

# CAPITA SYMONDS

BIM Innovation

BIM – Some things to all people.

Gary Ross - August 2012



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# 1. Executive Summary

Building information modelling (BIM) is now a very real part of Capita Symonds business and as such this document aims to clarify some of the myths, misunderstandings and over-selling of the BIM solution and break through the hype and geek speak - making “virtual reality” more like “reality”.

## 1.1 About the author

Gary Ross MSc trained as a mechanical building services engineer and made the switch to computer aided design (CAD) aspects of that work shortly after qualifying. During his career he has held senior engineering and CAD positions at the majority of large Building Services consultancies and contractors, moving on to work at Autodesk the vendors of Revit, AutoCAD etc in a development and client support role.

Gary achieved his Masters Degree (Computer aided design in construction) in 2011 and now works as BIM Innovation Associate Director at Capita Symonds, implementing BIM across their five principle building services offices and also inputting to central group strategy and development.

Concurrently he sits on BIM strategy panels for the Chartered institute of building services engineers (CIBSE), the Building services research and information association (BSRIA), and the Soft landings group for UK Central Government.

## 2. What is BIM?

Building Information Modelling (BIM) is not yet “all things to all people” – it can be best described as “some things to all people”.

Normally relating to buildings but just as often infrastructure, a BIM model contains the relevant information to enable an onlooker to interrogate it and receive the information they want in a way that suits him/her, at that time.

For instance an Architect, a caretaker and a member of the public may all want information about a project, but they require very different information at different times and they need it to be presented to them in different ways. Up until now, they would have sought this information from three very different places. BIM now enables a single source of information presented in ways that suits as many as possible.

For that reason, a BIM model will contain as much data about the project as is feasible. Following the principles of “just in time” delivery, a BIM model can also be described as “just enough, just in time”

Getting the level of information just right is a skill which only experienced BIM users will understand, and it is those who will profit most from being involved in BIM.

At Capita Symonds, all of our engineers are trained in this way, based on years of experience and shared learning.

### 3. How is BIM impacting the industry?

It has been suggested that BIM is having the same revolutionary effect on the construction industry as CAD did twenty years ago. But I beg to differ.

What CAD did was replace one small part of how Building Services companies operated and replaced it with a new way. I.e. removing tracers and replacing (or re-training them) with CAD users and machines.

Of course this did have a fairly dramatic effect over a number of years and generally the quality and speed of producing drawings has increased as the cost of CAD itself has slowly reduced, but those initial and subsequent delays in return on investment (ROI) are mainly due to the fact that only a very small part of the company was involved – almost like when typewriters self-invented typing pools many years before.

Eventually there was a “if you want to stay, play” attitude and CAD has become very much the norm.

#### 3.1 How does BIM differ?

Depending on where you source your information, and on the face of it, there is apparently no difference.

But if you do BIM properly, and take it seriously and most importantly if you intend to stay in business, BIM *must* have a profound effect on your company, your clients, and the projects you work on.

Because of this business-transformation effect, it is believed that BIM will take greater effort to be the norm in the majority of companies, as each staff member in each department will in some way be touched by BIM and as such the transformation itself will take longer and will be harder to achieve.

That initial formation of the wave of transformation consumes a huge amount of energy and resources for a company and because of that it will scare some away from change. Those that form and thereafter ride that wave however are expected to see good returns on their overall investment.

#### 3.2 Government influence

Of course there is a very strong push from UK government to drive BIM through the heart of the construction industry as a whole. As part of a series of efforts to save the government and UK Plc a target figure of 20% on construction projects.

The effect of such a strong push from government is currently only affecting those that wish to be involved, and Capita Symonds is one of those. Rather than following the crowd however, Capita Symonds is proactive in getting involved in the policies and governance groups, making efforts to support and offer guidance to Government groups and institutional bodies.

