

On Development of BIM Methodology and Digital Construction in Lithuania over the Period 2014-2020

23 May 2014

Introduction

This document has been developed by order of the public body “Skaitmeninė statyba“, which currently unites as many as 13 associated business structures from the construction sector, upon collecting and processing the primary information in Lithuania and several countries from the EU and beyond it advanced in this area as well as upon evaluating the current situation of the Lithuanian construction sector, the prospects of development in the EU construction market, the problems raised by organizations of the construction sector and the proposals provided.

A communication adopted by the European Commission in 2012 “Strategy for the sustainable competitiveness of the construction sector and its enterprises” states that the construction sector can significantly influence the development of the overall economy. It generates almost 10% of GDP and provides 20 million jobs in the EU, mainly in micro and small enterprises.

The construction sector is also major consumer of intermediate products (raw materials, chemicals, electrical and electronic equipment, transport, etc.) and related services. The quality of construction works also has a direct impact on the quality of life of all citizens. Not least, the energy performance of buildings and resource efficiency in manufacturing, transport and the use of products for the construction of buildings and infrastructures have an important impact on energy, climate change and the environment.

The competitiveness of construction companies is therefore an important issue not only for growth and employment in general but also to ensure the long-term sustainability of the sector.

However, the construction sector is also confronted by a number of structural problems: construction is highly sensitive to major fluctuations in economy and investments; the growing competition; there is a shortfall of skilled workers in many companies; low attractiveness to young people due to the working conditions; limited capacity for innovation; the phenomenon of undeclared work, etc.

The activities of the construction sector are an inherent part of long-term sustainable development of the country’s economic infrastructure (residential and non-residential, public and social, cultural heritage and other structures, public, engineering and communication infrastructure).

Over the period 2007–2013 the construction sector in Lithuania generated from 6 to 10% of GDP and provided from 7 to 12% of jobs in the country. About 50% of all energy is used in construction and maintenance as well as in construction production processes and buildings, while approximately 50% of all the country's material investments are used in buildings and engineering infrastructure. In 2008–2013 the public procurements for construction services alone ranged from 41 to 84% every year, i.e. around LTL 3.4–5.5 billion. According to the estimates of the European Construction Industry Federation, one job in the construction industry is directly or indirectly associated with roughly 2-3 jobs in other sectors (transport, energy, textile, ICT, catering, etc.).

Owing to the continuously changing level of prices in the construction sector, comparatively low labour productivity (in 2012 labour productivity in Lithuania amounted to ~62% of the EU27 average), the growing costs for resources and the shortfall of skilled human resource potential, the initiatives undertaken by other countries to boost the competitiveness of the construction sector and further efforts taken to maintain equivalent growth rates in the construction sector and to attain the EU development average, Lithuania is in need of major changes and a new approach in the spheres of labour productivity and management in the construction sector. With the rapid development of construction and information and communication technologies in the world, it is essential to react, form and implement a single digital construction information model in Lithuania.

Western European countries continuously focus on the development of this promising sphere. The Digital Construction project supported by the Danish government and successfully implemented since 2003, the national solutions developed by Finland, the United Kingdom, the Netherlands and other EU Member States, Norway, the US, Australia and other countries worldwide for over 10 years as well as participation in the activities of the buildingSMART alliance in coordinating and developing single construction information classification systems, construction data exchange formats, vocabularies, unified public procurement requirements, complex solutions of information and communication technologies (hereinafter – ICT) targeted at the sector, etc. can be mentioned as an example of the construction industry alone. The aforementioned solutions enable the enterprises of construction sector, IT and construction technology to gather into clusters and to create solutions generating added value. Innovations are thus encouraged, new jobs are created, competitiveness and productivity of the country's enterprises are increased. We are only making the first coordinated steps in this direction in Lithuania. Therefore, in order to become a high-tech country in the construction sector, Lithuania needs to develop e-business infrastructure which is still lacking and without which the above targets are simply impossible. It should also be noted that the creation of e-business infrastructure is not a one-year task; it must be

consistent and continuous, complex and coordinated planning and implementation of various programmes and projects. This process requires taking advantage of the available experience of the EU and other countries and joining the existing e-business development networks by focusing on the further development of solutions targeted at added value.

Therefore, the implementation of the digital construction programme 2014–2020 is important for the further development of organizations in the construction sector, whereas the measures provided for in it would make a significant positive influence on both the Lithuanian construction sector and other related business sectors.

What is “Skaitmeninė statyba“?

