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## COMPARATIVE ANALYSE OF PLANNED VERSUS ACTUAL BUDGETS AND CONSTRUCTION DEADLINES

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### Абстракт

Во трудот е презентирана споредбена анализа на планирани и стварни рокови и буџети при изградба на објекти. Преку теренско истражување собрани се, а потоа се анализирани податоци за 87 објекти изградени во Р.Македонија. Како главни причинители за пролонгирање на роковите и измените на предвидените буџети се детектирани: грешки во проектната документација, појава на непредвидени работи и вишоци, климатски услови, несоодветно планирање на реализацијата на проектот, законската регулатива, комуникацијата помеѓу учесниците и други влијанија. Се препорачува да при изградба на градбите се внимава на: квалитетот на проектната документација, континуираното планирање, синхронизирање, спроведување и контролирање на активностите од страна на искусни кадри; следење и контрола на реалната динамика во однос на планираната; познавање, навремено следење и примена на измени на законската регулатива и др.

### Клучни зборови

Буџет, градба, доцнење, рок на изведба.

### Abstract

This paper presents a comparative analysis of planned and actual deadlines and budgets for structures'/facilities construction. Data for 87 structures built in the Republic of Macedonia were collected by field research. Their analyze results pointed the main causes for the deadlines extension and changes to foreseen budgets: project documentation errors, unforeseen works and surplus, climatic conditions, unproper planning of project implementation, legislation, communication between the participants and other impacts. It is recommended to pay more attention to: project documentation quality, continuous planning, synchronization, implementation and control of activities by experienced personnel; monitoring and controlling the actual schedules compared to planned one; knowledge, timely monitoring and application of amendments to the legislation, etc.

### Key words

Budget, construction, delay, deadline.

## **1 INTRODUCTION**

The implementation of construction projects is a complex process that consists of several sub-processes. Their implementation requires some budgets and time. There is also a need of commitment of the project participants, as the outcome of the project implementation has impact on the work of all participants. [1-4]

The deadline and the budget have a key influence on the realization of the construction projects. They are an integral part of all construction contracts, so if deadlines and budgets are not managed well, they can easily break through. This usually leads to increased tension and mistrust among the parties involved in the construction process, lawsuits, financial flow problems, etc. [3-8]

A comprehensive analysis of the recent practices is needed to determine the adverse effects that may occur, what factors influence them in our construction practice, and what can be undertaken to manage them more successfully. In particular, in past years the country has been characterized by expansion of construction of various types of buildings in the field of: high-rise buildings, hydro-structures and line infrastructure facilities. New buildings have been intensively built and are being built, and existing ones are being maintained, upgraded, refurbished and adapted.

Given the high intensity of building construction, as well as the need for significant budgets for their completion, there is a clear need to analyze the planned and actual deadlines for completion of the buildings, and the planned and actual budgets needed for their construction.

Due to its importance, this issue has attracted a great deal of interest from researchers worldwide [3-10], but unfortunately the situation in the country is not the same. The research presented in this paper contributes to this issue, as it refers to the deadlines and budgets for the realization of construction projects in our country. The aim is to consider the real situation while managing and planning the deadlines and budgets for construction of buildings in the country and to give recommendations that will encourage the improvement of the situation regarding the construction of buildings with the required quality, in a timely manner and with foreseen budget.

## **2 LITERATURE REVIEW**

In the available literature on the quality management of construction projects, in almost every one of them, one of the main tasks is to have the construction project completed with the required quality in a timely manner and with the foreseen funds. That is why the research on the topic of deadlines and budgets is actual worldwide. This can be seen from the numerous published world papers on deadlines, budgets and their breakthroughs [3-10]. The research has been conducted, not only in the countries that are economic leaders, but also in those that are less developed [3,8,9]. Some research has also been done on building facilities in our circumstances, analyzing factors that influence dynamic plans, budgets and costs and identifies impacts on the deadlines, budgets and their breakthroughs [1]. The recommendations for quality preparation of project documentation have been given, for the purpose of creating conditions for efficient and cost-effective construction of infrastructure and other facilities within planned deadlines and with planned financial resources [2].