The reason we do this is because we can see what many others can't. Most companies will work on the basis that if they don't do any work for central government, they will not be affected by the changes. But as has been seen in both the US and in the Nordics a government push on something as fundamental as BIM is quickly adopted by the major constructors in those regions as their own policy, eventually leading to a circumstance where not only can you not work for central government without a good working knowledge of BIM, but you also cannot work with the larger or more advanced of the constructors.

What then remains is a set of companies who can, and a set that cannot. The "cans" have free range to work on any project and will go on to work on prestigious projects, and the "can not's" work on the smaller, secondary projects that tend to be more litigious, fast tracked and low income. This two-tier relationship is now clear to see in those US and Nordics regions.

### 3.3 How can BIM save 20%?

20% may seem like a huge number for a simple piece of software to achieve, but as mentioned, it's about a lot more than just software.

Fundamentally, using any 3D CAD system well and producing properly coordinated designs will make some saving and go a fair way towards the 20% goal. Reducing errors "on paper" reduces waste on site and that's if you adopt traditional installation methods.

If prefabrication is used (which 3D and BIM effectively enables) even in a small way, it can have a major effect on project waste. A UK M&E contractor reported recently that for every one man day spend pre-fabricating; they saved seven man days on site. If you work that figure through to "costs" and relate those savings to days lost due to sickness/injury and the very real cost of deaths the cost savings again are substantial, let alone the obvious impact on the people involved. In 2007 there were 84 recorded fatalities on construction sites, and 7857 injuries which involved more than three days sickness leave. In addition there were 339 convictions by the Health and Safety Executive with an average fine of £9096 per conviction.

If you apply that same seven to one ratio to these figures you will have 72 fewer deaths, 6734 fewer "three day" injuries and 290 fewer directors in the dock. BIM enables that.

BIM also enables designs to be changed quickly and easily, meaning in real terms that the delivered project is more likely to be task efficient and therefore better energy savings and paybacks can be achieved - not forgetting that the 20% cost saving is a relatively short term goal. Equal in importance to Government is the reduction in carbon, as Paul Morrell (the outgoing Government Chief advisor) said recently "If cash is king, then carbon is queen".

Finally there is the operation and maintenance of a building. The 1:10:100 rule, quoted by government says that a buildings costs are spread in that ratio, where design:construction:operation fits that same ratio. As we have seen above, the design and construction phases can see cost savings, but the real big hitter is in the operation phase of a building's life. BIM makes savings available there too by making access to information easier for the maintenance personnel.

Careful design in BIM can also show long term planned costs such as replacement of consumables, lifetime of furniture, fittings and equipment etc. By making an informed choice on day one, cost savings can be planned for 20 years later.

It is my belief that in future the demolition of a building will have a significant cost, as natural resources dwindle and landfill becomes more and more expensive, the simple demolition of a building will need to be more carefully planned, even at its design stage.

Take for instance the London Olympic park that was required to use 100% of the existing buildings in the construction of the new facilities.

If we start to build new buildings now, we must surely have to plan for the demolition of them in 20/30 years time and plan for whatever eventuality we have built into them - remembering that a few short years ago asbestos was a normal part of a building fabric, with no foreseen costs or problems. Who is to say that the same is not true of gypsum, concrete or phenolic foam? At the very least we should be measuring the amount and location of each material used, so that in years to come we can locate and re-use or dispose of those materials accordingly. BIM helps us to do that.

### 3.4 Change for change's sake?

There is a general consensus in the industry that the industry itself is inefficient, slow and consumed by red tape. Why then is there a resistance to anything that is seen as different to that? Sometimes consensus and logic are poles apart.

What has been time consuming and troublesome for the past forty years should really be the first thing that is changed, but the normal way of things is to stick with what is known, rather than change to a new system.

It is only therefore when change is almost enforced that we as an industry are able to change at all.

The fact remains however that those who are most adaptable to change tend to be the most successful in business. But more than that, it is those who are able to profit from change who will be seen as industry leaders.

