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# ANALYSIS OF BIM MANAGEMENT AND COORDINATION PROCESSES IN SLOVAKIA

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**ORIGINAL SCIENTIFIC ARTICLE**

## ABSTRACT

Building Information Modeling (BIM) is one of the main tools of digitization and enables the achievement of higher process efficiency, introducing new procedures to which companies on the market must adapt. There is a need for new professions that will ensure correct procedures and control mechanisms within the scope of defining, executing, and handing over BIM projects. This article focuses on the analysis of the rate of BIM adoption in Slovakia, especially in the field of BIM management and coordination in order to monitor the situation regarding the operation of specialized positions such as BIM managers and coordinators, based on data from industry research performed in the form of anonymous on-line survey.

***Key words:*** *BIM; BIM management; BIM coordination; construction; analysis*

## 1 INTRODUCTION

The growing trend of Building Information Modeling (BIM) utilization within the entire construction life cycle can be observed, gradually changing the construction market. [1-6] According to available data, the number of projects executed using BIM increase and as a result of market demand, growing need to address specific processes, especially related to BIM delivery such coordination, administration and management arise. New tasks and responsibilities in a project team throughout all phases of building's lifecycle rather become the domain of specialists - BIM managers and coordinators and we have to take into consideration that collaborative approach on a project and digital management of assets occupy a significant part of a workload. [7,8]

BIM can contribute to entire construction industry transformation and may result in increased efficiency. However, it is essential that the market actors themselves are prepared for this transformation, in terms of the use of information technology and human resources.

From the analysis [7,8], it is possible to identify the differences between the individual activities and positions that are performed in the project cycle and based on the evaluation of the time duration of the tasks, to determine the need and composition of the project team. The correct composition of the work team has a direct impact on the ability to deliver the project on time, in the required quality and in the agreed scope. However, the scope of a BIM project is often very unclear and ambiguous due to low experience of involved persons.

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## 2 METHODOLOGY

In order to properly analyse BIM management and coordination processes, we have chosen methods of analysis and synthesis, which are mainly based on a survey carried out in the form of an anonymous electronic questionnaire. On the basis of a detailed investigation of the entire process, we revealed connections, regularities and principles that were key to defining outputs in relation to the profession of BIM manager, or BIM coordinator and state-of-the-art in this field.

The first part of the work includes the theoretical part and terminology related to BIM followed by the analysis. We formulate essential information to understand the role of BIM managers and coordinators.

In the second part, we focus on evaluating BIM adoption in Slovakia in the recent years using the comparison method in order to point out the marginal conditions of specific tasks that result from a collaborative approach in the preparation, implementation and management of assets.

In the last part, the evaluation of key findings based on our own survey data is presented.

## 3 BUILDING INFORMATION MODELING

### 3.1 Terminology

Ambiguity and lack of clarity in communication regarding BIM results from low knowledge of the issue and weak theoretical preparation of individual participants in the project cycle. It can quite often be observed that stakeholders are not using the terminology correctly.

An information model is defined as a set of structured and unstructured information containers [9]. The term information container (permanent group of information) is relatively new for the field of construction and represent an information that can be repeatedly retrieved from a file, system or other storage, e.g. drawing, budget, schedule, model geometry, or image. BIM, or Building Information Modeling is defined as a use of a shared digital representation of a built asset to facilitate design, construction and operation processes to form a reliable basis for decisions [9]. Therefore, the goal of BIM is not to create the model itself but to reach and exchange information.

The term “BIM model” is being discussed and questioned frequently as the abbreviation BIM already includes the word model but industry simply adapted to this term. According to standards, two types of BIM model can be recognized:

- Project Information Model (PIM) [9],
- Asset Information Model (AIM) [9].

It is crucial that within any BIM project, cooperation between the parties involved takes place in a controlled and transparent manner. For this purpose, a Common Data Environment (CDE) can be used, which is defined as agreed source of information for any given project or asset, for collecting, managing and disseminating each information container through a managed process [9-11]. However, despite the fact it is understood as shared folder by many, it shall enable communication and processing (authorization) of any part of the project output, including drawings, objects or assets. The information managed in the CDE should not only be easily accessible and always up-to-date, but at the same time understandable for all parties.