Similar research has been carried out in other countries on exceeding the agreed prices in terms of the agreed time of various types of specific buildings in BiH [3].

According to [4], the estimation of construction costs is based mainly on the estimates made by the experts and their previous experience, which is often subjective. In the same paper, data basis of costs has been made for construction of buildings in the Republic of Serbia. This

data should allow for future scientifically systematic assessments, which could easily be expanded with historical data. [4].

The research has also been conducted in the United States of America, identifying the main causes of construction delays by identifying the perceptions of the various parties involved in project implementation. [5]

The paper [6] sets out a list of factors affecting the increase in costs, and the research has been conducted in Pakistan. According to the seriousness of the impact, a rating from the point of view of the respondents was made of 42 factors with a score of 1 to 10. The influence of each factor has been calculated by a simple calculation,  $\text{Impact} = \sum (f_i \cdot i) / n$ , where:  $i$  is the weight of the result from 1 to 10,  $f_i$  is the frequency of the factor of obtaining a result and  $n$  = number of answers. [6]

Other research has identified the most important factors that cause construction exceeding in Malaysia [7], namely: fluctuations in material prices, cash flow and financial difficulties faced by contractors; poor location management and supervision [7].

Investigating the initial and changed construction costs, as well as the risk factors contributing to the increase in construction costs of 16 bridges in Japan, the cases where increased costs and a standard deviation of 20% have occurred are set down in [8]. In 5 out of the 16 projects the costs increased about 30% to 40%. The main reasons for delays in the field of civil engineering in Jordan, with evaluation of their relative importance to large projects, are given in [9]. It was concluded that the most important factors for delays were: labor productivity, inadequate contractor experience, inadequate planning, involvement and slow decision making by the owners and financing of the work. [9]

A similar investigation and identification of the main causes that led to the delays in the construction projects in Egypt are given in [10].

### **3 IMPACT OF THE LEGISLATION ON DEADLINES AND BUDGETS**

The legislation in the country also deals with deadlines and budgets for construction of buildings. These are mainly the laws on: building [11]; preventing corruption and conflicts of interest [12]; public procurements [13] and contractual relations [14]. In fact, the impact of legislation on planning and implementation of construction and the dynamics of construction and the budgets is enormous.

The Law on Construction over the past ten years has been amended by 29 Laws on amendments of the Law on Construction; the Law on Public Procurement in the same period was amended by sixteen Laws on amendment of the Law on Public Procurement [13]. Adapting to newly valid laws requires time for their study, interpretation and implementation, which in some cases has led to a delay of the deadline and an increase in the budget.

By the Laws on amendment of the Law on Public Procurement, it have repeatedly been made attempts to define the emerging changed quantities and types of works under construction in relation to the basic contract. But in various releases, different amounts and types of work in progress are defined differently. The necessary procedures for their regulation are also defined in a different manner, which of course affects the total cost of building construction. In addition to the many changes, there are still no clear and functional system solutions for defining them quickly and simply, and then for their regulation also.

There is a significant difference between public procurement laws, obligations and the prevention of corruption and conflicts of interest. These laws may conflict with the occurrence of unforeseen works, their implementation and the way of payment.

When constructing certain facilities, especially in cases where the budgets for construction are secured by international bank loans, the use of FIDIC contracts prepared by the

International Federation of Consulting Engineers [15] is required. These agreements provide for a fair relationship between the contractors as they contain a risk-weighting mechanism and reduced loss of funds and time. FIDIC contracts clearly define the relationship between the investor, contractor and supervisor with responsibilities of and deadlines for each party. Despite the international application of these contracts, they are still largely applied in domestic practice to projects financed by EBRD and the World Bank.

#### 4 RESULTS FROM THE RESEARCH AND DISCUSSION

Actual/realized data on planned and actual deadlines and budgets for 87 (eighty-seven) buildings built on the territory of the Republic of Macedonia have been collected. The buildings are in the areas of civil engineering, high-rise, new buildings, extensions, reconstructions and rehabilitation. Many of them relate to roads and engineering facilities built on them. The data were obtained through interviews with direct participants in the construction, i. e with those who were key and responsible personnel assigned to manage the projects in the construction phase of the specific facility, but were also involved in already completed and other ongoing construction projects.

