

Whitepaper:

IFC – A driver for design quality in the AEC industry

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IFC - A driver for design quality in the AEC industryAuthors:
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MT Højgaard has analysed 153 projects and investigated how IFC influences the quality of the design material. It has yielded insight into specific patterns that are crucial for the quality of the design material. By using validated data collected from these projects, MT Højgaard can show how Industry Foundation Classes, IFC, significantly increases the quality of design materials in the AEC industry.

This paper presents a quantifiable benchmark of the quality of designs with IFC models versus designs that do not contain 3D-models in IFC. The paper also presents an analysis of how the quality of models is influenced by national regulations demanding IFC, as well as the contractual basis of a given project. There is a clear propensity for designs containing IFC models to be found at the higher end of our design quality spectrum. The research shows how the IFC format almost eliminates projects with a low design quality and that the use of IFC applied within the Danish ICT regulations 118/119 increases design quality with 45% compared to projects without IFC.

MT Højgaard, as a large contractor, applies the IFC format in a multitude of situations; including bidding, quality assurance, procurement, planning and monitoring of construction projects. As part of this, MT Højgaard uses IFC as part of its best practice.

BIM & VDC is at the core of MT Højgaards strategy and as such, the assessment of design quality is a pragmatic way of both selecting advantageous projects, minimising risks and identifying metrics for performance evaluation. By looking into the design quality of tenders and contracted projects, MT Højgaard has found that the investment gains of implementing IFC compare favourably to investment costs, which this analysis provides evidence for.

How MT Højgaard assesses design quality

The data set of the analysis consists of a record of quality assessments from 153 projects tendered in five different procurement forms and at a variety of design development stages. In spanning the 153 projects the data set consists of 381 different discipline-level contributions, each comprised of 3D models and/or drawings, project specifications and more. All the analysed projects have been formally tendered. In practice projects are controlled and scored on a scale from 1-100. The complete design material for each project and the contributions of each discipline are scored separately.

Results and statements

This analysis of the design material on 153 construction projects shows how the use of IFC increases the design quality of the projects. Projects with IFC and projects without IFC are respectively portrayed on the left and right side in figure 1. By plotting the average design quality of all discipline contributions involved in the given project with the design quality of the overall project, the following distribution of projects with IFC and projects without IFC is obtained. The results show a 33% increase in the quality of the design material when projects include IFC as a part of the design material (from an average score of 49 to 65).

