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Hooper, Martin

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BIM STANDARDISATION EFFORTS - THE CASE OF SWEDEN

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EDITOR: Turk Ž.

Martin Hooper, PhD Student
Dep. of Design Methodology, Construction Sciences, Lund University, Faculty of Engineering, Lund, Sweden
Martin.Hooper@construction.lth.se

SUMMARY: *Nations around the world are feverishly developing new standards relating to Building Information Modelling (BIM) in the construction industry which may enable teams to leverage greater value from BIM implementation and model authorship efforts. This study reflects on ongoing standardisation initiatives in Sweden and considers where current research efforts fit in. There is limited research presenting stakeholder perceptions on current BIM standardisation efforts whether driven by industry representatives or the research community. To address this gap, through a national survey, we studied the impact and correlation of particular process-orientated standardisation initiatives and related research efforts within the field of BIM. The aim is to determine the level of importance of common themes and establish their legitimacy. BIM experts are asked to rank individual standardisation projects and research themes and offer comment on their relevance in a context of national BIM initiatives. In doing so, we capture views on the value and contribution of ongoing BIM standardisation initiatives, are able to position current research efforts within a landscape of other national strategic BIM programmes and gain insight to the level of integration between industry and research communities working in this field. We found broad underlying support of the ongoing BIM standardisation efforts happening in Sweden. Results indicate scepticism over standardised BIM-Planning protocols such as those to be found in the US, but strong support for national BIM guidelines and associated state-driven vision. In addition, respondents highlight a number of alternative standardisation needs that are either missing or low priority on the national BIM standardisation agenda, including requirements management and measures to overcome barriers to BIM. Difficulties exist in translating standards from theory into practice and more local case examples are needed. Our findings are important; they tell us which standardisation efforts are important and help us to understand what aspects are essential to support stakeholders in achieving common BIM goals. They indicate emerging trends upon which further studies can build and contribute to literature on state-of-the-art BIM standardisation.*

KEYWORDS: *BIM, Building Information Modelling, Standards, Standardisation, Research Initiatives.*

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1. INTRODUCTION

The construction industry, like many other production industries, is regulated by a myriad of standards, guidelines, codes of practice and regulations. These enablers and controls make construction projects safer, reduce failures and aim to increase quality (Winch, 2010). They also represent and disseminate a collective understanding of the relevant principles applicable to our projects, enable and align stakeholder's expectations of project results (PMI, 2008) and aim to render the world equivalent across cultures, time, and geography (Timmermans & Epstein, 2010). Be it material strength and suitability, calculation method, quality levels, practice methodologies and outputs, the use of standards ensure progress and wellbeing in society. They are critical when communicating between stakeholders in a fragmented industry in temporary project organisations (Gustavsson et al, 2012).

Standardisation consists of building a society around a standard with an implied script that brings people and things together in a world already full of competing conventions and standards (Timmermans & Epstein, 2010). Samuelson (2011) highlights a tendency for sector culture to optimise at individual or organisation level only, not the entire process (since nobody owns in the whole process in construction). Consequently, it is important for us to categorise and understand the strategic difference between branch or sector standards and organisation standards (which may be even company secrets) in a BIM context. This study looks at those emerging standardisation efforts relating to the use and application of BIM in construction that are now underway in Sweden and which may reflect the broader trend of standards development in this field generally. Here we define BIM as an end to end delivery methodology. Standards related to IT are usually divided into three parts (Figure 1) being: *Concepts*, *Data Model* and *Process*. Common concepts and classification of concepts are necessary for everyone to speak the same language. Neutral formats for data models required for systems and players to exchange information clearly. Finally, a uniform processes for information delivery and a common working methodology is necessary (Ekholm et al, 2010). Around these 3 divisions we can arrange BIM standardisation themes.

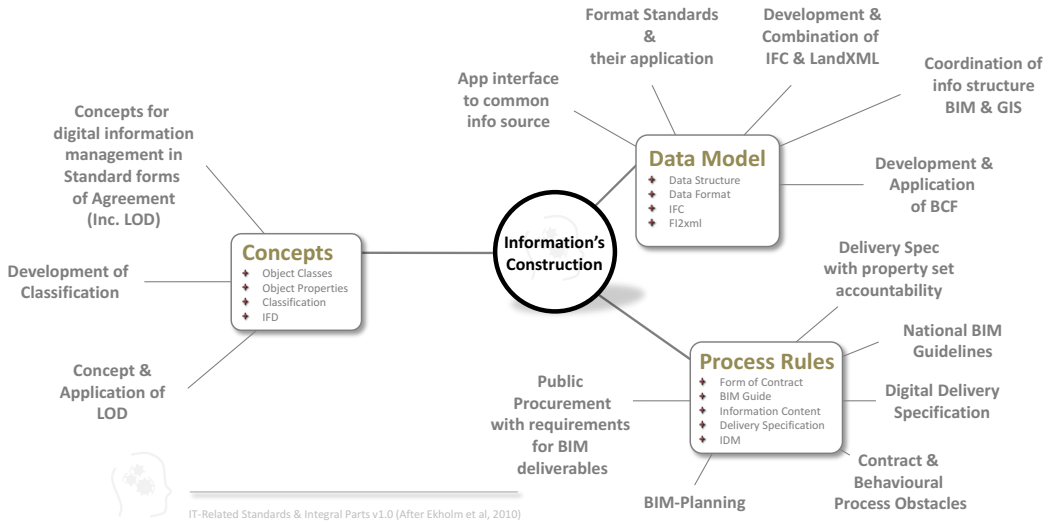

Figure 1: BIM Standardisation information platform (after Ekholm et al, 2010)

A growing awareness of the importance of the management of the standardisation and adoption processes for the eventual success of BIM has led to many studies (Howard & Björk, 2008; Gu & London, 2010; Ekholm, 2012a, 2012b; Hooper, 2012; Ekholm et al, 2013). This work has focused on a wide range of standardisation and adoption issues and has identified a number of promising initiatives. But what do other domain experts and industry stakeholders in general, think about the focus of current standardisation efforts and what they mean for them?