The Figure 1 shows the total planned and actual duration in days of the 87 analyzed buildings. The analysis showed a total difference of almost 10 days (more specifically: 9,675 days) more or 37.53% more than planned one.

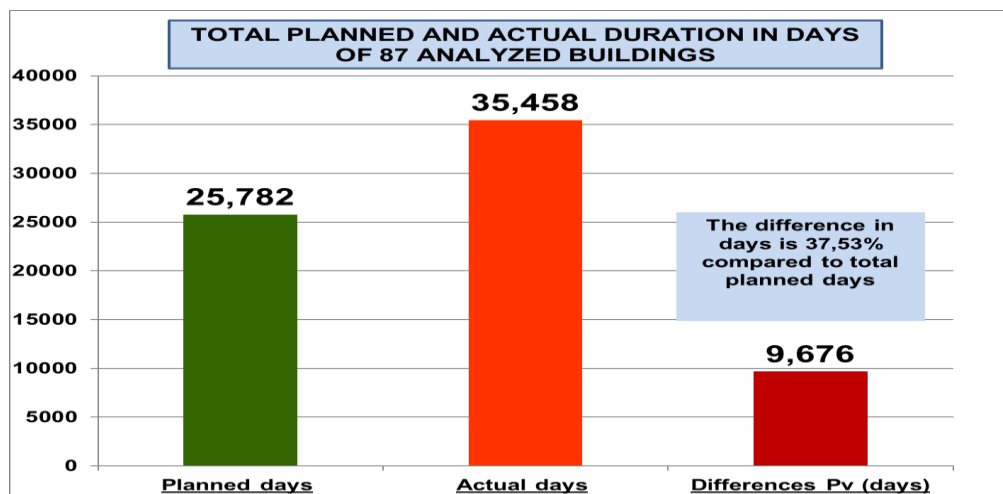


Figure 1 Total planned and actual duration in days of the 87 buildings analyzed

The Figure 2 shows that for the 87 analyzed buildings, a budget of around 8.4 billion VAT-excluded, was required. The Figure 1 shows that their construction was delayed by about  $9.7 \cdot 10^3$  days, so if you calculate an average daily contract penalty of 0.1% for each day of delay, you will see that this amount would be much higher than the maximum one. e.g.: 15% agreed penalty for delay, which clearly indicates the need to take measures and activities to better manage all processes affecting the deadlines and budgets.

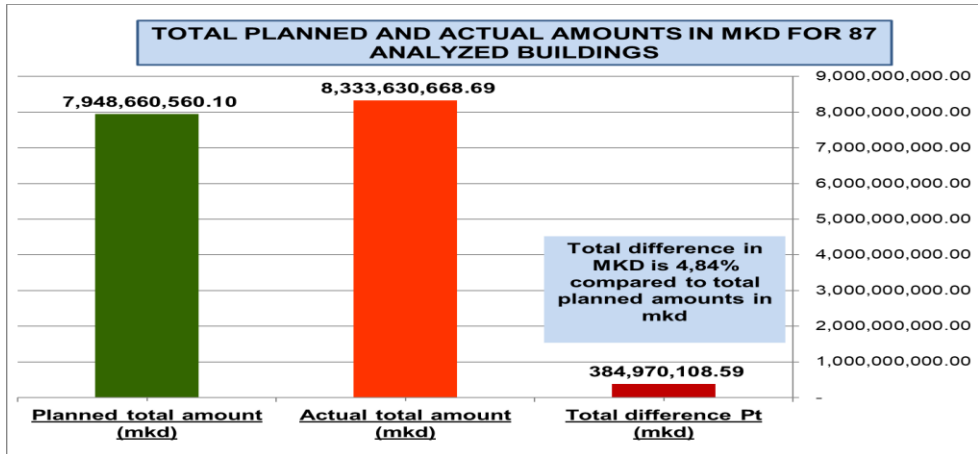


Figure 2 Total planned and actual amounts in MKD for 87 analyzed buildings

The Figure 3 shows the analysis of the data on the completion within the planned deadline. Unfortunately, 48 buildings which is more than a half, were completed later than planned deadline out of 87 buildings.

