



2005

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Recommended Citation

Hore, A.V. and West, R.P., (2005a), 'Attitudes towards electronic purchasing in the Irish construction industry', 2005 CIB W92/T23/W107 International Symposium on Procurement Systems, Las Vegas, USA, pp. 289-296.

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ATTITUDES TOWARDS ELECTRONIC PURCHASING IN THE IRISH CONSTRUCTION INDUSTRY

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ABSTRACT

It is well known that the adoption of information technology in materials procurement in the construction industry has been sporadic and piecemeal. Very significant inefficiencies and problems still exist in both paper transactions and non-integrated electronic solutions. There is a general lack of awareness and take-up of information communication technologies (ICT) within the Irish construction material purchasing supply chain. In order to verify this contention a methodology was adopted which involved the design and distribution of an on-line questionnaire to over 100 Irish construction companies. The survey was designed to ascertain the current level of technology take-up in business-to-business (B2B) purchasing transactions between building contractors and material suppliers; the driving forces which attract firms to adopt electronic purchasing; the barriers which have prevented some from doing so; and future developments which are perceived as important in encouraging more widespread adoption of technology within the Irish construction supply chain. Key results include a low level of awareness of appropriate technologies and the absence of appropriate industry standards. Recommendations include the introduction of standards for electronic data interchange in B2B purchasing transactions and the need for an increase in the ICT literacy skills of purchasing staff and familiarity with electronic purchasing.

Keywords: Construction, e-commerce, information technology, materials, procurement, purchasing.

INTRODUCTION

It is generally accepted that building materials account for up to 50% of all construction costs. In this field of business-to-business (B2B) interactions, there is a huge untapped potential for productivity gains. In Sweden (Laage-Hellman and Gadde, 1996), Finland (Wegelius-Lehtonen, 1995) and in the UK (Dawood, 1996), materials management has been identified as an area where significant cost savings could be made. Technologies are at last in place to process electronic transactions more easily and at less cost than one can process paper transactions (Kalakota and Whinston, 1996). ICT is changing almost all functional aspects of a modern business, particularly in industries such as financial services, travel and retailing. With the continued expansion of the Internet, e-commerce (EC) provides unparalleled opportunities for businesses to bring greater efficiencies in transaction based commercial activities (Shaw, 2000).

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Technologies such as Automatic Identification (Auto-I) and bar coding have become widespread within manufacturing, medicine and retail industries. However, the rate of adoption within the construction industry worldwide is very piecemeal.

The technology behind EC is not the problem. The problem is getting the buy-in from all parties concerned. It must be seen as beneficial to everyone and not another burden imposed by the buyers. It is for this key reason that a survey of the Irish Construction Industry was necessary, in order to gauge the attitudes of the industry to the adoption of EC technologies into their B2B transactions. Survey results are analysed in order to determine the major factors that are likely to attract organisations to use EC technologies, the driving forces which attract organisations to implement electronic purchasing, the barriers to preventing organisations from applying these technologies and the future developments which would encourage higher usage of electronic purchasing within the Irish construction supply chain. Recommendations are made concerning issues which should be addressed as part of an overall strategy to promote greater use of EC technologies within the Irish construction industry.

THE SURVEY

The survey examined four key areas relating to ICT purchasing awareness in the Irish construction industry: (i) current level of ICT take-up by main contractors and building suppliers in B2B purchasing transactions; (ii) driving forces which attract organisations to adopt electronic purchasing; (iii) barriers preventing organisations from applying these technologies and (iv) future developments which would encourage higher usage of electronic purchasing within the Irish construction supply chain. These themes formed the basis of a similar survey carried out in the UK by Marsh and Finch (1998). The questionnaire was structured in five parts.

Company profile: company type and turnover.

ICT Take-Up: opinion as to the general level of ICT utilisation within the Irish construction industry; the general level of ICT usage within the organisations B2B purchasing transactions; current state of awareness of ICT deployment in construction purchasing; willingness to consider applying exiting technologies in B2B transactions; importance of linking EC to business strategies; increasing significance of EC in the next 3 years; extent of use of particular EC technologies and concerns over web-based strategies.

Driving forces: the major factors which attracted, or are likely to attract, organisations to apply EC technologies. This part of the questionnaire contained questions relating to ten potential driving forces.

Barriers to adoption: the major barriers which have prevented the adoption of EC technologies, both for individual organisations and the Irish construction supply chain as a whole. This part of the questionnaire contained questions relating to a total of twelve potential barriers.

Future directions: future events which were perceived as important in enticing more Irish construction organisations to use EC technologies for labelling materials and

components. This part of the questionnaire contained questions relating to nine potential future directions.