There have been other detailed studies into the level of integration of information technology (IT) in construction (Samuelson, 2010, 2011, 2012; Gustavsson et al, 2012). The objective of the study reported in this paper is to identify which BIM standardisation initiatives are of most interest and to whom, to assess the extent to which

these standardisation needs are aligned with research efforts and to legitimise (or otherwise) existing research efforts and position them in the landscape of national BIM standardisation initiatives.

Ekholm et al (2013) presents a comprehensive set of 10 BIM standardisation projects based on industry collaborations and observations from what is happening elsewhere. However, hitherto there have been few studies to evaluate stakeholder perception of their importance. Early appraisal may provide an indication of the likely level of adoption.

To get a broad view it was decided to carry out a quantitative study (with some qualitative aspects) using experts informed opinions on the status of national BIM standardisation initiatives and ongoing research efforts in the field. 67 survey results were collected within 10 construction industry discipline stakeholder groups. The data is organised, comments analysed and a synthesis of the views is presented in this paper.

This study does not cover in depth specific international technical standardisation efforts, for example, IFC, IFD, IDM, MVD, COBie, OmniClass, however it does touch on these and their respective perceived level of relevance in Sweden. The focus is rather on considering the merit of process and organisational standardisation such as BIM contract support, BIM terminology and the concretisation of national BIM guidelines.

The remainder of this paper is structured as follows: it starts with a background into previous research and findings within standardisation efforts. The method used is explained which leads to a presentation of the results. A discussion section considers their meaning. The paper ends with a summary of the conclusions drawn from the main results, identifies contribution and positions this work in the field.

2. BIM STANDARDISATION EFFORTS

2.1 Standardisation & BIM

Standards are critical when communicating between different specialists over long periods (Howard & Björk, 2008). The most ambitious programme for standardisation, the industry foundation classes (IFC), has been under ongoing development since its first release in 1997 and only now successful case projects are emerging. Meanwhile nations, companies and individuals have been developing and attempting to standardise other BIM related best practices, in a rather fragmented and self-centred way, in anticipation of realising BIM benefits (Azhar, 2011). Maradza et el. (2013) in their study of standardisation of BIM in the UK and the US observes on the one hand a rapid process of development, but excessive self-interest, minimal end user participation and incompatible processes are emerging. Whilst Samuelson's IT Barometer surveys of the Nordic countries (2010 & 2012), continues to show low awareness of standards relating to IT in construction.

Howard & Björk, (2008) finds standards are only nominally supported - no-one is against them but few apply them comprehensively. Official endorsement helps but promotion essential. Furthermore, since there are so many standards relevant to BIM, a framework for presenting them, showing their capabilities, stage of implementation and potential benefits, would help users understand their impact on the supply chain. In a broader context, Timmermans & Epstein (2010) highlight the potential for collateral damage that standardisation may cause for those who defy standards and attempt to trace the ironies of unintended consequences of non-compliance.

Research on BIM benefits (Azhar, 2011) and IT in construction generally (Samuelson, 2010, 2011, 2012; Gustavsson et al, 2012) confirms expectations are not yet being met whilst also indicating that a lack of consistent adoption of particular standards represent a barrier to realisation of expected benefits such as improved productivity. Gustavsson et al (2012) furthermore advises that much that has been written about BIM hitherto aims to convince others on the possible benefits of using IT-tools whilst side-stepping in-depth reflective discussions on the organisational prerequisites needed for these benefits to be realised.

The UK has its BIM Task Group spawning the UK BIM Strategy 2011 (BIS, 2011) which mandates a certain level of BIM implementation on public projects by 2016. It is supported by the newly released BS1192 standards (BSI, 2013 & 2014) and other standardised documentation such as the CIC's BIM Protocols (CIC, 2013) to help the industry deliver. The US has its National BIM Standard (NBIMS) (NIBS, 2007) and a raft of support documents such as those published by the American Institute of Architects (AIA) (AIA, 2008, 2013a & 2013b). Where is Sweden?

In 1998 the research and development programme ITBoF (Information Technology in Building and Property) was launched in Sweden. It incorporated 70 discrete projects divided into research, standardisation and implementation. Within the area of standardisation the relation between IFC and the established Swedish construction classification system BSAB was investigated. Amongst other things the evaluation indicated a lack focus on *process-orientated* standardisation. A new programme – ICT 2008 – was later launched to address process standards and initiate pilot implementations to help align benefit expectations. By 2009 the industry was mature enough to initiate a sector-wide research and development programme driven by a consortium of industry representatives and lead by the umbrella organisations OpenBIM. OpenBIM's programme includes *application projects, development projects* and *research projects* which collectively aim to advance the sectors transition to object-orientated information management. OpenBIM, now incorporating other related organisations including the local chapter of BuildingSMART, has re-branded itself as BIM Alliance Sweden and continues in its role to spread good experience in BIM through the sector and promote associated standards (Ekholm, 2011).

More recently an SBUF (Development Fund of the Swedish Construction Industry) project supported by BIM Alliance Sweden was launched titled BIM Standardisation Needs. It was performed in collaboration with industry organisations and sought broad support from the sector. The final report recommends a comprehensive set of *10 BIM Standardisation Initiatives* set out by Ekholm et al. (2013) as part of a national drive to bring BIM mainstream. Meanwhile, Jacobsson & Linderoth (2012) reminds us, there are a number of significant differences in the construction industry compared with other industries when it comes to driving changes and development processes. Firstly, that the sector is project-based, meaning that partners collaborate in isolated constellations for limited periods. This makes it difficult to take advantage of learning knowledge development. Secondly, there is a power imbalance in the industry which means that bigger organisations within the sector do not have the same influence over their suppliers as for example Volvo, Ericsson or Ikea who own and control the whole process. The result is that this places the responsibility on the leadership within the construction sector to drive change and steer the direction of national development in construction including standards and their application.