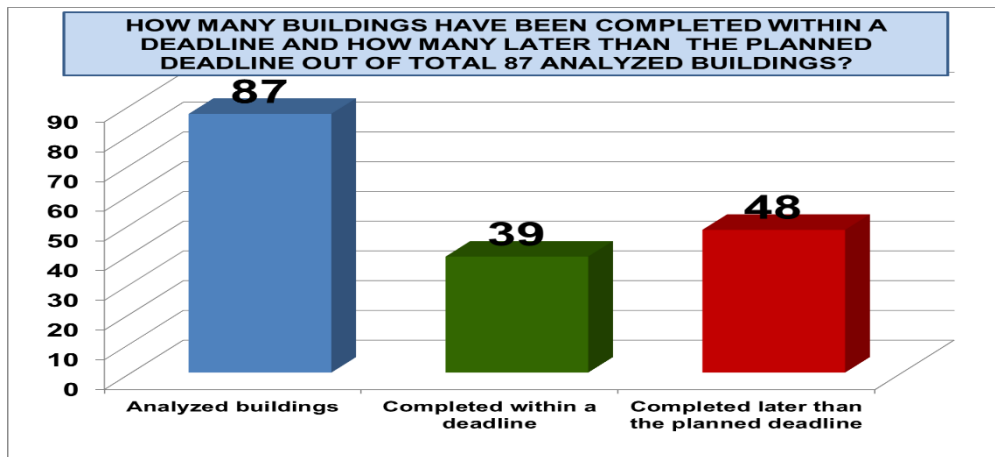


Figure 3 How many buildings were completed within a deadline and how many later than the planned deadline out of 87 analyzed buildings?

45 buildings only were completed with the planned budget (Figure 4) out of 87 buildings.

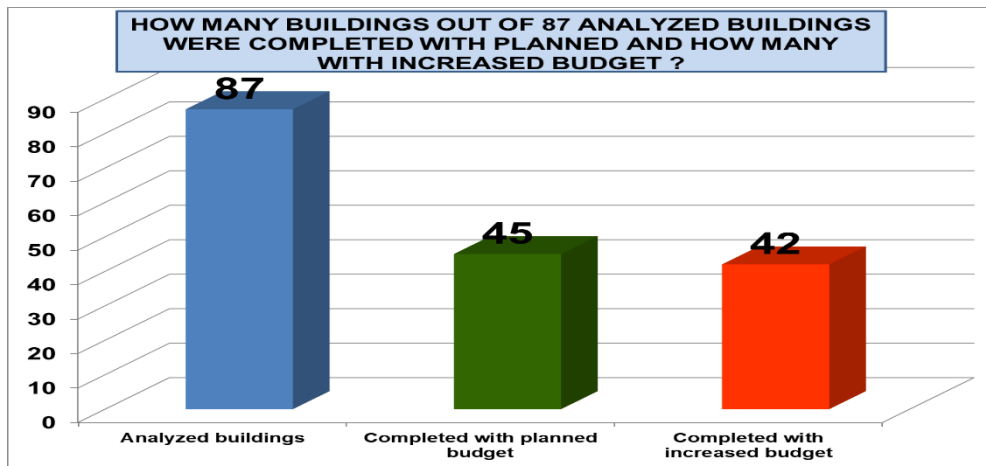


Figure 4 How many buildings out of 87 analyzed buildings, were completed with planned and how many with increased budget?

Figure 5 shows the reasons for deadline extension in the 48 buildings completed after the planned deadlines and are a part of the total of the 87 buildings. The data indicates the high influence of the project documentation errors, unforeseen works and climatic conditions to which it should be paid increased attention during their planning and organization, on the deadline extension. Thus, it is noted that the total number of reasons is greater than 87 as the total number of analyzed objects, because many reasons affects one building in some cases.

