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TIME CONSTRAINTS AS A RISK FACTOR IN THE DESIGN PROCESS OF WATER SUPPLY AND IRRIGATION SYSTEMS

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Abstract

The determination of design durations represents an important component of infrastructure project planning and directly influences the quality, reliability, and effectiveness of project preparation. However, concerns have increasingly emerged regarding the adequacy of design schedules specified within public procurement procedures, particularly for technically complex water infrastructure projects. This study evaluates the consistency of design durations applied in public procurement procedures for water supply and irrigation system design services in the Republic of Armenia.

The research is based on a comparative analysis of selected procurement procedures, normative design duration standards, and professionally justified design periods. In addition to direct schedule comparisons, a project complexity assessment framework was developed using technical indicators including the number of settlements served, pipeline length, water intake structures, pumping stations, regulating reservoirs, and water treatment facilities. The proposed framework was used to assess whether the design durations specified in procurement documentation were proportionate to the engineering effort required for project implementation.

The results revealed substantial discrepancies between tender-based and normative design durations. In many examined cases, design services were required to be completed within 20–30 days, whereas the corresponding normative or professionally justified durations ranged from 90 to 120 days. The observed deviations reached 75–83% in several projects. The analysis further demonstrated that projects with significantly different complexity levels were frequently assigned similar design durations, indicating that project complexity is not systematically incorporated into schedule determination.

The findings suggest that the current approach to establishing design durations does not adequately reflect the scope and complexity of engineering activities required for project preparation. The study concludes that incorporating project complexity criteria and broader application of normative duration standards could contribute to improving design quality, reducing implementation risks, and enhancing the effectiveness of public procurement procedures for water infrastructure projects.

Keywords: public procurement; design duration; project complexity; water supply systems; irrigation systems; infrastructure planning; engineering design; Armenia.

Introduction

Time is not merely an organizational resource in the engineering design process, but also a critical factor influencing the quality of design decisions and the overall performance of a project. International studies indicate that decisions made and activities undertaken during the early stages of a project have a significant impact on its subsequent development, while deficiencies at these stages may lead to cost overruns, schedule delays, and technical deviations [1,2]. At the same time, the reduction of design errors and the proper development of technical solutions are recognized as essential prerequisites for successful project implementation, since shortcomings originating during the design phase frequently result in rework, additional expenditures, and increased construction risks during later project stages [3,4].

International studies indicate that infrastructure project failures, cost overruns, and schedule delays are often attributable not only to problems arising during the construction phase, but also to inadequate assessments, design errors, and incomplete baseline data during the design and project preparation stages [5–8].

Numerous studies in the field of construction management emphasize that design errors may lead to redesign, additional work, cost increases, contractual disputes, and a decline in construction quality. As a result, the effects of deficiencies arising during the design phase often extend to subsequent stages of the project life cycle, affecting both construction performance and operational efficiency [9–12]. In this context, the time allocated for design activities should be regarded not merely as an organizational or contractual requirement, but also as an important factor influencing the quality of the design process and the development of subsequent project risks.

The design of water supply and irrigation systems is characterized by its complex and multidisciplinary engineering nature. Unlike many conventional construction projects, the design of water infrastructure involves spatially extensive linear systems, the assessment of variable topographic and hydrological conditions, the investigation of water sources, hydraulic calculations, water demand forecasting, pressure and flow distribution modeling, as well as the integrated design of pumping stations, regulating reservoirs, control facilities, and water metering systems [13–16]. In irrigation systems, additional importance is attached to the assessment of seasonal water use patterns, determination of crop water requirements, organization of water delivery regimes, accounting for water losses, and ensuring the hydraulic reliability of canals and pipelines [17–19]. The integrated solution of such multi-component engineering tasks requires adequate time resources, as each stage of the design process is based on data and calculations obtained during the preceding stages.

In recent years, GIS, EPANET, WaterGEMS, and other hydraulic modeling tools have been widely applied in the international practice of water supply and water infrastructure design, enabling engineers to evaluate network pressures, flow rates, velocities, water losses, alternative operational scenarios, and overall system reliability [20–22]. However, the effective application of these tools requires the collection of accurate baseline data, the development of network schematics, the formulation of demand scenarios, the verification of computational results, and the optimization of design solutions. Therefore, the availability of adequate time resources is an essential prerequisite not only for ensuring the completeness of design documentation, but also for supporting the reliability of hydraulic analyses and techno-economic decision-making.

