

## Support Tools for the Building Maintenance

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### Abstract

The philosophy of sustainable development is now part of every area of human life, including construction industry. The current priorities, which can be affected during the period of design, were mainly: energy consumption of the building's operation, characteristics of used building materials and the development of certification systems. Today, scientists are looking for new solutions for the application of sustainable development already in the operation period of buildings. The maintenance process is one of them. Use of advanced information technologies in cooperation with the Maintenance Manual of Buildings is one of the possible ways.

**Keywords:** maintenance manual, BIM, life cycle of buildings

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### 1. Introduction

The relationship between man and the environment was from the very beginning of human existence very connected. With the evolution of human society gradually leads to weakening of the immediate dependence. The Industrial Revolution marked the beginning of behavioral change towards the environment in which industrial development is more important than examining its impact on the environment. Decades which are characterized by industrial development, negative impacts on the environment and increased awareness have resulted in that people are starting to think how to use existing industries, including construction industry, with minimal impact on the environment.

With the development of knowledge and thinking of human society, the idea of sustainable development began to take shape. In 1968 the Club of Rome was founded, which brings together important personalities from different parts of the world. Their aim is the study and analysis of the evolution of human society and the limits of our planet. Significant events which highlighted the issue of sustainability was the publication of the book *The Limits to Growth* in 1972. The authors found with the aid of computer simulation, while the upward trend of pollution, industrial development and consumption of natural resources, there will be fatal consequences for the population already during the 21st century. The concept of sustainable development was defined in 1987 at the UNO conference. This organization has under the patronage of sustainable development and helps organizations and countries to implement the ideas into legislation and daily life of the population.

The construction industry is considered one of the biggest polluters of the environment. Therefore, it is necessary to limit of the demolition of buildings has been delayed, what can be achieved with quality and thoughtful maintenance of these buildings during the period of their operation. [1]

Well-executed maintenance will have a positive impact on all areas of human existence.

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## 2. Maintenance of Buildings

The aim of maintenance is to ensure that the building held the post for which it was designed, in the longest period of time with minimal faults. Maintenance also provides for improved of operational safety, optimize operational processes and minimize operational costs.

Maintenance of buildings can be divided into maintenance of building structures and maintenance of technical and technological equipment in the building. Construction structures consists of elements of long service life and short-life elements, the first group is composed of supporting structures, which repair and maintenance is extremely big financially demanding sometimes unrealistic. Therefore, it is necessary to plan and ensure a high quality maintenance of short-life elements to which we include surface treatment, insulation, windows and doors, metalwork, plumbing and joinery. In order to facilitate maintenance processing is used Maintenance Manual of Buildings in which are defined all activities to be undertaken within the framework of high-quality maintenance.

### 2.1. Maintenance Manual of Buildings

Maintenance Manual of Buildings defines instructions on how to take care of the building and is a tool for the building administrator - Facility Manager. The role of the Facility Manager is to ensure the most efficient maintenance, and that through cooperation with investors, designers and future owners. Nowadays, when emphasis is placed on sustainability in all areas of human life, manual should form an integral part of the documentation when handing over to the investor of the building into use. The contents of the Maintenance Manual of Buildings is proposed in Table 1. [2]

**Table1.** Composition of Maintenance Manual of Buildings

Parts	Definition	Contents	
Terms of use of buildings	Define the requirements for adequate use to prevent early wear and damage to health and property	Construction part	bearing capacity, cleaning and management work
			education of users
			building structures resistance to the action of chemicals
			proposal manipulation of doors, windows and fastening objects on building structures
			communication for the transport of specific equipment
		Technical and technological part	define requirements for secure, cost effective and trouble-free operation
			regulations, instructions, manuals
The technical inspection	Their task is to determine the current condition and the severity of defects in structures and technical and technological equipment in order to prevent future failures	Inspections are focused on:	
		discovery of deficiencies and defects during the warranty period and the subsequent application of remedies by the manufacturer / contractor	
		finding faults at an early phases, where correction could result in increased financial costs	
Rules for building maintenance	Define the course of planning. Their output is maintenance schedule	Maintenance Schedule	elements with long service life: foundations, vertical load-bearing structures, horizontal load-bearing structures and roofs, staircase
			elements with short-lived: treated wall surfaces, floors, filling the openings, metalwork, plumbing and joinery
		Repair and maintenance	defined time intervals for preventive maintenance
			provides employment and financial resources
			setting standards of maintenance

The decisive parameters affecting quality, cost and the composition individual maintenance processes is the time when the Maintenance Manual of Buildings is included in the building's life cycle and the period during which it is processing (fig.1).

