Journal of Construction Engineering, Management & Innovation
2023 6(4):218-238
DOI 10.31462/jcemi.2023.04218238

RESEARCH ARTICLE

A model proposal for managing time limits in construction contracts

Burak Öz

Zonguldak Bülent Ecevit University, Department of Civil Engineering, 67100 Zonguldak, Türkiye

Article History

Received 09 October 2023
Accepted 06 December 2023

Keywords

Construction works
Contract management
Periods
Delays
Smart technologies

Abstract

Delays in construction projects are a common problem around the world, negatively impacting both the project and the people involved; thus, a country's sustainable development depends on the successful completion of construction projects. In the construction management process, time limits have a profound impact on project success. If these time limits are not followed, construction may be delayed or contract parties may lose rights. With this novel model, construction contract parties will be able to track expiration dates carefully in order to avoid forfeitures. A smart email prototype is developed in this study to track time limits and alert parties daily before the expiration date to demonstrate the benefits of smart applications in improving project management processes and performance. Time limits during the tendering phase are examined under nine headings: "tender notices", "assigning a tender commission", "publishing a correction notice", "validity periods for tenders and guarantee letters", "finalizing the tender proceedings", "amending and clarifying tender documents", "signing contracts", "prohibitions and criminal liability", and "complaints or appeals". Smart technologies, such as the one proposed in this research, are being increasingly used in Construction Project Management to facilitate digital transformation, resulting in more efficient and effective projects.

1. Introduction

Construction works, goods, and services are part of public procurement; civil engineers often work on construction projects and consultancy services [1]. The public procurement process consists of two parts, namely tendering and procuring: The first process begins with the invitation to tender and ends with the awarding of the contract, while the second process begins with the signing of the contract and continues until the final acceptance date [2]. Public Procurement Law and Contract Law contain many time-related provisions and strict implementation requirements regarding time limits [3]. For example, when applicants fail to comply with related rules regarding time and procedure, contracting authorities or Public Procurement Authorities (PPAs) will reject complaints and appeals on tenders, which causes applicants to lose their rights [3]. There are other situations in which it is normally required to file a lawsuit within a specified timeframe; if a lawsuit is filed after the limit period has expired, it will be dismissed [4], and if a construction defect claim is not filed promptly or the defective work is not properly documented during repair, the chance of monetary recovery is lost [5]. It is necessary to set procedural time limits so courts can deal with cases

Correspondence Burak Öz burakoz@beun.edu.tr

eISSN 2630-5771

fairly and intensively, which leads to greater efficiency and organization [6]. The duration of limitation or prescription periods varies greatly according to the rules [7-11], not just contractual obligations, but all obligations [12]. Generally, prescriptions are either acquisitive or extinctive; acquisitive prescriptions grant individuals rights after a specified period, while extinctive prescriptions bar some court proceedings for a particular period [13]. The types of time limits in Turkish public and private law are, in the most general sense, statutory time limits and prescription time limits, which give or lose rights [14]. In addition to acquired prescriptions and extinctive prescriptions, acquisitive prescriptions are subdivided into ordinary and extraordinary timeouts [15]. Consequently, noncompliance with the time limits will lead to a termination of rights or obligations [7] or a delay in the construction process.

Time is an essential factor, along with cost and quality, so timely completion of construction work is a key point for the success of a construction project [16]. In other words, not following the timeframes specified in the contract delays the procurement and the planned service. Construction delays lead to claims and disputes and are detrimental to the success of a project in terms of quality, cost, and safety [17]. As a result, delays in construction have an impact not only on the construction industry but also on a country's economy as a whole [16].

The success of a construction project depends in large part on good data management and accessibility to data. The construction industry is faced with enormous amounts of data, but information technologies can efficiently process this data [18]. Information and communication technologies are increasingly being used by the construction industry to manage projects successfully [19]. However, for years, the main problem has probably been the development of programming models or algorithms [18]. It is essential for construction professionals to be able to access relevant information at the right time in order to implement an effective information management system [19, 20].

Time limits on construction management procedures have a profound impact on project performance. A violation of time limits specified in legislation may delay the planned procurement; therefore, following up on these periods carefully may prevent parties from forfeiting their rights. However, limited research has been conducted on time limits in civil procedures and smart technologies; furthermore, there has been no study in the literature on time limits in construction project management. To fill this gap, time limits in the public procurement process are investigated, which is a major task for ensuring that the parties (tenders/contractors, or contracting officers) involved in a contract comply with the specified periods in public procurement management to avoid losing rights. This research presents a smart email technology prototype for tracking time limits and provides systemic information on time limits. The proposed model alerts parties by sending automated emails before the expiration date of the acts to be executed.

2. Literature Review

The use of smart technologies can improve project management processes and performance, and the construction industry in the EU has seen significant progress in digital technologies such as data acquisition, automated processes, and digital information analysis [21]. Many studies have been conducted regarding the use of smart/digital technologies in project management. A study by Zhu et al. found that smart technology could enhance project performance and efficiency by reducing time, cost, and quality [21]. Srewil & Scherer described the importance of monitoring project progress during execution and providing timely corrective action recommendations when schedule delays were anticipated [22].

Increasingly, smart technologies are being used in Construction Project Management to facilitate digital transformation. The research reviewed by Rao et al. on real-time construction monitoring included sensors and methodologies for real-time

mapping, tracking of construction activities both indoors and outdoors, real-time hazard identification, monitoring worker health and behavior, and monitoring construction environments [23]. A radio frequency identification system designed by Zhang et al. was proposed as a means of sending a real-time warning message to a remote server in the event of unauthorized entry into hazardous zones [24]. According to Wang et al., the use of 3D laser scanning and BIM (Building Information Modeling) technology proved to be effective for designing and installing curtain walls [25]. Bazli et al. also suggested that 3D printing could be considered an economical alternative to remote housing [26]. According to the report of the European Commission, sensors are the technology with the highest level of market maturity and technological readiness, and 3D scanning is becoming increasingly popular [27].

The construction industry can benefit from human-robot collaboration in terms of safety and productivity. Zhang et al. investigated the application of human-robot collaboration in construction, including adaptive robot programming, human-robot interfaces, and safety management [28]. The use of drone technology in construction can increase productivity [29]. It is possible to use drones in construction for a variety of purposes, including excavation, health and safety, quality control, material tracking, structural damage assessment, data collection, land surveying, monitoring human performance, equipment planning, damage assessment, and real-time monitoring. Drones are increasingly being used on construction sites, especially in developed countries [29]; however, drone usage is hindered by several factors and barriers [30].

Several aspects of construction projects have been addressed separately through BIM and IoT, including safety risk assessment, conflict management, building construction sustainability, and monitoring of construction processes on-site, according to Mohammed [31]. Although IoT is still being widely adopted, drones are becoming more popular, robots and 3D printing are still in the development phase, and are only used for a limited number of applications. In Tai's project, three computer-assisted mobile learning tools, including animated geometrical analysis, augmented reality applications and 3D holograms, were developed to assist architects in conceptual sketching (regular video, 180-degree video, and 180-degree virtual reality video) [32]. Zoleykani et al. studied the application of extended reality technology to construction safety training and risk management [33]. Golabchi & Hammad developed a method for predicting labor utilization in construction projects using recurrent neural networks [34]. A digital twin and blockchain framework was proposed by Lee et al. to enhance subsequent contract execution, payment, and even decision-making by selectively storing and sharing key project-related information [35].