### 3.2 BIM management and coordination

The tasks of the BIM coordinator are to check compliance with the modeling process in terms of BIM manuals, EIR and BEP. [11] In the models, in principle, he constantly checks the individual elements, filling in their parameters, and in case of finding errors, he notifies the relevant designers. Its tasks also include digital transfer of models, collision detection, their evaluation and distribution to designers. In the coordination process, it is necessary to repeatedly check new models, identify collisions and prepare sets for digital transfer. It is therefore a continuous process.

Within the overall processes of the company, it is necessary to distinguish the position of BIM manager and BIM coordinator. In addition to the mentioned tasks in the solved project, the BIM manager should be present at the company's key decisions related to digitization and information modeling, including in the area of human resources, strategy and the selection of contracts. He is responsible for the creation of company BIM standards, the creation and management of the BIM department, the pricing of BIM modeling and the design of the structure of BIM and CDE software and its interoperability. Compared to the BIM manager, the BIM coordinator is a more efficient user and specialist of specific software (he should be among the best in the entire company) and at the same time a good engineer who controls the technical requirements (due to the modeling and coordination processes). However, he may not have such an overview of the market, standards, innovations, and interoperability within the company. [12,13]

## 4 RESULTS

### 4.1 BIM adoption in Slovakia

In October 2022, a survey was executed via an anonymous on-line questionnaire. In 2022, 1058 respondents participated in the survey. The total number of respondents for the years 2017-2022 is 10323. The highest representation in the survey has a group of respondents working in the field of Architecture and Engineering (48.68%), then the field of Construction (26.84%), Surveyors (11.34%), followed by Development (5.95%) and other areas, such as Facility management, Public institutions, Education, Business, and others, are represented by 7.18%.

The rate of BIM adoption in Slovakia reached 21.1% (see Figure 1) in 2022 and thus slightly increased by 4% over 6 years. The group of professionals on the market that are not yet using BIM, providing they are interested in the methodology, varies within monitored timeframe. For those who answered that they do not use BIM, do not plan to ever use this methodology, a slight decrease from 51% in 2019, to 45.84% in 2022 can be observed over last couple years.

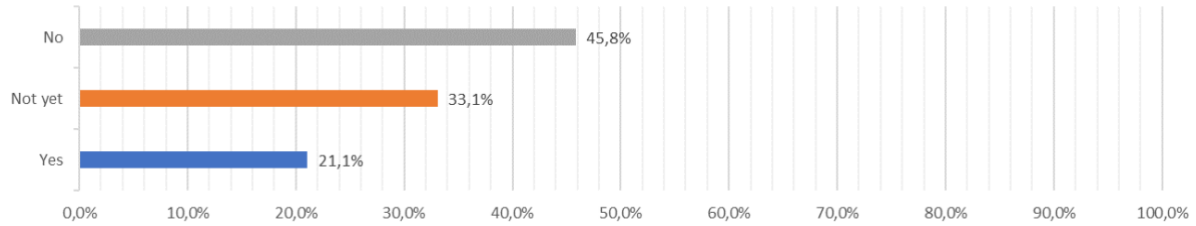


**Figure 1 Overall use of BIM in Slovakia, year 2022; blue color represents Yes, we already use BIM, orange color represents those that do not use BIM yet, but they are interested in a methodology, grey color represents those who neither use BIM, nor are interested in it.**

When comparing the areas of civil engineering (27.78%) and Infrastructure (8.82%), we can conclude that BIM has penetrated mainly into the areas of building design. While buildings sector (27,78%) is

almost 7% above average (21,08%), infrastructure is less developed at a level of approx. 12% lower than national average. Less than half of the respondents are in the group that has not yet discovered the benefits of BIM technology, and therefore does not plan to use BIM in the future, answering NO to the question “Do you use BIM?”.

Relatively low adoption level in Slovakia is related to the demand on the market. The survey reveals low demand for BIM with only 7% percent of companies require BIM in their supply chain, and up to 73% state that they have never received a request for BIM (Figure 2).