„Skaitmeninė statyba“ (Eng. *Digital Construction*) is a collaborative initiative of the Lithuanian business, science and government thanks to which a single infrastructure of development of digital construction models will be developed in Lithuania and integrated into related international networks in order to ensure that the whole information used in construction projects throughout the life-cycle of the construction object, from idea to demolition, would be created systematically by avoiding the overlap of activities, where the information is only supplemented in each construction stage or changed in the centralised database connected to various databases associated with the construction object concerned.

To that end, unified requirements for building information modelling (hereinafter – BIM) will be created; the single construction information classification system will be continuously developed; international data transfer formats will be introduced; BIM related standards will be implemented; public procurement specifications will be prepared; other digital construction related activities will be coordinated and organised; businesses will be encouraged to digitise and automate various construction processes bound together by a complex relationship, thus optimising operations; the competitiveness of the construction sector and related sectors will be increased and internationality will be promoted.

New terminology related to digital construction

The development of digital construction solutions necessitates the introduction of new terms. The terminology must be consistent and equally understood by all construction participants. The initial version:

- **CAD** – Computer-Aided Design
- **2D** – Two Dimensions (plane)
- **3D** – Three Dimensions

- **4D** – Four Dimensions (3D + time)
- **5D, nD or xD** – Five, n (undefined), x (unknown) Dimensions
- **BIM** – Building Information Modelling
- **PLM** – Project/Product Lifecycle Management
- **PDM** – Process and Documents Management

Maturity levels of Building Information Modelling (BIM)

The maturity model is required for a clear identification of the competence level and the definition of objectives. The identification of the BIM maturity level enables the implementation of BIM by ensuring sufficient preparation of participants for the change of requirements by simultaneously establishing the road of participant preparation and clarity.

A simple evaluation model ranging from 0 to 5 is proposed for determining the maturity level in order to ensure a clear status and an easy definition of tools, technologies and market preparedness for their use. At the same time, it eliminates any ambiguities from the term of building information modelling, which becomes clear by providing it with certain measure units enabling us to answer the question: “where we are?” and “are we already making BIM?”. Of course, transparency is yet another solid argument for BIM maturity identification model. It ensures a clear-cut and readily comprehensible definition of direction.

Definitions of levels

- 0 Information is transferred in paper format; there are no standards for ensuring electronic, paper-free data transfer.
- 1 Electronic formats are used for information transfer by usual file exchange methods.
- 2 Electronic formats with classified information and visualisation of standardised elements are used for information transfer; ICT for 3D, 4D or 5D modelling is used for individual at least two design or construction processes but databases are different and the comparison of the BIM level of different projects is complicated. File exchange within a single project takes place through different databases and commonplace file exchange methods.
- 3 Single construction information classification systems approved by the public body “Skaitmeninė statyba“ as well as unified databases or ICT complex solutions with classified information on the objects and its required levels for different project participants harmonised and tested by a group of

manufacturers are used for information transfer. It is possible to compare the BIM level of different projects. Projects are managed through WEB applications.

- 4 All structure of information used in the project and its transfer methods are standardised, classified and approved by the public body “Skaitmeninė statyba“. There are access points to specific project information and the methods of use to all project participants. The use of information in different platforms is ensured.
- 5 The same integrated and classified information is used throughout the life-cycle of the construction object, from idea to demolition, by supplementing and changing it in the centralised database connected to all databases associated to the construction object concerned. Different platforms can be used for information review and editing. The information of the models created is compared to actual construction results and the difference identified is not higher than +/-5%.

Long-term activity model of the public body “Skaitmeninė statyba“

Vision

To form a single digital infrastructure for developing ICT solutions in construction targeted at the development of the Lithuanian construction sector of sustainable environment and to encourage all market participants to use it.

The business profile of the Lithuanian construction sector of 2020 will be:

- **PEOPLE**, highly skilled, innovative, creative and prosperous people will improve the general image of the construction sector
- **CONSTRUCTION INDUSTRY**, technologically advanced, innovative, efficient and competitive
- **SUSTAINABLE/GREEN** industry always gives priority to energy-efficient, green and waste-free technologies as well as the reduction of carbon dioxide. The sector becomes an example of good practice to other sectors
- **GROWING/STABLE** industry, growing export promoting the overall economic growth
- **RELIABLE/TRANSPARENT** industry, projects implemented in the scope and quality coordinated with the client within the established deadlines and the budget

Mission

To contribute to the development of sustainable environment of the Lithuanian construction sector, both public and private, for cooperation and partnership by developing innovative solutions for rational exchange and dissemination of information in the construction sector, development of ICT systems and services in the construction sector; to educate and organise training.

