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A PRELIMINARY REVIEW ON THE LEGAL IMPLICATIONS OF BIM AND MODEL OWNERSHIP

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SUMMARY: *Building information modelling (BIM) promises some potentially radical benefits if adopted and correctly deployed on construction projects. However, significant literature evidence suggests that certain benefits of innovations such as BIM only become feasible and realizable when their legal frameworks are clear and implementable. Interestingly, existing legal frameworks for professional service delivery in architectural, engineering, construction and operations (AECO) industries are apparently biased to fragmented conventions than contemporary contractual risks in e-business. This, potentially, is a major concern against speedy adoption of BIM. Arguably, AECO industries have not remained static in the past years regarding the adoption of integrated technologies that enable creation and sharing of information across discipline boundaries. Moreover, integrated systems have a long history in construction which is not limited to BIM - there are other software applications that are being deployed to service integrated innovations and multidisciplinary business systems. Whilst the industry still struggles to improve on the speed of adopting and deploying these innovative technologies, the herculean task is how to create workable legal frameworks that will service the potential benefits being proposed in BIM. Some variables of contractual risks in changing technologies have been conceptualized in some recent studies; with recommendations on some useful modifications to conventional legal frameworks in e-contracting, which are not yet very definitive at present. This article reviews scholarly perspectives regarding legal implication of BIM adoption: ownership and control of BIM models, potential revolution in standard of care as a reaction to changes in processes and practices that are driven by past technologies. Professional liabilities in electronic and integrated project delivery systems are also discussed. In the end, conclusions are drawn on potential benefits of resolving these challenges.*

KEYWORDS: *building information modelling, contractual risks, duty of care, e-business, professional liability.*

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1. INTRODUCTION

Until recently, various elements of the construction industry (architectural, engineering, estimating, construction and operations - AECO) have raised some significant concerns on the limitations of 2-dimentional and entity-based tools. Hitherto, these issues are being raised in different perspectives, and have generated a wide range of polemical arguments mostly on technical rather than theoretical grounds. Specifically, some past studies express these limitations in terms of spatiality (e.g. (Jereb, 2009, Winch and Deeth, 1994)), while others link them to weakening the frameworks for facilitating and servicing certain goals of construction clients; including virtual visualization of projects and integrated building information systems throughout project life (Jeng and Eastman, 1998). Further to these, (McKinney and Fischer, 1998) have reported an unequivocal evidence on some limitations of entity-based CAD, including its inability to drive effective communication between different levels of end-users (including designers and other users), value integration and thorough collaboration amongst project teams.

As a workable alternative, a new tool – building information modelling (BIM) has been developed to trigger a potentially radical revolution in the industry, and this is being adopted in different parts of the world in slightly different patterns. According to (Olofsson et al., 2008), BIM reduces the gap between the construction industry and other industries that have used similar concept of digital technology to drive product performance with its unique characteristics. Available evidence in literature suggests that innovative attributes in BIM are unconventional, and these features are strongly anchored on effective collaboration between all parties that are involved in project life (Sher et al., 2009, Aranda-Mena et al., 2008). Technically, most reports on BIM mainly target its concept either as an introduction or implementation of new sets of strategies and procedures for electronic data management systems (EDMS) through different functions and stages in project life.

This study reviews BIM's facilitative attributes and its evident limitations in e-business models in construction. The ability of BIM to facilitate project performance as promised is being threatened by some lingering questions bothering on designing appropriate methodologies for bridging legal frameworks in conventional systems and similar provisions in BIM. Quite a significant number of studies have attested to this; suggesting that BIM implementation still has many unique challenges which may worsen in the future if they are not resolved quickly (Holzer, 2007). Whilst some studies focus on slow adoption of BIM and allied innovations as a vitally important challenge, others have seen the focal point of BIM as a question of workability rather than adoptability. For instance, (Aranda-Mena et al., 2008) reported some case studies to outline certain fundamental attributes that must be active before BIM benefits become realizable. The authors concluded that operators need appropriate business processes and skills to drive electronic data transfer and management, and must exhibit collaborative behavioural patterns, among others. To those, (Tse et al., 2005) and (Sher et al., 2009) have added the need to meet certain system requirements (hardware and software) and skill needs respectively.