An efficient construction workflow depends on timely discovery, analysis, and control of contract compliance. Hence, Chen et al. developed a prototype blockchain to facilitate information sharing, mitigate risk, and enable an efficient workflow with minimal management effort by identifying bottleneck activities on time and implementing mitigation strategies throughout the workflow [36]. According to Xie et al., time-related risk assessment affects project planning, control, and management [37]. As a result, it is clear there is a need for a novel way of automating daily emails to the relevant personnel in order to follow up on time limits for construction contracts.

3. Material and Methods

This prototype has been designed based on Turkish Public Procurement Law and Turkish Public Procurement Contract Law 4735 and related legislation [38, 39]. It includes all phases of public construction procurement, from tendering through execution, monitoring, and closing. Developing a simple and effective model began with analyzing the legislation relating to public procurement, followed by evaluating the provisions pertaining to time limits. The final steps included creating a database for the application and developing a flowchart for the algorithm. The proposed model will ensure that time limits specified in public

procurement laws are carefully monitored so that parties will not lose their rights.

Contracting personnel as well as tenderers and contractors may use modules that are designed for the tender or construction process. Participants will receive daily emails informing them of the action(s) to be taken so that time-limited procedures or actions can be completed on time; however, when the relevant action is completed or the relevant time limit expires, email sending stops. Fig. 1 illustrates this process simply. The prototype's algorithm was designed using flowcharts, which illustrate the steps, sequences, and decisions of a process [40].

3.1. Tender notices

Depending on the procurement procedures (including open, restricted and negotiated) and the estimated construction costs, Table 1 shows the notice periods for tenders. EU and Turkish public procurement procedures are subject to national rules and value limits or thresholds [41]. Tender notice periods and rules vary depending on threshold values and tender procedures. For instance, the most common processing time limit for open procedures is around 20 days, while the most common processing time limit for restricted and negotiated procedures is 10 days; these periods, however, may vary from country to country [42]. A contracting authority must cancel tender proceedings and renew notice if there is an error in the tender notice periods or rules [38].

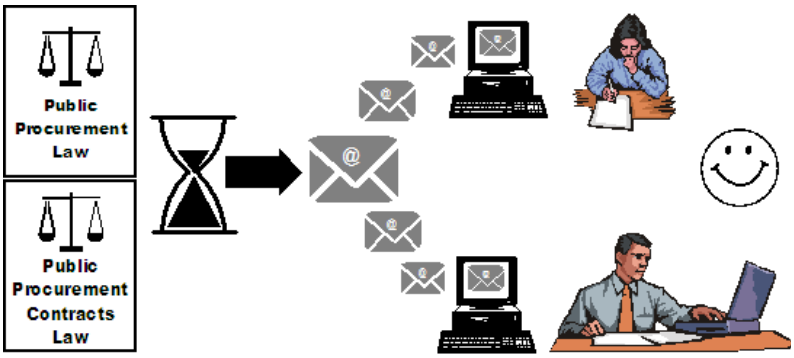

Fig. 1. A simple illustration of the proposed model

Table 1. Tender notice periods [38]

Procedure	Time limits	Starting date	Volume of the work	Action	In case of violation
Open	At least 7 days	Before the submission deadline of tenders	Estimated cost < threshold values set in Article 13(b)/1	Publish the notice.	Cancel the tender proceedings and renew the notice.
	At least 14 days		Estimated cost < threshold values set in Article 13(b)/2		
	At least 21 days		Estimated cost < threshold values set in Article 13(b)/3		
	At least 28 days		Estimated cost >= threshold values set in Article 13(a)		
	At least 24 days	Following 40 days after the prior notice	Estimated cost >= threshold values set in Article 13(a)	Publish the notice.	Set a time limit of 28 days.

Table 1. Cont'd

Restricted	At least 7 days	Before the submission deadline of tenders	Estimated cost < threshold values set in Article 13(b)/1	Send an invitation letter to the prequalified candidates.	Cancel the tender proceedings and renew the notice.
	At least 14 days		Estimated cost < threshold values set in Article 13(b)/2		
	At least 21 days		Estimated cost < threshold values set in Article 13(b)/3		
	At least 28 days		Estimated cost >= threshold values set in Article 13(a)		
	At least 24 days	Following 40 days after the prior notice	Estimated cost >= threshold values set in Article 13(a)	Send an invitation letter to the prequalified candidates.	Set a time limit of 28 days.
	At least 7 days	Before the submission deadline of tenders	Estimated cost < threshold values set in Article 13(b)/1	Publish the prequalification notice.	Cancel the tender proceedings and renew the notice.
	At least 7 days		Estimated cost < threshold values set in Article 13(b)/2		
	At least 7 days		Estimated cost < threshold values set in Article 13(b)/3		
	At least 14 days		Estimated cost >= threshold values set in Article 13(a)		
Negotiated	At least 7 days	Before the submission deadline of tenders	Estimated cost < threshold values set in Article 13(b)/1	Publish the notice.	Cancel the tender proceedings and renew the notice.
	At least 14 days		Estimated cost < threshold values set in Article 13(b)/2		
	At least 21 days		Estimated cost < threshold values set in Article 13(b)/3		
	At least 25 days		Estimated cost >= threshold values set in Article 13(a)		
Provided that the top-down condition: 13(a): The construction threshold value for 2023 is 290,284,533 TL. 13(b)/1: The construction threshold value for 2023 is 1,727,489 TL. 13(b)/2: The construction threshold value for 2023 is 14,396,542 TL. 13(b)/3: The construction threshold value for 2023 is 290,284,533TL.					

3.2. Assigning a tender commission

Tender commissions review the tender documents, receive and open tenders, evaluate the tenders according to the tender documents, and make a recommendation to the contracting office [38]. It is therefore vital that the tender commission members are assigned timely and that the records are submitted to each of them. The contracting authority shall assign a tender commission within three days after the notice day, as shown in Table 2.

3.3. Publishing a correction notice

A correction notice shall be published by the contracting authority according to the time limits shown in Table 3 when there are errors in the advertised notice; however, if the tender notices fail to comply with the relevant time limits, procurement proceedings cannot take place unless they are renewed [38]. It has also been stated by the European Commission that if the changes to the notice are very significant, either the notice must be republished or the deadline for tenders must be extended sufficiently [43].

3.4. Validity periods of tenders and guarantee letters

There must be a clear set period for tender validity in the tender documents to ensure that tenderers commit to their tenders; modification and/or withdrawal of tenders are not permitted during this period [44]. It is the contracting authorities' responsibility to determine the validity period of tenders and guarantee letters, and a violation of these periods, shown in Table 4, will result in the tender being canceled. An extension of the tender validity period is required if the process is not completed before the validity period expires. Typical tender validity periods are 30 to 60 days for small procurements, and 90 days for more complex ones [44]. Most construction contracts include a period of defect liability between the time of preliminary acceptance and final acceptance, which usually lasts between 12 and 24 months after completion; any defects occurring during this period are typically the contractor's responsibility [45].

3.5. Finalization of the proceedings of tenders

It is the contracting authority's responsibility to approve or cancel the tender decision based on the tender commission's decision and recommendation. The contracting authority's procedures for approving or canceling a tender decision and notifying tenderers of that decision are subject to certain time limits shown in Table 5 [38, 46].

