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Abstract

Completion of public-owned construction projects successfully is quite important for Turkey as a rapidly developing country. However, schedule delays and budget overruns are frequently encountered in such projects. One of the major reasons of this situation is the nonexistence of legislative provisions enforcing project parties to utilize advanced project planning and control methods in their projects. This paper firstly introduces the results of an investigation conducted on the public construction legislation in force in the Netherlands and related practices. Secondly, the results of a review on public construction legislation in force in Turkey are given to reveal the deficiencies in the regulations from the perspective of project planning and control. Subsequently, a number of legislative amendments are proposed to eliminate these deficiencies. Finally, to give some international context to the study, the two countries were compared. The findings showed that the legislation of the Netherlands also does not contain obligatory terms towards the implementation of advanced project planning and control methods. However, the usage of these methods are ensured through the quality control systems applied tightly based on the regulations put into force within the scope of contracts. Future research could focus on including more countries in the comparative study.

Keywords: *project control, project planning, public construction legislation, the Netherlands, Turkey.*

Introduction

The basic objective in any construction project is to complete the project within time, cost and scope along with the expectations and requirements in terms of quality, safety, environment, and stakeholder satisfaction (Atkinson, 1999; Bakker et al., 2010; Toor & Ogunlana, 2010). Complex, uncertain and dynamic conditions of today's construction sector require the usage of advanced planning and control methodologies in projects in order to increase the possibility of achieving success (Oberlender, 2014; O'Brien & Plotnick, 2015). Particularly using techniques such as the Critical Path Method, Line of Balance and Earned Value Management seems essential in order to properly manage the construction projects (Hinze, 2011; Newitt, 2008; Oberlender, 2014).

In Turkey, public institutions, which are liable to public law and using public resources, are subject to Public Procurement Law No: 4734 and Public Procurement Contracts Law No: 4735. In case public resources are to be consumed to purchase goods and services or realize construction works, the state institutions in Turkey are obliged to act in compliance with these laws and related regulations (Legislation Information System, 2020a; Legislation Information System, 2020b). Completion of public-owned construction projects successfully is quite important for Turkey as a rapidly developing country. However, schedule delays and budget overruns are frequently encountered in public-owned construction projects in Turkey. One of the causes for these delays and overruns is that projects are started without a proper planning and executed without using (advanced) project planning and control methods. The studies conducted on this issue point out the main reasons of this problem being the nonexistence of appropriate and sufficient provisions in the current regulations that will enforce the project parties to utilize the required project planning and control methods in their undertakings (Zalmai et al*,* 2016) and lack of awareness on such methods in the Turkish construction sector (Yurdakul, 1998; Gerger, 2006). Besides, Belirgen (2005) showed the existence of a meaningful statistical relationship between project planning and project success in engineering projects realized in Turkey based on an empirical analysis.

This paper firstly introduces the results of an investigation conducted on the public construction legislation in force in the Netherlands and related practices. Secondly, the results of a review on public construction legislation in force in Turkey are given to reveal the deficiencies in the regulations from the perspective of project planning and control. Subsequently, a number of legislative amendments are proposed to eliminate these deficiencies. Finally, to give some international context to the study, the legislation and related practices in the two countries were compared and conclusions were drawn.

Public Construction Legislation and Related Practices in the Netherlands

The Netherlands, which is composed of 12 provinces, does not have a strictly centralized state tradition. There are 3 levels of independent Dutch governments; 1 central government based in The Hague, 12 provinces, and 355 municipalities, respectively. Furthermore, there is an independent layer of 21 regional water management authorities (boards), who deal with the local polder systems, water safety, sewer water treatment and water quality. A more complicated setting is arranged for the Caribbean Islands, which is also another part of the Netherlands (Rijksoverheid, 2020). All of these Dutch governments have their own jurisdiction, can make their own decisions, and have their own political representatives. Also for the role as an employer to the civil engineering market, these governmental administrations have their own policies and responsibilities. Only on some issues, the central (national) government enforces rules by law. However, in general, the policies and applications of the National Ministry of Infrastructure and Water Management (Ministerie van Infrastructuur en Waterstaat) are followed. Rijkswaterstaat is a part of this Ministry, being the executive agency that operates and explores the national networks for canals & rivers, highways, and water defense works (Rijkwaterstaat, 2020). ProRail, which is the public organization that takes care of the national railway network (ProRail, 2020), is a bit more remote and independent from the Ministry of Infrastructure and Water Management, but it also reports to this Ministry. On the other hand, the Water Management Authorities, municipalities, and provinces report to their own political representatives, and are only supervised by the national government remotely (Rijksoverheid, 2020).

