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## AN INVESTIGATION INTO THE LEGAL ISSUES RELATING TO BUILDING INFORMATION MODELLING (BIM)

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### ABSTRACT

The UK Government Construction Strategy stipulates all Government construction projects need collaborative Level 2 BIM incorporated by 2016. The UK Government considers this will deliver improvements. However, literature identified significant legal issues stifling BIM implementation, including Design and Software Liability. A knowledge gap exists in the ranking of these issues. A web-based survey of the top 100 UK construction companies provides empirical data. Findings revealed the top five legal issues relating to BIM adoption, in order of importance, are; Model ownership, Incorporation of BIM into the contractual relationship of the parties involved. Design liability, Reliance on data and the Evolution and responsibility of model. Design responsibility, Lack of standardisation, litigation and protocols, Collaborative working, the Role of BIM co-ordinator and Sharing of copyrighted data, are the top five ranked design liability issues. The high ranking of these issues still raises concerns and contrasts with the BIM working group's findings that little change is required in the fundamental building blocks of copyright law, contracts and insurance to facilitate working at Level 2 of BIM maturity. Furthermore, industry findings reveal that interoperability between parties, compatibility, security issues, data transfer and collaborative working were ranked as the top five software liability issues.

Keywords: BIM, Legal issues, Ranking, Government procurement.

### INTRODUCTION AND CONTEXT

Succar (2009) defines BIM as “a set of interacting policies, processes and technologies generating a methodology to manage the essential building design and project data in digital format throughout the building’s life-cycle.” Arayici et al (2011) state that government policies ensure the building industry provides value for money, sustainable design and construction, all of which can be delivered through the use of BIM. However, as the 3D modelling capabilities and associated information schemas are becoming more complex, there has been a worrying growth in legal fears which may be acting as a hindrance on BIM’s wider implementation within the construction industry (Arensman and Ozbek, 2012). The legal barriers to BIM need to be addressed in order that BIM implementation progresses to meet the UK government’s 2016 target. If these are addressed through legislation or protocols, the

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users will perceive that they are no longer a barrier leading to greater implementation. As BIM is becoming more common, changes to contract documents to incorporate its use are also becoming more common. The use of BIM has changed the dynamic and has therefore produced concerns for organisations in relation to legal issues (Larson and Golden, 2008). Udom (2012) indicates that legal issues may differ between the different BIM maturity levels specified in the BIM working group document and therefore there is the need to produce protocols and guidelines which will address these issues. Currently, addendums to the standard conditions of contract mean it is possible to implement clauses to cover the different stages of BIM development meaning legal updates are incorporated contractually (Udom, 2012). The aims of this paper are to identify barriers from literature and to rank them in order of importance to assist in managing BIM implementation. The barriers were derived as follows.

### **Model ownership**

Arensman and Ozbek (2012) highlight the issue of who will own the final model after the completion of the project, a definition that is used for this research. At completion the client or owner of the project will want to own the model after completion for facilities management purposes (Hamil, 2011). Traditionally in construction designers have intellectual rights to their project designs and as a result they are often reluctant to permit the use of the model by others. Therefore some argue that as BIM does not change the inherent principles of design, ownership should lie with the designer (Hurtado and O'Connor, 2008). This is supported by Arensman and Ozbek (2012) who suggest the legal principle is that whoever creates the project model will own it. However, as the BIM model is worked on by a number of different organisations in collaboration it is not necessarily clear who this actually is. Therefore AIA (2007) and Bedrick (2006) suggest as the BIM model is produced by collaboration, ownership of the final model belongs to the client. This creates legal difficulties as the BIM model contains information from different parties and each wish to retain the intellectual property rights to the model that they contributed to (Larson and Golden, 2008). The loss of control over the design becomes a legal barrier to the implementation of BIM.