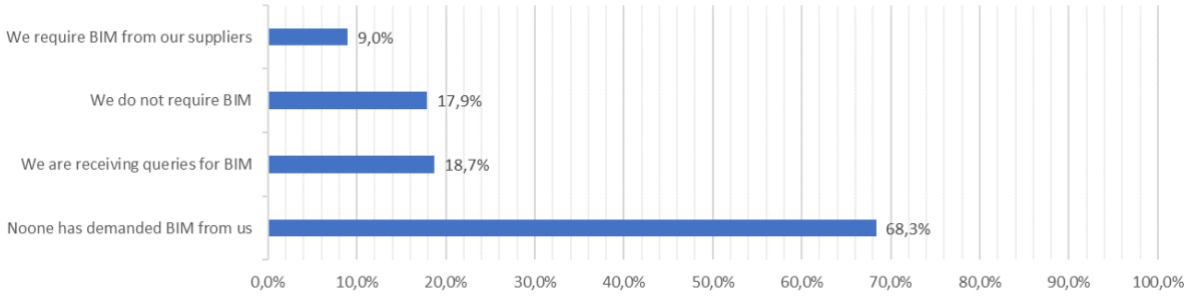


**Figure 2 Demand for BIM on the market.**

## 4.2 Analysis of BIM management and coordination processes

Most of the comparations can be done within the timeframe 2017-2022. The category of the BIM management and coordination related questions was included in the year 2020, therefore no data are available in a period 2017-2019.

Based on the survey, in the Slovak construction market in 2022, there were 3,40% of experts who are in the position of BIM manager or BIM coordinator (Figure 3). The ratio of represented professions in terms of field of their occupation shown on Figure 3. Professions from the field of design are most represented (50.7%), covering positions such as architect, engineer, structural engineer, and HVAC/MEP engineer. More than 33% are professions connected with the construction activities, such as construction manager, construction supervisor, project manager, etc. are included in. We can observe that the number of BIM managers and coordinators is gradually growing from 2.20% (2020) to 2.48% (2021) and finally to 3,40% (2022), see Figure 4.

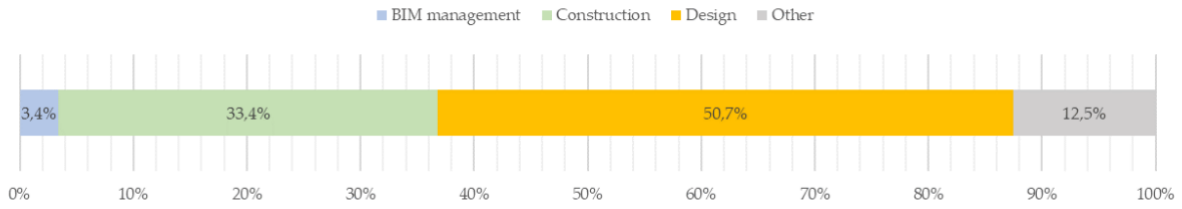


**Figure 3 Proportion of BIM managers and coordinators among other professions on the market 2022.**

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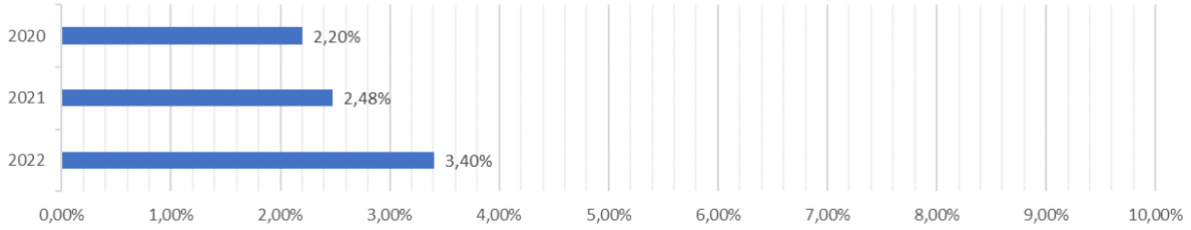


**Figure 4 Proportion of BIM managers and coordinators on the market 2020-2022.**

From the point of view of division by area of operation, the majority of BIM managers and coordinator operate in the field of buildings (61,11%). The remaining 38,89% work on infrastructural projects. The ratio is primarily determined by the number of BIM project s that are executed in these areas, where buildings clearly predominate (Figure 5). The proportion is influenced by growing number of BIM managers and coordinators that start working on infrastructural project.