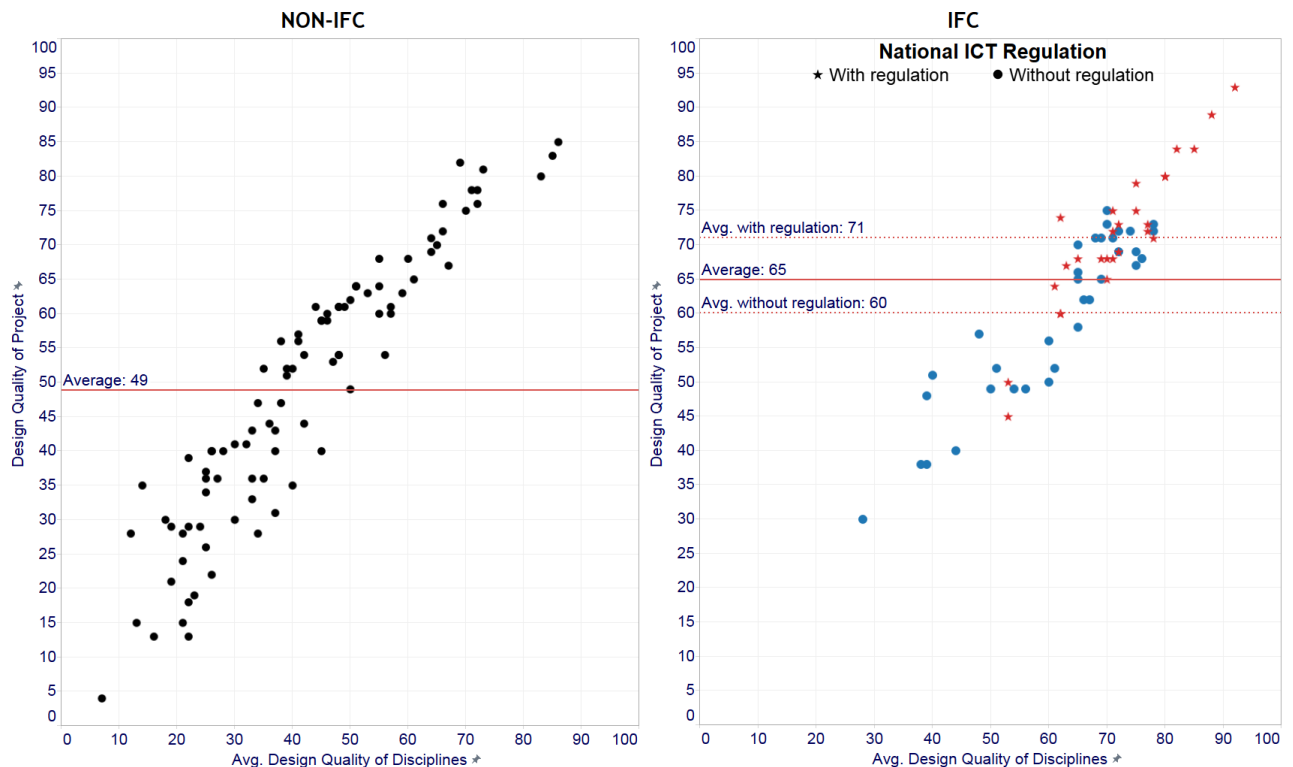


Figure 1: The figure illustrates the distribution of the quality of design materials from projects respectively without and with IFC. The graph on the right side identifies projects that use IFC and whether they are covered by the Danish ICT regulations 118 and 119.

Furthermore the analysis identifies projects that both include the use of IFC as an open format and are covered by the Danish ICT regulations 118 and 119. The Danish ICT regulations 118 and 119 are legal requirements prescribing the use of ICT, including IFC, on publicly funded construction projects in Denmark. The results show that the use of IFC as a standardised specification for sharing BIM data considerably increases the level of the design quality. In addition, the investigation reveals that if the use of IFC is complemented by a mandatory framework for applying it the quality of the design material shows an increase of 45% compared to projects without IFC. The combination of exchanging modelled data through an open format and a well-defined framework for applying IFC, provide a basis for executing construction projects on a stable foundation.

Well-coordinated design material is essential for securing the best circumstances for executing a project. With this investigation it is furthermore proven that the use of IFC plays an active role in the contribution to high design quality.

The influence of IFC on the quality of design material is depicted as a percentage distribution with a division in three categories. The amount of projects with a score of 0-39 is significantly reduced and the amount of projects with the highest design quality increases with 66% when the IFC format is used (figure 2). The platform for exchanging data through an open format almost results in an elimination of projects that have a low design quality (ranging from 0-39).