In public and municipal procurement systems, the time allocated for design services is often determined not by the actual engineering and technical requirements of the design process, but rather by administrative, budgetary, or procurement-related considerations. International literature indicates that an excessive emphasis on price and the limited application of selection criteria in public procurement may negatively affect service quality, restrict professional competition, and reduce overall project performance [23–25]. For this reason, European and international procurement practices are increasingly adopting value-based procurement approaches, quality-oriented evaluation criteria, and life-cycle cost considerations, as selection based solely on the lowest initial price or short-term economic indicators does not always ensure the efficient use of public investments [23–25].

In the international literature, infrastructure project complexity is commonly regarded as a multidimensional characteristic determined by the number of technical components within a project, the degree of interconnection among these components, the diversity of engineering solutions, and the range of professional disciplines involved [30–34]. Several authors have noted that increasing project complexity is accompanied by a greater volume of design activities, increased coordination requirements, a larger number of engineering calculations, and longer design durations. Consequently, complexity assessment approaches based on the structural and technical characteristics of projects are widely applied in the evaluation of infrastructure developments [30–34].

In the design of water supply and irrigation systems, complexity is primarily determined by the configuration of the system, the number of settlements served, the extent of linear infrastructure, the presence of water intake structures, and the need to design pumping stations, regulating reservoirs, and water treatment facilities [13–22, 30-34]. Therefore, when estimating the time required for design activities, it is appropriate to consider not only project cost or financial indicators, but also the scope and interconnection of the technical components that must be developed during the design process.

Conflict Setting

Despite the extensive body of international literature addressing design errors, construction delays, cost overruns, and risks associated with infrastructure projects, relatively few studies have quantitatively evaluated the discrepancy between the actual timeframes allocated for design activities and the engineering-based durations required for their proper execution. This research gap is particularly evident in the field of water supply and irrigation systems, where the design process involves the integrated development of technical, hydraulic, geodetic, engineering-geological, and economic components.

This issue is especially relevant in countries where short implementation periods are commonly applied in public and municipal procurement of design services, while design organizations are simultaneously expected to conduct field investigations, collect baseline data, perform engineering calculations, develop design solutions, prepare cost estimates, and complete other mandatory project tasks within the same timeframe. Under such conditions, a conflict arises between the actual complexity of the design process and the time constraints imposed by procurement documentation, potentially creating additional risks for the quality of design solutions and the overall performance of infrastructure projects.

The aim of this study is to evaluate time constraints as a risk factor in the design process of water supply and irrigation systems by comparing the actual design durations specified in procurement procedures with normative or professionally justified design durations and assessing the deviations between them. The main research question addressed in this paper is the extent to which the design timeframes established in public procurement procedures correspond to the actual engineering requirements of water infrastructure design and what risks may arise under such time-constrained conditions.

Materials and Methods

The study is based on a comparative assessment of public procurement procedures conducted for the design of water supply and irrigation systems. The analysis examined projects implemented by state and municipal authorities, in which the actual design durations specified in procurement documents were compared with normative or professionally justified design durations. The research utilized procurement documentation, technical specifications, contractual requirements, and the provisions of SN RA 12-01-2022 *"Design Work Duration Standards"*, which regulates the duration of design activities in the Republic of Armenia [26].

To assess schedule deviations, the ratio between the design duration specified in the procurement documentation and the normative or professionally justified design duration was calculated for each project. This comparative assessment made it possible to determine the degree of conformity between the actual design timeframes and the real engineering requirements of the design process, as well as to identify projects characterized by elevated levels of risk.

Research Results

The analysis of public procurement procedures for water supply and irrigation system design services implemented in the Republic of Armenia revealed substantial discrepancies between the design durations specified in tender documentation and the durations justified by normative requirements or professional engineering practice. In several cases, only 20–30 days were allocated for the completion of design services, whereas the corresponding normative or professionally justified durations ranged from 90 to 120 days, depending on the scale and complexity of the project [26].