Table 2. Assigning the tender commission [38]

Subject	Time limit	Starting date	Action	In case of violation
Tender commission	Within 3 days	Following the notice day	Assign a tender commission. Submit a copy of the records to each member of the tender commission.	Cancel the tender proceedings and renew the notice.

Table 3. Publishing a correction notice [38]

Notice/invitation periods	Time limits for a correction notice	Starting date	Action	In case of violation
7 days	N/A	N/A	N/A	Cancel the tender proceedings and renew the notice
14 days	Within 10 days	Following the advertisement	Publish a correction notice.	Cancel the tender proceedings and renew the notice.
21 days	Within 10 days			
24 days	Within 10 days			
25 days	Within 15 days			
28 days	Within 15 days			

Table 4. Validity periods of tenders and guarantee letters [38]

Subject	Time limit	Starting date	Action	In case of violation
Validity period of tenders	Following the tender date and until the possible contract signing date	Following the tender date	Include in the procurement notice and the administrative specification and specify in the tender document.	Extend this period maximum for the validity period specified in the tender document with the consent of the tenderer or sign the contract provided that the tenderer accepts; otherwise, cancel the procurement.
Tender security	At least 30 days more than the validity period of tenders		Include in the procurement notice and the administrative specification and specify in the tender document. The tender commission shall examine the preliminary letters of guarantee.	Exclude the tenderers from the procurement.
Performance bonds	At least from the completion date of the procurement	Before the contract signing	Specify the validity of performance bonds, and include them in the administrative specifications; sign the contract by receiving the performance bond.	Do not sign the contract unless the successful tenderer has not issued the performance bond.

Table 5. Finalization of the proceedings of tenders [38]

Subject	Time limit	Starting date	Action	In case of violation
Conclusion and approval of the tender proceedings	Within 5 days	Following the decision date of the tender commission	Approve or cancel the tender decision.	Late approval or cancellation is acceptable in case of necessity.
Notification of finalized tender decision	Within 3 days	Following the approval date of the contracting officer	Notify all tenderers.	Late notification is acceptable because it has no effect on the process and conclusion of the tender.

3.6. Amendments and clarifications in the tender documents

An amendment or clarification to the tender document can be requested by the tenderer, or in the event of errors or deficiencies found by the tenderer or contracting authority, the contracting authority will amend the tender document with an addendum and notify the tenderers who purchase it. If additional time is needed, the tender date is postponed. When the tenderer requests clarifications regarding the tender document within a specified period, as shown in Table 6, and if the contracting authority deems it necessary, explanations are provided [38, 47].

3.7. Contract signing phase

Upon notification of the successful tenderer, the contract must be signed within a specified timeframe. In some court cases, contracts can be terminated if the time limits in Table 7 are violated or one of the tenderers files an appeal or complaint that is considered valid and justified; otherwise, the current contract remains in effect.

Table 6. Amendments and clarifications in the tender documents [38]

Subject	Time limit	Starting date	Action	In case of violation
Amendments in the tender documents	Within 10 days	Before the submission deadline of tender	In case the tenderer or the contracting authority detects some errors or deficiencies, the contracting authority makes amendments with an addendum, appends to the tender document and notifies tenderers who purchase the tender document; renewing the notice is not necessary.	Cancel the procurement and renew the notice or postpone the submission date max 20 days once, make an addendum and renew the notice.
			In case the tenderer or the contracting authority detects some errors or deficiencies, the contracting authority makes amendments with an addendum, appends to the tender document and notifies tenderers who purchase the tender document; renewing the notice is not necessary.	You do not need to cancel the tender proceedings or renew the notice or postpone the submission date.
	At most 20 days	Following the tender date	If additional time is needed to prepare the tenders because of the amendment, the contracting authority postpones the submission date by renewing the notice once.	Cancel the tender proceedings and renew the notice.
Clarifications in the tender documents	Within 20 days	Before the deadline for submission of the tender	The tenderer may request clarifications in writing in the tender document.	The tenderer cannot make a request.
	Within 10 days		If the tenderer's written request is found appropriate, the contracting authority makes clarifications and notifies tenderers who purchase the tender document.	Cancel the tender proceedings and renew the notice or postpone the submission date max 20 days once, make an addendum and renew the notice.

Table 7. Contract signing phase [38]

Subject	Time limit	Starting date	Action	In case of violation
Waiting period before signing the contract	At least 5 days	Following the notification day of the tender result to all tenderers	Wait at least 5 days to sign the contract in procurement held in the negotiated procedure of 21 (b) and 21 (c).	You may terminate the contract if one of the tenderers has submitted a complaint application or an appeal application that has been considered justified and valid. In the other case, the current contract shall be valid.
	At least 10 days		Wait at least 10 days to sign the contract in other cases except for the negotiated procedure of 21 (b) and 21 (c).	
Invitation to the successful tenderer to sign the contract	Within 3 days	Following the end of the waiting period and the completion of prefiscal control if required	Notify the successful tenderer to sign the contract.	Late invitation is acceptable if the tenderer does not renounce his commitment.

Table 7. Cont'd

Period to contract signing for the successful tenderer	Within 10 days	Following the invitation to the successful domestic tenderer to sign the contract	Confirm whether the successful tenderer is prohibited from participating in the tenders from the PPA website at the date of signing the contract and if not, sign the contract with the successful tenderer	The current contract shall be valid; however, related officers may be subjected to some penal liability or late contract signing is acceptable if the successful tenderer does not renounce his commitment.
	Within 22 days	Following the invitation to the successful foreign tenderer to sign the contract		
Renouncing on commitment	within 5 days	Following the end of the period to contract signing for the successful tenderer	The successful tenderer may renounce his commitment provided that it is notified with a 10-day notary public notice.	Return the tender security; the tenderer gains the right to demand the recorded expenses.
The obligations and liabilities of the tenderer in the signing of the contract	Within 10 days	Following the invitation to the successful domestic tenderer to sign the contract	The successful tenderer must sign the contract.	Register the tender security as revenue and prohibit the tenderer from participating in the tenders for not less than 6 months and up to 1 year.
	Within 22 days	Following the invitation to the successful foreign tenderer to sign the contract		
Invitation to the second successful tenderer to sign the contract	Within 3 days	Following the end of the 10-day or 22-day period to contract signing	Notify the second successful tenderer to sign the contract in case the successful tenderer rejects signing the contract.	Late invitation is acceptable if the second successful tenderer does not renounce his commitment.
Period to contract signing for the second successful tenderer	Within 10 days	Following the invitation to the second domestic successful tenderer to sign the contract	Confirm whether the second successful tenderer is prohibited from participating in the tenders from the PPA website at the date of signing the contract and if not, sign the contract with the second successful tenderer.	The current contract shall be valid; however; related officers may be subjected to some penal liability or late contract signing is acceptable if the second successful tenderer does not renounce his commitment.
	Within 22 days	Following the invitation to the second successful foreign tenderer to sign the contract		
Renouncing commitment	Within 5 days	Following the end of the period to contract signing for the second successful tenderer	The second successful tenderer may renounce his commitment provided that it is notified with a 10-day notary public notice.	Return the tender security and the tenderer gains the right to demand the recorded expenses.
The obligations and liabilities of the tenderer in the signing of the contract	Within 10 days	Following the invitation to the second successful tenderer to sign the contract	The second successful tenderer must sign the contract.	Register the tender security as revenue and prohibit the tenderer from participating in the tenders for not less than 6 months and up to 1 year or cancel the tender proceedings.
	Within 22 days			

Table 7. Cont'd

Notification of the result	Within 15 days	Following the contract signing	Notify the result of the tender proceeding the PPA.	The current contract shall be valid; however, related officers may be subjected to some penal liability.

