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# Procurement System from Past to Present in Turkey: A Comparison for the Construction Works

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**----------ABSTRACT----------**

*This study is an attempt to investigate the procurement system processes in Turkey based on construction works. There are two pioneering legislative regulations have been made for over thirty years of Turkish procurement system; State Procurement Law, nr. 2886, which was prevailed between the years of 1984 and 2003 (in some cases still prevailed) and Public Procurement Law, nr. 4734, which has been valid since 2003 year. In this context, this study examines, presents and compares the completed public construction building projects procured under these Laws. Time-cost relationships of the public projects, which were procured under different procurement processes, have been individually investigated for both contractual and actual conditions. Consequently it was found that the current Law, 4734 provides significant improvement in application as well as a conceptual improvement. The findings of this study are consistent with the high expectations from the current Law, including prevention of the National wealth losses.*

***Keywords:*** *Project duration, public procurement law, state procurement law, time-cost relationship, Turkey*

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## I. Introduction

Construction projects experience various types of uncertainties. The work-completion and delivery system in the construction sector includes many stakeholders of the project, e.g. direct participants as; employers, designers and contractors and indirect participants as; government agencies, researchers, financial institutions, insurers, etc [1]. In the construction sector, the concept of a 'tender strategy' can be defined as *"the obtain process of a construction project and a result of a series of decisions taken at the early stages"* [1]. The employer should choose a tender strategy that overlaps with the characteristics of the project (duration, cost, quality level, precision, design, price, performance, flexibility, complexity, uncertainty and risk) to minimize the potential duration and cost exceed risks of any construction project. In order to select an appropriate procurement model, the purpose and objectives of the employer and the structure of the desired outcome product is required to be well analyzed in the early stages of the project. There is no "best" work-completion model valid for all projects [1].

Duration is the key element of a construction contract [2]. The contract completion date specified in the contract is the most significant clause of the contract and is the primary responsibility of the contractor towards the employer [2]. Therefore, accurate prediction of project duration for planning and bid preparation stage should contain realistic dates for the construction projects [3]. The employers of the public construction sector in Turkey provide the project duration in the tender document. Bidders only bid for the contract price, not for project duration. Although many contractors simply assume that the contract duration set by the client is realistic and prepare their bids accordingly, delay is one of the major problems often experienced on construction project sites [4]. Generally, construction contracts include materials related to the payment of the contractor "compensation" for the contractor in case the work cannot be completed within the time period required to be completed, or in some cases this may involve partly certain parts of the work [2]. This poses a great risk to the contractor and even causes the bankruptcy, along with major financial crises. Therefore, firms have to make effective decisions about the problems they face in order to survive and compete under increasing competition nature [5]. Various prediction approaches have been developed since the decisions on the future involve uncertainty for the firms. Prediction development is a multi-stage process with both pre-forecasts and formal estimates [5].

There is an inverse relationship between the durations and the costs of the construction projects [6]. In order to compress the duration of the activities included in the work program; increase of labor and machine resources, overtime work, or costly construction methods are required. Therefore, when the duration of an activity of a

project is shortened, the cost increases, but the duration of the activity and the project is shortened. In construction a project, this relationship between time and cost is often defined as a 'cut-off function' [6]. This time-cost problem, known as 'discrete time/cost trade-off problem' (DTCTP), is crucial at work program preparation stage and especially during the acceleration of work programs of the construction activities. Earlier, this problem was mentioned as time-cost trade-off (TCT) in which project duration can often be compressed by accelerating some of its activities at an additional expense [7]. Two main versions of the problem; the deadline problem (DTCTP-D) and the budget problem (DTCTP-B) have been investigated in the literature [8]. However, conventional commercial software as well as the suggested methods in the literature presents very limited options for the optimal solution of this problem [6].

