

Abstract

This doctoral dissertation addresses the integration of the Lean Construction (LC) concepts and BIM technology in construction project management by companies in construction industry. The primary objective of the dissertation was to identify a method for the joint application of Lean Construction and BIM technology in construction management by construction companies. The dissertation also examined the level of awareness and level of implementation of LC and BIM in Poland and analysed the benefits and challenges of their joint application. For the purpose of the dissertation, 8 research questions and 11 research hypotheses were defined, which were sought to be answered and verified using the following research methods (chronologically by application): umbrella literature review, systematic literature review, survey of 323 representatives of the construction industry, descriptive statistics, mathematical statistics performing hypothesis testing, standardised unstructured interviews with 7 interviewees, coding of interviews. The research process carried out the following research results: the LC concept is little known and rarely used by participants in construction projects in Poland (3% of respondents declare using LC, and 28% are in the process of or planning to implement it). The use of BIM technology is more common (7% of respondents declare use and 35% are in the process or planning to implement). There is very low simultaneous use of LC and BIM among companies in Poland, less than 1% of respondents.

The biggest challenge to the joint implementation and application of LC and BIM is the human factor (human capital management), including the psychological barrier of employees, the fear of change and the conservative attitude of construction staff towards innovation, the insufficient professionalisation of construction project management. A key element in achieving the joint application of LC and BIM in construction companies is that the staff understand the principals of the LC concept and the basics of BIM technology. It is crucial to manage the involvement of all participants in the construction project. The application of LC leads to increase transparency in the processes within the project, which improves communication and reduces conflicts. The joint application of LC and BIM has a synergistic effect, enabling the optimisation of processes, earlier detection of problems, better planning, increased transparency and streamlining of implemented activities. Implementing LC involves taking the time to learn and develop procedures, which may be seen as a disadvantage at beginning of the process, but later it brings measurable benefits. The barrier to entry for LC is low in terms of tools. What is mainly required is a change of mindset among all participants in the process, both top and middle management and staff directly involved in the implementation via the project.

It is important to note that, despite the low familiarity with the LC concept, the Polish construction industry appreciates the relevance of the principles inherent in the concept and partly uses the tools associated with it. In Poland, BIM is developing dynamically, but requires standardisation at the administrative level including the collection of good practices e.g. by professional organisations and the definition of legal guidelines. LC is developing much slower, mainly due to low awareness and limited education in this area. The joint use of LC and BIM can have a positive impact on efficiency, quality and waste reduction, which would also move into less negative environmental impact. The utilitarian outcome of this dissertation is the recommendations developed by the author creating guidelines in the form of a 10-point process indicating the key elements necessary to implement LC and BIM in a company.

Key words: Lean Construction, BIM, construction management, construction project, innovations in construction