Chapter 8.9

The Idealization of an Integrated BIM, Lean, and Green Model (BLG)

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ABSTRACT

Idealization, "a very high level view," is defined here as looking at the possibilities of integrating Green socially responsible requirements with Lean principles of construction practices with well-developed Unifying Models, such as Building Information Modeling (BIM). BIM, Lean, and Green (BLG) will allow a rapid prototyping of design and construction, the integration of drawings, specifications, and manufacturing in a Green best practice ambient that employs benchmarked Lean principles. This chapter explains our propositions on Green as a concept that gives direction on what to do right (effectiveness), on Lean that captures how to do it right (efficiently), and on BIM as an enabling platform that will facilitate the implementation of this effort. The integration of this concept addresses the quest for economically viable construction projects with the purpose of finding the best optimum performance. We consider the design as a theory, the project as an experiment, and the resulting products as a test that validates the theory. BLG allows for multiple executions of a theory to find the best option, and then test it against the final product. This chapter contributes to the body of knowledge but does not cover all aspects of the subject.

1. INTRODUCTION

According to Garcia-Bacca (1963, 1989), one invention does not necessitate the next logical

invention; that is, inventions and creativity are not predestined (Mitcham, 1994). However, the fact remains that past inventions, innovations and technologies created the current background of tools, knowledge and practices in the construction industry. In particular, the advent of Computer Aided Design (CAD), first in two dimensions, then three dimensions, and now in n^{th} dimension axiomatic design (Suh, 2001) capabilities has improved design aspects (Fowler, 2003; Iansiti, 1995). If Garcia-Bacca is correct, Building Information Modeling (BIM), defined as: 3D, object-oriented, Architect-Engineer-Contractor (AEC) specific CAD (Tang and Ogunlana, 2003), or Building Product Modeling (Eastman, 1999; Eastman et al., 2008), and now BIM-Lean-Green (BLG), are not predestined from CAD by necessity but by human intentionality.

The construction industry's needs are different than they used to be and require tracking an ever increasing number of parameters in a robust platform that can interoperate among multiple actors such as suppliers, vendors and the entire organization of a construction firm. The industry has focused its attention on Unifying Models that are rich in parameters to supply its needs. The unifying models prescribe product design and performance requirements (Foliente, 2000) through parameters, a concept known as Building Information Modeling (BIM) in the industry. BIM is a well-developed Unifying Model that can be understood as a model developed to support interoperability, which is the sharing, exchanging, and integration of information among project stakeholders and possibly during the entire project lifecycle in a collaborative fashion (Mutis 2007a). BIM unifies within a single model the information that is going to be shared, exchanged, and integrated among stakeholders from the design to the commissioning. Functions of the Unifying Model can be extended to facility management of the project.

The problems of interoperability remain significant at this point in time and is therefore an issue that cannot be brushed aside or minimized. Gallaher et al. (2004) in the National Institute of Standards and Technology (NIST) Report to the U.S. Department of Commerce estimated that approximately $15.8 billion (US Dollars) in annual interoperability costs were quantified for the capital facilities industry. Respondents also indicated that significant inefficiency and lost opportunity costs exist but were beyond the scope of the NIST report. The International building SMART efforts, processor of the International Alliance for Interoperability, are part of an IT culture dedicated to the interoperability problems and issues. European interoperability experts generated a STANDINN report and developed a handbook on interoperability between BIM and Green. Part of the problem is the rooting of platforms that do not have an open architecture. An open object format that can support the industry, such as an open architecture that allows Life Cycle inventory data to support sustainability and the proper measurement of embodied energy in accurate 3D representations with rich data describing key physical, performance and commercial properties, is relevant to the idealization of BIM, Lean and Green.

Multiple benefits have been attributed to BIM such as early and more accurate visualizations (Forsberg et al., 1996), lower levels of design corrections, earlier collaborations with other disciplines, energy efficiency, and sustainability evaluations (Eastman, 1999; Eastman et al., 2008; Krygiel et al., 2008; Kymmell, 2008), among others. The model captures however, only *some* aspects of design, materials, and *few* of the construction processes (Slaughter, 1993, 1998, 2000). Although BIM methods have motivated architects, owners, engineers, and other construction project actors to evaluate the traditional methods of working with architectural designs (drawings and specifications) and contractors' tools (estimating, scheduling project management, cost controls and tracking requests for information change orders), the industry must be aware of the limitations of

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