

# CHALLENGES OF TECHNOLOGY AWARENESS FOR LARGE MULTIDISCIPLINARY CONSULTANCIES

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A survey within a large multidisciplinary consultancy was conducted in 2008 examining the role and experience of some 1000 designers, the tools they used to carry out their work and their appreciation of the direction in terms of technology change being taken by the Architecture, Engineering and Construction industry. The survey revealed significant divergence from where the innovators such as the International Alliance for Interoperability perceived the industry should be heading, to how the designers and managers executed their work and the processes used for information sharing. Key findings from the survey identified that self perception of capability from users of design tools differed markedly from the level of training they had received. In addition use of industry standards for design processes and awareness of technological trends was very low implying both poor willingness to research emerging trends by the respondents and possibly ineffective communication from technology vendors and thought leaders. The target audience requiring change effort to mitigate issues revealed by the survey is identified in the conclusion.

Keywords: design standard, collaborative working, interoperability, training, CAD.

## INTRODUCTION

The Architecture, Engineering and Construction (AEC) sector has seen significant technological change over recent years. Organisations such as the Construct IT, the International Alliance for Interoperability (IAI), Constructing Excellence, and British Standards Institute (BSI), as well as software vendors have advocated collaborative information sharing, exploitation of new technologies and adoption of standards.

The take up has however been relatively poor with frequent criticism that the industry is unwilling to change. For example the 2004 study by the U.S. Department of Commerce, National Institute of Standards and Technology [NIST 2004] estimated that at least \$15.8B was lost annually due to the lack of interoperability, resulting in the establishment of a committee to create the National Building Information Model Standard (NBIMS) by the National Institute of Building Standards (NIBS) in February 2006.

The IT department within a large multidisciplinary consultancy was aware of the industry and technology trends but similarly appreciated the challenges that existed relating to take up of collaborative working and new technology adoption [Suchocki 2006]. An opportunity to achieve cost savings as well as potential service improvements by rationalising the installed CAD (computer aided draughting/design) product base was proposed, through the adoption of appropriate new processes and tools by a smaller user base.

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To achieve this rationalisation, the geographic dispersion of the organisation and historic procurement processes meant that a survey of the user community was identified as the most practical method to correctly understand the installed estate of products and design activities by users. Alternate engagement models with the business were reviewed, but more direct interaction was ruled out due to geographic dispersion as the organisation had over 100 offices and sites within the UK, some 10 locations internationally and an estimated 5000 potential participants within the design process to consult. Furthermore internal IT Business Partners as well as CAD suppliers had experienced resistance from both Management and CAD software users when promoting the adoption of alternate tools or processes, attributed to lack of trust in the intention of vendors and a perception that IT specialists are viewed as insufficiently knowledgeable to advise designers on best practice.

## **SURVEY OVERVIEW**

### **Audience**

The multidisciplinary organisation had a mixed target audience of individuals engaged in design services. The majority of employees operated within the civil engineering sector, but in addition included geospatial specialists, property designers, and specialists in a variety of engineering analysis services.

In order to capture awareness of technological trends across organisational hierarchies, the survey audience was also deliberately not limited to CAD technicians or 'power' users, but also targeted at engineers, architects, managers and directors engaged in the delivery of design services.

### **Structure**

The survey was divided into a number of sections some of which were made optional in order to be answered only by those to whom the questions might prove relevant. The areas surveyed included:

- Tenure
- Technical affiliation
- Level of responsibility
- Role Focus (grouped as either civil engineering, geospatial, architectural, building services, or structural)
- Weekly effort by design activity
- Design Data sharing activity
- Design products used
- Analysis products used
- Standards adhered to
- Interoperability issues
- Product capability
- Training history
- Openness to change
- Opinion on 3D CAD
- Awareness of emerging technology trends
- Primary motivators
- Membership of internal CAD forum

## KEY FINDINGS

The survey was launched in late July 2008 and closed at the end of August 2008. The estimated potential number of respondents was between 1500 and 2500 employees, dependant on whether the employee considered their participation in the design process being active or passive (typically managers, who may not have volunteered participation, but were seen as target respondents).

A final total of 921 individuals responded to the survey. Table 1 shows the mixture of respondent roles, which shows the majority to be in either a professional technical role, as a manager of designers or as technical CAD specialist. Table 2 identifies the respondent tenure in the organisation, with the majority having worked for less than 3 years; however some 40% of respondents had over 3 years service.