The questionnaire was internet-enabled and a total of 98 companies were emailed the website link, together with a background to the survey and detailed explanations as to how to complete the survey. A total of 54 responses were received including 29 from building suppliers and 25 from main contractors. From Table 1 it can be seen that the majority of companies within the survey had either medium to large size turnovers. Of the 30 large organisations, 16 were suppliers and 14 were contractors.

| Size | Turnover (€M pa) | Suppliers | Contractors | Total |
|-------------|-------------------------|------------------|--------------------|--------------|
| Small | <10 | 10% | 0% | 5% |
| Medium | 10 – 40 | 34% | 44% | 39% |
| Large | >40 | 56% | 56% | 56% |

Table 1 – Responses by organisation size

OVERALL LEVELS OF ICT TAKE-UP

The purpose of this section of the survey was to measure the overall level of ICT sophistication present in the sample. For the purpose of the survey, ICT was defined as any computer hardware or software that collects, processes, stores, analyses, and disseminates information for a specific business purpose.

ICT Adoption in Irish Construction Industry

93% of respondents to the survey were of the opinion that the current level of ICT take-up in the Irish construction industry was poor to satisfactory with only 7% rating the level of ICT up-take as good. More specifically, when asked about the current level of ICT usage in B2B purchasing transactions within their own organisations, 53% indicated that they used ICT, for example for e-mail, internet, eBanking and use pocket hand-held computers. Over 46% admitting little or no use of ICT to support the purchasing function of their business. However, over half of the respondents indicated that they were aware of the capabilities of ICT to support B2B purchasing transactions, with 57% confirming their willingness to consider existing technologies and a further 40% confirming that they were currently deploying existing ICT to support their purchasing functions. Only 26% of respondents were of the opinion that EC has affected the strategic direction of Irish construction businesses, however, 80% did expect an increasing significance in EC over the next 3 years. The survey further sought to examine the extent of the use of particular technologies in B2B purchasing transactions. The results of this can be seen in Table 2. From the sample, it can be seen that the level of usage is very low.

The survey results showed that the majority of existing available technologies are not predominately being used to support B2B sales and purchasing transactions (see Table 2). However, 32% of the sample indicated that they were using Enterprise Resource Planning (ERP) software to support their B2B communications. Also 80% of the sample confirmed that they had an Electronic Funds Transfer (EFT) capability.

On further analysis it was evident that the level of deployment of ICT was far greater among the suppliers surveyed. A number of suppliers confirmed that they traded via optic fibre or ASDL and exchange data electronically. A recurring feature included suppliers purchasing timber from Scandinavian countries over the Internet. The up-take of ICT to support their purchasing function was very low to non-existent in many of those companies surveyed.

| Technologies | Always | Most Times | Sometimes | Little Use | Not Yet Used |
|--|---------------|-------------------|------------------|-------------------|---------------------|
| Internet | 13% | 19% | 35% | 19% | 14% |
| Extranets | 2% | 6% | 17% | 20% | 55% |
| Electronic Catalogs | 4% | 6% | 42% | 21% | 28% |
| Bar Coding | 11% | 8% | 6% | 15% | 40% |
| Smart Cards | 0% | 0% | 10% | 14% | 76% |
| Radio Frequency ID | 3% | 6% | 0 | 6% | 85% |
| Enterprise Resource Planning Systems (ERP) | 4% | 4% | 2% | 11% | 79% |
| Hand Held Computers | 2% | 4% | 19% | 19% | 56% |
| Electronic Data Interchange (EDI) | 31% | 6% | 0% | 4% | 59% |
| Extensible Mark-Up Language (XML) | 0% | 0% | 6% | 14% | 80% |
| Electronic Funds Transfer (EFT) | 9% | 13% | 43% | 13% | 22% |

Table 2 – Use of particular technologies in sales/purchasing

Concerns over Web-based Communications

A key concern globally to the effective use of EC is the reluctance to use the Internet mainly due to security and broadband issues. The sample was divided in opinion as to whether their involvement in EC and the use of the Internet was expected to change within the next 3 years. Over 55% of the sample were concerned about the adoption of a web-based strategy for future B2B purchasing transactions. The sample were asked to categorise the level of their concern in regard to particular issues associated with web-based communications. Table 3 summarises the respondents' main concerns.

| Concern | Most Concerned | Moderately Concerned | Not Concerned |
|---|-----------------------|-----------------------------|----------------------|
| Lack of awareness or knowledge of Internet capabilities | 4% | 59% | 37% |
| Customer / supplier may not possess adequate eBusiness capabilities | 59% | 31% | 10% |
| Lack of available funding | 0% | 64% | 36% |
| Total costs | 30% | 52% | 18% |
| Security of sensitive data | 72% | 17% | 11% |
| Interoperability between transaction parties | 57% | 39% | 4% |
| Legal implications | 48% | 34% | 18% |
| Training and inability to use technology | 11% | 71% | 18% |
| Need for critical mass buy-in | 36% | 50% | 14% |

Table 3 – Concerns over web-based communications

The main concerns of the sample included security of sensitive data; customer/supplier not possessing EB capabilities; interoperability between transaction parties and legal implications. Less concern was given to knowledge awareness and lack of available funding. Many respondents included the lack of broadband in Ireland as an additional concern.