In this study, public construction legislation and related practices in the Netherlands have been investigated by gathering and studying the Dutch standardized contract formats and specifications used by the Rijkswaterstaat, ProRail and Water Management Authorities, respectively, and by interviewing planning practitioners expertized on the Dutch construction sector. In the Netherlands, the procurement legislations and contract legislations in force have been regulated separately. The national procurement law entitled as the Aanbestedingswet 2012 (Procurement Law, 2012) has been constituted in compliance with the European Union's public procurement directives and it contains quite strict regulations. The governments at all levels and all of the public authorities are obliged to implement these regulations in their procurements. Regarding the contracts used in public construction sector, the Netherlands follow a different route when compared to the procurement legislation. The governments are entirely free in determining the formats and contents of the contracts they utilize and in making any arrangements on the relevant specifications in accordance with their needs. However, in order to enhance efficiency in the public construction sector, some standardized contract forms have been created mutually between the public owners and the contractors' associations at the national level. These standardized contracts are used widely.

The Quality Control System (QCS) is the main tool generally utilized in managing the Dutch public construction contracts. QCS is a very systematic and a certified approach and the contractors are responsible for delivering the products in a project in compliance with the requirements of this quality system along with the quality control certificates. Prior to rewarding the contract, the contractors are obliged to submit a Certified Quality Certificate, which was formed according to NEN-EN ISO 9001, as a proof of a functioning QCS within his/her company. Before the contractor starts the execution of the project, a "Project Quality Plan" has to be submitted to the owner and this plan must be approved by the owner. However, this plan does not transfer any responsibilities to the owner. During the construction, the QCS becomes an important issue at all meetings held on site between the contractor and owner. The owner may also implement some quality tests on the site as well. The issues regarding the project planning and control are an important part of this Project Quality Plan along with all the other descriptions about the construction processes. The financial sustainability of a contractor depends on the cash flows realized by the payments made by the owner, i.e. these are all based on the QCS, reported progress or completed intermediate project products including their quality certificates. As all payment depend on the QCS, this automatically ensures the usage of detailed project planning methods and advanced planning tools by the contractor. Forward payments by governments are never included in the contracts. Furthermore, in some of the infrastructure projects, which may have a large impact on traffic flow, strict timeslots are given to the contractor. Failing to use these timeslots will result in huge penalties. Therefore, the contractor comes to a position that he/she has to prevent possible delays though applying a proper planning and control mechanism and an effective risk management. Generally, the level of specifications regarding the project planning and control are not very elaborated in the Netherlands except for some major projects. In general, the details of the requirements regarding the project planning and control already are ensured through the QCS within the contracts. Enforcement by law is considered to be too inflexible.

Rijkswaterstaat (Rijkwaterstaat, 2020) has quite limited planning specifications applied for the simple projects. However, all quality assurances need to be included, and a contractor will generally formulate several products in the planning to ensure his/her cash flow. Supervision on the construction site is sometimes needed for some critical processes, but this is generally

limited. For the larger Design & Construction contracts, a work breakdown structure (WBS) is required, including the tests and approvals by the owner. Also, the critical paths have to be highlighted by the contractor. A more elaborate Monte Carlo Simulation (MCS) based schedule or probabilistic scheduling may be requested in case of larger projects. *Water Management Authorities* (Rijksoverheid, 2020) generally realize smaller and local projects, but still count for a total expenditure of about 1.5 billion euro/year. Project planning and quality control are closely connected topics also in the projects of the Water Management Authorities. Before the start of the works, a general planning has to be submitted by the contractor. However, at intervals, a more detailed working plan is prepared. An IT tool for adequate communication between the contractor and supervisors named "VISI" is also used, and the requirements regarding the project planning and controlling are included within this system. *ProRail* (ProRail, 2020) applies the tightest contractual clauses regarding the project planning and control among the owners of the public construction sector of the Netherlands. The requirements are embedded in a general tight level of specifications and safety specifications implemented for all the projects in the railway construction sector. Works and temporary stops in rail services are generally scheduled in advance, long time ahead, and therefore the timeslots established are scarce. A detailed WBS is generally required, as well as a probabilistic approach to the planning. Critical Path Method, Linear Scheduling Method, Earned Value Management, S-Curve (Progress) Analysis and MCS based scheduling are among the project planning and control methods generally utilized by the contractors in the projects of ProRail.