*Table 1: Respondent Role within the Organisation*

| Role of Respondent | Senior Managers or Directors | Managers | Architects or Engineers | Technical CAD Users | Other |
|--------------------|------------------------------|----------|-------------------------|---------------------|-------|
| No. of Respondents | 44                           | 210      | 424                     | 200                 | 128   |

*Table 2: Tenure of Respondents*

| Tenure in the company | <1 year | 1 to 3 years | 3 to 5 years | 5 to 10 years | >10 years |
|-----------------------|---------|--------------|--------------|---------------|-----------|
| No. of Respondents    | 263     | 296          | 140          | 155           | 67        |

Approximately half the respondents answered the whole set of questions, whilst others bypassed a proportion of the questions due to their level of design activity or a lack of question relevance. From those who answered the full survey more than 1 hour per week was spent by around 300 users of engineering or architectural CAD tools, 100 analysis specialists, and by 60 GIS specialists.

### Capability vs Training

The survey results provided interesting contrasts, not least of which compared how the respondents evaluated their own capability against the amount of training they had received.

Figure 1 shows that despite reporting little or no training in the preceding 3 years, around one third of the respondents felt that they were experts or CAD champions. This implies either excellent on the job training or an over statement of the level of understanding by the CAD users.

Interestingly, despite the high opinion of their own capability the vast majority respondents believe they would benefit from specialised technology based training as detailed in Table 3. This is conflict with the above information showing little training provision to designers in the preceding 3 years.

### Innovation appetite vs Industry Trends

The lack of training is backed up by a similar poor awareness of technology trends. Figure 2 shows that nearly two thirds of respondents claimed to be completely unaware of Building Information Modelling (BIM) or use of the Industry Foundation Class (IFC) open data standard for interoperability [IAI 2006]. Positively, the vast majority would welcome the adoption of innovative technologies.

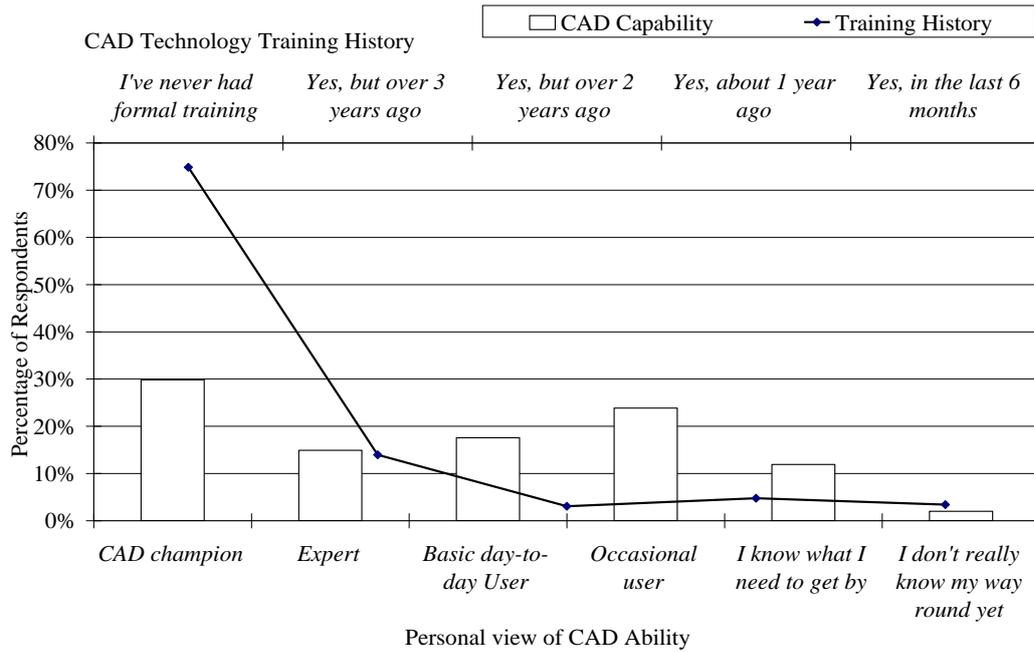


Figure 1 CAD Capability vs Recent Training History

Table 3 Expect benefit from receiving specialised technology based training.

| Strongly Agree | Somewhat Agree | Neutral | Somewhat disagree | Strongly disagree |
|----------------|----------------|---------|-------------------|-------------------|
| 182            | 208            | 119     | 29                | 23                |