3.8. Prohibitions and criminal liabilities

Many Procurement Laws prohibit the commitment of acts or conducts specified in tender proceedings, such as manipulating the tender process, using or attempting to fudge documents or securities, submitting more than one tender, or participating in tender proceedings despite being prohibited from participating in tenders. Those involved in such acts and conducts may be prohibited from participating in any public tender for the period set out in Table 8, and public prosecutors should be notified. The officers may be subject to disciplinary punishment and criminal prosecution; they must compensate for all losses and damages incurred by the parties and are not permitted to perform duties within the scope of the Public Procurement Law.

3.9. Complaint and appeal applications

It is necessary to submit a complaint application to the contracting authority regarding any issues outlined in the tender notice, other prequalification provisions, or tender documents not outlined in the tender notice. A reasoned decision is then made by the contracting authority within the specified time frame as shown in Table 9.

Applicants, including complainants, may appeal to the PPA only if the contracting authority fails to decide within the specified timeframe, or if the decision or complainant is deemed inappropriate by the applicants. The PPA decides on the appeal application within the specified period, as shown in Table 10. The application is rejected by the PPA if it does not comply with the related time, procedure, and form rules.

4. Results

First, we investigated public legislation provisions relating to time limits, and subsequently classified the actions and conducts that should be performed within these periods in the tender phase into nine categories: (1) tender notices, (2) assigning a tender commission, (3) publishing a correction notice, (4) validity periods of tenders and guarantee letters, (5) finalizing the tender proceedings, (6) amendments and clarifications in the tender documents, (7) contract signing phase, (8) prohibitions and criminal liabilities, and (9) complaint or appeal applications.

There are different time limits in Turkish public procurement legislation as stated in The European e-Justice [48]; a failure to comply with a mandatory procedural time limit invalidates an action, a minimum procedure time limit invalidates a procedural action before a specified date, a waiting period means a legal action cannot be taken until the deadline has passed, a court cannot take specific action before the performance period expires, and contract time limits are determined by the parties.

4.1. Planning algorithm

An automated daily email notification system is proposed in this study so stakeholders can receive timely recommendations so they are not deprived of their rights, suffer financial losses, or be late with their projects. The model includes tender and procurement phases in public procurement, such as construction works, goods and services. For this purpose, many functions and databases in the prototype have been planned using flow charts, but only a few of them could be shown in this study.

Basically, there will be two users of the model: contracting or procurement agencies and tenderers or contractors. Depending on their roles, the user can select either the tender process or the procurement process on the main screen. Only authorized users can update thresholds, monetary limits, notice periods, and time limits in the database using the administrator function. Fig. 2 illustrates the main function of the prototype.

Table 8. Time limits for prohibitions and criminal liabilities [38]

Subject	Time limit	Starting date	Action	In case of violation
Prohibition from participation in tenders	At most 45 days	Following the date on which the acts or conducts requiring prohibition are detected	Take prohibition decision within at most 45 days.	Related officers may be subjected to some penal liability.
	At most 15 days	Following the prohibition decision	Send the prohibition decision within at most 15 days to be published in the Official Gazette.	Related officers may be subjected to some penal liability.
	At least 6 months up to 1 year	Following the publication date of the prohibition decision in the Official Gazette	Prohibit the successful tenderer or the second successful tenderer who does not sign a contract, except for force majeure, from participation in any tender and notify the relevant or related ministry of any event.	Related officers may be subjected to some penal liability.
	At least 1 year up to 2 years	Following the publication date of the prohibition decision in the Official Gazette	Prohibit those who have been involved in the prohibited acts and conducts from participating in any tender and notify the relevant or related ministry of any event.	Related officers may be subjected to some penal liability.
Penal liability of tenderers	Immediately	Following the establishment	Notify the public prosecutors in case of those who have been involved in the prohibited acts or conducts constituting a crime under the Criminal Code.	Related officers may be subjected to some penal liability.
	At least 1 year up to 3 years	Starting from the ending date of the prohibition decision	Those involved in the prohibited acts and conducts constituting a crime under the Criminal Code shall be prohibited from participating in any tender by the court decision.	N/A
	Permanently	Following the establishment	Those who have been repeatedly convicted for prohibited acts and conducts are permanently prohibited from participating in public tenders by court decision.	N/A
	Within 15 days	Following the notification of the court decision to the PPA	The court decision on those who are permanently prohibited from participating in public tenders shall be announced by publication in the Official Gazette by the PPA.	N/A

Table 9. Complaint applications to the contracting authority [38]

Subject	Time limit	Starting date	Action	In case of violation
Complaint application to the contracting authority	Within 5 days	Start on the date first published or start on the date of purchase of the document	The tenderer may make a complaint application on procurement held in the negotiated procedure of 21 (b) and 21 (c) until 3 working days before the tender or application deadline.	Reject the complaint application.

Table 9. Cont'd

		The tenderer may make a complaint application on procurement held in other cases except for the negotiated procedure of 21 (b) and 21 (c) until 3 working days before the tender or application deadline.	
Within 10 days	Following the complaint application	Take a reasoned decision.	The complainant may submit an appeal application within ten days following the expiration date of the decision.
	Following the expiration date of the decision or the final notification date of the reasoned decision	Wait at least 10 days to sign the contract and enquire at the date that there has been no appeal application from the PPA website; otherwise, do not sign the contract.	Upon an appeal application of one of the tenderers, it may be mandatory to terminate the contract with the decision of the PPA or in the other case, the current contract shall be valid as it is.
Within 3 days	After the date of the reasoned decision	Notify the tenderers.	It does not violate the conclusion of the tender; however, the complainant may submit an appeal application within ten days.
Until the submission date	Before the procurement date or deadline for the application	In case of considering a correction on the tender documentation, postpone the application deadline or tender date at most 20 days with an addendum until 10 days before the deadline for submission of tenders once. In case of such defects or deficiencies found in the tender notice, advertise a correction notice within 15 days in procurement with a 25 or 40-day notification time limit and within 10 days in other cases following the advertisement.	Cancel the tender proceedings and renew the notice.

A simplified flow chart of public procurement tender functions is shown in Fig. 3. Managing time limits in public procurement begins with the tender notice advertisement. In the public procurement process, there are both linear and parallel sequences, for example, the assignment of a tender commission, corrections to the published notice, amendments, and complaints to the contracting authority are parallel processes, whereas an appeal must follow the complaint application.

