

Contribution to BIM standardization in Portugal

Proposal of an addendum to contract agreement

Extended abstract of dissertation for the degree of Master Civil Engineering

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ABSTRACT

The BIM concept means a significant improvement in project management processes, with emphasis on design and construction phases, where it's a very useful tool, for instance, in managing conflicts between projects of different specialities. Therefore, BIM stands as an important instrument for improving the quality and productivity in construction, making architecture, engineering and construction industry (AEC) more competitive.

However, for the mass adoption of BIM methodologies, it is necessary to pay attention to standardization-hiring-implementation trinomial because they are fundamental for a sustained diffusion of BIM practices. These three drivers of BIM concept's integration in traditional processes must evolve together in a structured manner and, if Portugal wants to implement BIM in the industry, it will be necessary to create normative bases to assist in the procurement and subsequent implementation of BIM.

Internationally we observe several countries with standards and guidelines that help stakeholders to be engaged to BIM, as well as documents that allow participants to understand their degree of BIM implementation and realize what is required at each maturity level.

In Portugal, due to the prematurity of a few cases of BIM implementation, it was necessary to map the needs not only in the tendering phase, where it is suggested to integrate a document with the owner BIM requirements and a multi-criteria matrix for evaluation of candidates and proposals, but also in the contract phase, for which it was developed a model of a BIM addendum to the contract agreement, which is integrated within the work of BIM Standardization Technical Committee (CT 197).

Keywords: Building Information Modeling, AEC industry, BIM addendum, BIM procurement, BIM normalization, BIM implementation.

INTRODUCTION

Despite the resilience of AEC industry to change, it cannot avoid the tendency of modern times and, in order to prevent the loss of competitiveness, it is forced to innovate and to use all the solutions provided by new technologies. Thus, it is inevitable the increasing digitalization of industry, resorting to more and more tools and methodologies such as those presented by BIM concept.

Due to that, BIM is a way for the innovation of AEC industry, and there are already some achieved benefits in some countries that resorted to the integration of BIM methodologies in their traditional processes.

However, Portugal still has a long way to cross in order to implement BIM successfully. In spite of being encouraged and praised practices, the few and sporadic Portuguese cases that used BIM were insignificant considering the size and potential of the Portuguese AEC industry. This lack of adherence is due largely to the lack of national standards and good practice guides that support BIM implementation and procurement.

This raises the motivation to contribute to BIM standards in Portugal in a context of gradual and progressive implementation of BIM at a national level, and the dissertation, that this extended abstract refers to, is included in the Portuguese BIM Committee for Standardization (CT197) given the growing need to produce standards and guidelines that can be used by the various actors involved in project design and/or construction. Therefore, the ultimate motivation of this work is, in fact, to contribute to include BIM in the way of thinking and doing of all stakeholders.

In terms of specific objectives, this work aims to contribute to BIM standards in Portugal, with special focus on the creation of bases to enable a procurement that includes methodologies and BIM tools in the process. Specifically, it is intended as a first step, to map and identify changes that BIM procurement brings to the current and traditional hiring process, both in the tendering and adjudication phases. Then, with a special focus to the adjudication phase, it will be proposed a model of an addendum to the BIM contract, i.e. a document that will be annexed to the traditional contract in order to bind the parties under BIM concept.

METHODS

The method used to achieve the proposed goals was a deep analysis of the literature, including existing cases in other countries in terms of standards and implementation practices that lead to BIM procurement.

After this structured analysis, it was possible to identify some needs and BIM challenges in Portugal that led to the presentation of a proposal for an addendum model to support BIM procurement and a consequent explanation of this document.

As validation methodology, surveys in the form of interview were conducted with experts in the field, in order to validate the proposed addendum model and identify potential improvement areas.

BIM STANDARDIZATION AND IMPLEMENTATION

With regard to international standards, there are already some countries that realized the importance and the benefits that BIM could have in AEC industry. So they took the initiative and developed standards that can be recommendations, guidelines or even changes to the law. This work is generally developed by governments or organizations founded with that purpose.

Although it is an increasingly discussed topic, BIM is not a popular subject in the reality of Portuguese industry, and the implementation of BIM methodologies and tools in Portugal is lagging behind the rest of Europe, particularly when making comparisons with United Kingdom.

So in Portugal there is a paradigm in which all stakeholders in the design and construction phases of a project are very loyal to traditional methods and, moreover, do not have the proper knowledge or the confidence to take risks implementing BIM procedures on their work.

Therefore, after reviewing international BIM habits and thinking about how to adapt the best practices to Portuguese AEC industry, it was concluded that the best way to contribute to the normalization of BIM procurement in Portugal would be through the establishment of an addendum to traditional contract agreement regarding all issues that should be considered in BIM. This addendum will have the intention to provide support to the BIM procurement, remaining resilient to any changes in BIM standards documentation or in employer's information requirements.

To this end, this model was built to be a reference when someone is writing a BIM addendum to a contract agreement and the model should be adjusted according to the will of the stakeholders and the specifications of the project. Also, in order to avoid losing its validity, the document is intended to be versatile and timeless because it isn't committed to standards or with any employer's information requirements that may no longer make sense or become obsolete in the near future.