The identified discrepancies indicate that the evaluation of design schedules cannot be limited to a direct comparison between actual and normative durations. Since the engineering effort required for project implementation may vary significantly depending on project characteristics, the adequacy of design schedules should also be assessed with consideration of project technical complexity.

As the duration of the design process is directly determined by the scope and complexity of the engineering activities involved, a comparative assessment of projects requires the application of a unified design complexity criterion. Based on a review of international practice, this study proposes that project complexity should be evaluated not by the construction cost of the facility, but by the number of technical components to be developed during the design process and the degree of interconnection among them.

For the purpose of comparative project assessment, design complexity is proposed to be characterized by the following principal technical components:

1. Number of settlements served by the system;
2. Total length of transmission and distribution pipelines;
3. Presence of water intake structures;
4. Number of pumping stations;
5. Number of regulating reservoirs;
6. Presence of water treatment facilities.

These components were selected as indicators reflecting the scope and complexity of the principal engineering activities involved in the design of water supply and irrigation systems. If the design assignment includes additional engineering or technological facilities that are not covered by the above-listed components, their impact on the required design duration should be assessed separately and justified through additional calculations.

Table 1

Proposed Weighting System for Project Complexity Assessment

Complexity Component	Assigned Score	Engineering Justification
Number of settlements served	2 points per settlement	Increases field investigations, stakeholder coordination, demand assessment, and network design requirements
Pipeline length	1 point per 10 km	Increases surveying activities, hydraulic calculations, and design documentation volume
Water intake structure	5 points	Requires hydrological, hydraulic, and structural design studies
Pumping station	4 points	Requires hydraulic, structural, electrical, and mechanical design solutions
Regulating reservoir	3 points	Requires hydraulic and structural design as well as operational analysis
Water treatment facility	6 points	Represents the most technically complex component, requiring process, hydraulic, structural, electrical, and mechanical design

The weighting system presented in Table 1 was developed to provide a unified basis for the comparative assessment of project complexity. The assigned scores do not represent exact engineering labor requirements but rather reflect the relative contribution of each technical component to the overall complexity of the design process. The total project complexity score (PCS) was calculated as the sum of the scores assigned to all technical components included in a project.

$$PCS=\sum W_i$$

where: **PCS** – Project Complexity Score; $\mathbf{W_i}$ – score assigned to each technical component included in the project.

Based on the calculated PCS values, the examined projects were classified into three relative complexity categories (Tab. 2).

Table 2

Project Complexity Classification

Project Complexity Score (PCS)	Complexity Level
0–10	Low Complexity
11–20	Medium Complexity
>20	High Complexity

To provide a consistent basis for comparative assessment, the selected technical components were used as the foundation for evaluating project design complexity. This approach is not intended to determine the exact engineering effort required for each project but rather to serve as a comparative indicator of the relative complexity of different design assignments. Projects that include a larger number of interconnected technical components generally require more extensive hydraulic calculations, field investigations, development of technological solutions, engineering coordination activities, and preparation of technical documentation. Consequently, such projects require longer design periods to ensure the proper completion of all engineering tasks.

To facilitate the comparative assessment of projects with different engineering characteristics, the proposed design complexity components were subsequently used to classify the examined projects according to their relative complexity levels. This classification provided the basis for evaluating whether the design durations specified within public procurement procedures were proportionate to the engineering effort required for project implementation.

Comparative Assessment of Project Complexity

To enable the comparative assessment of projects with different technical characteristics, the selected components were used as a unified basis for evaluating design complexity. The assessment was based on the assumption that an increase in project complexity leads to a corresponding increase in the volume of engineering activities, which, in turn, requires a longer design period.

The complexity assessment considered the number of settlements served by the system, the total length of transmission and distribution pipelines, as well as the presence of major hydraulic and technological facilities included in the project. The increase in these factors results in a greater volume of field investigations, hydraulic calculations, development of technological solutions, engineering coordination activities, and preparation of design documentation.

For the purposes of comparative analysis, the examined projects were classified into three main categories:

- Low-complexity projects;
- Medium-complexity projects;

- High-complexity projects.

The classification was based on the number of technical components included in the project and the degree of interconnection among them. High-complexity projects typically involve multiple settlements, extensive pipeline systems, and various hydraulic or technological facilities, whereas low-complexity projects are generally limited to relatively simple engineering solutions.

