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## **8 Challenges, risks and benefits for SMEs**

### **8.1 Same old, same old, the need to modify work practices and cultures**

The transition to a BIM collaborative working environment poses a number of challenges, risks as well as benefits for small and medium enterprises in the constructions sector as whole. The technology gap within the construction industry continues to widen between large companies and SMEs / micro-SMEs. Amongst the former, Information and Communication Technology (ICT) is pervasive and has become a key infrastructure covering all aspects of business including design, construction, asset management, life cycle, marketing, cost management etc. Amongst the latter however, ICT is often limited to traditional 2D drawings, perhaps some static 3D visuals, email and possibly a symbolic internet presence. The status quo creates a divide in the industry and potentially may lead to a Macro versus Micro effect that will certainly hamper any effort for collaboration within the industry. The real challenge here, one would argue, is for those large organisations with experience and expertise in BIM to match their legitimate marketing discourse with a similar level of actions by providing reliable and credible case studies and even collaborate with SMEs to raise industry level and help to achieve a faster and smoother transition to BIM.

Access to BIM by SMEs and in particular micro SME's tends to be hampered by a lack of ICT infrastructure as an enabler to a quick deployment of BIM. Working in a dynamic workflow is a major shift in working practices and extends beyond acquiring expensive hardware and software. A radical change of attitude and work practices is required to work in this dynamic and collaborative environment. Furthermore, the learning curve is lengthy and demands sustained training and up skilling of personnel as well as changes to organisation's business model. A recent study by the authors examining BIM as a collaborative tool concluded that contrary to literature claims, a case study has shown that the present investment, in terms of time, cost, and effort required to implementing the technology means that BIM is unlikely to be adopted on small simple projects or by micro-SME's where conventional CAD is adequate.

The burden of the additional expenditure is not insignificant in a highly competitive and difficult economic climate in which small businesses are often struggling to stay afloat. The reported cost of installing a full BIM station varies from £10 to £15 K at the lower end and from £30 to £70 k at the leading edge end. And in the absence of a clear and coherent national / professional strategy on BIM on the one hand and the lack of clarity on the level and time scale of return on investment makes it even more difficult to make substantial financial commitments as highlighted by BIM4sme:

*“Moreover, as the group are SMEs themselves the equation of cost is foremost in our minds, but perhaps the more important question is ‘what do I get for my money, what are the benefits and how long before my investment is paid off.’”*

Embarking on a BIM implementation process is not only a daunting task but carries considerable risks from a business viewpoint. SMEs do not possess the financial resilience of larger organisation to be able to absorb potential losses nor dedicate significant resources be they financial, human or time. Failure of very careful planning, getting it wrong could mean business ruin. It is these risks and challenges that call for careful planning and gradual implementation of collaborative BIM together with strategic and technical support for SMEs. Despite the above risks and challenges, we strongly believe that a managed transition to Level 2 BIM and beyond offers sound benefits for SME from both a pragmatic business viewpoint and most importantly the long term readiness and resilience for a rapidly changing construction industry. Work efficiency benefits are well documented in the literature and include access to up to date information, error reduction / elimination, ability to visualise complex information, avoiding duplication of work and rework etc. Other more strategic business benefits may include access to bigger markets, partnerships with larger companies, expanding to emerging niche markets, ability to compete using the same tools and skills as larger organisations.

Level 2 on the BIM Maturity Index (Fig. 8.1) assumes that everybody ought to be operating at the very top end by 2016. What is the level of progress towards this goal? The reality is a mere guess, particularly amongst the big majority of small companies across all built environment professions. It remains difficult to build a full picture of the level of true understanding and implementation due to the lack of reliable data and limited take up of BIM surveys. Recent surveys tend to be unrepresentative due to the small number of respondents. For instance, the National Building Specifications (NBS) survey received 1500 respondents in contrast to thirty thousand RIBA members. Despite the low intake in these surveys, the results do not provide an encouraging reading; the National Federation of Builders (NFB) survey provides an insight into the state of readiness of construction SMEs in relation to level 2 BIM uptake. Of all contractors surveyed only 30% work with electronic 3D drawings, 54% of which are large contractors and only 25% are SME contractors.

Some might also argue that a good proportion of the above claims are file sharing through a management system, often set up by the main contractor or the local authority and used by the various professionals, or simply through a simple drop box. Only an increasingly number of large design and construction organisations run their own complete data management systems. The type of data shared tends to be mostly 2D drawing or PDF files, spreadsheets

and word files. One may even argue that most of these repositories are there to comply with BS1192-2007 and at best provide a level of passive data exchange, which may assist coordination.