2. INDUSTRY ISSUES ON THE LEGAL FEASIBILITY OF BIM IMPLEMENTATION

Available evidence from a recent survey as reported in (Ahuja et al., 2009) and a pool of market reports suggest that e-business is getting more popular in the industry. Moreover, (Luciani, 2008) surmised, based on a significant analogous corollary, that the era of e-processes has truly begun in many facets of practices in the construction industry. Specifically, past studies have outlined a number of unique possible benefits in BIM deliverables such as gaming and virtual reality, integrated delivery systems, automation and simulation, and how they aid e-processes (Bedrick, 2006, Ballesty et al., 2007, Hiremath and Skibniewski, 2004, Li et al., 2009). However, whilst it is still difficult to gauge and compare rates of intra-discipline adoption of e-processes, and the performance of allied strategies; it is possible to conclude that the use of manual and paper-based procedures and tools will become less attractive and fairly unmarketable as the world heads into an era of digital innovation. Our world is not just folding down its space and system of conducting information, it is also unfolding proactive opportunities to improve service quality and transaction outcomes. Yet, the gap between legal frameworks that service fragmented business models and proposed alternatives in electronic innovations is still a major concern (Engsbo, 2003). Existing legal frameworks in the industry have remained relatively unchanged for many decades; if at all any, the changes have not substantially addressed the dynamics of e-processes and allied digital

innovations. Consequently, to drive future and recent developments in the direction of change being triggered by e-innovations, existing legal instruments must be reformulated and strategically deployed to achieve all necessary goals as and when due.

BIM is many steps away from fragmented processes. There is clear evidence in literature regarding its attributes. Specifically, a recent survey reported by (Huang et al., 2009) shows that BIM is being used as a digital repository for integrated system whereby *players* are provided with platforms to contribute and share data, simulate and visualize possible outcomes during design, embed virtual objects with robust information at different stages and deploy several instruments of collaboration to drive project goals. To this, (Maher, 2008) added some facilitative attributes such as ability for multiple users to access project database and interact simultaneously thereby saving time and improving outcomes through *real time* communication. Ultimately, other studies (e.g. (Marshall-Ponting and Aouad, 2005, Gül et al., 2008, Bedrick, 2006)) have summarized how these attributes impact on the industry: it uniquely manage conflicts in inputs and automate updated reviews. According to these authors, it can also automate changes, be used and stored not only during design but throughout project life. Conclusion from this study, and supported by others, shows that BIM can animate designs in multiple dimension – never has this been possible in the history of construction development process.

Meanwhile, while the industry continues to explore extended potential benefits of BIM in different parts of the world, some issues have continued to emerge. For instance, as BIM adoption continued to improve, it is still slow (Azhar et al., 2008). Much effort is being invested into BIM adoption by many industry stakeholders. However, the overarching question is: can BIM deliver its technical benefits without adapting existing legal instruments, or possibly formulate new ones? Some problems with existing legal instruments in the industry have been outlined by (Campbell and Harris, 2005). Akin to this, a perspective that was reported in (Holzer, 2007) also suggest that BIM may not facilitate lasting solutions to the limitations of conventional fragmented processes unless apparent issues which are complicated by gaps in its legal frameworks and e-business models are addressed. Some of these challenges are identified Figure 1 below, and reviewed subsequently.