There are several international examples with this kind of addenda that inspired the development of this proposal for a Portuguese BIM Addendum, for example, the American Institute of Architects (AIA) *E203 Building Information Modeling and Digital Data Exhibit* or *ConsensusDOCS 301 BIM Addendum*.

The proposal for a Portuguese addendum is supposed to be a contribution to BIM procurement in Portugal and its content will be shortly presented in this extended abstract, but first let's take a look on BIM procurement challenges in Portugal.

BIM PROCUREMENT CHALLENGES IN PORTUGAL

It should be noticed that the implementation of BIM in procurement procedures inevitably requires adaptations and changes to traditional processes. Therefore, it is essential a systematic treatment and better adaptation of the entire process, due to the more collaborative nature of BIM methodology and the greater complexity in terms of management of information and the associated flows. Having said that, the normalization is the best way to systematize the changes to the procurement process, by using guidelines or normative documents of support.

Throughout the procurement process, there are two phases that are critical and need to adapt to be able to integrate BIM: the tendering phase and the adjudication phase. Owing to the resilience of all stakeholders to make root changes in the procurement process and also because of the legal implications that these changes could raise, it is suggested that the stages of tendering and contracting agreement remain the same and with the same procedures, and the BIM adaptation comes from the introduction of documents attached to traditional contracts agreement and procurement programs. Thereby, it is found the solution to integrate BIM in Portuguese AEC industry, by joining two divergent philosophies: the need to innovate the industry with the implementation of BIM methodologies and the resistance to innovation by stakeholders that, by nature, are averse to change.

In terms of documents needed to be included in the tendering process there are the employer's information requirements and the model to assess BIM candidates and proposals. On the other hand, in the adjudication phase should be added to the contract agreement an addendum that commits the parties involved in the project with all matters regarding BIM concept. Note that, despite the BIM addendum take effect at the adjudication stage, it will also be part of the tender phase as an information attached to project specifications. In order to better understand the incorporation of BIM documents in the tendering phase, look at Figure 1:

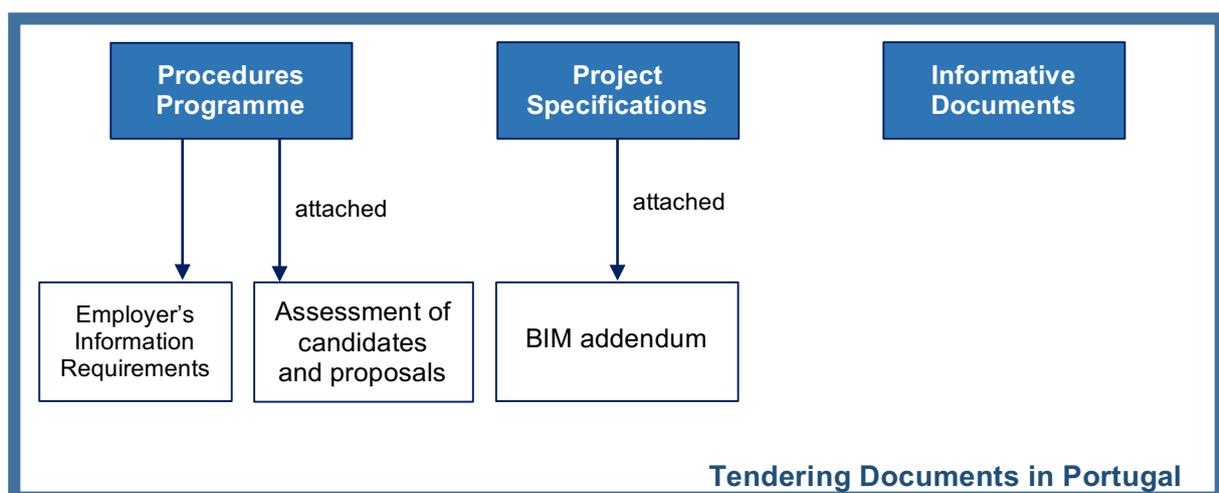


Figure 1 – Tendering Documents in Portugal

PROPOSAL FOR A PORTUGUESE BIM ADDENDUM

The development of a BIM contract deserves special attention, not only to ensure a proper structure for BIM implementation process, but also to define correctly the collaboration dynamics. It was precisely with this thought that was created the BIM Addendum model, striving above all to design a document that would help in the adoption of BIM tools and methodologies, by clarifying the implications of BIM implementation.

It was intended to create an addendum, to help in BIM procurement, with a wide field of application and, at the same time, with practical applicability to a given situation. As such, it was designed not to be conditioned or become outdated with, for instance, any BIM standards evolutions or changes in the usual employer's information requirements, and this was a point always present in the developing process of the proposed model.