This classification makes it possible to compare the design durations specified for different projects and to assess the extent to which they are proportional to the engineering effort required for project implementation.

The comparative assessment of the examined projects revealed substantial differences in their relative complexity levels. While some projects were limited to the design of a water supply system for a single settlement or a relatively short pipeline network, others involved multi-settlement systems, extensive transmission pipelines, water intake structures, pumping stations, regulating reservoirs, and other hydraulic facilities. Consequently, the engineering effort required for project design may vary considerably from one project to another.

However, despite the existing differences in technical complexity, the design durations specified in tender documentation were often similar or of the same order of magnitude. In several cases, high-complexity projects were assigned design periods that did not differ substantially from those established for relatively simple projects. This finding indicates that project technical complexity was not adequately considered in the determination of design schedules.

Fig. 1 and Fig. 2 present the results of the comparative assessment of design durations applied in the examined procurement procedures. The analysis demonstrates that the design periods specified in tender documentation were substantially shorter than both the normative durations and the minimum professionally justified design periods adopted in this study. In several projects, the observed deviations reached 75–83%, indicating a significant mismatch between the engineering effort required for project design and the time allocated for its completion.

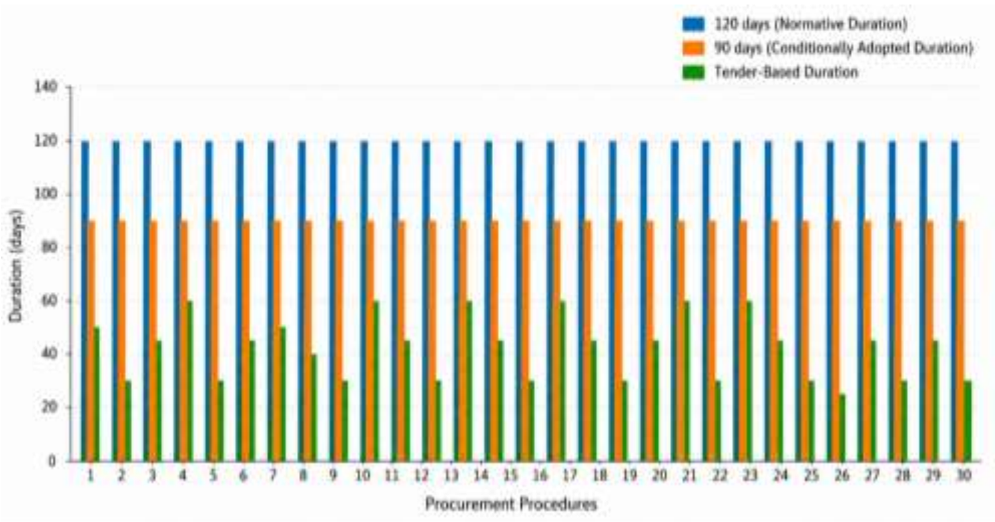

Fig. 1 Comparative Assessment of Design Durations in the Examined Procurement Procedures

Fig. 1 illustrates the design durations specified in the examined public procurement procedures compared with the minimum professionally justified design duration adopted in this study. The results demonstrate that the majority of procurement procedures allocated substantially shorter periods for design activities than those required for the proper completion of engineering investigations, calculations, and documentation. In several cases, design periods were limited to 20–30 days, despite the significantly greater effort required for project preparation.

Fig. 2 presents the percentage deviations between the design durations specified in procurement documentation and the corresponding normative or professionally justified durations. The results indicate that the observed deviations frequently exceed 50% and, in several projects, reach 75–83%. Such discrepancies suggest that the allocated design periods are often insufficient for the completion of the engineering activities required by projects of similar scale and complexity.

The largest deviations were identified in projects involving multi-settlement water supply and irrigation systems. Such projects require field investigations, geodetic surveys, hydraulic calculations, development of technological solutions, preparation of cost-estimation documentation, coordination procedures, and expert review processes, all of which demand substantial time and professional resources.