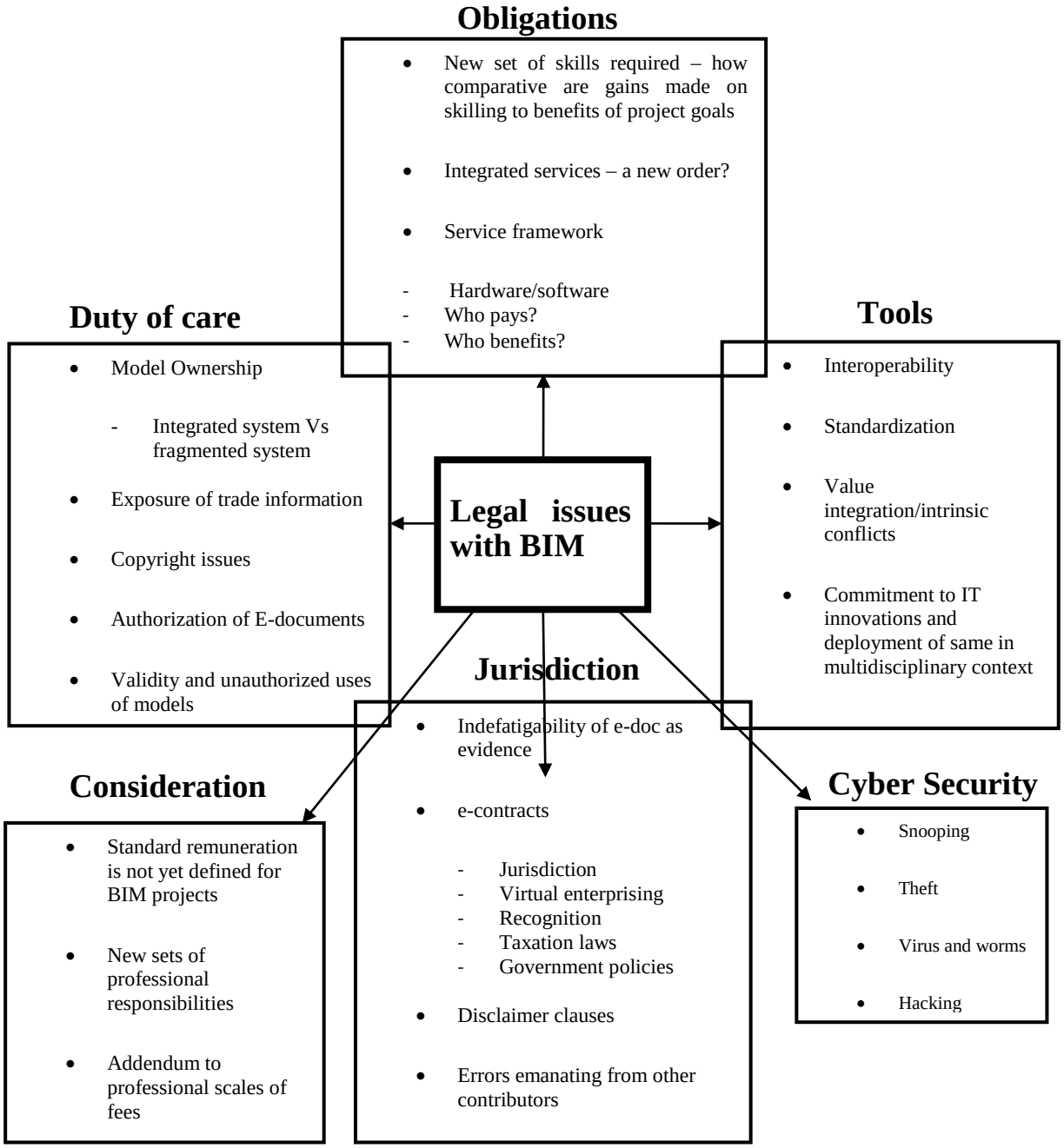

FIG. 1: A taxonomy of legal limitations in BIM

2.1 Tools and Duty of care: Model Authorship and Ownership

Inputs in conventional design systems are fragmented, and existing regulations regarding responsibilities and management of professional services are made to support this. Consequently, the focus of existing legal provisions on this is that input authors reserve most rights to issue, protect and be answerable to all issues arising from their services. It is not yet definitive from literature how independent ownership of inputs to project development processes contributes to the problems of fragmented processes. However, some studies have presented significant empirical evidence regarding how client involvement in design and construction processes may improve project performance (e.g. (Abrahams and Farrell, 2003, Kajewski et al., 2003, Kometa et al., 1995, Moses et al., 2008)). Similarly, the conceptualization of BIM has been hinged on its focus on clients, and its legal frameworks are being targeted at this as procedural strength. The American Institute of Architects (AIA) is one of the few professional organizations in the world that have formalized and documented legal regulations for digital design systems. Section 2.2 of AIA's E202 Document™ states:

> *In contributing to content of the Model* [BIM], *Model Element Author* [every participant in BIM integrated system] *does not convey any ownership rights in the content provided or in the software used to generate the content. Unless otherwise granted in separate license, any subsequent Model Element Author's and Model User's right to use, modify or further transmit the model specifically limited to the design and construction of the project, and nothing contained in this Exhibit conveys any other right to use the Model for another purpose.* (AIA, 2008)

Akin to AIA's position on model ownership as stated above, (Bedrick, 2006) argued that since BIM model is a product of collaboration, ownership of the final output (i.e. the design model) belongs to the client rather than designers' individual ownership of inputs as obtainable in conventional systems. This position is aimed at fostering longer relationship between clients and project teams as extended duty of care not only during construction but throughout the life of the model – presumably, beyond project life. However, not many studies agree with this AIA's philosophy on model ownership, and several reports have queried that this could result in certain unsatisfactory consequences to the client. According to (Dean and Ryan, 2009), the inclusion of disclaimer notes in design is an indication that designers no longer want to bear to the risks of design errors, rather use this as excuse to transfer risks due to them to clients, who are the ultimate owners of the project model. Apparently therefore, model ownership as a legal challenge is multifaceted.