Table 10. Appeal applications to the PPA [38]

Subject	Time limit	Starting date	Action	In case of violation
Appeal application to the PPA	Within 10 days	Following the expiration date of the decision or the final notification date of the reasoned decision	The complainant may submit an appeal application.	The PPA shall reject the appeal application.
	Until the final decision	Following an appeal application	Wait for the final decision of the PPA to sign the contract.	It may be mandatory to terminate the contract with the decision of the PPA or in the other case the current contract shall be valid as it is.
	Within 5 days	Following the date of cancellation of the tender proceedings	An appeal application may be submitted directly to the PPA in case the contracting authority cancels the tender for any reason upon a complaint or appeal.	The PPA shall reject the appeal application.
	Within 10 days	Following the date on which the related documents are recorded by the PPA	The PPA shall make the final decision upon the appeal application on procurement held in the negotiated procedure of 21 (b) and 21 (c) within 10 days.	N/A
	Within 20 days		The PPA shall make the final decision upon an appeal application on procurement held in other cases except for the negotiated procedure of 21 (b) and 21 (c) within 20 days.	N/A
	Within 10 days		The PPA shall make the final decision against actions taken by the contracting authority to cancel the tender upon a complaint or appeal.	N/A
	5 working days	Following the decision date of the PPA	The PPA notifies the parties of his decision within 5 working days.	N/A
	Within 5 days	Following the notification date of the decision of the PPA	The PPA publishes his decision on the Authority's website.	N/A
	Immediately		Execute the final decision of the PPA.	If the final decision is not executed at all, it shall be notified to public prosecutors.
	Within 60 days	Following the publishment of the final decision on the Authority's website	Against the decisions made by the Public Procurement Board, the tenderer or the contracting authority may apply to the Ankara administrative court for the stay of execution and cancellation of the decision.	They lose the right to file a suit against the PPA decision.

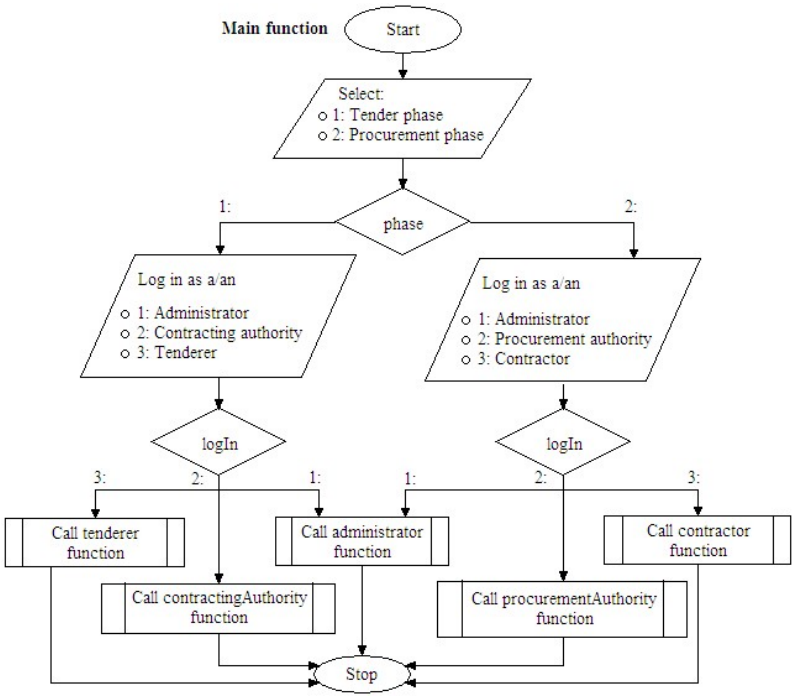

Fig. 2. Flowchart showing the main function

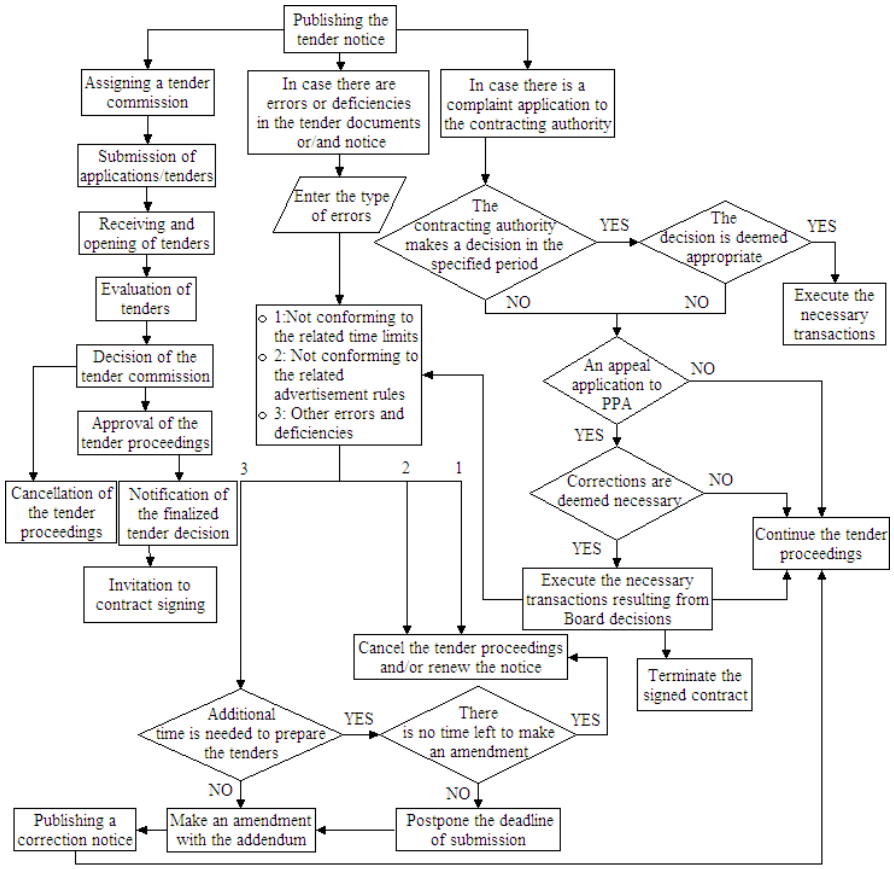

Fig. 3. Flowchart showing

Fig. 4 illustrates the addendum function, which is an example of smart email reminders. When tenderers or contracting agencies detect errors or deficiencies, they amend the tender document with an addendum and notify the tenderers who purchased the tender document. The submission date is postponed if additional time is required to prepare tenders due to amendments made with an addendum.

5. Discussion

This study aimed to ensure that the parties to public construction contracts comply with the contractual time limits for certain transactions and actions during the tendering or construction phases. This was accomplished by researching articles with time limits, creating a database, and planning an algorithm using flow charts to alert contracting parties to timely recommendations. Due to the result, none of the parties involved in construction contracts will lose their rights, will suffer financial losses, or will be delayed in completing their projects.

Delays refer to not completing the project within the agreed-upon time for some reason [49]. Construction project delays are one of the most common problems around the world [50] and negatively affect not only the project but also the parties involved [51]. Generally, major delay factors contribute significantly to construction delays during the planning and design phase, and controlling the causes of construction delays in this phase will help to complete projects on time [52]. Studies discuss various factors that can cause delays in construction projects and their consequences, but no research has been conducted on delays and loss of rights caused by noncompliance with various time limits in contract management. The time limits in our study were examined from the tender notice to the contract signing and have been shown in the relevant tables.