Driving Forces to apply existing technologies in construction purchasing

There was broad agreement among the survey returns regarding the significance of driving forces identified in the survey. Table 4 presents the results in ranking order of importance. Client persuasion or perceived threats by competitors who may have applied such technologies were, surprisingly, not considered to be major driving forces. However, all other driving forces met with either agreement or strong agreement. Reduced paperwork, savings in manpower and fewer errors in recording and handling information ranked higher than issues such as service differentiation and the position of competitor organisations all ranked highly. This indicates that ICT is perceived as a tool for cost reduction, rather than as a strategic issue within the industry. Given their frequency, it is suggested that reduced paperwork, avoidance of re-keying, error reduction, man-power saved, and reduced costs of capturing data are grouped as the most significant overall driving forces.

However, it is important to recognise that this survey was targeted at IT managers and not senior management, therefore strategic driving forces were not considered in this part of the survey.

| Rank | Driving Force |
|-------------|---|
| 1 | Reducing paperwork (orders, invoices and delivery docket) |
| 1 | Saving manpower in processing invoices and other information |
| 2 | Fewer errors in recording and handling information |
| 3 | Reduced cost of capturing data |
| 4 | Avoidance of re-keying information into computer systems |
| 5 | Improved accessibility to time and cost data: providing real time information |
| 6 | Service differentiation from competitors |
| 7 | Ability to contribute to data interchange in a national standard format |
| 8 | Clients who may encourage or stipulate the use of ICT in purchasing |
| 9 | Competitor organisations who may have applied ICT in purchasing processes |

Table 4 – Overall sample ranking of driving forces for adoption of exiting technologies

Barriers within organisations

Respondents were asked to rank the order of importance in respect to the perceived barriers to the adoption of EC within their organisation. The perceived importance of barriers followed a common pattern across the respondents. Table 5 indicates the barriers identified as being important in ranking order. Respondents tended to disagree with the suggestion that employees are likely to resist the introduction of new technology and neither agree nor disagree that uncertainty about how to measure the costs and benefits is a major barrier against adoption. Perhaps unsurprisingly, development costs and

reliability issues were considered to be particularly important barriers within organisations with a lower existing level of general ICT utilisation.

| Rank | Organisational barrier |
|-------------|--|
| 1 | Potential benefits of electronic purchasing are not likely to be sufficient to justify investments |
| 2 | Development costs are prohibitive (hardware, software and training) |
| 3 | Uncertainty about how to measure the costs and benefits of such investments |
| 4 | Employees are likely to resist the introduction of new technologies |
| 5 | Technology is not yet reliable enough for use in construction environment |
| 6 | A lack of awareness of ICT deployment in purchasing |

Table 5 – Ranking of barriers which undermine the use of ICT in construction purchasing within sample

Barriers within the construction purchasing supply chain in Ireland generally

Respondents were also asked to rank the order of importance in respect to the perceived barriers to the adoption of EC within the Irish construction industry. Again, there was common agreement in the survey concerning the general factors in the industry, which undermine the use of ICT in construction purchasing. Table 6 presents the results in ranking order of importance.

| Rank | Industry barrier |
|-------------|---|
| 1 | There is a general lack of awareness of ICT capabilities in construction purchasing and its potential benefits to the Irish construction supply chain |
| 2 | The temporary nature of relationships between organisations results in an unwillingness to invest in ICT which may only be short lived |
| 3 | There is no motivation for organisations to apply ICT in construction purchasing when other parties will benefit |
| 4 | There is a high incidence of technologically conservative organisations in the Irish construction industry |
| 5 | There are too many construction products and components to make the adoption of ICTs in construction purchasing widespread |
| 6 | There is a general lack of leadership from the government to actively promote the use of ICT in construction procurement |

Table 6 – Overall sample ranking of barriers against adoption of ICT within construction purchasing in Ireland

Respondents tended to disagree with the suggestion that there were too many construction products and components to make the adoption of ICT in construction purchasing widespread. Surprisingly the sample did not feel there was a general lack of leadership from the Irish government to actively promote the use of ICT in construction procurement. A general lack of awareness of the ICT capabilities and benefits to the Irish construction supply chain, the temporary nature of B2B relationships and an unwillingness to invest to the betterment of others were the main barriers concerning the sample.