What BIM gives us is the chance to take a fresh look with a new pair of eyes over everything that we do, day to day, and be able to change it, only where needed, and only ever for the better. BIM therefore is an enabler to change itself, and is driven at profiting from that change.

## 4. Implementing BIM

Based on the above, one would assume that as long as you implement BIM, you will begin to see better projects and increased ROI. But that is not necessarily the case.

### 4.1 Bottom-up implementation

Many companies will place full responsibility for BIM implementation and innovation in the hands of those who are apparently best placed to understand this new technology.

In this case that person is either a CAD operator or a junior engineer (let's call them person A), who has seen a sales pitch seminar, done some further reading and decides he likes what he sees. He will then ask Company A for funding to buy one license of the software and will spend his lunch hours and after-hours reading help files and internet searching for clues on how to make it do what it did in the demo.

Depending on the answer he had about funding, he is now either working on a 30 day free trial of the software, an illegal copy, or if he is lucky he will have a legal version, possibly sharing it with five others.

At some point he will ask for training funding, and this may or may not get approval, normally the latter due to the "high" cost (bearing in mind the £6k already handed out) and the fact that he can't be released from his office for the three days it will take. If he does get some approval he will be asked if the training centre can do the training over one or maximum two days rather than three, and the company expects to see a one third cost saving for every day saved.

Person A will at that point suggest using the software on a live project, and his boss, seeing the images the tool can produce, will suggest they use it on pinch points and plantrooms - the parts of the project most needing some 3D modelling as they are the most complex.

### 4.2 Top-down implementation

There is a very small group of companies who choose another way, which is almost opposite. In this case person B, again possibly a CAD operator or junior engineer will go to his boss, having seen some software demonstrated.

In this case, his boss takes the request to board level and between them they are asked to look into the feasibility of adopting the software in the company. Person B and his boss go away for a few weeks and look into how this can be done, and what it will cost to do it well. They will also make some suggestions as to potential ROI, barriers to adoption, risks etc, so that the Board can make a good, informed decision.

The Board agrees to put the implementation in place, and tasks a group of CAD and engineering leaders to make it happen.

This is on the basis that:

- a) Each potential person who needs the software will have a license and high specification machine available.
- b) Each person using the software must have good training before they work on a project.
- c) Each person must have access to licenses of supporting software to make the most of the possibilities and make the original demonstrated abilities possible.
- d) Allowance will be made for the learning curve in project programs and budgets.
- e) Projects will be carefully chosen for BIM trials and will be closely monitored.
- f) If the above works well – they will make a policy decision that all projects will be BIM projects in future.

### 4.3 So which is best?

In our examples above, there is clearly more than one way to approach BIM adoption, and hopefully the reader will identify with one or the other, as experience shows that both are happening in the industry with person and company A being the mainstream of current thinking.

#### 4.3.1 *Person/Company A*

Person A will more than likely attempt the difficult parts of his trial project and fail to produce on time, and within budget. The images he produces are good but not great value for money, taken that three images have cost £6k and days/weeks of work.

So his boss is not happy even though person A has toiled every lunchtime, freetime, evening and weekend for weeks. He knows it would have been easier with a better specification machine than the one he already had two years previous, but he either forgot to include that in his budget request or figured if he put that in the budget request as well, he would never get the software. His wife is also not happy, seeing him come home frustrated, late and exhausted every day.

The outcome is that neither person A nor his boss are motivated to try to use BIM a second time and will more than likely not use it again. Another person in another department in company A will have the same thoughts a few months later and he will follow the same process. This pattern continues ad infinitum.

If person A still thinks that BIM is his future he will look around for a company where BIM is part of normal operating policy. If he doesn't he will go back to being a normal CAD operator or junior engineer.

#### 4.3.2 *Person/Company B*

Person B, after opening what is seemingly a can of worms at company B gets all of his information together and presents it to the board with his boss. The board approve it with the above imperatives and set the group to work.

Person B then finds some simple projects and works towards what the software can do well, rather than what can fix the biggest of problems, after all they are on a learning curve.