Should not be forgotten cooperation of facility managers with the experts of the individual phases. Communication among specialists help facilitate modern technology, of which at present we include the process of BIM (Building Information Modeling).

### 3. BIM (Building Information Modeling)

BIM is an advanced technology, with which you can create and manage virtual models consisting of digital information on physical and functional characteristics of a facility. In the BIM process are shared data concerning spatial and legal relationships, geographic and geospatial information, quantities and properties of building components, preliminary costs, the amount of material inventories and timing. In the modeling process can also include information on the ecology and sustainability. This technology facilitates the work of facility managers in the processing and updating Maintenance Manuals of Buildings.

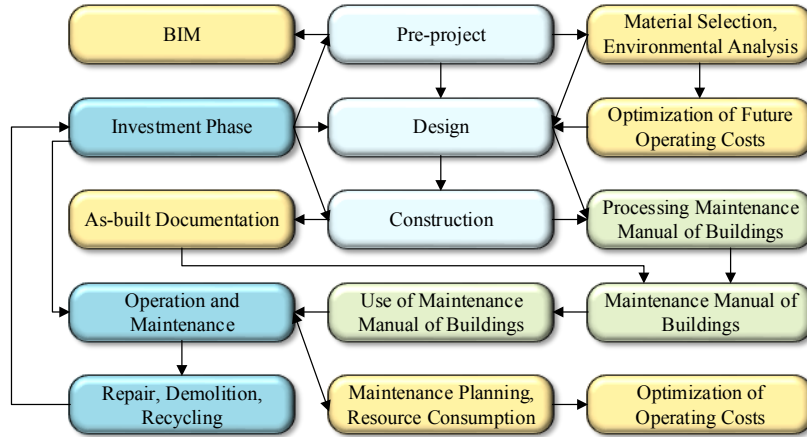


Figure 1. The Involvement of Support Tools in the Life Cycle of the Buildings

Implementation of BIM technology in building maintenance is only at the research stage according to analysis. The most research is carried in Finland and the USA. In these countries, BIM is already in use in design practice. Finland recorded the greatest progress, which are already at a stage that creates manuals related to this issue. Facility managers and owners in the UK, according to surveys, they know about BIM. So far, to them is not obvious how to effectively use this technology for FM. According to them, there are at present not best practices and directives involving FM in the BIM process. One possible approach for FM practice is the transfer of BIM data into existing maintenance management system using a computer (Computerized Maintenance Management System - CMMS). The second approach is to manage maintenance directly in BIM technology, which examined mainly in Australia and Taiwan. Experts from several countries are in agreement on the absence of good directives and the procedures for maintenance of buildings using BIM technology.

Currently in Slovakia it gets to the forefront the use of technology BIM, but mainly in the design phase. [3-10]

Figure 2 shows the strengths and weaknesses of the two support tools for building maintenance.

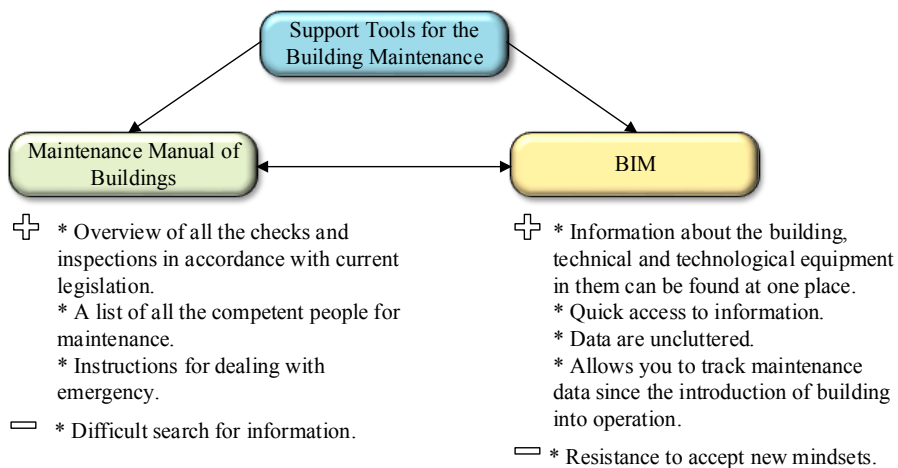


Figure 2. Evaluation of Support Tools

#### 4. Summary

According to the analysis of support tools for building maintenance it can be concluded that the trend of sustainable development, which was initially an exception in organizations, is now an integral part thereof. Maintenance Manual of Buildings is in the building maintenance tool which can not only prolong service life, but also can ensure trouble-free operation of the building during its use phase. Building Information Modeling - BIM provides all relevant information about the building and is such relevant tool for maintenance. Complementarity of these tools can ensure continuous improvement of the maintenance process.

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