We can observe the level of deployment of BIM in the field of civil engineering based on isolated data, and we can therefore conclude that the use of BIM is growing. The survey shows that the current usage has risen to the level of 27.97% (2021) compared to 2020 (24.63%), an increase of more than 3%. However, the number of companies that have suitable candidates in the position of either BIM manager or BIM coordinator is still relatively low.

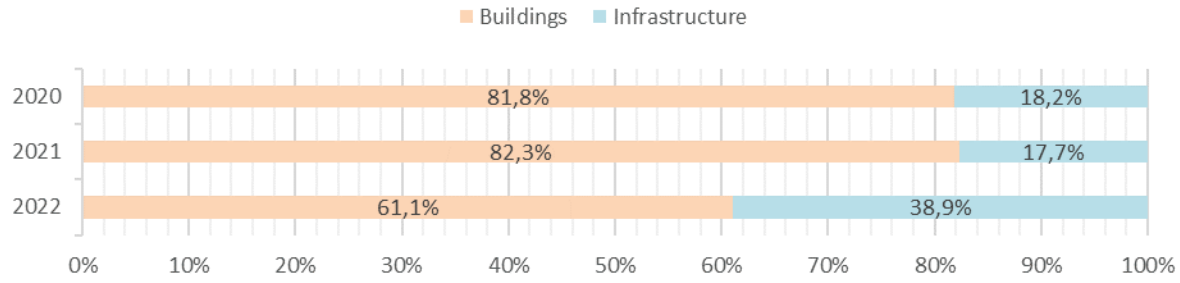


**Figure 5 Comparing the ratio of BIM managers and coordinators in the field of buildings and infrastructural projects.**

Small and medium-sized enterprises (firms with 10-249 employees) often form the largest group in construction supply chains. In the survey, representatives of such companies make up 83.28% of the respondents. The distribution and ratio of BIM managers and coordinators based on the size of the company in the buildings sector is shown in Tab. 1 and the ratio within infrastructure is presented in Tab. 2. In both tables, distribution is made into several categories and highest number is marked with green background and it is clear, that most of BIM managers and coordinators are working in companies with over 100 employees. The same applies to buildings and infrastructure.

**Tab. 1 The size of the company in which BIM managers and coordinators work**

| Buildings | 1 - 4 | 5 - 10 | 11 - 20 | 21 - 49 | 50 - 99 | over 100 |
|---|---|---|---|---|---|---|
| **2020** | 0,00% | 0,00% | 0,00% | 9,09% | 31,82% | 40,91% |
| **2021** | 15,00% | 0,00% | 0,00% | 25,00% | 15,00% | 25,00% |
| **2022** | 5,56% | 0,00% | 2,78% | 2,78% | 8,33% | 41,67% |

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**Tab. 2 The size of the company in which BIM managers and coordinators work**

| Infrastructure | 1 - 4 | 5 - 10 | 11 - 20 | 21 - 49 | 50 - 99 | over 100 |
|---|---|---|---|---|---|---|
| **2020** | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 18,18% |
| **2021** | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 20,00% |
| **2022** | 2,78% | 2,78% | 0,00% | 2,78% | 11,11% | 19,44% |

In the process of preparing and processing the BIM model, BIM-related activities have been added to the teams of investors, design offices and construction companies, which require professional specialization and a time space that is so large that it is no longer possible to assign these activities to employees with other duties and specialization. This mainly concerns the preparation of EIR, BEP documents, internal BIM manuals, but also the processes of control and coordination of BIM models and their further processing, e.g. during the processes of reporting measurements, creating a budget and various analyses. Currently, only slightly more than 10% of active BIM users state that they have BEP on all projects. From this point of view, the vast majority of BIM projects (almost 65%) are probably initiated by an internal company request, as BEP is absent on these projects, and we can therefore consider it unmanaged (Fig. 5). Among other things, the absence of an assignment has an impact on the number of operations provided by BIM managers and coordinators.