Objectives

The objectives of implementation of BIM technologies in the construction sector can be defined by three major points:

1. to develop the strategy of building project design, construction and operation based on computer-aided modelling technologies of the object and its development processes; 2. to ensure the integrated management of graphical and information data flows enabling to combine virtual graphics (CAD) with information flows (DB) and process and document management (PDM); 3. to transform individual executors into commands, decentralised tools into complex solutions; to integrate individual tasks into processes in order to perform the life-cycle operations of a construction project better, cheaper and faster.

To that end, the following actions are planned in Lithuania:

- To form a single information structure and coding (classification system) of the construction sector; to create an e-environment and to ensure preconditions for improving labour productivity in the business enterprises of the Lithuanian construction sector;
- To analyse the e-solutions of digital construction available in the world, the EU and Lithuania. To select the most appropriate solutions and to apply them to the Lithuanian market in order to integrate a single classification system into these solutions;
- To develop and promote the experience of e-entrepreneurship in the Lithuanian construction sector; to promote the introduction and use of already available digital construction e-solutions and to create new ones;
- To develop international cooperation; to promote local and international relations among business and educational establishments with a view to developing e-construction solutions;
- To carry out the activities of education and training in the area of e-construction solutions;
- Etc.

Benefit to market participants:

Government of the Republic of Lithuania and clients – because it will increase the transparency, accuracy and evaluation of public procurements, reduce public procurement costs, create more new jobs, encourage innovations, increase competitiveness, ensure “greener” construction, possibilities of new businesses for new and existing construction sector and related enterprises, etc.;

Public procurement subjects, real estate developers, private customers – more reliable investment planning; as much as 30% lower price of construction project during its life-cycle; lower number of changes; higher number of projects completed within deadlines; higher quality, etc.

Designers – faster design; less time costs; fewer errors; more profit; a possibility to participate in international construction projects, etc.

Contractors – more accurate estimates; cash flows; resource management; lower cost price; higher competitiveness and profitability; possibility to participate in international construction projects, etc.

Lithuanian people – it is a firm and real step towards a better life quality.

Benefit of BIM application by construction process:

- More cost-efficient construction process. Whereas the creation of a digital building model (BIM model) requires accurate designing, design errors, the correction of which on the construction site becomes very expensive, are avoided. What is more, the calculations of excess quantities are avoided, i.e. budget growth, because the digital model can yield accurate quantities of construction materials.
- Faster and cheaper maintenance, repairs and renovation because a digital construction model means the information kept in a single location to be used for construction, repair or renovation works. For example, the digital information of buildings under renovation would lower the price and speed of reconstruction design at least twice.
- Better planning and design of new areas, fewer errors and more rational solutions. Combined information on construction objects and engineering networks provides an opportunity for better quality design of new construction objects or networks in the existing environment.
- Better quality and more rational design process, i.e. a smaller need for object changes in the future. The BIM model visualises the project solutions of all parts in the design process; therefore, the client can be better aware of results; errors between individual parts of the project are eliminated.

- Unified realistic information on the object. Whereas the information model of the construction object is an accurate collection of project data, errors arising in cases when official project drawings are not consistent with the reality and additional efforts are required to check the reliability of drawings can be avoided.

What will be the results and how will we measure them?

The key concept: Projects are implemented according to the planned schedule, budget, scope and quality

- **20% lower costs**

By evaluating the planned budget in the life-cycle and the life-cycle costs of the constructed property. (In the projects of public sector it is essential to calculate the planned maintenance costs of the life-cycle not shorter than 20 years for all projects. This part should be made mandatory in project calculations and its measurements should start upon the launch of the construction object into operation. It is recommended to start accumulating the data in a single system. Clients from the private sector should also be encouraged to carry out these actions)

- **80% of projects in time**

construction objects are built in the agreed scope and quality and as close to the established time and speed as possible.

- **50% higher export**

to reduce the trade gap between the total export and total import of construction products and materials.

- **50% lower emissions**

to reduce the emissions of green-house gases in the built-up environment (construction sector).

How does the Lithuanian construction sector compare to the EU and the world by the development of BIM?

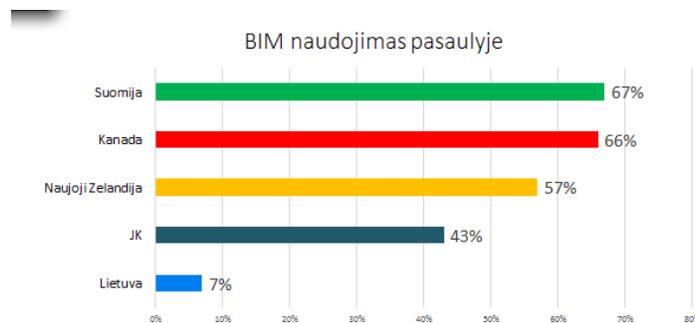
Over 200 representatives of various construction market participant groups participated in the survey. The below information is taken from the Digital Construction Feasibility Study carried out in 2014 by order of the Lithuanian Construction Technology Platform (LCTP) in cooperation with the Lithuanian Builders Association.