Evaluation of Public Construction Legislation in Turkey in the Context of Project Planning and Control

The laws and regulations in force in Turkey, which are reviewed in this study (Legislation Information System, 2020a, 2020b, 2020c), are the Public Procurement Law No. 4734 (4734 sayılı Kamu İhale Kanunu) (*A1*), Public Procurement Contracts Law No. 4735 (4735 sayılı Kamu İhale Sözleşmeleri Kanunu) (*A2*), Annex to the Implementation Regulation for Construction Works Tenders – General Conditions of Construction Works (Yapım İşleri Genel Şartnamesi) (*B*), Implementation Regulation for Construction Works Tenders (Yapım İşleri İhaleleri Uygulama Yönetmeliği) (*C*), Public Tender General Communiqué (Kamu İhale Genel Tebliği) (*D*), and Annex to the Implementation Regulation for Construction Works Tenders - Contract Template for Construction Works (Yapım İşleri İhaleleri Uygulama Yönetmeliği eki Yapım İşlerine Ait Tip Sözleşme) (*E*). The legislation in question has been scanned through a number of keywords related to the scope of the study as shown in Table 1. These keywords are *planning/scheduling/control, activity criticality/float times, time extensions, work increase/decrease, delays/delay penalty, delay analysis/float time usage entitlement, advanced or detailed planning and scheduling*, and *advanced or detailed controlling/monitoring*. The results of this investigation (Table 1) show that the legislation designated in the form of A1, A2, B, C, D, and E above hardly contains provisions in terms of advanced project planning and control methods, the names of which are mentioned below. Therefore, it can be concluded that it is not possible to enforce the usage of such methods in public-owned construction projects with the current legislation in force.

The methods investigated during the review of the legislation up to now and to be referred in the legislative amendments that will be proposed in the following sections are the Critical Path Method (CPM), Line of Balance Method (LOB), and Linear Scheduling Method (LSM) as the planning and scheduling methods (Harmelink & Rowings, 1998; Ammar, 2013;

Ökmen, 2013; O'Brien & Plotnick, 2015; Ioannou & Yang, 2016; PMI, 2017); the Earned Value Management (EVM) and S-Curve Analysis (SCA) as the project control methods (McConnell, 1985; Marzouk & Hisham, 2014; PMI, 2017); and the Time Impact Analysis (TIA) as the delay analysis method (Arditi & Pattanakitchamroon, 2006; Al-Gahtani & Mohan, 2007; Braimah, 2013). The reason of using these methods in this study is that relevant literature extensively states their advantageous features and effectiveness in construction project management. However, it should be mentioned that new methods and advanced extensions to the current methods are continuously under development by researchers, therefore following the new developments in this field and quickly reflecting them to regulations and sectoral practice is needed.

Table 1. Evaluation of Turkish Construction Legislation.

Legislation	Planning/ Scheduling/ Control	Activity Criticality/ Float times	Time Extension	Work Increase/ Decrease	Delay/ Delay Penalty	Advanced or Detailed Planning and Scheduling	Advanced or Detailed Controlling/ Monitoring	Delay Analysis/Float Time Usage Entitlement
A1	✓	X	X	X	✓	X	X	X
A2	✓	X	✓	✓	X	X	X	X
B	✓	X	✓	✓	✓	✓	X	X
C	✓	X	X	X	X	X	X	X
D	✓	X	✓	X	X	X	X	X
E	✓	X	✓	✓	✓	X	X	X

Amendment Proposals for the Elimination of Deficiencies in Public Construction Legislation of Turkey

This section introduces a number of amendment proposals to eliminate the legislative deficiencies identified in the previous part. The proposals have been set up in the form of legal regulations either as a modification or an addition to the current legislation. In case a modification is proposed, the old text is over-lined and subsequently the new text is written under-lined. In case a new provision is added, the added text is given completely under-lined.

Amendment Proposal 1

In the clause (r) of the article no. 27 of the "Public Procurement Law No. 4734" titled *"Content of the tender, prequalification document and the mandatory points to be included in the Administrative Specification"*, the subjects that are required to be specified as a minimum in the Administrative Specification, which is one of the main documents prepared and delivered to bidders before the tenders by the Contracting Administrations, are the start and end date of work, the location of construction site, the delivery terms, and the penalties in case of delay. The following amendment is proposed for the article no. 27 in question. By this amendment, the project duration specified within the Administrative Specifications would be an estimated value determined by the Contracting Administrations. In current practice, completion date of the work is declared by the Administrations to the Contractors as an irrevocable constraint, thereby preventing optimum solutions for scheduling. Moreover, this amendment mandates the specification of the delay analysis method that will be used to find out the responsibilities of the parties in case a delay occurs.