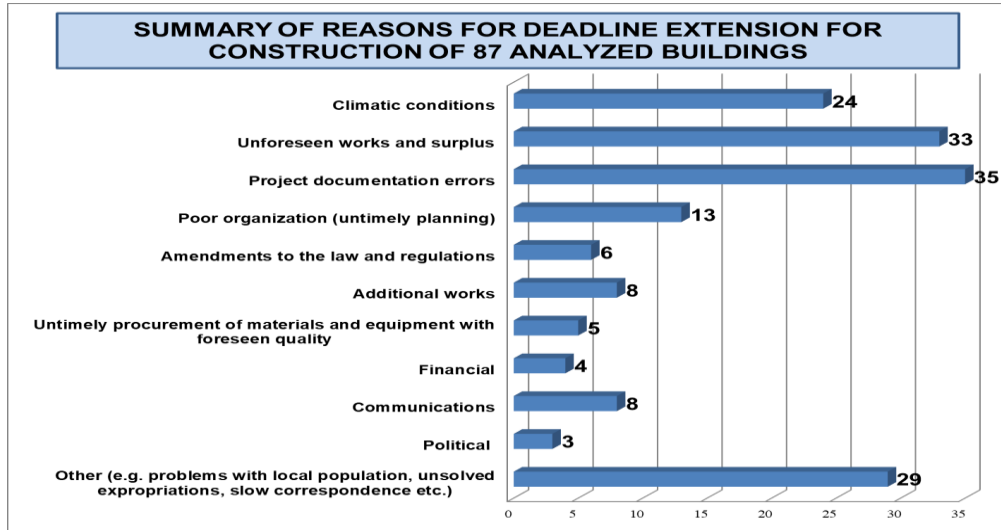


Figure 5 Summary of reasons for deadline delay for the construction of 87 analyzed buildings

The Figure 6 shows the reasons that caused the deadline to be prolonged in the construction of 12 roads that have been completed after the planned deadline, out of the total of 24 roads, which are part of the total of 87 buildings. The data indicates a high impact on the deadline extension in the construction of the roads due to: climatic conditions, unforeseen works and project documentation errors. The total number of reasons is greater than 24 as the total number of roads analyzed, because combinations of multiple causes affect one facility in some cases.

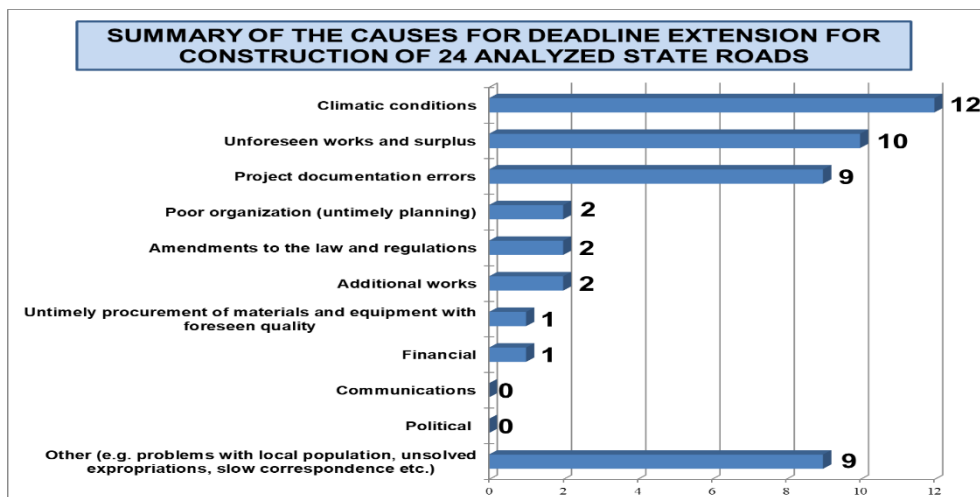


Figure 6 Summary of the causes for deadline extension for construction of 24 analyzed state roads

The Figure 7 shows the number and percentage of constructions out of the 87 analyzed buildings for which a dynamic plan was prepared. The analysis showed that for 27 facilities or

for 31% of the buildings a dynamic plan was not prepared, while for 60 facilities or for 69% such plan was prepared.