### **Incorporation of BIM into the contractual relationship of the parties involved; Shifting of risk; and Lack of standardisation, litigation and protocols**

Construction contracts are designed to allocate and assign the balance of risk, responsibility and reward. Getting the form of contract correct is an essential precondition to the accomplishment of a project (Tolson, 2007). Realising that BIM produced vastly different contractual needs, the Construction Industry Council (CIC), supported by the BIM Task Group, has produced a Standard Protocol for use in projects using BIM (Construction Industry Council and BIM Task Group, 2013). The rationale was to provide a legal addendum to support BIM use on all Level 2 BIM projects. The Protocol aims to make as few changes as possible to the pre-existing contractual arrangements on projects, along with acting as a contractual document which takes preference over existing agreements (Construction Industry Council and BIM Task Group, 2013). Mosey (2014) further examines the process of entering into the contractual relationship showing that the Early Contractor involvement procedure is more suited to BIM contracts than single stage tendering. The procurement route chosen then affects the use of BIM. Separately, the ICE (2013) published a guide on how to use BIM with NEC3 Contracts alongside the CIC BIM Protocol (ICE, 2013). The British standard, PAS1192:2, helps provide guidance on BIM adoption and its requirements which are associated with projects being delivered using BIM (British Standards Institution, 2013). While this provides a means of incorporation, it shows a

lack of standardisation of approach to the problem which has not been settled by case law. The legal system has not tested the standards and protocols, meaning a lack of 'case law' exists for guidance during disputes.

### **Reliance on data**

Arensman and Ozbek (2012) identify the issue of the reliability of the information in the model on which the different parties depend. Al-Shammari (2014) indicates that Level 2 BIM models may be corrupted during the transfer between the design team. The resulting corruption can cause conflicts between the parties but is hard to detect. Furthermore the vulnerability of that data is highlighted by Olatunji (2010) who considers the issue of liability in cyber security. Electronic files are still vulnerable to worms and viruses, data theft, snooping and hacking (Olatunji, 2010).

### **Evolution and responsibility of model**

Throughout the period of design the BIM model progresses in development. As the design progresses there are different inputs of data within the BIM model and the management of the model must be such that responsibility is distributed to the correct party (Lip, 2012). Design professionals and contractors may point the control of the model to the lead designer, but this makes that person responsible when problems arise with the model and information related to the project. According to Sieminski, (2007) it is often difficult to determine the responsible party for an error, as different persons and organisations have the ability to change data during the BIM process.

### **Intellectual Property (IP) Rights and Sharing of copyright data**

Collaboration is the main driver for BIM implementation (Eadie et al., 2013). Yet legal concerns relating to co-operation of industry professionals remains problematic (Bryde, et al., 2013). Sharing the BIM model, whilst not restricting the flow of information to other members of the design team and the client, during the design process, results in plagiarism of ideas and designs. Bryde, et al., (2013) state this is due to a lack of protection awarded to ownership and IP rights of BIM generated data.

### **The alteration of standard form appointments**

Udom (2012) explains that having the BIM protocol as a stand-alone document can be important due to the possibility of conflict occurring between the protocol and the clauses of the principal contract. This can result in disputes.

### **Claims / Disputes and Additional project insurance**

BIM is a relatively recent addition to construction industry practice and therefore new to legal and contractual issues, insurance barriers have not been fully developed, thus leaving a knowledge gap in terms of what is insurable or non-insurable with regard to BIM (Sieminski, 2007). Sieminski (2007) further explains that the use of BIM should not raise liability issues; although there may be initial concerns to the extent that model generated information could be seen to be an input into construction means and methods. Matthews (2011) provides details of a recorded legal case regarding BIM. The case involved a life sciences building in the United States of America where the mechanical, electrical and plumbing (MEP) engineer did not inform the contractor about the ventilation ducting construction sequence. As a result, the contractor, who worked off 2-D drawings despite the availability of the MEP BIM model, ran out of space with only 70% of the sequence complete. A multi-million dollar settlement was reached out of court between the different parties (Matthews, 2011). This highlights that claims and disputes still arise with BIM. They can be contested separately as in this case or under design liability or software liability. Any consultants who are

working under a system where a third party has access to, and can modify, information models ought to inform their brokers and insurers as they may need additional policies (Earley, 2013). This insurance can cover errors and design liability.