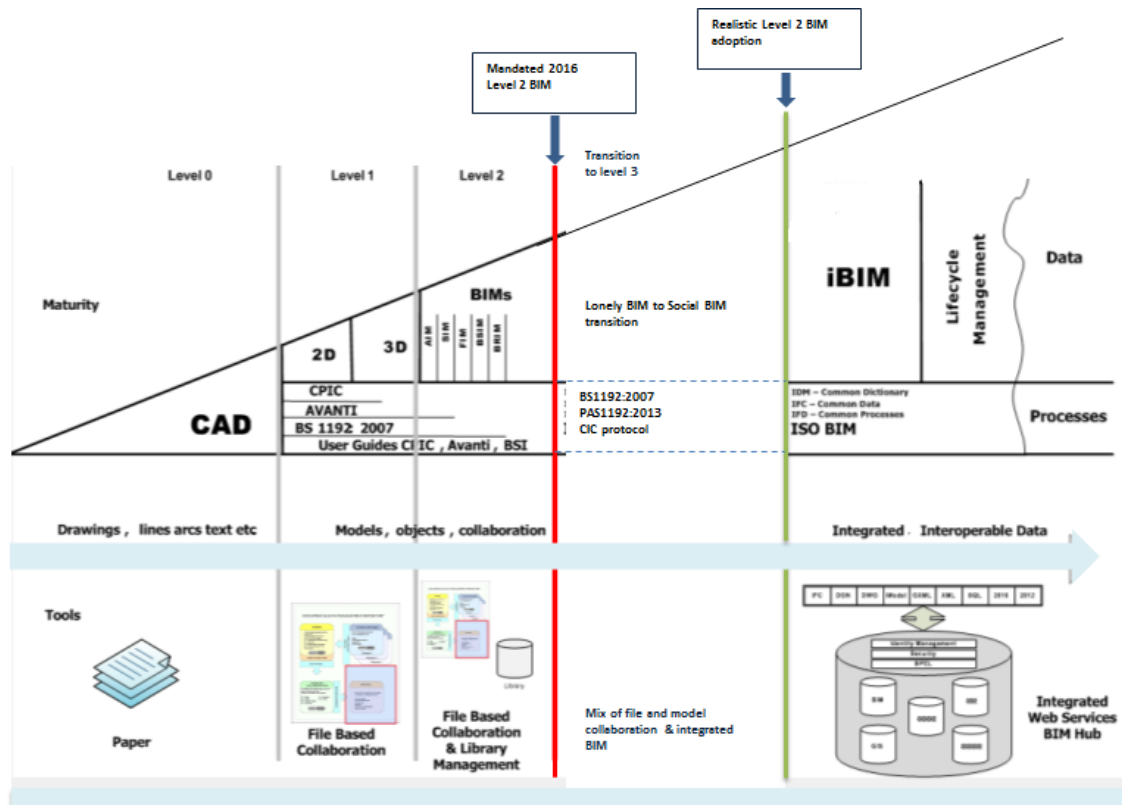


Figure 8.1 Modified BIM Maturity Index: from Mandated to Realistic BIM Adoption through a Transition Period (After Bew R. 2008)

Achieving Level 2 BIM by the government 2016 deadline may not be within the reach of all and real change requires a modification of work practices and cultures. The following modifications are essential for any small business aspiring to enter the digital age and harvest some of its rewards.

- It is a recognised fact that in the new digital age there is a conflicting generational skills gap within the construction industry. First, a new younger generation of graduate professionals well trained and versed in ICT tools and working methods has been entering the construction industry professions next to a well-established older generation whose knowledge of these technologies is limited to say the least. And often do not share the same attitudes as far as the potential of these technologies. Second, the managerial power within the industry dominantly resides with the older generation. The latter is often sceptical and reluctant to adopt unfamiliar technologies and working practices in which the risk is perceived to be high. A resolution of this

generational gap is critical through a combination of faith in the technologically skilled younger generation combined with an element of business risk; and the recognition that the status quo is not an option in the medium to long term.

- There seems to be a resistance amongst SMEs and micro-SMEs in particular to look beyond tools required to do the job. This sense of immediacy, often born out of work environment necessity, needs to give way to an attitude in looking beyond the immediate through continuous planning and investment is the best guarantor for long-term business success.
- Embracing BIM technologies within the context of digital Britain is not a series of technical fixes but demands first a belief in this radical change and second the consistent embedding of these new technologies in the business processes and workflows of the whole organisation.
- Developing a business model and outlook that recognises the inevitability of change and continuous learning both at the corporate and individual level are essential. Once a full commitment is made, it could be argued that real transitional change to BIM for an SME may be implemented more efficiently and in a shorter time scale. Smaller staff numbers, versatility of skills and relatively smaller number of workflows, compared to larger organisation, could render the change process more manageable.
- The inherent agility of SMEs to adapt to changing business conditions could be deployed to modify work practices and shorten the transition period to level 2 BIM and beyond.

