.12***	***1.87***	***2.99***

3.4 Current Status of the Project

Using the Generic Change Model, the pilot project has now reached stage 5 (Plan the implementation of change). The final design of the pilot project is underway. All partners in the group are preparing final development and implementation costings. A programme for the pilot has been prepared and the operation of the new purchasing system for this project will begin in January 2004. The pilot project will be monitored on an on-going basis and preliminary report on the operation of the new system is expected in May 2004. A detailed report on the outcome of the pilot project is expected in Autumn 2004.

3.5 Problems Encountered to Date

It has taken almost two years to get the pilot project to this stage. This long timescale has been caused by a number of factors. Firstly, there is a significant lack of trust in the industry and no company is willing to concede any advantage however small. This leads to reduced co-operation on new initiatives. Secondly, the nature of the industry changed between 2001 and 2003 with a downfall in construction activity. This has led to an additional tightening of profit margins and a further reduction in the willingness of companies to invest in research. Thirdly, a number of the partners that originally joined SIG 1, to develop a new electronic

administration system for materials purchasing, subsequently left the group. Finally, a number of people who were involved with specific companies have since moved to other companies.

3.6 Overcoming Problems

It is difficult to keep a SIG focussed when it is continually meeting obstacles that thwart~~s~~ its progress. Nevertheless, the core of this group has remained together through the belief of the key individuals that the issue concerned is worth resolving. The issue of lack of trust between organisations remains, but the duration of the project has broken down the barriers between the individuals involved. This has resulted in a considerable level of open discussion, whilst maintaining respect for any individual organisation's desire for privacy in relation to sensitive information. The mix of experience in the group has provided solid evidence of the success of electronic purchasing systems in other sectors and this has eventually led to the situation whereby each of the group's participants is prepared to proceed with the pilot project and to cover its own costs in the project.

In some cases, the CITA members of SIG 1 decided not to continue their involvement with the project. However, as CITA has a significant number of members there was always another company willing to join the project. All the companies involved in the project are aware of the CITA philosophy that the outcome of the project will be available to all CITA members. Some individuals who have left member companies have re-emerged with other companies, some of which are also involved with the project. Despite all of these problems the core project group has remained focussed and is actively working on the pilot project.

4. CONCLUSION

From brief analysis of the current administrative system for ordering, supplying and paying for timber, it was found that companies are currently incurring significant add-on costs, 87% of which could potentially be removed by use of an electronic purchasing system based on currently available technology. From the results of the CITA pilot project into the use of the proposed new electronic administration system for materials purchasing and payment, it is evident that change in the Irish construction industry happens slowly. It takes a long time to build trust and to build cooperation between those who are normally in competition with each other. However, from the results of the CITA pilot project it is also evident that persistence does pay off and that a positive result would further reinforce the view that cooperation can lead to significant advances.

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