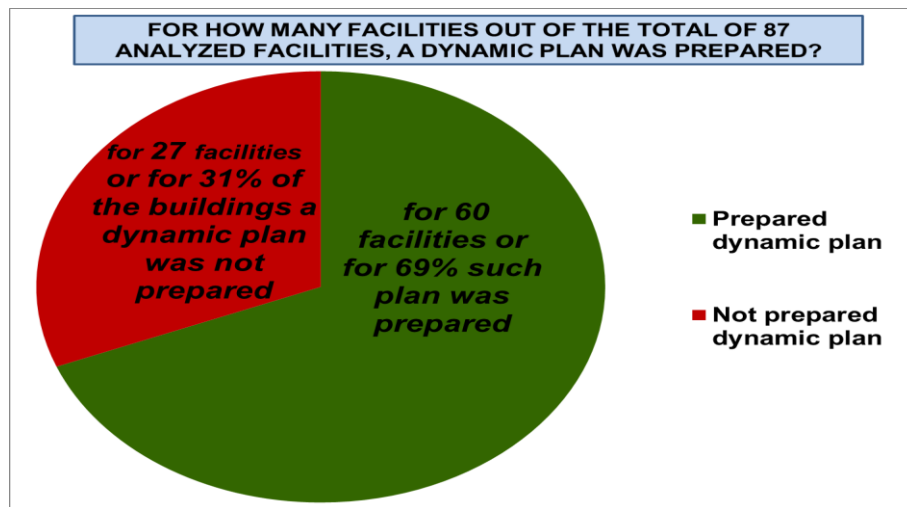


Figure 7 For how many facilities out of the total of 87 analyzed facilities, a dynamic plan was prepared?

The data from the Figure 8 shows that out of the total of 87 analyzed buildings, only for 12 facilities a general dynamic plan with a duration, number of workers and type of mechanization per item was prepared, while for 48 facilities a dynamic plan with a duration per item only was prepared. The analysis showed that the sub-plans in the function of the general dynamic plan were not prepared. The analysis showed that the plans are often superficially controlled or not controlled at all. And, the cases in which a control of the dynamic plans were made and in which a deviations were recorded, were revised in average 3 times or in rare cases 7 to 9 times.

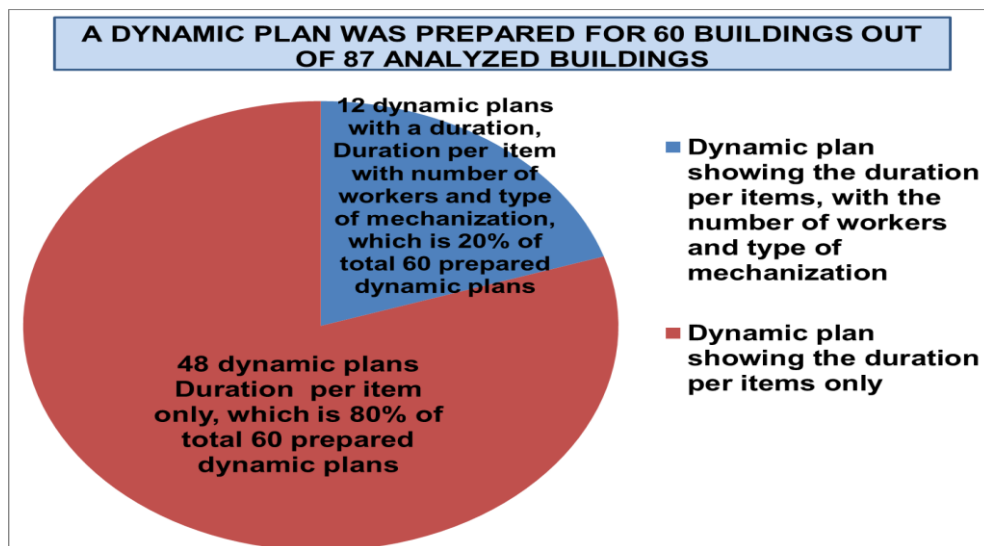


Figure 8 A dynamic plan was prepared for 60 buildings out of 87 analyzed buildings

The Figures 7 and 8 evidence that construction management can and should be planned and controlled much better. The analysis showed that very often legal entities do not hire planners with appropriate experience and competences, which unfortunately results in large deviations / extension of planned deadlines and increase in the budgets, which in turn leads to a continuous loss of significant financial funds which, if were not lost would have been reinvested.