Foremost, contributors to BIM models may depend on inputs from other members of the project team. On the one hand, all parties are bound by relative responsibilities to industry standards on duty of care in a new world of innovation and virtual enterprise where data generation is quick and external resources are not necessarily verified or guaranteed (Haynes, 2009). The crux however is that there is no guarantee that such over-reliance on external sources would not be detrimental to client's goal in the long run. Asides, if this becomes substantial, it is also presently not clear from existing legal instruments how to define their impact, indemnify clients and formulate deterrent for error sources (as per specific types, causes and forms of error), ditto potential breach of trust that may trigger these. On the other hand, all users have the choice to adopt tools that serve their purposes best, including software, connotations, detailing, language of expression, professional communication pattern, presentation style and so on. These indices will not always agree with other users' inputs, even though a common goal is been pursued. A dimension to this has been reported in (Ballesty et al., 2007). The study argues that BIM deployers have different adoption and implementation capabilities, and thus, will generate outcomes with variable accuracy. Reported case studies in (Aranda-Mena et al., 2008) also evidenced the theory that inaccuracies can be transmitted from one modeller to the other, and this can affect final project outcomes.

The bottom-line is, modellers have different targets on consensus project goals; and those targets commonly align with their professional backgrounds. In cases where integrated services are provided, different professionals apparently provide different aspects of professional services at every stage as they become necessary – this has always been the safest way in conventional practice. In conventional systems, individual team members are not just responsible for their inputs; they also manage the use of what comes of those inputs after the project. It is a possibility that when models are enshrined exclusively to clients, inputs can be put to unauthorized uses that are not constructive to originators' goals and intents. Moreover, as there is no provision

yet on all feasible rights and obligations of all parties that are involved in BIM development and deployment, there could be severe legal consequences wherever existing legal provisions are silent or could deserve further interpretations.

2.2 Obligations and Consideration

Common liabilities, responsibilities, expectations from design teams and professional indemnities are hinged on remunerations for professional services rendered by individual members of the project team (Hoxley, 2000). Existing provisions for remunerations of professional services in the industry are largely driven by conventional fragmented concepts. Significant evidence also exists suggesting that new processes and skills are required in BIM to achieve improved project outcomes –these are not very identical to conventional processes (Sher et al., 2009). There can be few viewpoints from this. For instance, appropriate considerations for professional services that are involved in BIM protocols are not yet institutionalized. As these protocols have not been definitively standardized across all disciplines, it is difficult to ascertain comparative fairness in how these protocols are valued and remunerated. Where definitive scales of fees are operational, this theory also applies - professional responsibilities in BIM project development processes must be commensurate with the product. Although, no empirical evidence has yet been reported on the relationship between lack of proportionate consideration as a disincentive factor and the reluctance of many practitioners to adopt BIM, it is clear that formulation of commensurate compensation is, and will continue to be, a strong motivation. This is because there is high probability that BIM improves service delivery and new process instruments are required to drive this.

Moreover, there is little empirical evidence upon which to conclude on how the cost of BIM compares, in terms of direct costs and effectiveness, with other design tools. In a case study made available by (Azhar et al., 2008), BIM costs significantly less than the minimum allowable professional fees in conventional design processes in any part of the world, and many significant savings were also made on non-value adding processes. (Aranda-Mena et al., 2009) have also suggested some ways it makes business sense to implement BIM. The limitation of both studies cited above is that they are not based on strong empirical explanatory variables like size of firms, nature of projects, strategising model and implementation instruments or similar. On this basis, contrary opinions may thrive against generalization of perspectives regarding cost effectiveness of BIM. Different situations apply in different parts of the world and it is possible that BIM implementation cost is higher than predicted due to varying project factors. The best way to address this polemical situation is to standardize service procedures and formulate workable legal instruments to service BIM deliverables and allied innovations.