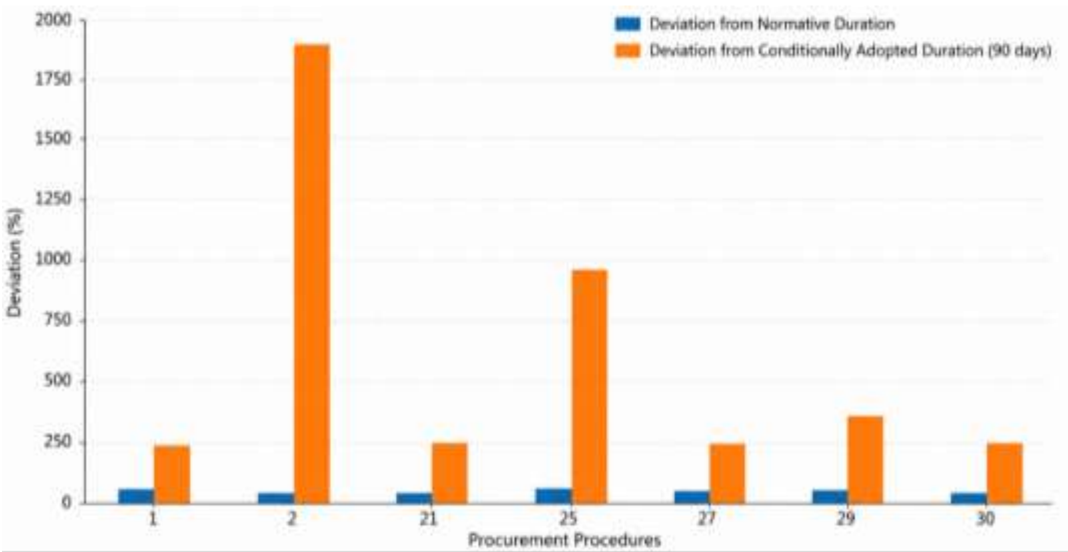

Fig. 2 Comparative Assessment of Design Duration Deviations

The results indicate that the differences between the design durations specified in tender documentation and those justified by normative requirements or professional practice represent a systemic rather than an isolated phenomenon. The findings suggest that the process of establishing design schedules does not adequately reflect project technical complexity and the engineering effort required for successful project implementation.

Discussion

The results of this study demonstrate that the design durations specified in public procurement procedures for water supply and irrigation system design services in Armenia are frequently substantially shorter than both normative requirements and professionally justified design periods. The observed deviations, which in several cases reached 75–83%, indicate that the current approach to determining design schedules does not adequately reflect the actual scope and complexity of design activities.

The findings suggest that design duration is often treated as an administrative or organizational parameter, whereas it should be directly determined by project scope and complexity. International studies on project complexity have demonstrated that complexity is one of the principal factors influencing engineering workload, planning requirements, and overall project performance [30-34]. Consequently, projects involving multiple settlements, extensive transmission pipelines, and complex hydraulic infrastructure require substantially greater design effort than relatively simple infrastructure projects.

The comparative assessment conducted in this study revealed that projects with significantly different complexity levels were frequently assigned similar design durations. This observation indicates that project complexity is not systematically incorporated into the determination of design schedules. Such an approach may create conditions in which engineering investigations, hydraulic calculations, design verification activities, and technical coordination procedures must be performed under severe time constraints.

International research has repeatedly demonstrated that deficiencies in project preparation and shortcomings during the design phase may lead to design errors, rework, quality deviations, and implementation problems during subsequent project stages [3–5, 9, 10, 12]. In construction and infrastructure projects, excessively compressed design schedules may limit opportunities for field investigations, engineering reviews, and other essential technical activities, thereby increasing technical uncertainty and the likelihood of project modifications during implementation [4, 6, 9, 10].

The results obtained in this study are also consistent with findings from the broader project management literature, according to which unrealistic planning assumptions frequently contribute to schedule-related risks, implementation difficulties, and reduced project performance [2,6, 29, 37]. Although the present study focuses specifically on design services, the identified patterns suggest that establishing design durations without adequate consideration of project complexity and engineering workload may generate similar risks in the water infrastructure sector.

From a policy perspective, the findings highlight the need for more structured and technically justified approaches to determining design durations within public procurement procedures. The incorporation of project complexity criteria into procurement planning, together with the broader application of normative duration standards, could contribute to improving the quality of design documentation and reducing implementation risks. Such measures would also be consistent with international practice, which emphasizes adequate project preparation as a prerequisite for successful infrastructure delivery [23-25].