Linderoth (2013) further warns us that we should not get locked into insisting on so-called *'best-practice'*, which might in the long run turn out to be the worst practice. Implying that those who stick to today's best practices are likely to be tomorrow's losers. Rather, players should feel the way forward with caution and be flexible. A business-as-usual approach to working routines leads to stagnation. In the US a standard BIM Addendum (Low & Muncey, 2009) was developed through industry consensus to enhance and leverage possible benefits to be gained through the use of BIM and the principle of a federal model. This and other so-called consensus documents were established by industry and research organisations honing in on eliminating known barriers to BIM whilst adopting a life-cycle perspective.

2.2 Standard Solutions & Innovation

CIFS (2011) argues that we need standard solutions in order to be innovative. Further remarking that in a time where we strive for the unique and the remarkable, the term *'standard solution'* implies something grey and boring. Like the word *'routine'*, we mostly use it negatively. However, we could not manage without either routines or standard solutions. Without them, we would have to start over each time and our projects would never get off the ground. We need the familiar and well tested. In the context of BIM there is good reason to support standard solutions for without them, we would be unable to create new things and be innovative.

2.3 To standardise or not to standardise

Meanwhile Schäfermeyer & Rosenkranz (2011), in the broader context of production, ask the question: to standardise or not to standardise? They define that: *"A process is only successfully standardised if it is executed each time in a predefined (optimal) way by processing the same activities in the same order and producing exactly the same specified output"*. Bilal (McPhee et al, 2013) remarks standardisation of workflows is desirable within manufacturing and prefabrication industries where the same products are generated repetitively, however suggests there is less clarity whether this definition is applicable to BIM processes within AEC industry.

Lighthart (McPhee et al, 2013) offers a counter-argument affirming that the existence of the NBIMS and other similar standards worldwide is testament to the need to standardise what we in the AEC industry have been doing for centuries. The latitude those standards allow, and the lax enforcement of those standards from office to

office testifies to the difficulty of setting standards for conveying information that everyone can live with all of the time. Hence, some prefer guidelines only.

Today the larger contracting companies employ standardised BIM-Manuals when procuring design services (Skanska, 2014). They set out particular demands on BIM-Authors (the design team) categorised into general requirements and project-specific, and may include modelling guidelines pertaining to particular BIM-Uses which are desirable to be executed. The question here then is: what is within these so-called organisation-specific BIM-Manuals that may be standardised to the benefit of the wider industry?

Other studies (Gobar Adviseurs, 2010 & Hooper, 2012) consider the positioning and impact of a broad range of existing national BIM guideline documents and standards worldwide. Hooper (2012) finds that the impact of discrete in-house BIM-Manuals which are emerging in Sweden as a response to a lack of state leadership in BIM adoption may have an adverse effect on the nation's competitiveness. Furthermore, because many BIM practice procedures are hidden within organisation's discrete BIM-Manuals, with restricted audiences, the nation runs a real risk of developing a *constellation of fragmented approaches* – something the SBUF project BIM Standardisation Needs aims to address.

Samuelson (2012) finds that many industry practitioners consider a lack of standards a major obstacle to the effective utilisation of IT in construction. The same survey reveals Architects invest the most amongst consultants in BIM and drive comes mostly from enthusiastic individuals (bottom-up) as opposed to management (top-down). Claims that there is a lack of standardisation in the construction industry to support BIM processes are corroborated by Gu & London (2010) and Azhar (2011) who highlight challenges that standards aim to address.

2.4 Research Gap & Contribution

Notwithstanding previous research, the question remains, what standards are important to whom and how much? Furthermore, what level of importance does each standardisation initiative hold generally? The research problem tackled here builds upon this research gap and aims to inform prioritisations in current industry standardisation efforts. This study aims to reveal new perspective on those BIM standardisation efforts going on in Sweden and evaluate alignment with associated research initiatives.

3. METHOD

3.1 Rationale & Survey Design

A quantitative survey approach was adopted from a realism perspective (Saunders et al, 2009). Application of this approach supported the investigation of the phenomena under study in so far that it allows for the collection of data from a cross-section of relevant people, from a wide and inclusive population that may enable generalizable results to emerge (Denscombe, 2008). Surveys enable collection of empirical data based on real-world observations, and add credibility and robustness to the results (ibid).

The survey questionnaire was designed to measure respondent's opinions on current standardisation efforts quantitatively in a way that can be readily repeated, comparable and cover all categories of industry stakeholders. The goal was to collect at least 50 completed questionnaires, our target sample population being those with prior BIM expertise. Questions move from the general to the specific and the survey as a whole is purposefully short.

3.2 Method Execution

To access a reasonable sample size, cooperation with BIM Alliance Sweden – a national membership-based body responsible for coordinating BIM standardisation efforts and promoting the use of BIM in industry – was sought. Respondents were asked to answer a short web-based questionnaire concerning their understanding of BIM research and standardisation efforts. The aim of the survey is to describe the current situation and the purpose to obtain data for mapping and drawing conclusions (Denscombe, 2008). The questionnaire was circulated, initially through directly emailing a group (Cluster 1) of known BIM experts from diverse disciplines in Sweden (100 members), then to increase sample size the same questionnaire was made accessible and visible though BIM Alliance Sweden's associated discussion forum on Linked-In (Cluster 2). The BIM Alliance

Sweden Linked-In discussion group forum has in excess of 1500 members. This bolstered the response number from 25, a response rate of 25%, to 50 completed questionnaires. The questionnaire was then circulated through the BIM Alliance Sweden's mailing list (Cluster 3), being around 1000 members - a pool of industry representatives from diverse disciplines.

The total response rate across these 3 clusters could not be measured since those in Cluster 1 (known BIM experts) could also exist in Cluster 2 (BIM Alliance Sweden's Linked-In Discussion Forum and, or Cluster 3 (BIM Alliance Sweden's mailing list)) since anonymity was preserved. The response rate could therefore have been higher or lower. However our priority was to capture as high a number of responses as possible to support a sound result. Combined these data collection opportunities enabled pooling of 67 completed questionnaires from a broad range of experts.