The Figure 9 shows what kind of meetings were held in all 87 buildings. It can be noticed that only in 33 facilities were held regular monthly and in 21 facilities regular weekly meetings while most of the meetings were held on irregular basis/if needed.

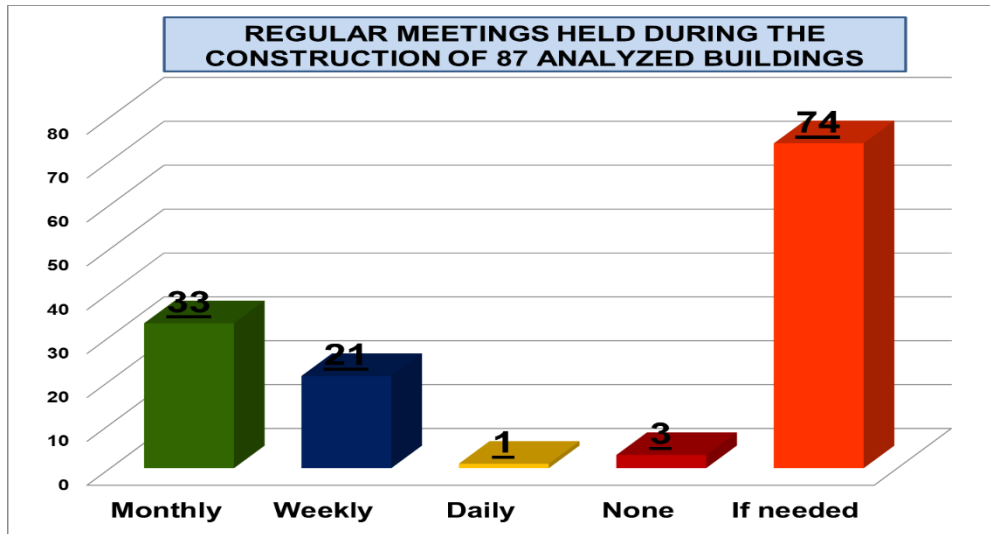


Figure 9 Regular meetings held during the construction of 87 analyzed buildings

The Figure 10 shows the types of contracts used in the 87 analyzed buildings. It can be noticed that as many as in 62 cases of attorney non typified contracts were concluded, of 16 modified FIDICs, and in only 9 cases original international release was used.