- **Are 3D models and BIM used in your projects?**

- No >65%;
- 28% use them for individual parts;
- ~7% use 3D and BIM for project preparation.

Note: 7% use them – “Without terminology, single classification systems, data exchange formats and standards, it is only an assumption of market participants”

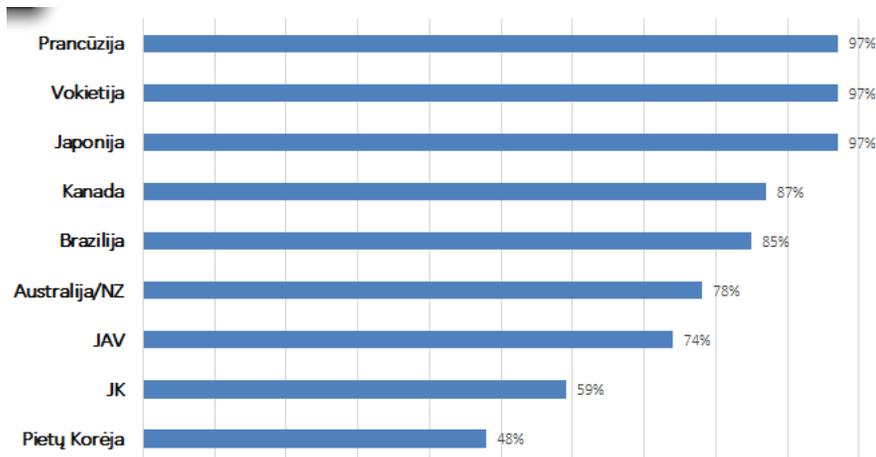
- **Do you know what classification systems of construction costs, works and materials are?**
 - 15% know and use them;
 - 48% know but do not use them;
 - 37% do not know.
- **Are you planning on using modelling in your further activities (AECO / BIM)?**
 - 77% are planning on using it;
 - 23% do not know and are not planning to use it;
- **How do we compare in the world of BIM?**



Use of BIM in the world

Finland, Canada, New Zealand, UK, Lithuania

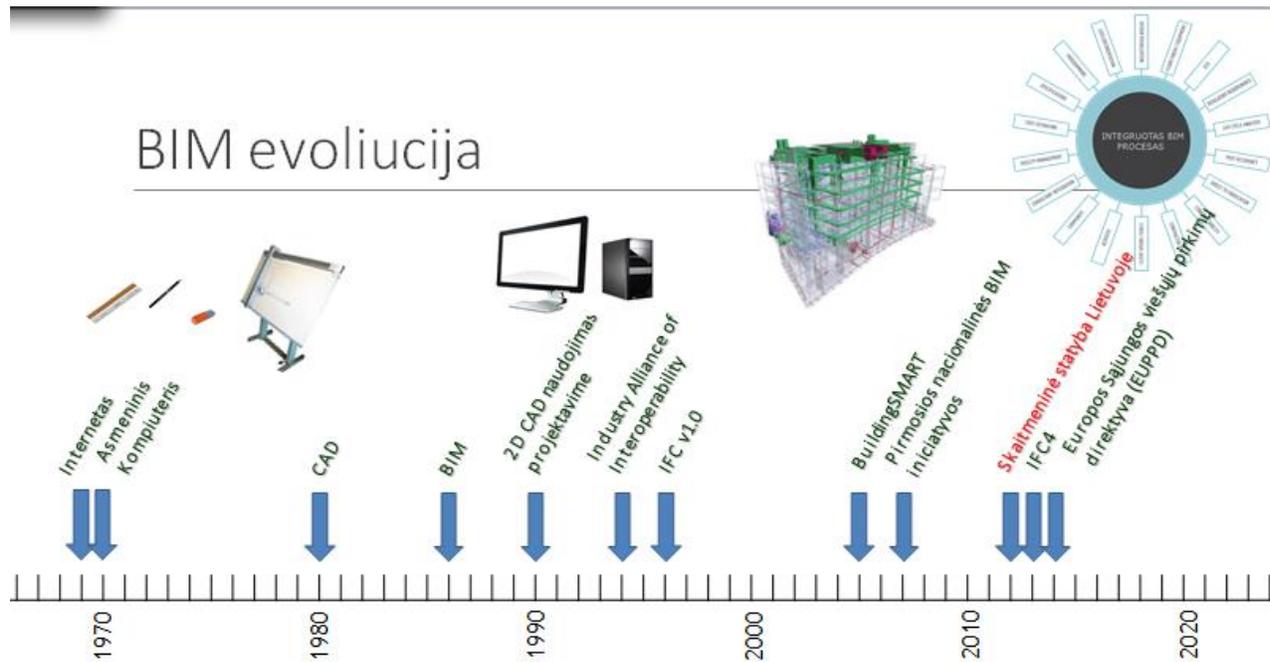
- **Survey of foreign contractors about the positive payback of BIM investments**