3.3 Sampling Framework

The sampling framework, an objective list of the population from which respondents are selected (Denscombe, 2008), is made up of those who have prior knowledge of BIM, experience of its impact on the industry, and include Construction Clients, Owners, Architects, Engineers, Contractors, Suppliers, Facilities Managers, Software Suppliers, and Academic Experts. The survey questionnaire was produced, distributed and the results collected and analysis through an online survey tool (Survey Monkey).

3.4 Data Analysis

The quantitative data is presented in a way that reveals trends as opposed to hard facts. Participants are asked to provide nuanced responses (scale of 1-5) to propositions and rank the importance of current standardisation and research efforts, also on a scale of 1-5. Interpretation of the supplementary qualitative data collected focuses on patterns (Czarniawska, 1998) and representative extracts were selected to construct the narratives.

4. A REVIEW OF BIM STANDARDISATION NEEDS AND RESEARCH INITIATIVES – SWEDEN

The following section presents the results of the survey on a review of BIM standardisation efforts - the case of Sweden. The returned questionnaires provided adequate quantitative data to generate a series of readily understood charts and diagrams which, for simplicity and accuracy, were directly derived from those automatically generated within the selected web-based survey tool. The emerging results are delivered in a form that may provide interesting insight into industry views on ongoing efforts, and prioritisation. They present a snap-shot in time. Qualitative aspects, in the form of re-occurring commentary, were recorded and augment the quantitative data.

A total of 67 completed questionnaires were collected. Respondents were first asked to confirm their discipline background to later enable an analysis of discipline trends. Figure 2 presents the distribution of respondents. A high proportion of Architects (22% being 15) and Academic Experts (29% being 19) responded which, whilst cannot be said to reflect the relevance of BIM standardisation efforts across an industry of diverse stakeholders, does indicate interest levels across the sector.

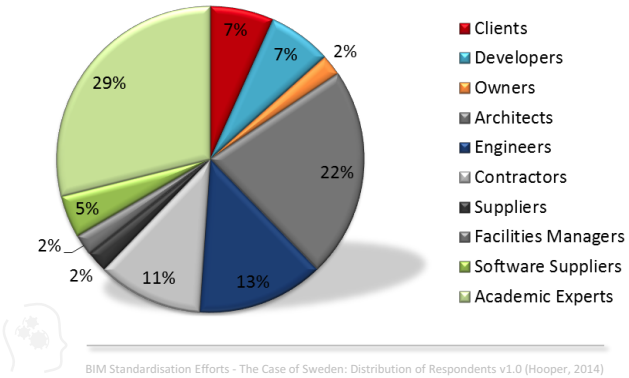

Figure 2: Survey Results - Distribution of Respondents

A lesser proportion of Owners (2%), Facilities Managers (2%) and Suppliers (2%) responded. Within the 10 main discipline areas, a small number of respondents also branded themselves as particular specialists including BIM-Strategists, Project Managers and Responsible for IT.

4.1 Improvements since introduction of BIM

The first question: *what has improved since BIM and by how much?* sought a soft introduction to the questionnaire where common perceptions in improvements since BIM could be measured generally. In concurrence with other surveys (Samuelson, 2012; McGraw Hill, 2009 & 2010) improved *Communication* ranked highly. Predominantly Architects and Contractors thought *Project Results* improved whilst Clients were less certain. The impact of BIM on *Accuracy* and *Project Planning* was smaller but still significant. Other highlighted improvement areas included better design information coordination, efficiency and review. Curiously 2% thought accuracy had been very negatively impacted since BIM (Figure 3).