Article 27- (r) The date of commencement of the work subject to the tender, estimated date of completion, the place of delivery, the conditions of penalty in case of delay and the method to be followed for delay analysis.

Amendment Proposal 2

The article no. 24 of the "Public Procurement Contracts Law No. 4735" titled *"Additional work, reduction of work and liquidation of the work within the scope of the contract"* is proposed to be amended by adding the following provision to the article no. 24. Although no specific method is prescribed in the present state of law, Contracting Administrations generally extend the duration of the work as much as the time calculated by applying "the rate of work increase to the contract value" onto the completion date of the work specified in the contract. Unfortunately, this approach causes improper time extension decisions. In this respect, the proposed amendment paves the way for determining the time extension amounts more realistically in case of a work increase through updating the work programs prepared with advanced project planning methods such as CPM.

Article 24- ... In the event of a work increase due to unforeseen circumstances, the work that is subject to the increase; ... within the framework of the provisions of the contract and the tender document, yet excluding the period, the same contractor shall have the work done. The additional duration due to any increase in the amount of work will be determined by updating the work program in accordance with the work increase.

Amendment Proposal 3

The definition of the "Work Program" in clause no. 1 of the article no. 4 of the "General Conditions of Construction Works", which is an annex to the "Implementation Regulation for Construction Works Tenders", is proposed to be amended as follows in accordance with the proposals offered so far. This amendment will ensure meeting the requirements such as preparing the work programs on a daily basis taking into account the estimated project duration and the annual allowance amounts stipulated by the Administration in the contract, arranging the work program in such a way that a more appropriate solution is reached, and allocating the allowances to the months accordingly in the work program. In other words, the Contractor is given the opportunity to prepare the optimum work program taking into consideration his / her available resources and financial situation together with the foresights provided by the Administration.

Article 4 – (1) Work program: Taking into account the estimated duration of the work specified in the contract and the estimated expiry dates of the work, if any, and the estimated annual payment amounts, work program is the schedule that shows the work items/ groups of the construction work, the ~~monthly~~ daily production and work quantities, the foreseen amount of material that is allowed to be paid in case be prepared on site in advance, the annual appropriation slice of the production in accordance with the proposed production rate and procedure, and their distribution to months.

Amendment Proposal 4

The clauses no. 1 and 5 of the article no. 17 of the "General Conditions of Construction Works" titled *"Work Program"* are proposed to be amended as given below and a new clause, the clause no. 8, is recommended to be added to the end of the article. The amendment proposed for the clause no. 1 mandates the work program to be prepared in the detail required by the Administration. The disputable term "comprehensive work" existing in the current legislation has been eliminated by the amendment proposed for the clause no. 5. Furthermore, through this amendment proposal, it is also obliged to prepare work programs in all kinds of construction projects by using advanced project planning methods such as CPM through the means of licensed computer programs. Besides, the amended clause no. 5 contains provisions about how and in what detail the work programs will be prepared and it mandates the utilization of the advanced work programs effectively during managing, controlling and tracking the progress of the projects. On the other hand, the clause no. 8, which is the newly added clause, ensures the usage of advanced project planning and control methods effectively during the execution of the work, the regularly updating of the work programs in order to reflect the latest situation in the project, the evaluation of the progress by an advanced approach such as "Earned Value Management" instead of the traditional "physical and financial realization" approach generally used in the current application, the demonstration of the precautions taken by the Contractor clearly and detailed if it is understood that the work will be delayed, the implementation of the delay analysis whenever required by using the "Time Impact Analysis" with taking into account the rights of float time usage, and the determination of the amount of responsibilities of the parties in case of a delay.

Article 17 –
(1) The Contractor shall prepare a work program in accordance with the examples given by the Administration and in sufficient detail compatible with the nature of the work, and shall submit it to the Administration for approval within the period specified in the contract or its annexes.

...

(5) ~~In a comprehensive work, the administration may require that the work program be organized using a package software work program or computer-aided work program that is prepared according to the feature of the work instead of the bar diagram.~~ *The work program should be organized through licensed software using one or more of the Critical Path Method, Line of Balance Method or Linear Scheduling Method according to the nature of the work. The method and software to be used will be specified in the contract. The information such as the relationships between work items or activities, criticalities of activities, float times of non-critical activities, start-up and completion dates, etc. should be clearly indicated in the work schedule using tables, bar diagrams, network diagrams or production graphs in the details requested by the Administration. Managing, controlling and progress tracking will be realized from the beginning until the end of the work effectively through using the work program.*

...