Managing time limits in public procurement begins with the tender notice advertisement. The tender notice period depends on the procurement procedure and the estimated cost, as shown in Table 1. Turkish and EU public procurement procedures are subject to national rules and cost limits or thresholds [41]. When the tender notice periods or rules are not correct in the advertisement, the contracting authority must cancel the tender proceedings and renew the notice, causing delays in the tender or in the services. Tender commissions review the tender documents, receive and open tenders, evaluate the tenders according to the tender documents, and make a recommendation to the contracting office; therefore, it is essential that the commission members are assigned on time, as can be seen in Table 2, by the contracting authority and that records are provided to each member. The contracting authority shall publish a correction notice when the advertised notice contains errors within the specified time limits shown in Table 3, except for the deadline for submitting tenders; however, if tender notices fail to comply with the relevant time limits, procurement proceedings cannot proceed unless they are renewed. Contracting authorities determine the validity period for tenders and guarantee letters, and violations of these periods shown in Table 4 result in tender cancellations. The tender commission must submit its decision and recommendation to the contracting authority for approval or cancellation within certain time limits shown in Table 5; however, late approval or cancellation is acceptable if necessary. There is a time limit within which tenderers can request clarification regarding the tender document, as shown in Table 6, and if additional time is required, the tender date is postponed. Contracts must be signed within a specified period after the successful tenderer has been notified, as shown in Table 7. If the time limit is violated or one of the tenderers submits a valid and justified appeal or complaint, then the current contract may be terminated; otherwise, the current contract remains in effect. There are numerous procurement laws that prohibit certain acts or conduct in tendering processes. If such acts and conducts have been committed, then a person may be prevented from participating in any public tender for the period listed in Table 8, and public prosecutors will be notified.

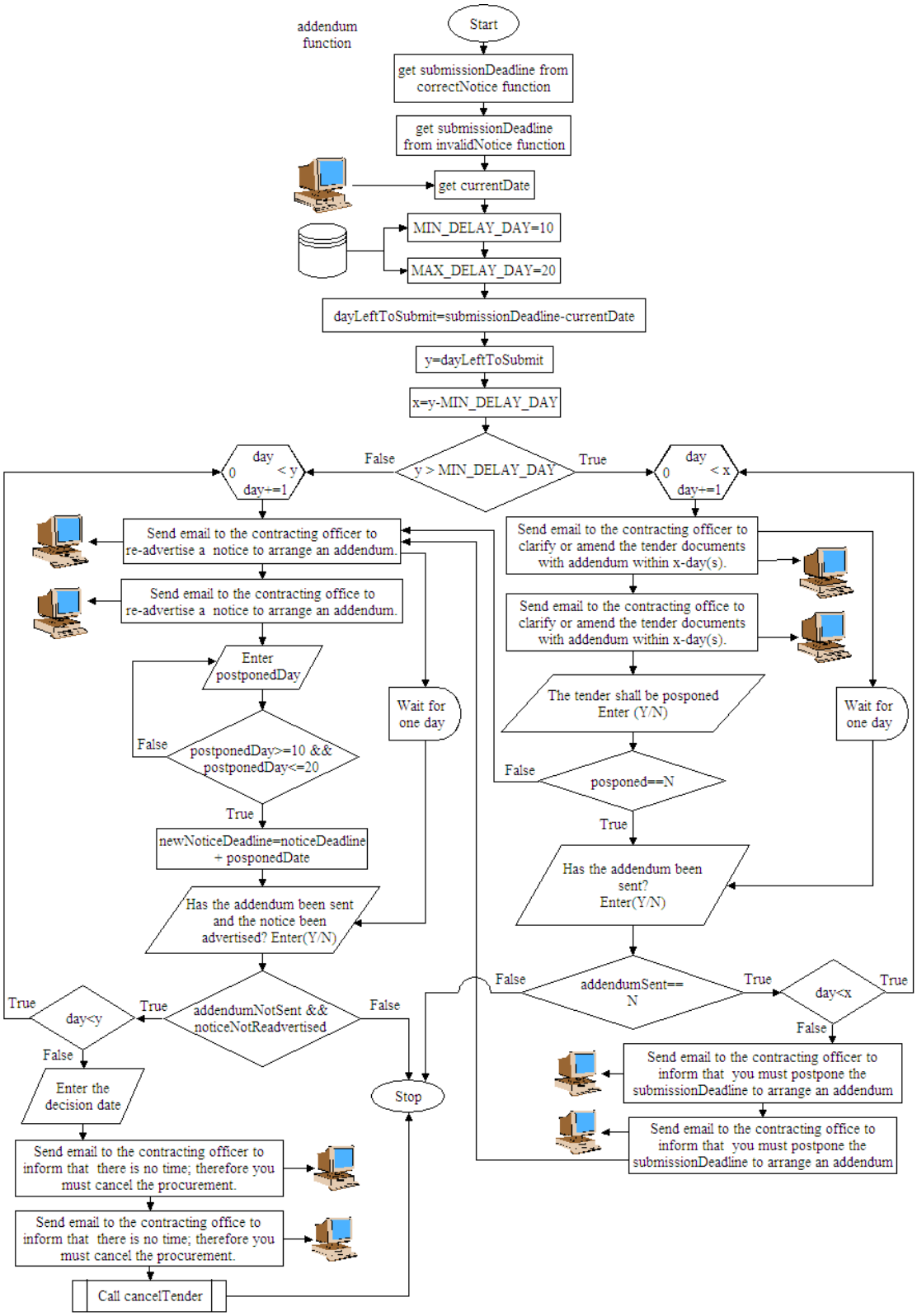

Fig. 4. Flowchart showing the addendum function

Applicants, including the complainant, may submit an appeal application to the PPA if a decision is not taken by the contracting authority within the specified time, or if the decision or complainant is not considered appropriate. If the contracting authority does not take a decision within the specified time, or if the decision or complainant is considered inappropriate, applicants or complainants may appeal to the PPA. Appeals are decided by the PPA within a specified period, as shown in Table 10. When an application doesn't follow the required time, procedure, and form rules, it is rejected.

The majority of studies on successful project management examine the use of information and communication technologies and the applications of smart technologies [53-59]. Construction management can be improved by using a variety of tools, such as BIM, which can manage all aspects of a construction project throughout its lifecycle [60], or the use of project management software, such as Microsoft Project and Primavera, can help identify the reasons for delays by recording, monitoring, controlling, and reporting their progress [61], or when it comes to solving resource allocation problems, Asta PowerProject shows to be the most effective method, while Primavera shows to have the fastest leveling module [62].

A prototype of an automated daily email notification is proposed in this study in order to ensure stakeholders receive timely recommendations so as not to be deprived of their rights, incur financial losses, or get late with their projects. For this purpose, many functions as shown in Fig. 3 have been planned using flow charts, but only a few could be illustrated in this study. On the main function shown in Fig. 2, the user can select either the tender process or the procurement process, depending on their role. There are many functions that are called from the main function. An example of a smart email reminder is shown in Fig. 4. A tender document is amended with an addendum when tenderers or contracting agencies discover errors or deficiencies. In the event that additional time is required to prepare tenders, the submission date is postponed.

Keeping track of the time limits stipulated in public procurement legislation is crucial for successful contract and project management. Public contracting agencies and tenderers conduct the procurement proceedings by using an "Electronic Public Procurement Platform (EPPP)," which is a system developed to track online tenders. However, it does not include time limits, nor does it include public procurement processes, such as construction. Therefore, a novel model has been proposed to ensure that procedures and acts are completed on time. While the proposed model can be used independently, it can also be effectively used when integrated with EPPP or BIM.

