

BIM Business Value Analysis

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Abstract

Great emphasis is nowadays placed on the design of a building in accordance with BIM, which connects different fields into one single project. BIM helps organize all phases of the life cycle of the building. This allows for aspects of better financial planning of the project and reduces costs during operations. The financial aspect is the main thing that interests any investor, besides of course other benefits. Therefore, the business value of BIM should be for every investor to learn in advance what might bring him to this investment decision.

With the help of data provided by the British construction company Skanska UK, which has been implementing many projects with BIM, there was created an analysis of the business value of BIM (BIM benefits) for non-BIM, low-BIM and high-BIM projects. The KPI system was used for this analysis. The results of the analysis showed that BIM benefits depend on the degree of integration of BIM elements into the project. In the cases of non-BIM or low-BIM projects there is even a risk of loss.

Keywords

Building Information Modeling (BIM);

Key Performance Indicator (KPI);

Business Value.

Introduction

Regarding the term BIM there should be recognised above all optimization of the process in the lifecycle of a building i.e. from the initial project design to end use, while especially recognizing these phases that involve the highest proportion of data. Main effectiveness lies in the cooperation of all interested parties, leading towards ensuring a comprehensive mutual transmission of data, reducing errors in projects, improving their quality, increasing productivity, shortening construction time and lowering building costs [1]. For the moment investment firms should not solve the question whether to use BIM, but rather how to use it to increase effectiveness.

With reference to Table 1 it is possible to identify a few key areas where firms in foreign markets using BIM generate the added value with the help of this technology.

Internal Business Value of BIM	North America (2009) ¹¹				Europe (2010) ¹²			
	Did not answer	None/Low	Moderate	High/Very high	Did not answer	None/Low	Moderate	High/Very high
Fewer claims/litigation	14%	40%	26%	20%	13%	38%	26%	23%
Increased profits	2%	46%	31%	21%	4%	26%	33%	37%
Maintaining repeat business with past clients	5%	31%	28%	36%	3%	28%	32%	37%
Marketing new business to new clients	2%	22%	27%	49%**	3%	26%	25%	46%**
Offering new services	2%	24%	27%	47%**	4%	18%	31%	47%**
Overall better construction project outcomes	2%	25%	25%	48%**	0%	36%	37%	27%
Recruiting and retention of staff	6%	43%	30%	21%	10%	34%	36%	20%
Reduced construction cost	6%	37%	32%	25%	4%	36%	30%	30%
Reduced errors and omissions in construction documents	4%	21%	28%	47%**	2%	13%	24%	61%**
Reducing cycle time of specific workflows	3%	41%	29%	27%	4%	16%	28%	52%**
Reducing overall project duration	3%	41%	29%	27%	2%	24%	33%	41%**
Reducing rework	3%	25%	27%	45%**	7%	18%	25%	50%**
Younger staff's learning of how buildings go together is improved	6%	33%	30%	31%	7%	26%	32%	35%

Figure 1: The Internal Business Value of BIM
(Results are indicated as a % of respondents who see the most value) [2] [3]

The increase of effectiveness by introducing BIM into a project is verifiable. By using the already implemented buildings projects there can be measured the difference between those in which BIM has been introduced and those in which it has not. This is how there can be determined its Business Value. The following analysis should try to clarify what a real contribution this methodology has brought to already implemented projects. The goal of the comparison is to demonstrate its operational effectiveness.

It is necessary to stress that the data used for conducting this analysis were provided by the British Building Company Skanska UK. It concerns thus the buildings constructed on the territory of Great Britain. The important element of knowledge is that Skanska UK already has undertaken several tens of projects in which BIM has been introduced. In this area Great Britain is much further ahead of the Czech Republic, something confirmed here by a governmental regulation introducing an obligation to use BIM in public contracts from 2016.

Methodology

The key instrument in carrying forward the analysis has been the system KPI (Key Performance Indicator). The KPI system expresses an indicator of process performance, involving services determining the state or level of a given performance in time [4]. In order to evaluate the business value of BIM there were selected 109 building projects from several operational centers with a division according to the degree of using BIM on a given project (94 non-BIM projects, 7 low-BIM projects, 8 high-BIM projects).

For each such project there was created by a project manager a KPI measure, the result of which provides a view, from where the project is situated at a certain time. Data were delivered by each operational unit from quarterly operational effectiveness reports for the period Q1/2012 - Q4/2013. This means practically that each project team headed by a project manager got KPI tables to fill in, to evaluate honestly and thus to create a precise self-evaluation. These evaluations were updated quarterly, which is why a trend of development in the monitored projects was produced and that is why there could be determined the influence of using BIM on a project. The KPI evaluation is obligatory for the majority of British Skanska projects, and thus it was not difficult to map the value of BIM in these projects.