2.3 Jurisdiction and Cyber Security of electronic design management

Jurisdiction is a substantial issue in electronic transactions. For instance, (De Groote, 2009) raises questions that urge discussions on internet tort jurisdictions and how affected parties are treated in specific damages, especially across trans-border operations where there are different legal standpoints in the various territories involved. Existing industry laws target manual and fragmented design and construction processes. Instruments for institutionalising digital authentication of e-transactions seem unpopular at the moment. As much as copyright and allied title deeds, most design documentations are non-parametric and paper-based, and participants are often expected to sign off documentation with definite instruments. Arguably however, there is a world of difference between activities and procedures of integrated electronic design and fragmented systems. Even though the industry deploys e-innovative tools to service process and product improvement, legal framework for transacting universally are apparently grossly inadequate in the industry. Many studies have identified several issues regarding legal liabilities in electronic mediums, including effective formulation of e-contracting, acceptability of authorization styles, repudiation, jurisdiction and acceptability of electronic documents as inexorable evidence in many law courts, taxation laws and cyber snooping problems (Mao et al., 2007, Reimers, 2001, Ren and Hassan, 2007, Deveci, 2005, Endeshaw, 1998). Additionally, several thorny issues and specific cases on this subject have been detailed in (Kennedy and Doyle, 2007, Kennedy and Doyle, 2008, Kennedy et al., 2009, Osen, 2000).

BIM seems to be an exception in terms of players' exposure to dispute and dysfunctional relationships. According to (Bedrick, 2006), not many disputes have been reported on BIM projects since its evolution. Although there seems to be many potential platforms that can foster lasting harmony between role payers in BIM, however several case studies on BIM now exist in literature showing that BIM is an end in itself and not an absolute solution to wipe off all the limitations in the industry (Aranda-Mena et al., 2008, Barbosa et al., 2009, Fusell et al., 2007, Olofsson et al., 2008). Meanwhile, there are also strong indications that BIM is vulnerable several issues like most e-process products. For instance, BIM is a cross-boundary system. However, instruments are limited by geographical boundaries. Different legal instruments (e.g. laws, regulatory frameworks, codes and industry standards) apply in different places while virtual enterprising, an internet-based phenomenon, enjoys unlimited boundary of the 'global village'. Also, where the industry is driven by fragmented frameworks, virtual enterprises are not only derecognized, they may be sabotaged by certain government policies and taxation laws. To address this (Succar, 2009) suggests that BIM adoption and implementation frameworks must be comprehensive and objective, involving all stakeholders – the industry, government and research.

3 CONCLUSION

The construction industry is currently recording some phenomena issues regarding paradigm shifts from fragmented processes to digital innovations. BIM, as an example of this, promises a wide range attributes that can generate many potentially radical outcomes. Unlike fragmented process, BIM triggers process improvements through its facilitative platforms for integrative communication, data generation and transfer, better understanding and commitment of players to team spirit, and unequivocal reliance on collaboration to succeed. This study relied on these attributes and other existing theories on contemporary skill structures in BIM to argue that BIM requires a new set of legal instruments to achieve its promises. Moreover, as new set of process patterns and tools are required to generate improved outcomes through BIM, it is necessary that these reflect in remunerative considerations. BIM also purports extended relationship between model authors and project life by extending ownership of model to clients. The challenge this poses however is that data generation system in BIM is not error-proof. There can be substantial implications on client interests if this persists in the long run. Consequently, this study recommends further works on methodologies for institutionalising propertization and deployment of digital innovations such that clients can buy-out project models with long-term indemnity rather than fragmented protocols which current legal instruments portend.

Moreover, BIM deployment has a number of other unresolved issues. These include methods for aligning economic benefits when leveraging parties' support and commitment to BIM instrumentation. Admissibility of e-documents as strong legal instruments, authorization and tort jurisdiction are other issues which are conceptualized in the study. Also identified as important is the issue of liability in cyber security. Electronic files are still vulnerable to worms and viruses, data theft, snooping and hacking. The overarching recommendation therefore is that as BIM purports a new order and fraternity, new legal instruments are required to forestall damages that are caused by these factors. However, the pattern of departure from all existing aspects or all provisions already made for fragmented instruments must be studied based on reliable empirical data before those new tools are formulated.

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