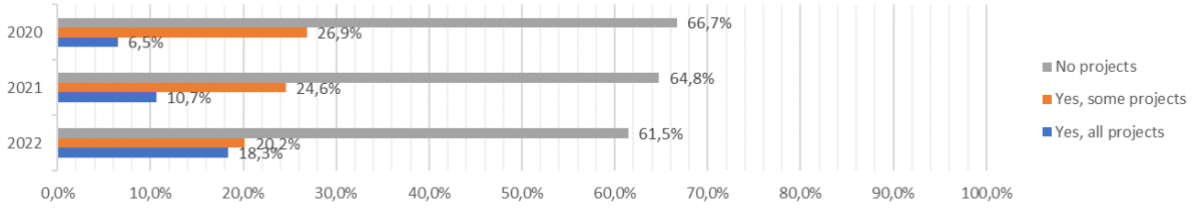


**Figure 6 Do you follow the BEP on projects?**

For the purpose of effective and transparent communication across the project, the BIM manager has the responsibility for administration and management of the CDE. Some sources name this profession as CDE manager or administrator. It is rather important to understand that tasks related to CDE administration can have a major impact on the volume of work performed by BIM managers and coordinators [7,8]. If we were to look at BIM from a process point of view, CDE is used today by only less than 35% of active BIM users in Slovakia, which represents about 5% of the market. It implies that in the majority of BIM projects (65.3%) the communication on the BIM project and the handover itself, whether interim or final, takes place outside the CDE. This form of communication is proven inefficient and often leads to errors in coordination within the project team, interdisciplinary as well as within the individual tasks associated with revision, comments, and determination of requirements. The ratio of projects using CDE is presented in Figure 7.

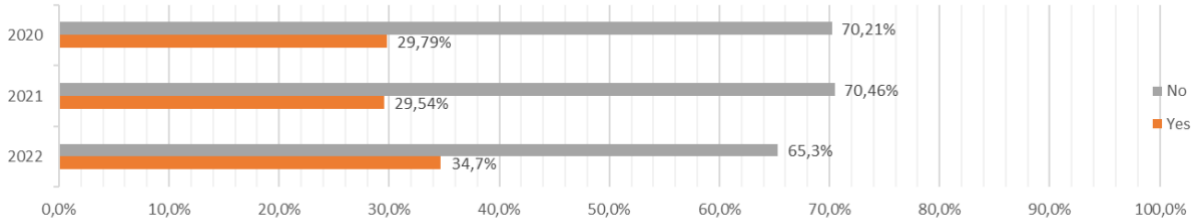


**Figure 7 Do you use CDE on projects?**

## 5 CONCLUSION

The rate of BIM adoption in Slovakia is gradually increasing and reaching 21.1% today, creating an opportunity for new professions, such as BIM manager or coordinator to be introduced to the market. However, their representation is relatively low (3.4%). However, with the increasing number of BIM projects, we can expect the number will continuously increase. These new positions in the construction industry, related to BIM management, are not sufficiently defined today, and there is also a lack of specification of their roles, duties, and responsibilities. The role of such employees who create, coordinate and check BIM models, manage the project team, and who are responsible for data management and BIM implementation within the company, or deploying BIM on a project cannot be replaced by another profession, even though many companies, especially in the early stages of BIM adoption, delegate these tasks to other team members. However, such a solution is only possible for small and relatively simple projects. In the case of larger projects, the activities of the BIM coordinator are diametrically different from the activities of the designer in terms of content and scope, and therefore it is necessary to count on specialized workers who, in addition to knowledge, also have relevant software skills, and individual companies must gradually fill these positions. This is also supported by the result of the survey, which shows that the highest number of BIM managers and coordinators work in companies with more than 100 employees.

In the future research, it is necessary to aim to the workload due to the time-consuming nature of BIM management and coordination related tasks.

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