Source: McGraw-Hill Construction, 2013

France, Germany, Japan, Canada, Brazil, Australia/NZ, USA, UK, South Korea

BIM evolution



From Digital Construction Feasibility Study 2014 (LCTP)

BIM evoliucija – BIM evolution

Internetas, asmeninis kompiuteris – Internet, Personal Computer

2D CAD naudojimas projektavime – 2D CAD use in design

Pirmosios nacionalinės BIM iniciatyvos – First national BIM initiatives

Skaitmeninė statyba Lietuvoje – Digital construction in Lithuania

Europos Sąjungos viešųjų pirkimų direktyva – European Union Public Procurement Directive (EUPPD)

What will we do? Digital construction activity model:

In the long-term activities of digital construction a strategy is primarily selected to evaluate the good practice of other countries and to adjust the selected existing and developed solutions of foreign countries as well as to create new solutions upon evaluating specific needs only. The anticipated main activity groups are as follows:

- **WEB portal “Skaitmeninė statyba“** (An initial version of minimal functionality created)
- **BIM Roadmap** (Short-term roadmap approved)
- **Unified terminology** (Initial version created)
- **Requirements for BIM models** (To adapt by selecting a conception and possible solutions)
- **Classification and coding system** (To adapt by selecting a conception)
- **Processes and data exchange** (To introduce by making minimum adaptations of IFC data exchange format, as appropriate)

- **Public procurement regulation and sample contracts** (To develop by adjusting the practice of other countries)
- **BIM guides** (To adjust the practice of other countries)
- **Templates and libraries of BIM elements** (To adapt and create)
- **Research studies and BIM maturity assessment** (To develop our own on the basis of foreign practice)
- **Regulation infrastructure** (To create our own on the basis of the good practice)
- **Training, certification and continuous in-service training** (To adapt and develop)
- **Pilot teams (mandatory condition) and pilot projects** (To develop our own; to analyse the good practice of other countries)

It is expected to develop a plan with a schedule for BIM development in Lithuania during the period 2014–2020.

Functional model of the public body “Skaitmeninė statyba“



Verslo ir visuomenės poreikiai - Business and public needs

SISTEMOS KŪRIMAS - SYSTEM DEVELOPMENT

Ir kt. – etc.

REGULIAVIMAS - REGULATION

PASLAUGOS – SERVICES

Nacionalinis statybos klasifikatorius – National Construction Classification

IKT sprendimų taikymo galimybių tyrimai ir taikymas – Feasibility studies of application of ICT solutions and their application
Specifikacijos bei standartai – Specifications and standards
Demonstraciniai projektai – Demonstration projects
WEB portalas – WEB portal
IKT sprendimai verslui – ICT business solutions
Seminarai, konferencijos, webinarai – Seminars, conferences, webinars
Sertifikavimas – Certification
IR KITOS – ETC.
NAUDOJIMAS – USE
Architektai – Architects
Projektuotojai/inžinieriai – Designers/engineers
Statybos įmonės – Construction enterprises
Ir kt. – Etc.
Savivaldybės - Municipalities
Agentūros – Agencies
IT įmonės – IT companies
Gamintojai – Manufacturers

Initial organizational structure

Stage I provides for a minimum organizational structure: Meeting of Stakeholders, Director (part-time), Accounting (services purchased at the initial stage) and Initial Working Groups (WG) with Leaders and Members (freelancers – working on a voluntary basis; remuneration is paid after specific tasks are formed and financing is raised). Activities are performed; once the budget is raised, the leaders of WG and experts can be hired by the organization as part-time employees.

Working groups are set up for implementing the anticipated roadmap.

Stage II. Activities are carried out and the budget is formed; projects are planned; teams and project budgets are set up. The positions of “Project Managers” of the public body „Skaitmeninė statyba“ are expanded, if appropriate.

The activity financing model is developed and approved by the Meeting of Stakeholders.