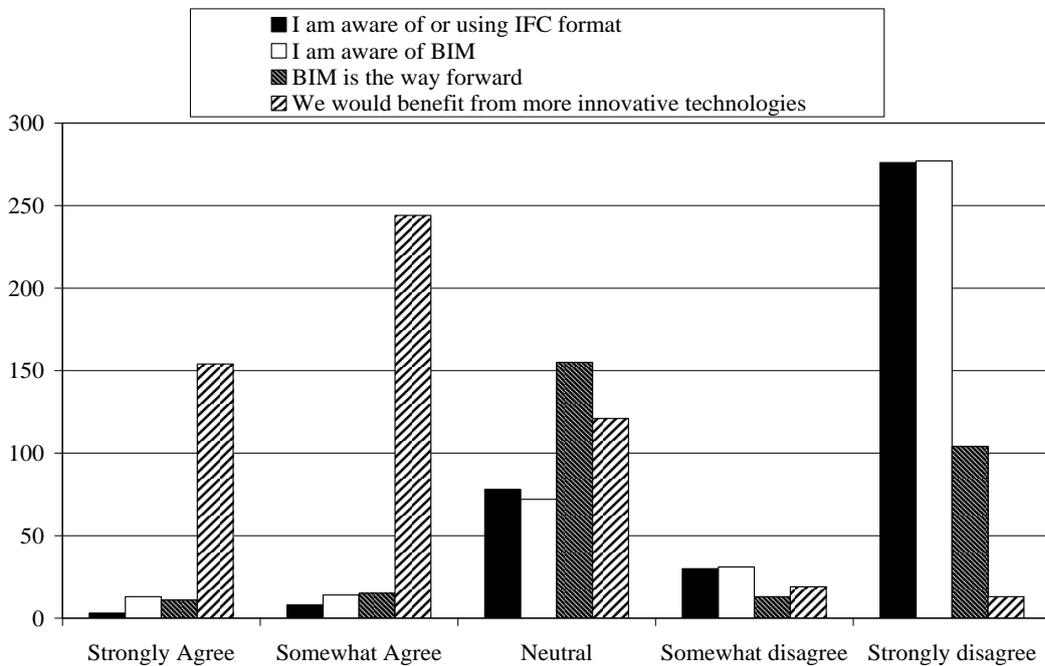


Figure 2 Respondent Awareness of BIM and IFC contrasted with Innovation Demand

Further questioning was made against openness to change shown in Table 4 and opinion on 3D CAD in Table 5.

Both returned the expected majority positive view from respondents, however it is telling that over 10% were ambivalent or resistant to change and 20% remained

unconvinced by the value of 3D suggesting a view that 3D CAD might add effort with no obvious benefit, or perhaps that it only provides value in visualisation as opposed to functioning as a key modelling tool in the design process.

*Table 4: Respondent openness to change*

|   |     |
|---|-----|
| Very open (we should always be looking to evolve) | 591 |
| Don't care either way                             | 40  |
| Prefer to stay as I am thanks                     | 32  |

*Table 5: Perception of 3D CAD*

|   |     |
|---|-----|
| Brilliant, can't see how we can live without 3D                       | 112 |
| Being able to use 3D in design would help                             | 358 |
| It's alright but can't see how 3D will help                           | 96  |
| Not worth the hassle, I can't see what the hype and fuss is all about | 22  |

Further analysis of the responses has revealed that over 25% of those who were not open to change and nearly 30% of those who had a negative view on 3D CAD were in senior management positions, with 58% and 85% respectively of those senior managers having over 3 years service. This suggests that enthusiasm for change and adoption of 3D CAD is predominantly within the user base, whereas Senior Managers and Directors prefer to rely on known processes and tools to achieve required project and business outcomes.

### **Adoption of Standards**

The survey examined the degree to which respondents were aware of industry standards and the extent of their adoption within design processes. Figure 3 shows that the vast majority of respondents used in house or client/project standards. Use of the widely adopted, but now superseded BS 1192:1998 [BSI 1998] and its replacement BS 1192:2007 [BSI 2008] was extremely low, as was the use of BS EN ISO 13567-1:2002 [BSI 2002] or the CPIC Uniclass [CPIC 2003] naming conventions. Disconcertingly more respondents claimed to use their own standards than the sum of those who stated they used industry standards.

It is probable that the users of inhouse or client/project standards were in fact using a variation on BS1192:1998 as this CAD standard would have commonly been used as the basis for inhouse standards. However the results suggest it is highly unlikely that the respondents are unaware of this practice.

Despite the low awareness of current technology trends and use of industry standards there does not appear to be a strong belief that the organisation was lagging behind its competitors. When questioned if competitors were able to deliver like for like services more efficiently Table 6 shows that there was a bias towards agreement, however the majority were neutral suggesting they believed other organisations were at a similar level of maturity.