Using his research and training, he finds that BIM can do things he didn't expect it to do, and yes he can achieve the same as was demonstrated by the sales guy.

He makes a point of showing his company how he has achieved the good things, and also shows how to get around the parts that may once have been blockers.

Once he has done this on a few projects, he can then help to lead Company B into bigger challenges in a progressive and supported way.

#### 4.3.3 *Outcome*

The above scenarios are both experiences of the author at different companies. Company A was actually a few different companies, all with the same outlook. Company B was and is Capita Symonds.

It has been seen that Person A will either stay at Company A – or more than likely move to Company B at some point, but never the other way round.

Company A will protest at BIM being pushed by the government and will talk down proclamations of success in BIM.

Company B goes quietly about its business and will still be in business in years to come.

If you are person A and still see BIM as your future, I suggest you give us a call.

## 5. How to be successful in BIM

Success in BIM is achieved by adopting some of the very principles of BIM :

### 5.1 Project execution plan

Every BIM project carried out at Capita Symonds has a project execution plan. This lays down the ground rules and expectations of the project.

To be successful in BIM, you must first set out realistic goals and milestones that will get you there. There is good value in being brutally honest – are you up to it? Can your staff handle it? Can you afford the initial outlay?

You must set out a timescale within which you intend to be making a ROI on BIM. Experience shows that the first project will take three times as long (as “normal”) to complete in BIM. The second will take twice as long, and the third will approximate what was normal previously. The fourth project should start to show cost and time savings overall. Taking the above example, to get back to overall profit on the bottom line takes around ten projects. That could be a month’s work or ten years work, depending on the projects you choose. If you don’t have an allowance for that, then you will suffer from it.

### 5.2 Just enough, just in time

#### 5.2.1 *Training*

There is no value in training all staff at once, only to have some of them waiting six months before their project starts. The rules of training say that you remember a third of what was trained, a day after the training.

If your staff are put straight to work in BIM, they will retain that third and recall the other two thirds at some point.

If they don’t touch BIM for more than a few weeks that initial third retained reduces dramatically and you’ll be re-training them from scratch after a six month gap.

#### 5.2.2 *Software and hardware*

It goes without saying that you need the software available as users take training. On a larger scale, software may come bundled in five license packs, so you need to think ahead if you choose that option. Capita Symonds purchased hundreds of licenses, with a good plan to quickly get trained users using them, but there’s no need to buy more than you need for the near future.

Hardware is similar – you need a good machine at or above the recommended specification bearing in mind that the specification will go up next year. Do not scrimp on machines. If a software vendor suggests a recommended specification, you can guarantee that they know more about it than you do, and they know exactly why it’s worth that extra £40 for an ever so slightly better graphics card.

One thing to remember with hardware is that it is pretty much the only commodity that gets cheaper each year, even each quarter. There is no value at all in bulk buying machines and then storing them for two years before you use them.

Buy as you go, and give power users the best and newest machines, passing lesser machines down to new or occasional users.

### 5.3 Work in progress

Work in progress or WIP as it's known is an important part of the BS/PAS 1192 and AEC-UK BIM standards on which Capita bases its own procedures, and into which we input.

It is worth mentioning here a reminder to bear in mind that currently used BIM software is relatively new compared to say CAD. In itself it is a work in progress, which is a polite way of saying that it's simply not finished.

But software which is a work in progress is two things. One is an immature tool which has some way to go, and the other is software that has room to improve and expand into.

Capita Symonds has close working links with the software vendors, and we work hard to do all we can to make sure that the improvements made are the best ones for the construction industry at large.

Another work in progress worth remembering is your own development. Do not expect miracles or even fireworks on your first few projects – they will not come. By the time you are seeing those miracles happen, you will see them as common place and you'll be looking for more miracles somewhere else in the project.

### 5.4 Collaboration

Collaboration is one of BIM's successes. BIM almost forces design teams together much closer than ever before, and this only ever benefits the project.