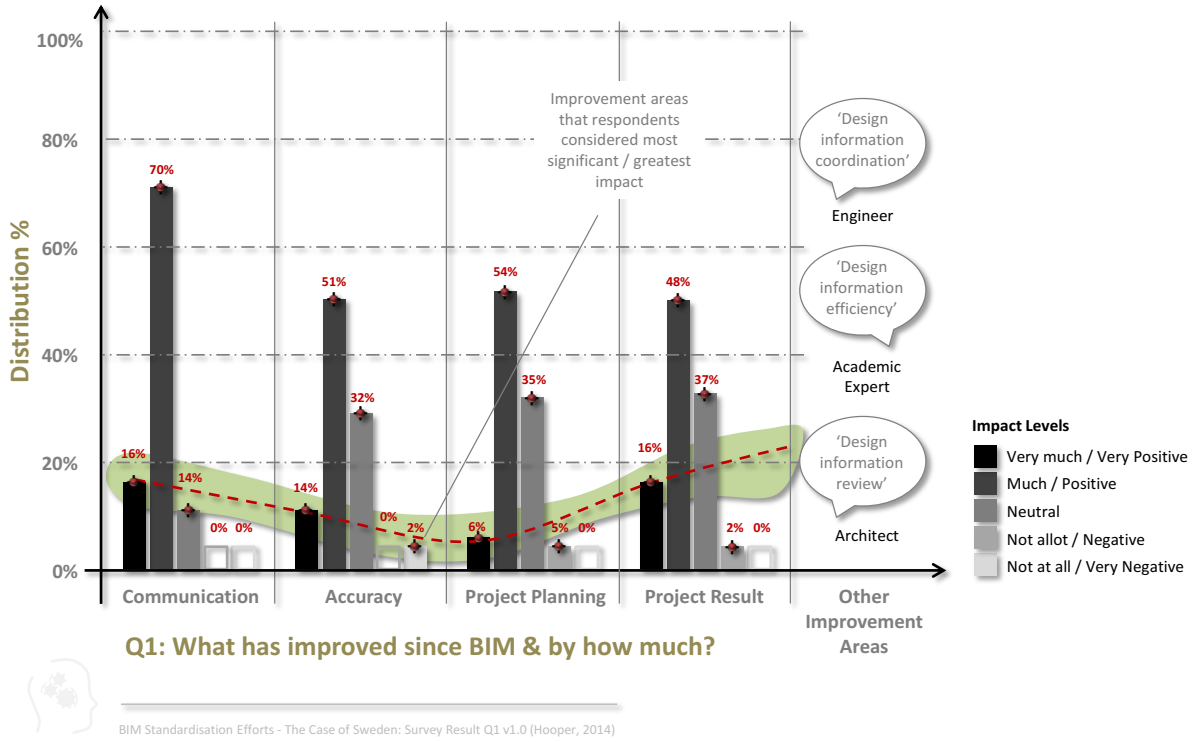

Figure 3: Survey Results - BIM improvements & perceived impact levels

4.2 Experienced BIM benefits

The second question: w*hich BIM benefits have you witnessed or experienced and how much?* sought to encourage respondents to think about their own circumstances and reveal trends in experienced BIM project benefits. Categories include: *Improved Decision Support*, *Quality of Output*, *Productivity* and *Confidence in Completeness of Scope*. Informants provided a similar response profile to question 1 (Q1) – being a higher impact on decision making and lesser in other categories. An aggregated 4% witnessed no or a negative impact on *Confidence in completeness of scope*. Others experienced benefits through fewer claims, better coordination and access to current information (Figure 4).

There was no obvious trend amongst Clients however; *Improved Decision Support* and *Confidence in Completeness of Scope* had benefited most. Architects and Engineers thought positively about *Improved Decision Support, Quality of Output* and *Confidence in Completeness of Scope* but were less convinced about gains in *Productivity*. Whereas Contractors where generally very positive about gains in *Productivity*. Academic Experts where generally very positive across the board with some neutrality on *Productivity*.

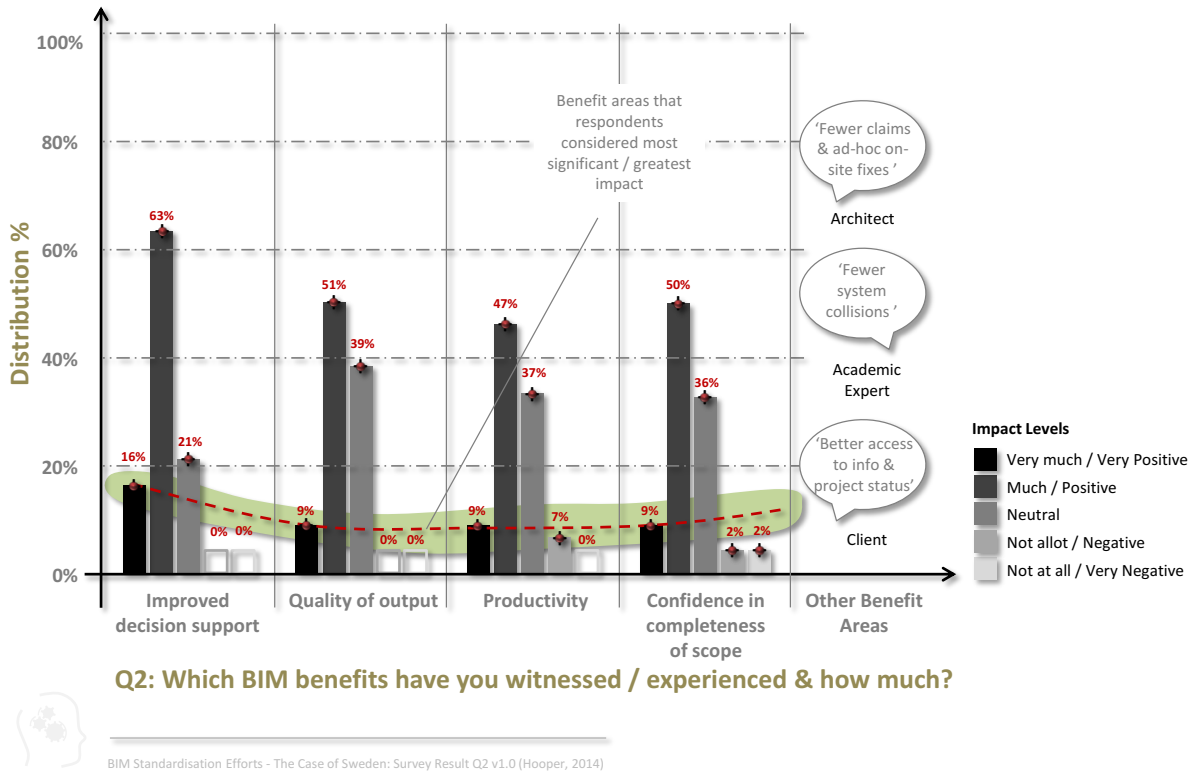

Figure 4: Survey Results - BIM benefits witnessed & perceived impact levels

4.3 10 BIM Standardisation Projects

The third survey question introduced respondents to the *10 BIM Standardisation Projects* recommended by Ekholm et al. (2013) and endorsed by BIM Alliance Sweden. We asked: *which BIM Standardisation initiatives are important and how much?*