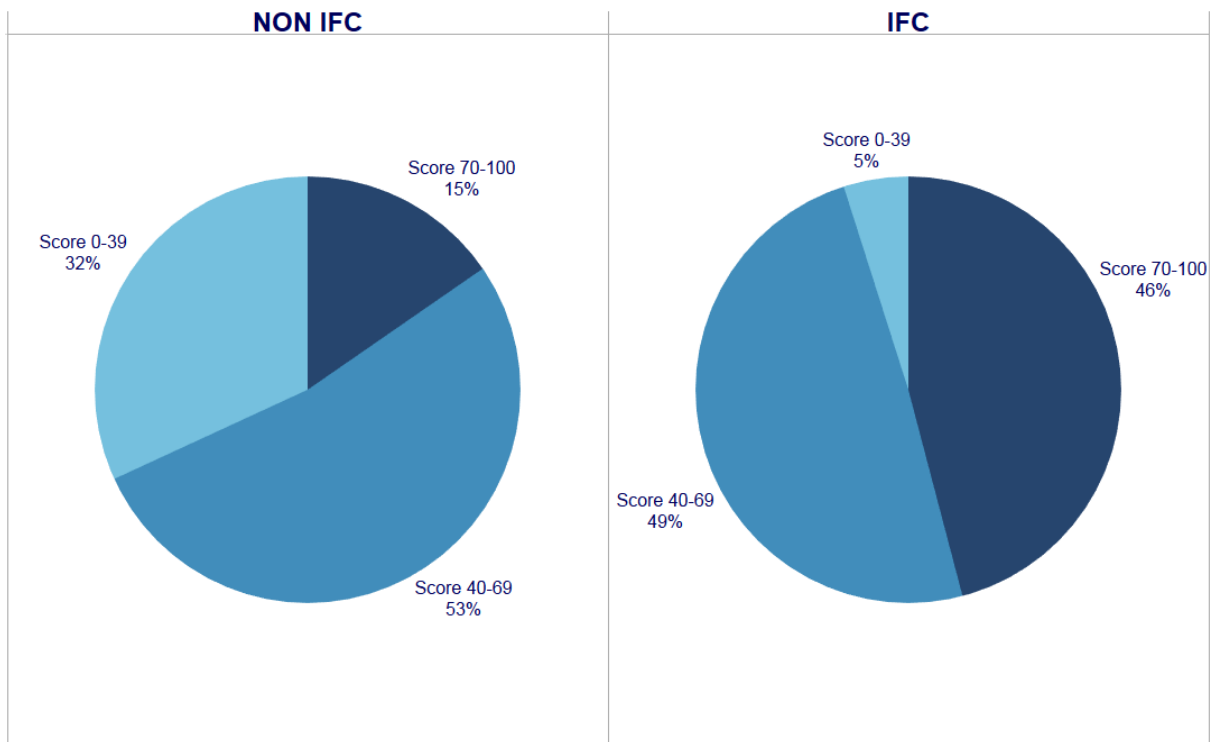


Figure 2: The figure shows the distribution of the design quality for projects without IFC and with IFC.

Comparing projects without IFC and without the Danish ICT regulations to projects with IFC applied within the framework of the ICT regulations the analysis reveals how the variance of design quality is reduced (figure 3).

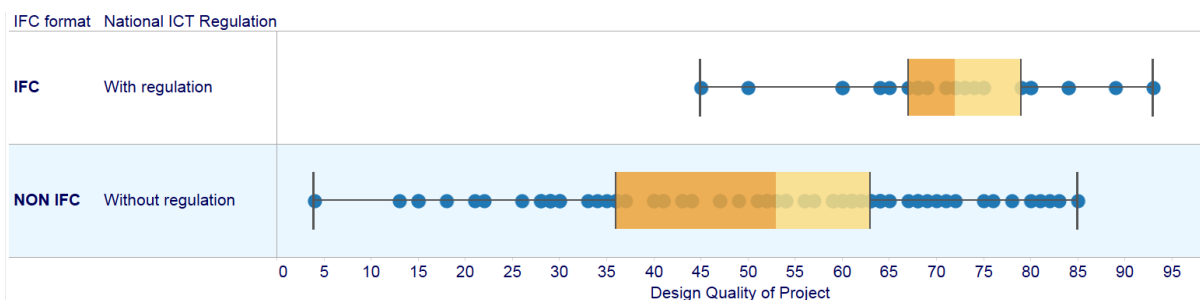


Figure 3: The figure illustrates the variance of design quality for projects without IFC or the Danish ICT regulations and project with IFC applied within the framework of the Danish ICT regulations

The reduction of the variance means that projects tend to be closer to the mean value. This indicates that, by using IFC and the framework implied by the Danish ICT regulations 118 and 119, the probability of having a project with higher quality design material is increased by 33%.

The benefits of IFC have been confirmed by one of MT Højgaards BIM Coordinators on a large construction project in Denmark. The BIM Coordinator expresses how IFC have facilitated the execution of the project:

Benefits of IFC

"We have used IFC to export our models from Revit to Solibri and check for changes between two versions of the same model. This showed that not only had the geometry been changed but also the naming of the objects and families in Revit. We wouldn't have noticed this otherwise."

"We have also used IFC to get our models from Revit through ArchiCad and to BIMX, so that we could view the models on our iPads in the building site. Our precast concrete elements have been modeled in Tekla, and we have used IFC for clash detections between these and the HVAC and Architectural models."

"IFC reduces errors in general! The open standard makes it possible to collect all models very easy. Especially with the 2014 export from Revit to IFC we have used this possibility."

IFC as a means for enhanced communication

"We have made test for communication in BCF between the concrete supplier in Tekla BIM Sight and MT Højgaard in Revit. We believe that this can be used in future projects."

Appendix

MT Højgaard has developed a systematic practice for quality assurance and data collection/analysis, see <http://mth.com/Methods/Building-Information-Modeling/Downloads-bim.aspx>, to ensure that received design material supports a sound execution on the construction site, concurrently improving our execution record and portfolio of delivered projects. When diverse projects are reviewed on a quantifiable, common ground the BIM-QC must build on uniform control: The answers to an individual quality assurance procedure is recorded through 36 control points in the categories of *Reception Control; Modelling Technique and Information Content; Consistency and the Basis for Take-Offs & Planning*.