The first chapter of the model begins by making a small framework, explaining the scope of the document. Then, it gives a clear indication to the concerned parties that the addendum is indivisible to the contract agreement to which it is attached and it also mentions that agreements in the same field will have to be accompanied, or at least make reference, to the BIM Addendum. This ensures that the entire procurement chain and all possible stakeholders are knowledgeable of the existence of BIM Addendum and consequently are obliged to work according to it. At last, it was considered appropriate to clarify some concepts and definitions that arise throughout the procurement process in BIM. In order not to create an extensive list that would misguide the purpose of the addendum, it was chosen to make reference to the "BIM Glossary" developed by Subcommittee 3 of CT197, so any doubt about any term should be clarified with the definition present in this glossary.

Then, there is a chapter exclusively for BIM Manager. This person plays a key role, especially when the BIM implementation isn't well established yet. This new character, as well as being the link between all stakeholders, has also the responsibility to ensure the accomplishment of BIM requirements and the proper execution of all that is done within BIM methodologies.

As already noted, the BIM Manager is responsible for the coordination of everything involving BIM, combining all tasks with the work of other actors. However, with regard to the archive, BIM Manager is the only one with access and ability to change it. Therefore, it is given special attention to the archive in BIM Manager's chapter, because it is an exclusive competence of the BIM Manager.

If condensed to one word, it may be said that BIM comes down to "information", more precisely its own way to create, manage and cross information. Following this reasoning, its possible to realize how important is the safe storage of copies of all information involved in the project, otherwise all the effort and commitment in the implementation of an integrated BIM project would be in vain. Having said that, and to avoid any accidents, the addendum adds some rules to the archive management.

To end this chapter, there's an open space to place some extra rules for the archive or to refer other BIM Manager responsibilities that eventually make sense due to project and/or the characteristics of BIM uses defined by the owner.

The third and last chapter of BIM addendum is related to the "Protocol" to adopt. It starts to shortly introduce BIM Execution Plan and then it makes reference to all points that are mandatory in the elaboration of this document.

It also mentions that all conflicts that are associated to errors and omissions should be evaluated by the CCP. Since there is a Portuguese law to the effect, it makes sense that all cases of errors or omissions should be managed by the Portuguese law. So the addendum states that the fact that you're working in BIM does not make it permissible to adopt another approach in solving these cases.

In case of doubt or dispute in what concerns to information sharing, BIM Addendum safeguard that all shares shall be made in IFC format. Naturally, if both parties use the same software, they can exchange information between themselves in the format they want. However, it doesn't mean they aren't obliged to deliver an IFC format to the BIM Manager.

This last chapter also explains that the various participants were hired by the project owner to build the project and to do it using the tools and BIM methodologies. Therefore, it makes sense that at the end of the work, the owner shall have a total right over the product he has paid. Thus, it is understood that all ownership rights of the BIM project (elements, models, information, etc.) belong exclusively to the owner.

STUDY LIMITATIONS

There are several factors that limited the work, including the fact that the Portuguese industry does not have an established maturity level, which makes it difficult to know the maturity level that the BIM addendum proposal is applicable.

Furthermore, in preparing the addendum it was not addressed independently design vs construction, or public procurement vs private procurement. Although it has tried to create a suitable model for both cases and has always differentiated when it was relevant to do, the truth is that this situation consists in a limitation of performed study.

Despite being a clear contribution, it should be noted that the proposed addendum does not allows BIM procurement only for itself. It must be created a "documents ecosystem" beyond the addendum to support and enable an effective and efficient BIM procurement.

The BIM addendum was only validated with three interviews with a designer, an engineering and a project owner. Although it has covered the three main types of actors, interviews served only as a test to the model, and a rigorous validation should require surveys to more people and entities.

Also note that, as we have seen, there are a wide range of limitations in BIM implementation, which are related to the resilience of stakeholders to adopt new procedures beyond those traditionally practiced, with the lack of fiscal and regulatory incentives for those willing to invest in innovation, with the lack of training and formation in engineering and architecture schools on new methodologies such as BIM features, with the monopolisation of software companies who practice unbearable prices for most of the small and medium enterprises wishing to integrate BIM in their business model, among others.

FINAL CONSIDERATIONS

The survey of the needs in BIM integration throughout the contracting process is a fundamental approach to the problem, in order to have an overview of the necessary steps and to be able to act according with it. Thus, the mapping of BIM needs that has been done is a benefit because it has identified clearly those needs and their chronological application.

In what concerns to the tendering phase, the owner has to present its BIM requirements on tender specifications and, to do so, should be supported by people with BIM knowledge. Moreover, the BIM valuation model to be presented to the candidates shall also appear in the tender documents and the owner will also need to be helped in the preparation of such documents.

The BIM addendum model proposed to the adjudication phase, is an important step in the practical realization of a need that has been identified a long time ago by BIM researchers. Of course it will have to be improved and adapted to the realities that it will be exposed to but, in any case, it guarantees from the beginning some comfort and safety to the Portuguese owner that wishes to hire in BIM and is poorly informed on the subject.

In short, the proposed objectives for this study were successfully achieved and, based on responses during the model validation process, it can be concluded that the BIM Addendum that has been developed is an important step in order to create Portuguese BIM standards, consisting in a support tool for contracting, which certainly has the potential to contribute positively to the implementation of BIM in Portugal.

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