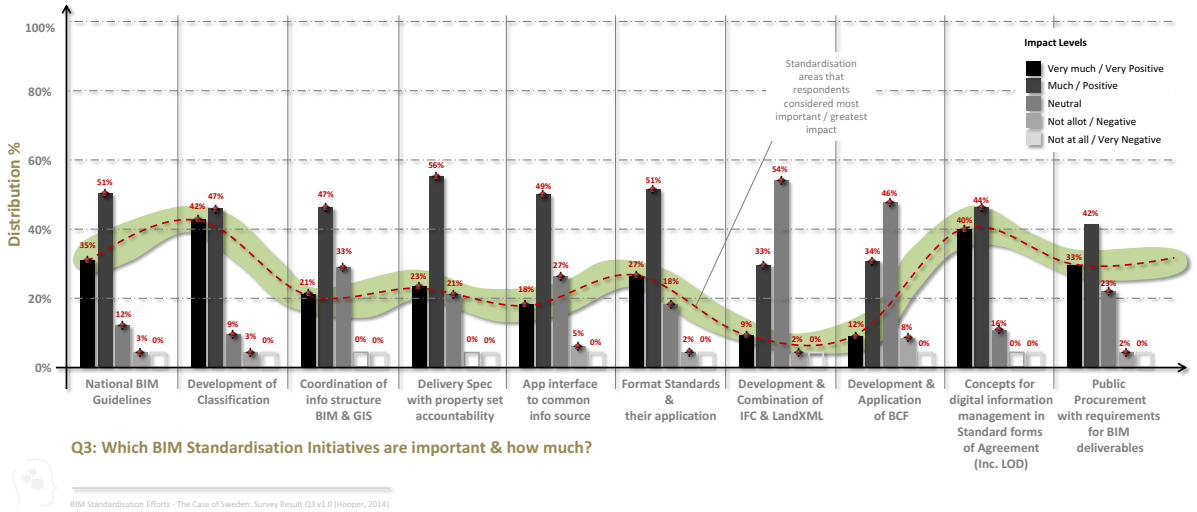

Figure 5: Survey Results - Standardisation Initiatives & perceived impact levels

Here we can readily identify that standardisation efforts relating to *National BIM Guidelines*, *Classification*, and *Concepts of digital information management in Standard form of Contract* are considered the most important, with around 40% of participants designating each of these initiatives as very important (Figure 5). There was a significant level of neutrality across the categories, indicating uncertainty, but low levels of negativity. None of

the 10 BIM Standardisation Projects were considered completely irrelevant and, in general, a positive level of support exists for each. However, lower levels of support emerged for *IFC & LandXML* and *BCF (BIM Collaboration Format)*.

All Clients & Developers strongly supported the need for *National Guidelines* and, like Contractors, indicated the most scepticism to the usefulness of *IFC & LandXML* and *BCF (BIM Collaboration Format)*. Amongst the different disciplines Architects and Engineers assigned consistently the highest importance to *Classification* as did around half of the Academic Experts. There is generally significant support across the board with Architects showing the highest level of enthusiasm for all. Contractors place more consistent support for *Concepts for digital information management in Standard forms of Agreement* and *Public Procurement with requirements for BIM deliverables* than any other discipline and some highlighted a specific need for *BIM-oriented standard forms of agreement* and *standardised organisation of BIM-requirements for publically procured projects.* Academic Experts gave the most inconsistent responses, with no one category showing notably more or less support than others, with the exception of *National Guidelines*. In other categories no particular patterns were observable, results were sporadic.

4.4 Research Efforts & where help is needed

The fourth question sought to identify where the industry feels help is needed and refers to categories in which research is being carried out with national financial support. The chart below (Figure 6) shows high levels of support for research on *Digital Delivery Specification*, *Contract & Behavioural Process Obstacles* and *Concept & Application of LOD*, with increased neutrality on *BIM-Planning.*

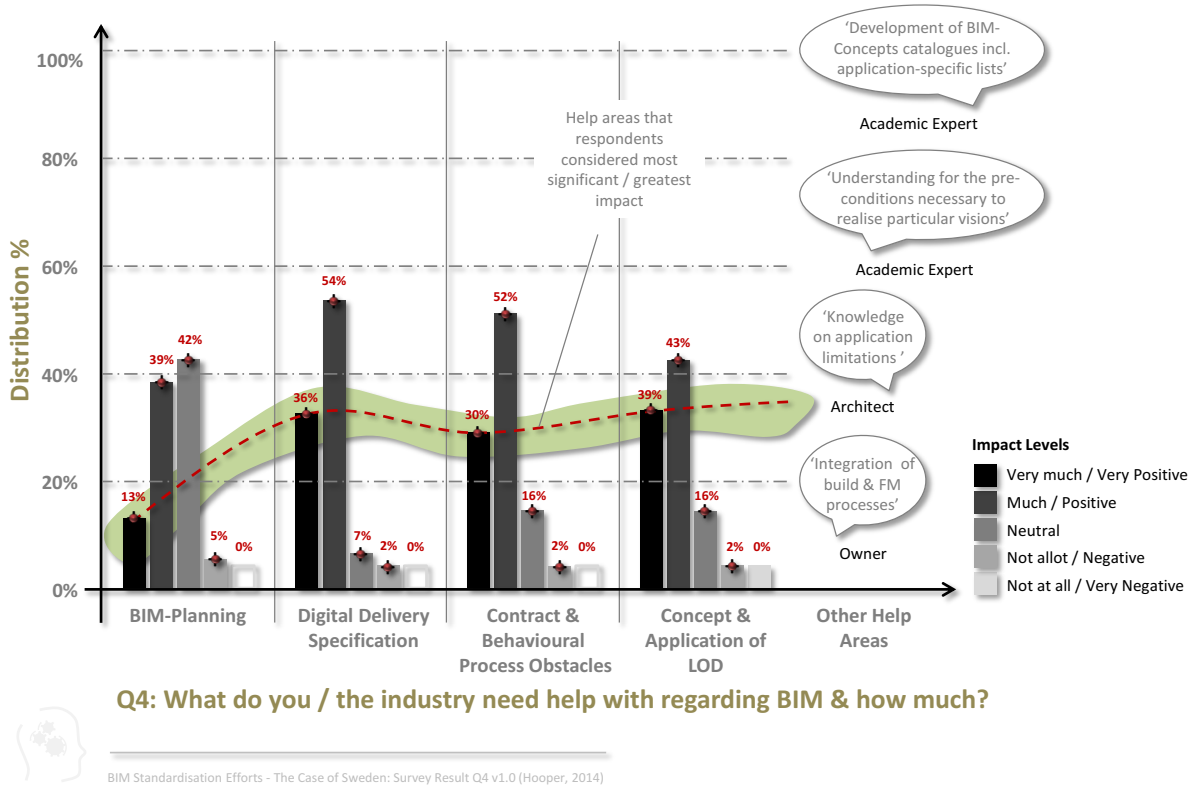

Figure 6: Survey Results - BIM help needed & perceived impact levels

Strong support was present across all categories. Amongst the categories *BIM-Planning* received the most neutral backing across all disciplines. Other emerging patterns were less obvious; however Architects and Engineers displayed the most support for *Contract & Behavioural Process Obstacles* with around 40% awarding the highest impact level. *Digital Delivery Specification* and *Concept & Application of LOD* received strong support and *BIM-Planning* again was assigned the most neutrality and the most negative impact ratings. Contractors indicated evident neutrality to *BIM-Planning*, were modestly positive to *Digital Delivery*