In total there were defined in advance ten KPI:

- KPI #1 Are we on schedule?
- KPI #2 Are we on budget?
- KPI #3 Is our cash position as forecast?
- KPI #4 Are we actively managing risk?
- KPI #5 What is the quality of the discussion we have with the client about how to improve project performance?
- KPI #6 Is our target profit holding?
- KPI #7 Is this an environmentally conscious site?
- KPI #8 Is this a safe site?
- KPI #9 Are the identified important stakeholders happy with our performance?
- KPI #10 Is this a quality site?

Each KPI has 5 Compliance Indicators, which are different for each KPI and are accorded a potential score - red (0), yellow (1), green (2) or gold (3). Besides these indicators all KPI have in addition 2 to 3 Performance Measures.

KPI Scoring Matrix
KPI # 1 Are we on schedule?
Compliance Indicator

Potential Score:
 Red = 0
 Yellow = 1
 Green = 2
 Gold = 3

1	Do you have a programme and is it updated monthly/weekly?	Red	0
2	Are concerned parties involved in the planning process (i.e. supervisors, skilled workers, subcontractors, designers)? Is this communicated and discussed with everyone in the project?	Yellow	1
3	Is the programme divided into clear sub-projects with responsibilities assigned?	Green	2
4	Do we use planning tools in the planning process including critical path analysis where this is relevant?	Gold	3
5	Is the programme reviewed by senior management on a regular basis?	Red	0
a. Sub Total			6

Performance Measure

		Potential Score	
	On or ahead of programme	5 - 10	
	Behind programme	0 - 4	
b. Sub Total			10
Total Score (a x b)			60

Figure 2: Example KPI

All data were divided according to the type of projects, quarterly periods, the rate of involvement of BIM on the project (non-BIM, BIM < 1.3, BIM > 1.3). For finding operational effectiveness there were calculated average values for KPI indicators for projects non-BIM, low-BIM a high-BIM and consequently there were calculated percentage differences among these values for mutual comparison of the three types of projects.

Results

Within the context of a summary account of resulting values there were created tables, the results of which are in part presented by Figure 3 and 4. Here are expressed differences in KPI averages among all projects across all operational units right through the entire analyzed period Q1/2012 - Q2/2013. By comparing differences between BIM projects and non-BIM projects there were discovered the following facts:

- Fact 1: BIM projects achieve on average 11% better results than non-BIM projects in terms of KPI values.
- Fact 2: BIM projects achieve considerably better results especially on financial indicators:
 - Budget keeping (+ 18%),
 - Cash according forecast (+ 17%),
 - Target Profit holding (+ 27%).

Other indicators:

- Risk management - Active risk management (+ 13%),
- Quality of the discussion with client (+10%),
- Environmentally conscious site (+ 11%),
- Site safety (+ 8%)
- Site quality (+ 2%).

Indicators in which there were achieved zero or negative evaluations of BIM projects were:

- Stakeholders' satisfaction with performance (0%),
- Schedule keeping (- 2%).