## **8.2 Keeping up with changing technologies, opportunities and risks**

It is generally acknowledged that in the digital age there is a generational skills gap within the construction industry. First, a new young generation of graduate professionals well trained and versed in ICT tools and working methods has been entering the construction industry professions next to a well-established older generation whose knowledge of these technologies may be limited. Also for micro-SMEs in particular, there may be a resistance to looking beyond tools required to do the job, particularly in a difficult economic climate where business survival becomes the overriding priority. First small, medium sized and large organisations may not share the same attitudes and values regarding the potential of these technologies. Second, the managerial power within the industry dominantly resides with the older generation; often sceptical and reluctant to adopt unfamiliar technologies and working practices, which are perceived to embody high risks. Clearly, the industry is going through a major transition and the BIM Task Group's push/pull strategy may help to firm up minds, shorten the transition period and open the doors wider for the aspirations of younger

professionals. Opportunities as well as risks certainly exist but what strategies are put in place and actions to be taken will be the secret for success or failure. One thing is certain; a gradual implementation of these new technologies can meet the transformative and evolutionary effect only if matched with a strategic top down business vision.

Opportunities offered to SMEs and micros by BIM technologies have been the subject of a long debate and may range from work efficiencies to a full business transformation. The American experience, as advocated by the American Institute of Architects (AIA), highlighted the significant access to business opportunities by small and medium architecture practices in the USA due to their increased competitive BIM capabilities on larger projects. These capabilities may be focused on specialist expertise such as environmental modelling, integrated project management and advanced visualisation. Providing these additional services and others, traditionally seen either costly or perceived as of little value, not only improve customer service but will also increase business opportunity. There is agreement within the industry that significant work efficiencies can be made to work flows, overall management of the business, project data management and communication amongst others. BIM technology, if fully implemented, can bring a small business work practices and skills to a level comparable to that of a larger organisation hence facilitating business opportunities through for example sub-contracting, direct competition for work packages or large projects via partnership. The transition to full implementation of BIM has already begun creating new business opportunities as well as job roles which may be compared to those created by the introduction of CAD in the seventies and eighties. BIM manager, Design Manager and Information or Data Manager are not uncommon in the industry, roles which require an expertise in the application of these new technologies and most importantly oriented to a newly qualified young workforce. New niche businesses specialising in 3D modelling, data management, advanced building modelling, environmental modelling etc. are opportunities for new young business starters or / and an expansion for an SME.

Any opportunities created by the introduction of BIM technologies, however, are not free of risks and smaller organisations are more exposed given their limited infrastructure and ability to sustain sudden change. One may argue that the biggest risk facing SMEs is no change at all, and to quote the American Architect Thom Mayne during the AIA Building Information Modelling Panel Discussion "If you want to survive, you're going to change; if you don't, you're going to perish. It's as simple as that." It is, therefore a question of first identifying the changes required, second setting up a change implementation plan and thirdly finding the change management mechanisms appropriate to the business.

Changes would principally include hardware / software update, staff training, develop a BIM business ethos, update to or introduction of BIM workflows, and tackling old attitudes and work practices. Any change plan for a small construction organisation ought to be evolutionary and follow clearly identified incremental steps taking into consideration business decisions on key issues such as financial commitments, staff workload, time to embed changes for the long term and the ability to add value to the overall business. The appropriate change management mechanism for an SME may not be a standard “off the shelf solution” but rather one that is based on the company’s history, market, client base and most importantly staff resources. For instance, a change mechanism may be based on partnerships with other construction SMEs whereby shared experiences and expertise are of mutual benefit. Experimentations by micro-SMEs embarking on a BIM implementation journey are not uncommon and limited evidence suggests that the will to of organisations may be another key enabler, a view advocated by Mervyn Richard’s.