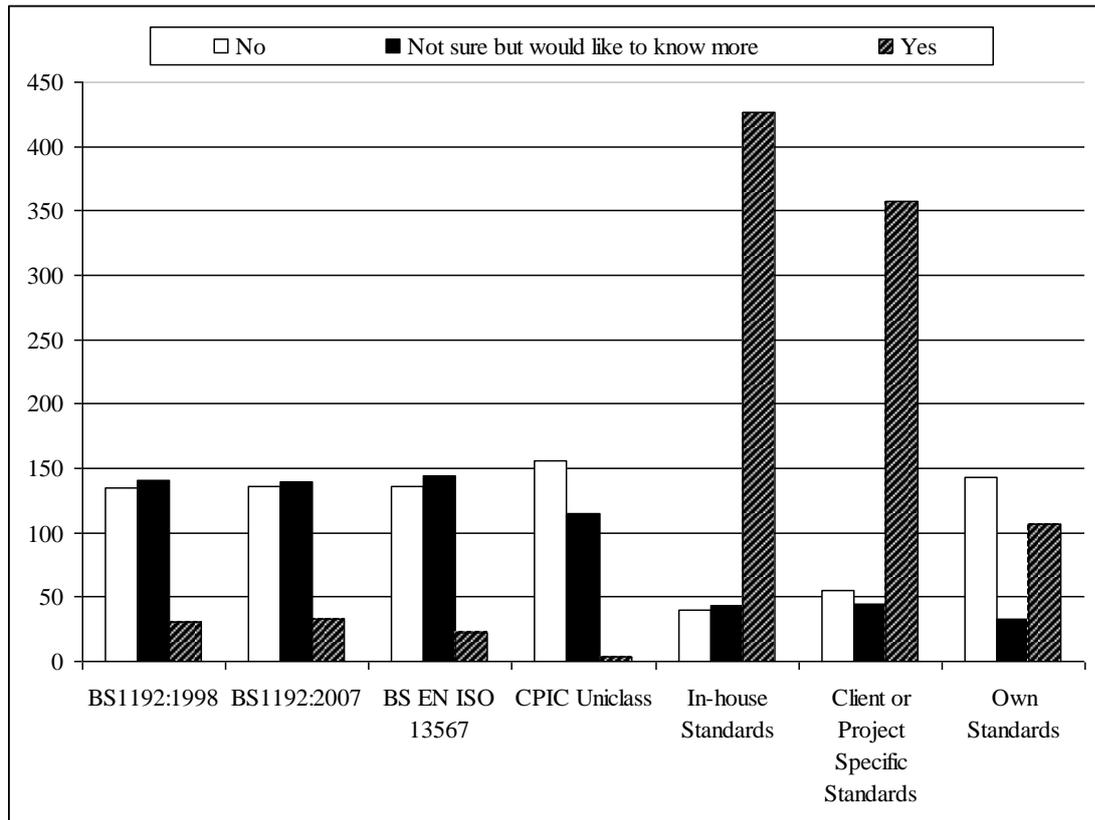


Figure 3 Standards Awareness and Adoption

Table 6: Opinion if competitors delivered services more efficiently

| Strongly Agree | Somewhat Agree | Neutral | Somewhat disagree | Strongly disagree |
|----------------|----------------|---------|-------------------|-------------------|
| 59             | 117            | 256     | 72                | 29                |

## CONCLUSION

The presented findings cover only a small proportion of the areas questioned, and further analysis of the survey is being carried out; in particular to identify suitable candidates who may be in a position to utilise new design products within the civil engineering, architectural and GIS verticals. However it is evident from the results that the industry faces significant challenges in adopting new working procedures, emerging technologies and industry wide standards.

There is a possible correlation of factors that has led to this state. Only 8 senior managers or directors from 44 and 94 managers from 210 had service of less than 3 years. This suggests that their ability to manage design processes would therefore have relied on organisational experience and traditional models rather than exploring new approaches to work, or bringing in experience from outside. This would then lead to a low investment in employee training as the business benefit was not apparent coupled with the resultant low awareness of technology trends. Training is however stated by designers as a key omission in their personal development and hence barrier to effective adoption of new technologies and processes.

Hence, it is the managers of design and business leaders that are the audience most in need of increased awareness of the new trends. The appetite to introduce innovation,

3D modelling and embrace change clearly exists amongst the consulted respondents contrasted with a distinct indication that the Senior Managers and Directors, and particularly those with over 3 years tenure, were more likely to be reticent. Given that change will only be realised if design management processes and risk evaluation encompass new standards such as BS1192:2007, it would be inappropriate to devote significant additional effort to promote the technology improvements to the users of CAD tools, but rather that clear identification of the benefits, adoption examples and process standards is needed in the first instance to educate their managers. This recommendation strongly supports a current initiative by the BSI B555 Technical Committee for construction design and modelling that is preparing an Executives Guide to BIM as well as a document providing strategic Guidance for BS 1192:2007.

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