6. Limitations

There are some limitations to the study, as certain transactions and actions required in cases of violations of some time limits have been clarified in related legislation, but other cases need to be investigated further in court or PPA decisions. Due to page limitations, this part focuses exclusively on the tendering or contracting process for construction works, and only part of the algorithm is shown.

7. Conclusions

Delays in construction projects are common around the world, negatively affecting both the project and its stakeholders. A construction project's success depends on its completion on time, within budget, and with the right quality. The time limits on construction management procedures are therefore crucial to the efficiency of a project; if these aren't followed, procurement or service may be delayed. Construction Project Management is increasingly utilizing smart technologies to facilitate digital transformation, making projects more efficient and smooth.

Similar to tendering practices in the European Union and internationally, the Turkish Public Procurement Legislation has been prepared and put into practice to bring the Turkish Public Procurement Legislation into alignment with these practices. Periods that are violated will result in a

loss of time or delay in service, which will negatively impact the economy as well as the contracting parties. A daily email notification system is proposed to notify stakeholders during tendering or construction of timely recommendations. Consequently, none of the parties involved in construction contracts will lose their rights, suffer financial losses or be late.

There are a number of ways that the proposed model may benefit literature and practices, which could shed light on future research. The model can be used independently or integrated with EPPP or BIM to provide effective solutions. Furthermore, it can be customized to fit different countries' needs; the method is useful not only in the public sector but also in other sectors where time limits are crucial. Future modifications will enable it to be used in a variety of fields and contribute to a country's economic development. While the model is simple, it is highly effective and is considered original in this regard.

This study generally aims to contribute to the practices of procurement procedures (construction works, goods, or services), including both tendering/contracting and construction. There is very limited literature available about time limits in civil procedures and smart technologies, and very few studies or no models have been found that examine time limits in construction projects. It was intended to fill the knowledge gap in the literature and also to develop a model specifically to control and manage tendering/contracting in construction. The study will hopefully prevent contract parties from losing their rights, ensure deadline compliance, and improve construction management effectiveness.

Declaration

Funding

This research received no external funding.

Author Contributions

B. Öz: Conceptualization, Methodology, Software, Resources, Data Curation, Writing-Original draft, Writing- Review & Editing.

Acknowledgments

Not applicable.

Data Availability Statement

No new data were created or analyzed in this study.

Ethics Committee Permission

Not applicable.

Conflict of Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

[1] Oz B (2021) Tender evaluation models in public construction works and consultancy services. In: Hasdemir B, Turhan M, Karaman C (Eds.) Research and Reviews in Engineering. Gece Kitablığı, pp. 45-64.

[2] Taşdelen A (2011) The stages of tender and contract and their decisive role on the distinction of jurisdictional disputes in public procurement process. Journal of Istanbul University Law Faculty 69(1-2): 43-63.

[3] Yıldız H (2021) Decisions of the public procurement authority in the procurement process and the judicial review of these decisions. Journal of Ankara University Law Faculty 70(1): 295-333.

[4] Know Your Limitations (n.d.): A Brief Overview of Limitation Periods in Ontario; O'Connor MacLeod Hanna LLP. https://www.omh.ca/articles/know-your-limitations-a-brief-overview-of-limitation-periods-in-ontario.html. Accessed 23 May 2023.

[5] Zimmerman A (2022) How time limits for construction-defect claims can hurt profits. Hotel Management.

[6] Averkienė D (2013) The meaning of procedural time limits in civil procedure. Societal Studies 4(4): 1571-1584.

[7] Filipek M (2022) Time limits in the public procurement procedure. Studia Iuridica Lublinensia 31(4): 139-153.

[8] LexisNexis Construction expert: Limitation Periods in Construction Contracts. LexisNexis. https://www.lexisnexis.co.uk/legal/guidance/limitation-periods-in-construction-contracts. Accessed 23 May 2023.

[9] LexisNexis Local Government expert: Time Limits in Procurement Procedures. LexisNexis. https://www.lexisnexis.co.uk/legal/guidance/time-limits-in-procurement-procedures. Accessed 23 May 2023.

[10] Practical Law Construction: Limitation Periods For Breach of Contract Claims: Where to Begin? Construction Blog. http://constructionblog.practicallaw.com/limitation-periods-for-breach-of-contract-claims-where-to-begin/. Accessed 23 May 2023.

[11] Local Government Association: Time Limits. https://www.local.gov.uk/national-procurement-strategy/pcr-toolkit-2015/what-improvements-can-we-make-way-we-buy/time-limits. Accessed 23 May 2023.

[12] Penadés JP, Velencoso LMM (2014) European Perspectives on the Common European Sales Law. Springer International Publishing, pp. 287-303.

[13] Encyclopaedia Britannica (1998) The Editors of Encyclopaedia Britannica. Encyclopedia Britannica. https://www.britannica.com/topic/prescription-property-law.Accessed 23 May 2023.

[14] Yılmaz E (2013) The legal time periods regulated in civil procedure code. Journal of Yasar University 8(Special): 3167-3190.

[15] Dinçer BE (2019) Provisions of Prescription According to Turkish Code of Obligations. Master Dissertation, Çankaya University.

[16] Tafesse S (2021) A review on the critical factors causing delay of delivery time in construction projects. International Journal of Engineering Technologies (IJET) 6(4): 69-81.

[17] Maritz T, Prinsloo HF (2017) A decision support framework for extension of time claims for the JBCC principal building agreement. Acta Structilia 23(2): 109-146.

[18] Huang Y, Shi Q, Zuo J, Pena-Mora F, Chen J (2021) Research status and challenges of data-driven construction project management in the big data context. Advances in Civil Engineering 1-19.

[19] Martínez-Rojas M, Marín N, Vila M A (2016) The role of information technologies to address data handling in construction project management. Journal of Computing in Civil Engineering 30(4).

[20] Adekunle P, Aigbavboa C, Akinradewo O, Oke A, Aghimien D (2022) Construction information management: Benefits to the construction industry. Sustainability 14(18): 11366.

[21] Zhu H, Hwang BG, Ngo J, Tan JPS (2022) Applications of smart technologies in construction project management. Journal of Construction Engineering and Management 148(4).

[22] Srewil Y, Scherer RJ (2013) Effective construction process monitoring and control through a collaborative cyber-physical approach. IFIP Advances in Information and Communication Technology. Springer Berlin Heidelberg, pp. 172-179.

[23] Rao AS, Radanovic M, Liu Y, Hu S, Fang Y, Khoshelham K, Palaniswami M, Ngo T (2022) Real-time monitoring of construction sites: Sensors, methods, and applications. Automation in Construction 136: 104099.

[24] Zhang M, Ghodrati N, Poshdar M, Seet BC, Yongchareon S (2022) A construction accident prevention system based on the internet of things (IoT). SSRN Electronic Journal 159.

[25] Wang J, Yi T, Liang X, Ueda T (2022) Application of 3D laser scanning technology using laser radar system to error analysis in the curtain wall construction. Remote Sensing 15(1): 64.