### **Standard of care**

Another concern that Arensman and Ozbek (2012) identify relates to the standard of care that an architect must use. Designers are required to accomplish their duties to the client in line with what the client would expect from a reasonably competent designer. BIM is seen as becoming the new standard within the construction industry, and with this change, the standard of care will also need to be modified. This potentially leads to clients having a higher expectation in regard to the skill and care that is undertaken by architects on a given project.

### **BIM compensation**

The last issue that Arensman and Ozbek (2012) raise relates to the compensation for the parties using BIM, along with the value which is added when adopting BIM on a project. As BIM will save the client money due to the decrease in variations as the BIM process highlights clashes within the model. However, there are currently no financial incentives for parties to adopt BIM on a project. Post (2006) suggests professionals are attempting to quantify the value added through BIM adoption in previous in order to attempt to gain financial compensation.

### **Breach of duty to warn**

Sinclair (2013) shows that in a BIM environment it is particularly important that the ‘duty to warn’ is carried out when potential dangers on site or obvious errors in the design/specification of another consultant become evident.

### **Design liability**

There are many issues around design liability: Design responsibility (Glover, 2012; Lip, 2012), Lack of standardization and litigation and protocols (Construction Industry Council and BIM Task Group, 2013), Collaborative working (Dossick et al. 2009), Role of BIM co-ordinator (Glover, 2012) and sharing of copyright data (Wheatley and Brown, 2007) have been issues previously linked to this issue by previous research. These result in claims and disputes and insurance difficulties. This paper ranks these issues for the first time in Table 2.

### **Software liability**

Software liability is a multifaceted problem that affects BIM adoption. Previous literature has linked the following issues to it: Interoperability between parties involved (Lip, 2012; Eadie et al, 2014), Compatibility (buildingSMART, 2012), Security issues (Mahamadu et al.,2013), Data transfer (buildingSMART, 2012), Collaborative working (Dossick et al. 2009), Lack of standardisation, litigation and protocols (Construction Industry Council and BIM Task Group, 2013), Software malfunction , and Sharing of copyright data (Wheatley and Brown, 2007). This paper ranks these issues for the first time in Table 3.

### **RESEARCH METHOD**

The empirical data was gathered via an online LimeSurvey™ questionnaire. LimeSurvey™ is an online survey programme that allows the user to manage the survey from a web-interface. As BIM implementation is being implemented by construction contractors, the sample was limited to the top 100 in the UK according to the Construction Index turnover column (Hood, 2013). These organisations were contacted as they best represent the leaders of the UK construction industry and are

involved with complex jobs. The UK BIM Strategy highlights their contribution as they can wield great pressure on companies further down the supply chain (Efficiency and Reform Group, 2011).

Each company was contacted by email, telephone or through the business orientated social networking web site, LinkedIn, to determine whether they would be willing to participate in the survey. Out of the 100 companies, two organisations were automatically ruled out due to firstly, an amalgamation with another company on the list and a winding up petition ordered against a further company. From the 98 remaining, 22 said that they did not have the expertise to partake in the survey and 39 said it was against company policy to participate. A further 17 companies did not respond through the LinkedIn and email advances and the receptionist refused to allow contact. This left 20 organisations that were emailed access to the online survey. If a response from a willing participant was not received within a week then post-notification was carried out through a reminder email. Responses were received from 13 achieving a response rate of 65%.

The Relative Importance Index (RII), a standard way of ranking elements, was adopted to determine each participant's ranking on the different legal issues surrounding the adoption of BIM. This has been used previously in other research works to estimate the ranking of predictors (Chao, 2008). The closer the RII is to 1 then the more significant the barrier and/or issue is. An RII was calculated for each barrier/issue to provide an overall ranking. The RII is defined by the following formula;

$$Relative\ Importance\ Index\ (RII) = \frac{\sum W}{A \times N} \quad (0 \leq index \leq 1)$$

Where;

W is the weighting that is given to each issue by the participant. As rankings were based on a Likert scale of between 1 and 5, where 1 is the least significant and 5 is the most significant,  $\sum W$  will be the summation of the values between 1 and 5; A is the highest weight, in this study 5; and N is the total number of respondents.