(8) The Contractor is responsible for conducting the work effectively by using the work program which has been prepared in accordance with the points specified in the clause no. 5 and approved by the Administration and responsible for providing the latest progress in construction to the Administration with the results of S-Curve Analysis and Earned Value Management on a regular basis and whenever required. Due to time-outs in critical activities or the use-outs in float times of non-critical activities, the amount of elongation at the planned completion date should be communicated to the Administration at regular intervals and, if

necessary, by updating the work program. The notifications must also include sufficient explanations on how to control the time-outs that have occurred and how to finish the work in the planned period. Apart from these, the Administration may ask the Contractor to carry out a study based on Time Impact Analysis for finding out which party is defective to what extent if time extension is requested or if the work is delayed. If there are any provisions in the contract related to the float time entitlement, these issues shall also be taken into consideration in the analysis.

The contents of Table 1 would change as shown in Table 2 if all of the amendments proposed in this study are implemented. Table 2 also includes the results of the amendments proposed for the "Implementation Regulation for Construction Works Tenders (Yapım İşleri İhaleleri Uygulama Yönetmeliği) (*C*)", "Public Tender General Communiqué (Kamu İhale Genel Tebliği) (*D*)" and "Annex to the Implementation Regulation for Construction Works Tenders - Contract Template for Construction Works (Yapım İşleri İhaleleri Uygulama Yönetmeliği eki Yapım İşlerine Ait Tip Sözleşme) (*E*)" although the amendments in question were not discussed in the paper due to size limitation. As can be observed in Table 2, the subjects shown in the columns occupy place in at least one of the arrangements mentioned in the rows. This can be considered as a sufficient criteria to eliminate the legislative deficiencies detected in this study when the principle of "hierarchy of norms" of law is taken into account.

Table 2. Re-evaluation of Turkish construction legislation after amendment proposals.

Legislation	Planning/ Scheduling/ Control	Activity Criticality/ Float times	Time Extension	Work Increase/ Decrease	Delay/ Delay Penalty	Advanced or Detailed Planning and Scheduling	Advanced or Detailed Controlling/ Monitoring	Delay Analysis/Float Time Usage Entitlement
A1	✓	X	X	X	✓	✓	X	✓
A2	✓	X	✓	✓	✓	✓	X	✓
B	✓	✓	✓	✓	✓	✓	✓	✓
C	✓	X	X	X	✓	✓	X	X
D	✓	✓	X	X	✓	X	✓	✓
E	✓	✓	✓	✓	✓	X	✓	✓

Discussion of the Findings and Conclusions

Ensuring the usage of advanced project planning and control methods such as CPM, LSM, and EVM through legislation emerges as a priority for the public construction sector in Turkey. This study has revealed that almost no obligation exists in regulations regarding the usage of these methods. This situation yields to ineffective project management from the contractors' perspective and ineffective progress monitoring from the owners' viewpoint. In turn, cost overruns and schedule delays frequently occur in public-owned construction projects. This study aims to create an awareness on this issue and introduces an approach that can be followed to resolve this problem.

In this study, the public construction legislation in force in the Netherlands and the related practices also have been investigated in terms of project planning and control. The results of this investigation have shown that, in the Netherlands, the usage of advanced project planning and control procedures in public-owned construction projects are ensured mainly through the adoption of a comprehensive quality control system, the details of which are determined within the contracts through negotiations conducted between the public owners and

contractors. In other words, although the legislative regulations do not contain obligatory terms towards the implementation of advanced project planning and control procedures in the public construction legislation of the Netherlands similar to the situation in Turkey, the usage of such methods is ensured through the quality control systems applied tightly based on the regulations put into force within the scope of contracts. Although different corporation cultures among the public-owner organizations in Turkey already provide the conditions of realizing procedures similar to the current practice in the Netherlands, generalization of the usage of such a model is also possible in Turkey. In other words, a similar approach may also be followed in Turkey besides the implementation of legislative amendments as proposed in this paper so that the problem could be solved in a multi-dimensional manner, i.e. from legislative, application and contractual points of view. Furthermore, it can be argued that legislative amendments similar to the ones proposed in this study may be applicable and required also for the legislation of the Netherlands to provide the aforementioned multi-dimensional solution also to the case of the Netherlands. Obviously, schedule delays and cost overruns in the public-owned construction projects also occur in the Netherlands. Future research could focus on the opportunities of legislative amendments in the Netherlands, but also in the other European countries.

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