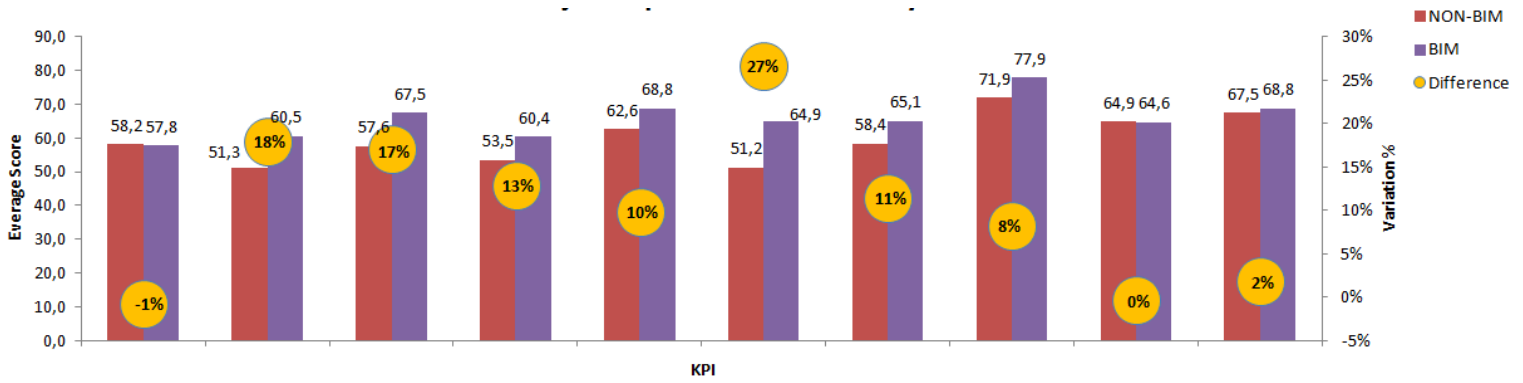


Figure 3: BIM vs. non-BIM Project Operational Efficiency Performance

- Fact 3: The more the BIM is used on the site, the better are the project results in all areas (20% on average). Here have been compared the projects high-BIM (>1.3) versus non-BIM and low-BIM (<1.3) versus non-BIM.
 - Schedule keeping (+ 28%) and (- 18%),
 - Budget keeping (+ 38%) and (+ 1%),
 - Cash according forecast (+ 24%) and (+ 13%),
 - Risk management - Active risk management (+ 31%) and (- 1%),
 - Quality of the discussion with client (+13%) and (+ 7%),
 - Target Profit holding (+ 42%) and (+ 13%),
 - Environmentally conscious site (+23%) and (+ 1%),
 - Site safety (+ 10%) and (+ 7%),
 - Stakeholders' satisfaction with performance (+ 2%) and (- 3%),
 - Site quality (+ 17%) and (- 12%).

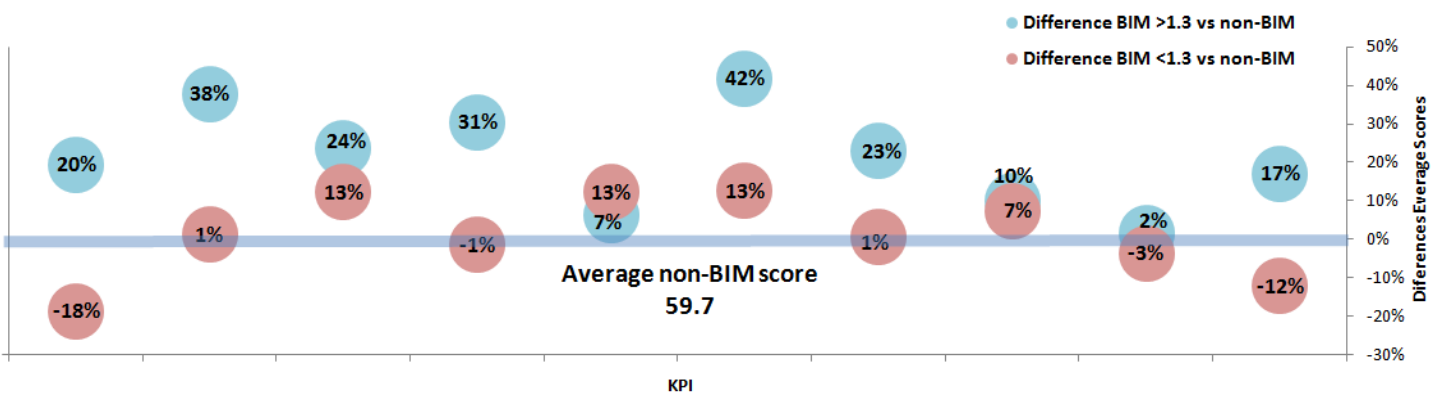


Figure 4: Maturity of BIM Matters

Conclusion and discussion

The results of the analysis confirm the benefits of introducing BIM to a project, giving a total increase of operational effectiveness and Business Value against non-BIM projects. This elaborates into the named categories-the prospect of improving economic results, holding or higher profits, keeping to budget, increasing the quality of the project, improving sustainability, reducing risks,

producing a safer building, a general improvement of conditions for marketing and new opportunities for growth. On average, mature BIM projects (>1.3) score 20% better than non-BIM projects. However, a surprising item of knowledge was found within the context of comparing low-BIM (<1.3) versus non-BIM projects, where low-BIM projects had the same, and even worse results than non-BIM projects, namely on such indicators as Schedule keeping, Active risk management, Stakeholders' satisfaction with performance and Site quality. From this should be recognised the necessity to focus on an actually appropriate BIM introduction to a project using all the imperative measures, because otherwise there cannot be fulfilled the desired operational effectiveness.

The significance of this analysis is above all in providing feedback for building firms and investors on the matter of Business Value. They are interested above all in what BIM will bring to them and how much it will cost them. That is why a requirement in any further research is increased analytical attention to the calculation of costs involved in introducing the very idea of BIM into any project.

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