## MAIN DISCUSSION

### Findings in relation to the ranking of Legal issues

Table 1 indicates that the top four legal issues relating to BIM adoption, in order of importance, are; Model ownership, Incorporation of BIM into the contractual relationship of the parties involved, Design liability, and Reliance on data.

**Table 1 Legal Issues Ranking**

Legal Issues	RII	Rank
Model ownership	0.734	1
Incorporation of BIM into the contractual relationship of the parties involved	0.716	2
Design liability	0.716	3
Reliance on data	0.7	4
Evolution and responsibility of model	0.7	5
Sharing of copyright data	0.667	6
Lack of standardisation, litigation and protocols	0.6	7
Intellectual Property (IP) Rights	0.6	8
The alteration of standard form appointments	0.6	9
Claims / Disputes	0.6	10
Shifting of risk	0.6	11

<b>Legal Issues</b>	<b>RII</b>	<b>Rank</b>
Standard of care	0.566	<b>12</b>
BIM compensation	0.566	<b>13</b>
Breach of duty to warn	0.55	<b>14</b>
Software liability	0.534	<b>15</b>
Additional project insurance	0.516	<b>16</b>

### **Findings in relation to the ranking of Design Liability issues**

Table 2 indicates that Design responsibility, Lack of standardisation, litigation and protocols, Collaborative working, and the Role of BIM co-ordinator are the top four ranked design liability issues.

**Table 2 Design Liability Issues Ranking**

<b>Design Liability Issues</b>	<b>RII</b>	<b>Rank</b>
Design responsibility	0.65	<b>1</b>
Lack of standardisation, litigation and protocols	0.634	<b>2</b>
Collaborative working	0.634	<b>3</b>
Role of BIM co-ordinator	0.6	<b>4</b>
Sharing of copyright data	0.584	<b>5</b>
Claims / Disputes	0.534	<b>6</b>
Insurance	0.516	<b>7</b>

### **Findings in relation to the ranking of Software Liability issues**

Table 3 shows interoperability between parties, compatibility, security issues, and data transfer were ranked as the top four software liability issues.

**Table 3 Software Liability Issues Ranking**

<b>Software Liability Issues</b>	<b>RII</b>	<b>Rank</b>
Interoperability between parties involved	0.734	<b>1</b>
Compatibility	0.684	<b>2</b>
Security issues	0.634	<b>3</b>
Data transfer	0.634	<b>4</b>
Collaborative working	0.6	<b>5</b>
Lack of standardisation, litigation and protocols	0.584	<b>6</b>
Claims / Disputes	0.584	<b>7</b>
Software malfunction	0.566	<b>8</b>
Sharing of copyright data	0.516	<b>9</b>

### **Conclusions**

This paper has produced a ranking of the legal, design liability and software liability issues relating to BIM implementation for the first time. It supports the findings of Larson and Golden (2008) by proving that model ownership was the biggest legal difficulty still to be fixed in relation to BIM. That the incorporation of BIM into the contractual relationship of the parties involved is ranked second shows that the existing protocols are not enough to meet all the legal requirements. Design liability is ranked third among the legal barriers it includes as its top three, in rank order; Design responsibility, Lack of standardization, litigation and protocols. The highest ranked Design liability barrier was design responsibility indicating that the work of Glover (2012) and Lip (2012) in finding a solution is really important. Interoperability between parties, compatibility, and security issues are the top three software liability



issues. The top ranking of interoperability corroborates previous findings of Eadie et al (2014). Further work needs to be completed to minimize the impact of barriers through changes to relevant legislation and protocols.

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