Specification, and offered the strongest support to *Contract & Behavioural Process Obstacles* and *Concept & Application of LOD*. A similar profile emerged from the Academic Experts albeit more nuanced. Of all, Clients were most positive about *BIM-Planning* with around 30% awarding the highest impact level. Strong support also emerged for *Digital Delivery Specification* and *Concept & Application of LOD* with around half designating these as top priority. Other participants were too small in number to draw generalizable conclusions.

4.5 Alignment of BIM Research & Standardisation Efforts

The fifth and final survey question asks: *What is lacking or misaligned in research and national initiatives to support BIM Standardisation efforts?* In an attempt to measure the level of alignment between the *10 BIM Standardisations Projects* and current research efforts in the same field, we employed a combination of both quantitative and qualitative units of analysis. Firstly we transcribed commentaries and interpreted them into short statements grouped by respondent discipline (perspective). We then aggregated re-occurring themes and quantified occurrences under theme headings accordingly. The table in Figure 7 summaries a selection of responses. What is interesting here is who said what insofar that we can start to identify patterns in common perspectives.

Discipline	Lacking or Misaligned Standardisation Efforts
Construction Client	'A common set terminology (& concepts).'
Construction Client	'A common definition and understanding of what BIM is & is not. Too many discrete interpretations'
Architect	'State leadership to drive BIM-initiatives / development.'
Architect	'Much is misaligned. Great ignorance in the industry, many discrete fantasies about what BIM is and is not, open formats and software.'
Architect	'Branch standardisation of the basics: roles & responsibilities, requirement documents, project stages, LOD.'
Architect	'A common understanding of LOD and practical object definition levels for model purpose (ie. generic furniture objects through design phases, product specific for construction documents).'
Architect	'Insistence and realisation of the branch adopting open standards throughout, not only amongst BIM-Experts.'
Engineer	'Important to coordinate standards that also function for quantity analysis of BIM models.'
Engineer	'Difficulty in translating between the extremely theoretical world (eg. ISO work) to the practical reality many of us find ourselves in.'
Contractor	'Focus should be more on removing barriers to use of BIM in production.'
Contractor	'Qualitative research on the benefits of BIM for different players (eg. Owners & FM).'
Developer	'The collection, analysis and evaluation of requirements management documents (eg. MPS).'
Academic Expert	'We should take advantage of lessons learnt from successful standardisation efforts in other fields.'
Academic Expert	'Research and development of BIM in the early project stages.'
Academic Expert	'Requirements management, verification and analysis in terms of building functions and values'
Academic Expert	'FM processes'
Academic Expert	'Case evidence of the true benefits of BIM at discrete stages to discrete players.'
Academic Expert	'Development of BIM-Concepts catalogues, incl. application-specific lists.'
Academic Expert	'Lack of national guidelines together with a state endorsed national BIM strategy may present a hinder to reaching consensus over standardisation efforts..'

Q5: What is lacking or misaligned in research and national initiatives to support BIM Standardisation efforts?

BIM Standardisation Efforts - The Case of Sweden: Survey Result Q5 v1.0 (Hooper, 2014)

Figure 7: Survey Results – Alignment of BIM Research & Standardisation Efforts

Highlighted are certain lacks in understanding and utilisation of Level of Development (LOD) to support information deliveries and state engagement in promoting standards. Scope for improvement in alignment resides in the transition of theoretical work to practical implementations and that more local case examples are needed. Furthermore that we should take advantage of lessons learnt from successful standardisation efforts in other fields.

A broad range of perceived lacks or misalignments emerged. From those who commented, Figure 8 presents the specific re-occurring themes (and their extent) that stand outside the *10 BIM Standardisation Projects*. 23% indicated a desire to better align industry standard BIM concepts – taking the form, for example, as some sort of national reference source or database. Also significant (16%) was concern over a lack of state leadership, vision and the need for national guidelines. There were calls for alignment on model progression, status and LOD (10%) and further work requested on classification (7%). Others (5%) identified a gap between theoretical and practical implementation, expressing that ISO standards are obtusely assembled and problematic to apply in practice. Lower on the chart are appeals to increase focus on requirements management, cognisance to other industries and case evidence of BIM benefits (each at 3%). Surprisingly there was little comment on contractual requirements.