### **8.3 Tailoring BIM to suit business models, filtering out achievable BIM outcomes in relation to organisational size and resources**

Within the UK construction sector, BIM literature (the evangelical model as opposed to the evolutionary one) with all its facets and mantras (collaboration, communication, project efficiency, carbon reduction, whole life asset management etc.) has focused on implementation in large design and construction companies. These organisations operate at a much larger business scale than SMEs and Micros representing the majority interests in the sector. For these large organisations, engaging with BIM may offer competitive advantages, which can be easily afforded, not only to maintain leadership in the market but also to harvest the business benefits BIM may bring to the table. In that context, where does the debate leave the SMEs in the sector? Where is the argument and counter-argument necessary to feed informed decision making, particularly for small companies. It seems that until recently, this 90% majority stakeholder interest has been left on the margins of the debate. With the cut-off date for the UK Government’s mandate imminent, will there be a gradual awakening, realisation and actions in respect of how BIM may impact on UK construction in the round (the evolutionary model). From the sub-groups set up to deliver on the Government’s BIM agenda, BIM4SME, has developed as a cross discipline grouping of interests championing BIM and promoting, in particular, the interests of construction sector SMEs. Its primary and only focus is to support the SME community in its understanding and use of BIM, whether they are consultants, contractors, specialists, suppliers or manufacturers.

As BIM paradigms continue to emerge, develop and evolve across construction disciplines, the idea of BIM requiring new business models has become more established and

is challenging traditional methods of delivering building projects. Typically, in a traditional model, the overall process consists of two interlocking sub-processes or activity nodes, design/construction activities (process node) and policy and codes (policy node). Technology is normally embedded within the activities of each node with limited cross over. A typical example would be an architecture design office running specialist software on free standing PCs or linked via an intranet and all communications with policy organisations are done through traditional channels of communication such as meetings, post and email.

Razvi (2008) in an article entitled “BIM and the Process Improvement Movement” published in BIM Think Space blog that, in a BIM business model, a third technology node which interlocks with the other two has become critical to process development as illustrated in Figure 8.3. In a BIM working Environment the interlocking area between the three nodes will proportionately increase with the maturity of the BIM system providing more opportunities for collaboration between stakeholders.

The IT infrastructure and expertise required to support a BIM model are sufficiently complex that they need to be run and managed often by external specialist network and data management agencies. A number of these companies are already active in the market including data repositories and providers of web and cloud based construction collaboration technologies. Such a business model could be considered imperative for an organisation in the construction sector to capitalise on the benefits of implementing BIM, (efficient workflow, collaborative working, building partnerships, good communication etc.) and add value to their business.

Software as a service provided by technology companies has passed the good idea stage and its uptake by construction industry organisations is on the increase. This method of accessing advanced ICT technologies may help to free design and construction organisations from a burden they neither have expertise in nor is it a core of their business. Additionally, the rapid change in IT software (release of new versions and issues of compatibility amongst others) may make leasing BIM and data management software an attractive proposition that allows organisations to focus on areas of expertise and business growth