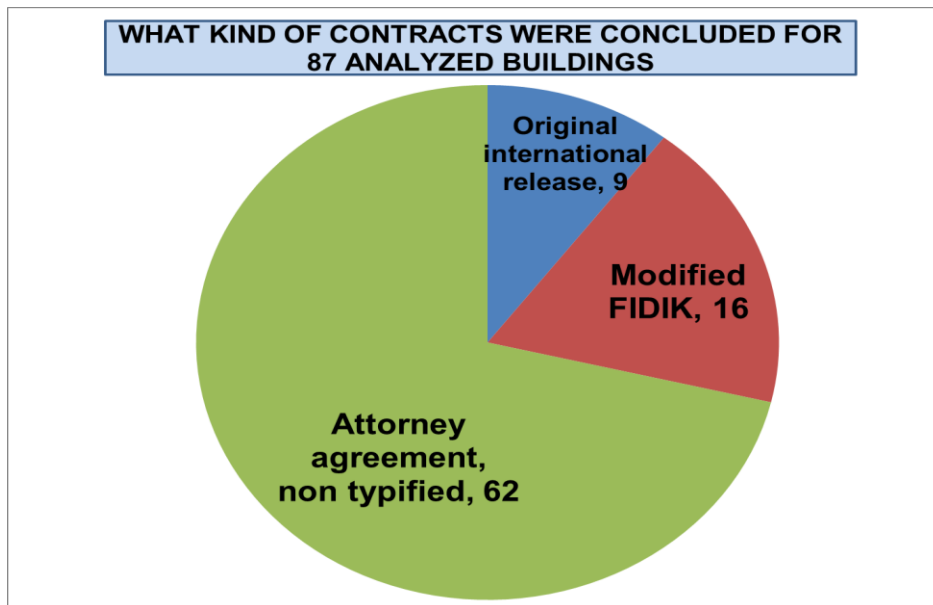
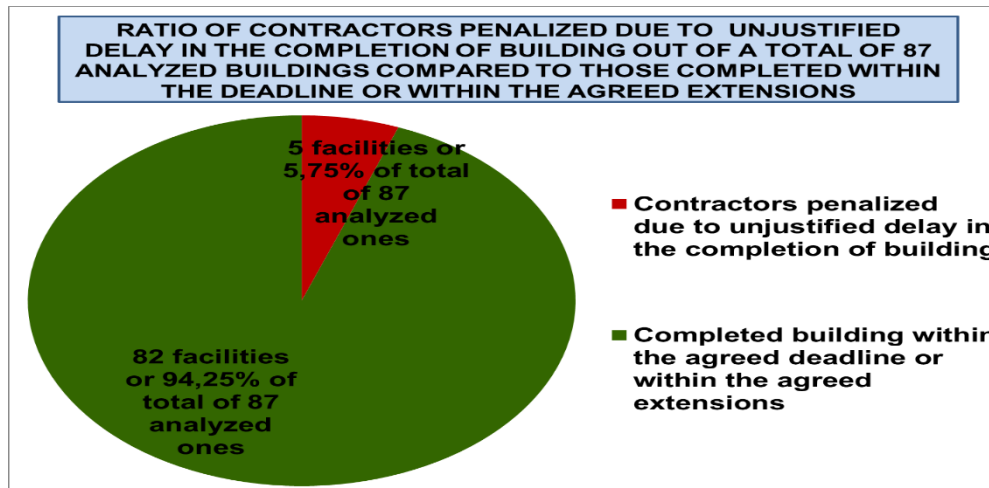


Figure 10 What kind of contracts were concluded for 87 analyzed buildings

The Figure 11 shows the percentage and number of contractors who were penalized due to unjustified delay in the completion of the construction, out of 87 analyzed buildings which is 5.75%.





*Figure 11: Ratio of contractors penalized due to unjustified delay in the completion of building out of a total of 87 analyzed buildings compared to those completed within the deadline or within the agreed extensions*

## 5 CONCLUSIONS AND RECOMMENDATIONS

In order to contribute to the increase in the number of construction projects that will be built with the required quality within the deadline and with the foreseen budget, the following general conclusions and recommendations were made:

- project management requires continuous planning, synchronization, implementation and control of activities by experienced experts, appropriate to the category and complexity of the facility;
- to continuously monitor and control the real dynamics in relation to the planned, in order to timely perceive possible deviations;
- good knowledge, timely monitoring of changes in the legislation and its application;
- the procedure for regulating the changes during construction is complex and requires a great deal of effort and time, so a simplified and functional solution for fast and efficient acting in such cases needs to be adopted;
- each of the parties involved in the construction, within its competences, should have a plan for dealing with the changes of the laws;
- construction of buildings requires large investments, and on the other hand, the construction has to meet all requirements in compliance with the legislation, contract documentation, technical rules, standards and norms. Therefore, the great responsibility that the participants have, that should be provided with the appropriate working conditions including independence of action; is becoming clear.
- the quality of the completed works should meet at least the criteria prescribed by the applicable standards for that work, rulebooks, technical conditions, laws, projects, but also meet the obligations assumed in compliance with the contractual documentation. In fact the quality has to be achieved on the whole building and on all individually performed works;
- in order to successfully manage the procedures for regulating the changes during the construction, it is necessary to hire and nominate experienced and competent personnel in due time by the investor, contractor, supervisor, and if necessary the

designer and other participants who will be provided with the necessary working conditions;

- common to all participants in the construction is the great responsibility they have for their actions in terms of security achieved, technical compliance, justification, cost-effectiveness, transparency, legitimacy and legality. But the responsibility of the participants does not end with the completion of the construction. All of the above mentioned responsibilities have a continuous and permanent status. It is specific that different parts of the legislation have priority for different participants in the construction, depending on their role in the construction

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