Overall, the results suggest that improving the methodology used to determine design durations may represent an important step toward enhancing the quality, efficiency, and long-term sustainability of water infrastructure projects.

Conclusions

1. The study revealed a systemic mismatch between the design durations specified in public procurement procedures and the durations justified by normative requirements and professional engineering practice. In many cases, projects requiring extensive engineering investigations and design activities were assigned design periods significantly shorter than those considered technically reasonable.
2. The results demonstrated that project complexity is not systematically incorporated into the determination of design schedules. Projects with substantially different technical characteristics, engineering workloads, and infrastructure components were frequently assigned similar design durations, indicating the absence of a complexity-based approach to schedule determination.
3. The findings suggest that improving the methodology used to establish design durations, including the integration of project complexity criteria and wider application of normative standards, could contribute to enhancing design quality, reducing implementation risks, and improving the overall effectiveness of public procurement procedures for water infrastructure projects.

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ԺԱՄԱՆԱԿԱՅԻՆ ՍԱՀՄԱՆԱՓԱԿՈՒՄՆԵՐԸ ՈՐՊԵՍ ՋՐԱՄԱՏԱԿԱՐԱՐՄԱՆ և ՈՌՈԳՄԱՆ ՀԱՄԱԿԱՐԳԵՐԻ ՆԱԽԱԳԾՄԱՆ ԳՈՐԾԸՆԹԱՑԻ ՌԻՍԿԱՅԻՆ ԳՈՐԾՈՆ

Է.Յու. Գալստյան
Ակադեմիկոս Ի.Վ. Եղիազարովի անվան ջրային հիմնահարցերի և հիդրոտեխնիկայի ինստիտուտ

Նախագծային աշխատանքների տևողության հիմնավորված սահմանումը ենթակառուցվածքային ծրագրերի պլանավորման կարևոր բաղադրիչներից է և անմիջական ազդեցություն ունի նախագծերի նախապատրաստման որակի, հուսալիության և արդյունավետության վրա: Միաժամանակ վերջին տարիներին աճել են մտահոգությունները պետական գնումների շրջանակներում սահմանվող նախագծային ժամկետների բավարարության վերաբերյալ, հատկապես տեխնիկապես բարդ ջրային ենթակառուցվածքային նախագծերի դեպքում: Սույն հետազոտության նպատակն է գնահատել Հայաստանի Հանրապետությունում ջրամատակարարման և ոռոգման համակարգերի նախագծման ծառայությունների պետական գնումների գործընթացներում կիրառվող նախագծային ժամկետների հիմնավորվածությունը:

Հետազոտությունը հիմնված է ընտրված մրցութային ընթացակարգերի, նախագծային աշխատանքների տևողության նորմատիվների և մասնագիտական տեսանկյունից հիմնավորված նախագծային ժամկետների համեմատական վերլուծության վրա: Ժամկետների ուղղակի համեմատությունից բացի մշակվել է նախագծերի բարդության գնահատման մոտեցում, որը հիմնված է բնակավայրերի քանակի, խողովակաշարերի երկարության, ջրընդունիչ կառույցների, պոմպակայանների, կարգավորիչ ջրամբարների և ջրի մաքրման կայանների առկայության վրա: Առաջարկվող մոտեցումն օգտագործվել է գնահատելու համար, թե որքանով են մրցութային փաստաթղթերով սահմանված նախագծային ժամկետները համապատասխանում նախագծերի իրականացման համար անհրաժեշտ ինժեներական աշխատածավալին:

Արդյունքները ցույց տվեցին մրցութային և նորմատիվ նախագծային ժամկետների միջև առկա էական անհամապատասխանությունները: Ուսումնասիրված բազմաթիվ դեպքերում նախագծային աշխատանքների իրականացման համար սահմանվել են ընդամենը 20–30 օրյա ժամկետներ, մինչդեռ համապատասխան նորմատիվ կամ մասնագիտականորեն հիմնավորված տևողությունները կազմել են 90–120 օր: Առանձին նախագծերում արձանագրված շեղումները հասել են 75–83 %-ի: Վերլուծությունը նաև ցույց տվեց, որ էականորեն տարբեր բարդության մակարդակներ ունեցող նախագծերի համար հաճախ սահմանվել են նույն կամ միմյանց մոտ նախագծային ժամկետներ, ինչը վկայում է, որ նախագծերի բարդությունը համակարգված ձևով չի ներառվում ժամկետների սահմանման գործընթացում:

Ստացված արդյունքները ցույց են տալիս, որ նախագծային ժամկետների սահմանման գործող մոտեցումները բավարար չափով չեն արտացոլում նախագծերի նախապատրաստման համար անհրաժեշտ ինժեներական աշխատանքների ծավալն ու բարդությունը: Հետազոտության արդյունքները թույլ են տալիս եզրակացնել, որ նախագծերի բարդության չափանիշների ներառումը և նախագծային աշխատանքների տևողության նորմատիվների առավել լայն կիրառումը կարող են նպաստել նախագծային փաստաթղթերի որակի բարձրացմանը, ծրագրերի իրականացման ռիսկերի նվազեցմանը և ջրային ենթակառուցվածքների ոլորտում պետական գնումների արդյունավետության բարձրացմանը:

Բանալի բառեր՝ պետական գնումներ, նախագծային ժամկետ, նախագծերի բարդություն, ջրամատակարարման համակարգեր, ոռոգման համակարգեր, ենթակառուցվածքների պլանավորում, ինժեներական նախագծում, Հայաստան:

ВРЕМЕННЫЕ ОГРАНИЧЕНИЯ КАК РИСК-ФАКТОР ПРИ ПРОЕКТИРОВАНИИ СИСТЕМ ВОДОСНАБЖЕНИЯ И ОРОШЕНИЯ

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Обоснованное определение продолжительности проектных работ является важным элементом планирования инфраструктурных проектов и оказывает непосредственное влияние на качество, надежность и эффективность подготовки проектов. В последние годы все большее внимание уделяется достаточности сроков

E.Yu. Galstyan

TIME CONSTRAINTS AS A RISK FACTOR IN THE DESIGN PROCESS OF WATER SUPPLY AND IRRIGATION SYSTEMS

проектирования, устанавливаемых в рамках процедур государственных закупок, особенно для технически сложных объектов водохозяйственной инфраструктуры. Целью настоящего исследования является оценка обоснованности сроков проектирования, применяемых при государственных закупках услуг по проектированию систем водоснабжения и орошения в Республике Армения.

Исследование основано на сравнительном анализе отдельных процедур закупок, нормативов продолжительности проектных работ и профессионально обоснованных сроков проектирования. Помимо прямого сравнения сроков была разработана методика оценки сложности проектов, основанная на таких технических показателях, как количество обслуживаемых населенных пунктов, протяженность трубопроводов, наличие водозаборных сооружений, насосных станций, регулирующих резервуаров и водоочистных сооружений. Предложенный подход использовался для оценки соответствия сроков проектирования, установленных в закупочной документации, объему инженерных работ, необходимому для реализации проектов.

Результаты исследования выявили существенные расхождения между сроками проектирования, установленными конкурсной документацией, и нормативными либо профессионально обоснованными сроками. Во многих рассмотренных случаях на выполнение проектных работ отводилось лишь 20–30 дней, тогда как соответствующая нормативная или профессионально обоснованная продолжительность составляла от 90 до 120 дней. В ряде проектов отклонения достигали 75–83 %. Анализ также показал, что для проектов с существенно различным уровнем сложности нередко устанавливались одинаковые или близкие сроки проектирования, что свидетельствует об отсутствии систематического учета сложности проекта при определении сроков.

Полученные результаты показывают, что существующий подход к установлению сроков проектирования недостаточно отражает объем и сложность инженерных работ, необходимых для подготовки проектов. Сделан вывод о том, что включение критериев сложности проектов и более широкое применение нормативов продолжительности проектных работ могут способствовать повышению качества проектной документации, снижению рисков реализации проектов и повышению эффективности государственных закупок в сфере водохозяйственной инфраструктуры.

***Ключевые слова*:** государственные закупки; сроки проектирования; сложность проектов; системы водоснабжения; оросительные системы; инфраструктурное планирование; инженерное проектирование; Армения.

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