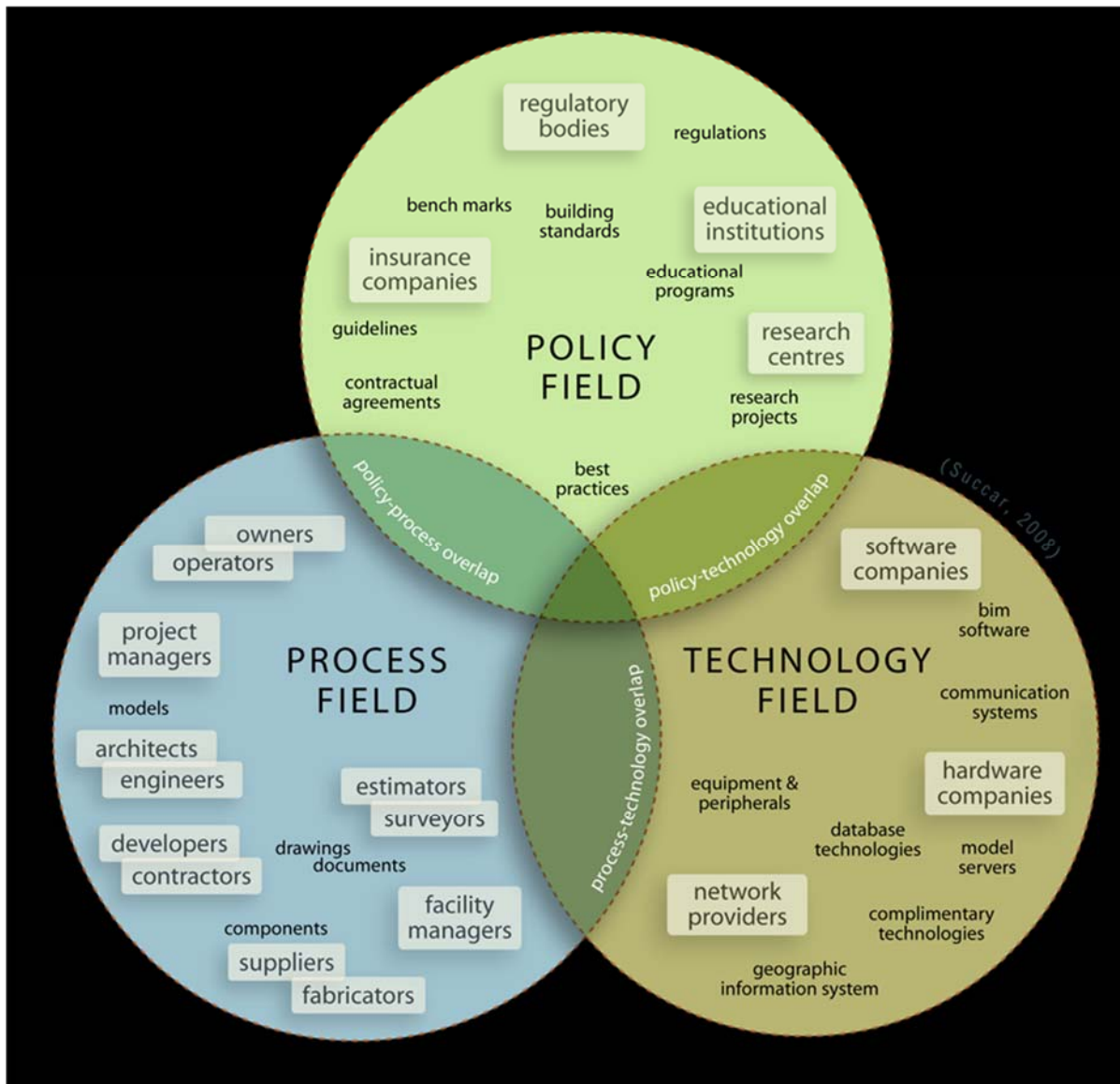


Figure 8.3 The 3 Interlocking nodes of BIM: in a BIM working Environment the common areas will be much bigger providing increased collaboration opportunities between all stakeholders. (After Razvi S. 2008)

#### 8.4 Considering generic and bespoke aspects of BIM principles and practice

“A comprehensive and growing collection of BIM (Building Information Modelling) objects spanning all building fabric systems”, this is how the NBS describes its National BIM library as an example of generic BIM. Modelling buildings’ performance, constructability, health and safety and so forth relies on populating the BIM model early in the design process to facilitate testing, simulations and early problem resolution. This is expected to happen before many consultants have worked the details of their design. Generic objects developed on standard average components are often used early on in the design to be able to run these simulations and test performance. Increasingly manufacturers are supplying the market with their specific

component and material parametric objects ready to be used in a BIM model. The use of these objects is common practice in many software packages, a simple typical example would be a wall in a Revit model for a standard family home will consist of 3 layers: internal, external and middle for insulation and structure.

Three features are key to the usability of the NBS national data base, namely integration, intuitiveness and quality. Access to BIM objects is facilitated by a direct link from the design tool using a bespoke Plug-ins for the major design software packages. Intuitiveness is embedded in intelligent search and filtering capabilities following the needs and established practices of specifiers, and most importantly the quality of data as all objects including contained data need the highest level of accuracy and standards. The generic aspects of BIM, be it a component data base or BIM model viewers, contribute to the implementation of BIM and can be an easy access options to SMEs and Micros embarking on a BIM journey.

With reference to section 8.3 above, the number of technology companies already active or entering the market is increasing. These companies provide bespoke technological solutions ranging from complete BIM solutions to very specialist service applications. Clash detection, specialist project document management systems are typical bespoke solutions. For instance BIMsync, currently in Beta format from BIM technologies, is an automated specification tool allowing for 2-way syncing between specification and model production of a validated approved specification. An innovative application that is exploiting a developing niche BIM market bridging the gap between a BIM model, specification and approved validation of specification. At the other end of the spectrum, Solibri is a bespoke Model Checker software with wide capabilities. It performs advanced clash detection, deficiency detection, BIM and accessibility compliance, model comparisons etc. at the higher end of BIM workflow.

Navigating generic and bespoke aspects of BIM is an exercise every built environment organisation will have to go through as part of an analysis of their business model and the separation between discipline specific and cross-discipline activities. The analysis exercise would help frame business and workflow priorities and identify aspects of BIM principles and tools relevant to the business model.

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