To be successful in anything new you have to learn from others and share ideas, pitfalls and good practice. This very document is an example of good collaboration. Are we giving away our trade secrets? No. Are we giving away what we think will help others? Exactly – just enough – just in time.

As early adopters of BIM Capita Symonds has taken in a lot of valuable information and lessons learned from other companies and we see it as our moral duty to give back to the industry.

We do this through working with Government, presenting at BIM events, helping to run BIM community projects etc.

In a more formal way we are able to give early advice to the contractors, clients and design teams we work with to enable them to understand how BIM can work for them, and how they can win BIM projects alongside us.

## 6. Frequently asked questions

Below are questions that pop up in conversations around BIM all the time:

### **Q. Who owns the model?**

**A.** Whoever is paying for it! It is the choice of the client whether he/she appoints a BIM manager on the project/framework, but we suggest that somebody needs to take responsibility for the overall coordination and collaboration. A lot of the time the Architect or lead consultant will be approached with this task, but in BIM terms it should be whoever is the most BIM-able.

Fundamentally though, the ownership of each part of the BIM model is the responsibility of the discipline that created it. Overall - he who pays for it owns it, although you will find that most contracts still don't ask for a BIM model (and hence no-one is paying for it), even though one is probably expected. This needs to be carefully discussed at project inception.

### **Q. What's the difference between 3D CAD and BIM?**

**A.** 3D CAD plus information = BIM.

### **Q. Is BIM new?**

**A.** No – BIM as defined above has been around for several years in both the construction and other industries. All that is new is the acronym, the tools and the ability to exploit the BIM model in more ways than ever before. In theory you can do BIM with a pencil and paper – you just need a lot of paper and a very good filing system.

### **Q. Does BIM cost more?**

**A.** There is no one answer for this as all projects and scopes are different. As well as that, each company will use greater or lesser effort than the next to create a similar BIM model. Overall on a project, taking all things into consideration it has been found to be cheaper than traditional methods.

Certainly as far as set up costs show – BIM is cheaper to implement now than CAD was twenty years ago.

### **Q. What does 4D 5D and nD mean?**

**A.** 4D, 5D and onwards (nD) are simply additional dimensions to those we know as 2D and 3D. Most often, the 4th dimension is seen to be time and the 5th is cost. Be aware that very little is standardised so it's possible that everyone is wrong, or at least confused.

For this reason you'll often see or hear the 4th and 5th dimensions with an explanatory bracket following – 4D (time).

In its text about 4D and 5D, Wikipedia says: *"If a light is shone on a three dimensional object, a two-dimensional shadow is cast. By dimensional analogy, light shone on a two-dimensional object in a two-dimensional world would cast a one-dimensional shadow, and light on a one-dimensional object in a one-dimensional world would cast a zero-dimensional shadow, that is, a point of non-light. Going the other way, one may infer that light shone on a four-dimensional object in a four-dimensional world would cast a three-dimensional shadow."* - well, that's cleared that up then!

**Q. What are the levels of BIM?**

**A.** The government BIM strategy group have given very precise ideas about what BIM levels 1, 2, and 3 are. Full details can be found here to avoid duplication: [www.bimtaskgroup.org](http://www.bimtaskgroup.org)

There are also other softer levels of BIM which will give levels such as BIM level 2.5.

The higher levels of BIM are achieved by increasing/applying knowledge to the data/information:

- Data comprised of the basic, unrefined, and generally unfiltered information
- Information relates to description, definition, or perspective (what, who, when, where).
- Knowledge comprises strategy, practice, method, or approach (how).
- Wisdom embodies principle, insight, moral, or archetype (why).

It is Capita Symonds Policy that all projects are carried out to BIM level 2 and we are working towards BIM Level 3 well in time for when it is demanded.

## Further information

For further information please contact Gary Ross by email ([gary.ross@capita.co.uk](mailto:gary.ross@capita.co.uk)) or follow on twitter (#Garybimross).

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