[26] Bazli M, Ashrafi H, Rajabipour A, Kutay C (2023) 3D printing for remote housing: Benefits and challenges. Automation in Construction 148: 104772.

[27] European Commission: Digitalisation in the construction sector: Analytical Report. In European Construction Sector Observatory. https://ec.europa.eu/docsroom/documents/45547. Accessed 23 May 2023.

[28] Zhang M, Xu R, Wu H, Pan J, Luo X (2023) Human–robot collaboration for on-site construction. Automation in Construction 150: 104812.

[29] Yıldız S, Kıvrak S, Arslan G (2021) Using drone technologies for construction project management: A narrative review. Journal of Construction Engineering, Management & Innovation 4(4): 229-244.

[30] Aiyetan AO, Das DK (2022) Use of drones for construction in developing countries: Barriers and

strategic interventions. International Journal of Construction Management 23(16): 1-10.

[31] Mohammed BH, Sallehuddin H, Yadegaridehkordi E, Safie Mohd Satar N, Hussain AHB, Abdelghanymohamed S (2022) Nexus between building information modeling and internet of things in the construction industries. Applied Sciences 12(20): 10629.

[32] Tai NC (2023) Applications of augmented reality and virtual reality on computer-assisted teaching for analytical sketching of architectural scene and construction. Journal of Asian Architecture and Building Engineering 22(3): 1664-1681.

[33] Zoleykani MJ, Abbasianjahromi H, Banihashemi S, Tabadkani SA, Hajirasouli A (2023) Extended reality (XR) technologies in the construction safety: Systematic review and analysis. Construction Innovation. https://doi.org/10.1108/ci-05-2022-0131

[34] Golabchi H, Hammad A (2023) Estimating labor resource requirements in construction projects using machine learning. Construction Innovation. https://doi.org/10.1108/ci-11-2021-0211

[35] Lee D, Lee SH, Masoud N, Krishnan MS, Li VC (2021) Integrated digital twin and blockchain framework to support accountable information sharing in construction projects. Automation in Construction 127: 103688.

[36] Chen G, Liu M, Zhang Y, Wan, Z, Hsiang SM, He C (2023) Using images to detect, plan, analyze, and coordinate a smart contract in construction. Journal of Management in Engineering 39(2).

[37] Xie H, Hong Y, Brilakis I (2022) Analysis of user needs in time-related risk management for holistic project understanding. Journal of Construction Engineering and Management 148(4).

[38] Turkish Public Procurement Law No 4734. http://www2.ihale.gov.tr/english/4734_English.pdf. Accessed 23 May 2023.

[39] Turkish Public Procurement Contract Law No 4735. https://www.mevzuat.gov.tr/mevzuatmetin/1.5.4735.pdf. Accessed 23 May 2023.

[40] Zak D (2015) An Introduction to Programming with C++, Eighth Edition. Cengage Learning: 20 Channel Center Street, pp. 1-634.

[41] Public Tendering Rules in the EU: Your Europe. https://europa.eu/youreurope/business/selling-in-eu/public-contracts/public-tendering-rules/index_en.htm. Accessed 23 May 2023.

[42] OECD: Public Procurement in EU Member States-The Regulation of Contract Below the EU Thresholds and in Areas not Covered by the Detailed Rules of the EU Directives. OECD iLibrary. https://www.oecd-ilibrary.org/docserver/5km91p7s1mxv-en.pdf?expires=1680763805&id=id&accname=guest&checksum=31EFCEF35FFCF86C3D07B68761017CA8. Accessed 23 May 2023.

[43] European Commission: Public procurement standard forms guidance. https://ec.europa.eu › renditions › native. Accessed 23 May 2023.

[44] The Procurement ClassRoom: Understanding bid validity and the bid validity period-the procurement classroom. https://www.procurementclassroom.com/understanding-bid-validity-and-the-bid-validity-period/. Accessed 23 May 2023.

[45] Pinsent Masons LLP: Limitation periods under English law. Pinsent Masons. https://www.pinsentmasons.com/out-law/guides/limitation-periods-under-english-law. Accessed 23 May 2023.

[46] Keskin P (2019) Process Capability Analysis (PCA) of Tender Evaluation Process in Public Agencies. Master Dissertation, Izmir Institute of Technology.

[47] World Bank Standard procurement document: Request for bids goods (one-envelope bidding process). In World Bank (pp. 1-138). http://www.worldbank.org. Accessed 23 May 2023.

[48] European Judicial Network: What are the types of deadlines relevant for civil procedures? Time Limits on Procedures; European Judicial Network. https://e-justice.europa.eu/content_procedural_time_limits-279-ew-maximizeMS_EJN-en.do?member=1. Accessed 23 May 2023.

[49] Comu S, Moeini R, Elibol O, Chen J (2023) Bayesian belief network model for quantifying the delay risk of marine construction projects in developing countries. Journal of Construction Engineering, Management & Innovation 6(2): 124-140.

[50] Rooholelm V, Sheikh Aboumasoudi A (2020) Designing pattern for project delay analysis with several periods extension of time, continuous and discrete (Pr-to-Pr). Computers & Industrial Engineering 146: 106576.

[51] Kazemi A, Kim, ES, Kazemi MH (2020) Identifying and prioritizing delay factors in Iran's oil construction projects. International Journal of Energy Sector Management 15(3): 476-495.

[52] Alemu TT, Thakur MS (2021) The impact of major delay factors on project's phase: A comparative study. Journal of Construction Engineering, Management & Innovation 4(4): 187-197.

[53] Vodák J, Šulyová D, Kubina M (2021) Advanced technologies and their use in smart city management. Sustainability 13(10): 5746.

[54] Ngo J, Hwang BG (2022) Critical project management knowledge and skills for managing projects with smart technologies. Journal of Management in Engineering 38(6).

[55] Xu M, Nie X, Li H, Cheng JCP, Mei Z (2022) Smart construction sites: A promising approach to improving on-site HSE management performance. Journal of Building Engineering 49: 104007.

[56] Yuan F, Zhang Y, Zhang J (2023) IoT technology for intelligent management of energy, equipment and security in smart house. International Journal of Advanced Computer Science and Applications (IJACSA) 14(1).

[57] Liu Y, Zhang Y, Ren S, Yang M, Wang Y, Huisingh D (2020) How can smart technologies contribute to sustainable product lifecycle management? Journal of Cleaner Production 249: 119423.

[58] Shahrour I, Bian H, Xie X, Zhang Z (2020) Use of smart technology to ımprove management of utility tunnels. Applied Sciences 10(2): 711.

[59] Siountri K, Skondras E, Vergados DD (2020) Developing smart buildings using blockchain, ınternet of things, and building information modeling. International Journal of Interdisciplinary Telecommunications and Networking (IJITN) 12(3):1-15.

[60] Onungwa IO, Uduma-Olugu N, Igwe JM (2017) Building information modelling as a construction management tool in Nigeria. WIT Transactions on The Built Environment 169: 25-33.

[61] Saini H, Singh K, Malik U (2017) Project management in construction using PRIMAVERA. International Journal of Civil Engineering and Technology (IJCIET) 8(8): 536-549.

[62] Albayati NHF, Aminbakhsh S (2023) Resource allocation capabilities of commercial project management software packages for resource leveling and resource constrained project scheduling problems: A comparative study. Journal of Construction Engineering, Management & Innovation 6(2): 104-123.