Future directions

This part of the survey focused on the respondents position in regard to statements as to the likely future direction of EC in the Irish construction industry. The results revealed either agreement or strong agreement with almost all of the future directions aimed at encouraging adoption of electronic purchasing. Table 7 summarises the results. Significantly, issues concerning the level of awareness of the benefits of deploying existing technologies and the willingness of the parties in the supply chain to embrace ICT in purchasing transactions were considered to be of relatively low importance within the overall sample. The importance of the introduction of industry standards for electronic data interchange, the increase of ICT literacy and familiarity with electronic purchasing and the involvement of EC for improving the efficiency and effectiveness of the supply chain were considered to be the highest ranking issues among all respondents.

| Future directions | Strongly Agree | Agree | No Opinion | Disagree | Strongly disagree |
|--|----------------|-------|------------|----------|-------------------|
| There is a general awareness of the benefits of deploying existing technologies in construction purchasing processes | 2% | 35% | 13% | 42% | 8% |
| A construction industry standard should be introduced for electronic data interchange in business-to-business transactions | 24% | 58% | 8% | 8% | 2% |
| There is an increase in IT literacy and familiarity of electronic purchasing | 2% | 73% | 11% | 14% | 0 |
| There should be a longer term relationships between supply chain organisations | 15% | 60% | 13% | 12% | 0 |
| Closer collaboration is required between contractors and suppliers | 20% | 67% | 7% | 3% | 3% |
| Main contractors should stipulate the use of electronic purchasing in future business-to-business transactions with suppliers | 4% | 44% | 23% | 21% | 8% |
| Time consuming and inappropriate search methods for the mass of information available on the Internet, discourage one from making full of the technology | 6% | 45% | 21% | 23% | 5% |
| Involvement in e-business is of vital importance for improving efficiency and effectiveness along the supply chain | 11% | 56% | 20% | 13% | 0 |
| Customers/Manufacturers/Suppliers are very keen on doing business with our company electronically via the Internet | 2% | 27% | 23% | 40% | 8% |

Table 7 – Overall importance of future directions for adoption of electronic purchasing

RECOMMENDATIONS

Increased awareness within the Irish construction industry is likely to be the key factor in encouraging wider uptake of EC technologies. An industry wide education initiative, which combines the results of a pilot initiative with dissemination of information within the technical press, could, in part achieve this goal. Such an initiative would most

fruitfully comprise of a special interest group to pilot test the technology (Gunnigan et al, 2004). Particular effort should be made to increase awareness of EC technologies among contractors and suppliers with lower levels of ICT utilisation (Hore and West, 2004 and Hore et al, 2004).

Influential organisations (who have the power to enforce the use of technology on a project-wide basis) should also be made aware of the potential benefits of electronic purchasing. Such organisations would include larger contractors and clients who have an ongoing interest in construction. In retailing, a relatively small number of large influential retail outlets were able to exercise sufficient pressure to ensure the adoption of electronic purchasing on an industry wide basis. In construction, such an approval would require the cooperation of many small contractors and suppliers, for whom the required level of capital investment could represent a significant cost to their businesses. Common technological and operational guidelines or protocols would play a crucial role in easing the application of electronic purchasing.

The Construction Information Technology Alliance (CITA), which represents all the sectors of the Irish construction industry, is well positioned to oversee the development of such guidelines (Thomas and Hore, 2003). This body should address a number of issues including standards for EC techniques, EDI standards such as the use of eXtensible Mark-Up Language (XML) messaging, facilitation of pilot projects, as well as recommending procedures for implementing the technology at an organisational level.

Esoteric applications like auctions, complex choreography of interactive messages and point-and-click catalogue technology are not practical applications for the Irish construction industry. The biggest savings from eBusiness can be achieved from exchanging orders and invoices electronically. B2B savings can be realised on the elimination of duplicate data entry by achieving a 3 way match of the purchase order, delivery advice note and the invoice.

CONCLUSIONS

The results of this survey suggest that the overall use of ICT in construction purchasing in Ireland is very low at present. It also revealed that ICT deployment is greater among the suppliers surveyed. There was a positive correlation between EDI utilisation and turnover. There was considerable concern within the sample in respect to the adoption of a web-based strategy in construction purchasing, due to the perceived lack of security of transaction data and lack of broadband facilities across the country.

Reduced paper volumes, error reduction and manpower savings were ranked as the most important driving forces for applying ICT in construction purchasing. The lack of clarity as to the potential benefits of electronic purchasing and the prohibitive costs associated with implementation of such technology were considered to be the major barriers within organisations to the greater deployment of electronic purchasing. Increased awareness and the introduction of industry standards were seen as the most important future

directions which would encourage the greater use of electronic purchasing. Other important issues included the need for increased ICT literacy skills within the workforce and the fostering of long term relationships between organisations within the supply chain.

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