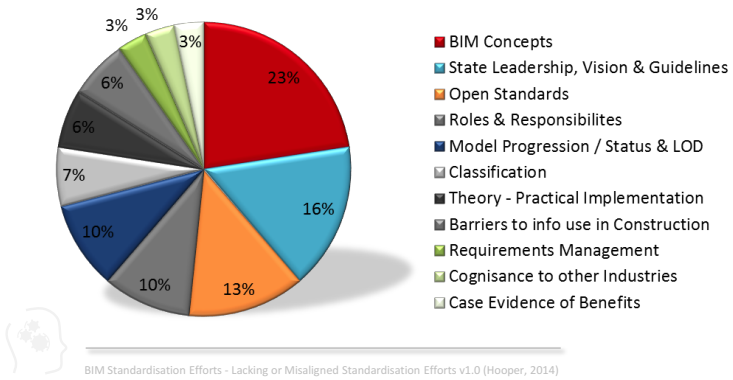

Figure 8: Lacking or Misaligned Standardisation Efforts: Re-occurring themes

5. DISCUSSIONS & CONCLUSIONS

5.1 Introduction

We sought to ascertain the value and contribution of resent BIM research efforts and position them within a landscape of other national strategic BIM development and standardisation initiatives and have now reported on the present state of opinion on current BIM standardisation efforts within academic and industry spheres. We can now say with greater certainty that most of the 10 *National BIM Standardisation Projects* have a high level of support; however there was a general consensus that *IFC & LandXML* and *BCF (BIM Collaboration Format)* assumes a lower level of overall importance at this time. A possible explanation for this may be a lack of understanding of these concepts amongst participants. It was not possible to generalise or identify specific trends outside the main participant discipline groups being: Clients, Architects & Engineers, Contractors, and Academic Experts. This left trends associated with Owners, Suppliers and Facility Managers difficult to measure.

5.2 General Observations

The survey respondents highlight different aspects of BIM standardisation needs. The general conclusion that stands out most clearly is that there is not just one way to organise and prioritise standardisation efforts, not even within the same industry. More than anything, the study highlights diversity. Looking at particular trends we can observe, Clients and Developers found improvements in *Communication* but were less convinced about overall improvement in *Project Results* so far. Looking forward, they thought *National Guidelines* were essential and expressed strong support for *BIM Requirements* on public projects. Architects, for instance place higher importance on front-end standardisation activities such as *BIM-Planning, Digital Delivery Specification* and *Classification* whilst less on downstream pursuits. They called for a state organ to drive BIM standardisation and

National Guidelines. Contractors observed improvements in *Communication* but where more neutral on *Project Results*. They found *Productivity* increases and indicated support for research in standardised *Contractual Support*. They were not so interested in standardised *BIM Concepts*. Academic Experts observed improvements across the board since BIM with greater neutrality on *Productivity*. They recommend effort on *National Guidelines* and *Classification* whilst also placing providence in *Digital Delivery Specifications* and standardisation of *BIM Concepts*.

This indicates a certain imbalance and needs to be considered in relation to the overall benefits that future adoption of particular standards may imply. There are compelling arguments both for and against adoption of standards or embracement of standard solutions (compare with Linderoth, 2013; CIFS, 2011; Timmermans & Epstein, 2010). But one thing is for sure: timing, positioning and the establishment of specific benefits associated with the adoption of particular standards can be viewed as critical (compare with Howard & Björk, 2008).

The diverse rolls found in construction and stakeholder's individual propensity to benefit from BIM standardisation efforts is significant. Some have specific objectives and goals and need standards to support the means to these goals. Others create and maintain their own standards and compel others to comply (Linderoth, 2009; Hooper, 2012). The results here indicate variations in attitudes to standardisation and the meaning of the *10 BIM Standardisation Projects* for them and the broader industry. Many question the relevance of *Development & Combination of IFC and LandXML*. Uncertainty emerged regarding the need for *BIM-Planning* (an essential activity to realise common benefits of BIM efforts). However, a general level of support for ongoing BIM standardisation efforts was observed and evidence of positive alignment of themes within research, improvement areas highlighted. Finally, there was call (predominately Architects and Engineers) for state driven promotion of BIM Standards whilst Academic Experts advocated borrowing from neighbouring industries.

5.3 Contribution

This work has therefore contributed with a comprehensive survey presenting a snap-shot in time of the views of 67 diverse industry representatives on BIM Standardisation efforts in Sweden. It provides quantification of the importance of standardisation efforts. The findings of this study provide useful information for the AEC industry, practitioners and researchers alike, on the positioning and perceived level of importance of ongoing standardisation efforts relating to BIM. This is valuable because it enables us to objectively understand their usefulness. Our findings are important; they tell us that greater knowledge is required in *Digital Delivery Specification, Contractual Support* and *Concept & Application of LOD* whilst confirming, at a general level, that most disciplines attach a significant level of importance to all *10 BIM Standardisation Projects* – and in particular *National BIM Guidelines*, *Classification* and *BIM Concepts for Digital Information Management* (such as LOD). The data implies that a new determination is required to align industry and research community efforts to deliver BIM Standards starting with a cross disciplinary effort to deliver *Nation BIM Guidelines* in a form that reflects the AEC industry's needs and expectations.

5.4 Context, Significance & Implications of the Results

The survey was carried out in Sweden where a strong contractor-led AEC sector exists. Some state organisations are now demanding BIM. A central government mandate, of the kind found in the UK, Denmark, Norway and Finland is absent; however the level of BIM maturity places Sweden firmly on the map (WSP & Kairos Future, 2011). The context has its particular characteristics, nevertheless this survey is of international appeal since the subject and themes are of universal applicability and results may inform trends connected to international standardisation efforts such as those by buildingSmart.

The results, emerging from the ordinal data mapped to the Likert scale (Denscombe, 2008) adds legitimacy to the selected *10 BIM Standardisation Projects* highlighted by Ekholm et al. (2013) and underpin research efforts in the field such as Jacobsson & Linderoth (2013); Gustavsson et al (2012); Samuelson (2012); and Hooper (2012). Furthermore the data collected from this survey, if corroborated with further evidence, could be used to help allocate an accordant scale of resources to the *10 BIM Standardisation Projects*. It may also offer insight into market interests that may inform new value propositions in bringing BIM products and services to market. Validity of the data, analysis and organisation of it into charts was maintained by utility of a reliable online survey instrument ensuring accuracy. Explanations derived from the automatically organised data-set were deductively extrapolated.

5.5 Further Research

Whilst the results of the survey only represent a snap-shot-in-time, they do provide a state-of-the-art picture of stakeholder opinion on current BIM standardisation initiatives in Sweden and supply us with insight on which we can extrapolate trends and emerging themes. A re-run of the survey on completion and implementation of said initiatives could provide industry leaders with valuable feedback on whether planned standardisation efforts have made a difference.

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