In Turkey, development of the 'leading' construction industry has a significant role in contributing to the overall development [9]. The concept of Turkish construction works is currently legislated by the current Public Procurement Law, *nr. 4734*, which was published by the Public Procurement Authority (PPA) in 2003 with high expectations to improve the weakness of the previous one, State Procurement Law, *nr. 2886*, which was in force between the years 1984 and 2003. The purpose of the current Law, 4734 is *"to establish the principles and procedures to be applied in any procurement held by public authorities and institutions governed by public law or under public control or using public funds"* [10]. A recent study performed by Bayram (2017) indicated that based on the current Law, 4734, 66% of the Turkish public construction projects suffered from cost overruns and 30% were in serious situation, which indicated that budget exceeds over 20% [9]. On the other hand, 50% of the projects suffered from delays and 32% were serious [9]. These results indicate that despite the conceptual improvement, reliable time-cost relationship models are still a problem to be investigated in Turkish construction sector whilst construction projects often suffer from delays and budget exceeds. A (limited) literature review based on the mentioned problem in Turkey is presented below.

Arditi et al. (1985) collected a total of 384 projects data in Turkey in which 126 from contractors and 258 from public agencies between the years of 1970 and 80. The average delays for contractors and agencies were calculated as 34.60% and 43.65%, respectively [11]. Considering building type constructions, Odabasi (2009) claimed that the effect of 'cost' on 'duration' was not found to be significant [12]. Erdis (2013) found that 50% of the projects executed under the previous law, *nr. 2886* and only 20% of the projects executed under the current law, *nr. 4734*, suffered from delays [13].

Generally, time problems have been investigated in the global literature as [14];

- Classical Methods (critical path method (CPM), program evaluation and review technique (PERT), line-of-balance (LOB), etc.) [15],
- Modifications to Classical Methods (critical path segment (CPS), intelligent bar charts (IBC), repetitive scheduling method (RSM), etc.) [16],
- Soft Computing (fuzzy logic (FL), genetic algorithm (GA), building information modeling (BIM), etc.) [17, 18, 19].

Efficient models to predict construction duration/cost have been stayed up to date over the world. For instance, in the last two years, several studies have been conducted on this topic. Mustefa (2015) found that 100% of the road construction projects suffered both time and cost overrun in Ethiopia. The rate of time overrun ranged from a minimum of 25% to the maximum of 264.38% of the contract amount [20]. Dursun et al. (2015) obtained optimum design solutions that minimize unit cost of construction and construction duration using differential evolution for single family housing projects in Germany [21]. Al Haj and El-Sayegh (2015) presented a nonlinear-integer programming model that is developed to solve the time–cost optimization problem taking into account the impact of total float loss [22]. Mensah et al. (2016) developed a working model for estimating the duration of prefabricated steel bridge projects on rural roads in Ghana [23]. Bettemir and Birgonül (2016) solved discrete time-cost tradeoff (TCT) problem by minimum cost-slope method based network analysis algorithm [24].

Previous studies indicate that there are considerable attempts to establish a time-cost relationship for various construction markets. As mentioned above, in Turkey, such study for time-cost relationship has not yet been deeply investigated for the construction building projects. This study is an attempt to investigate whether such time-cost relationship can be generalized to Turkish public procurement system. The main purpose of this study is to present a time-cost relationship equation which can be used by the bidders of the Turkish public construction sector, to make a decision whether the contract duration is acceptable for the upcoming projects. The duration and cost data were obtained from a total of 308 projects, which were procured between 1995 and 2002 in accordance with State Procurement Law, *nr. 2886*. A total of 210 projects, procured between 2003 and 2011 in accordance with Public Procurement Law, *nr. 4734* were also analyzed. All these 518 projects, procured in accordance with *nr. 2886* and *nr. 4734* were executed in the Turkish metropolitans of; Adana, Ankara and Gaziantep. The projects in the database were limited to those with contract duration and actual duration not less than one 100 days as the duration under 100 days was considered to have limited scope. Time-cost relationships

of the projects were individually analyzed for *nr. 2886* and *nr. 4734*. The evolution of the Turkish Public Procurement System was discussed based on the obtained results.

## II. Material And Method

Methods for time–cost relationship problems have been classified over the years. A classification has been made as; heuristic methods, mathematical programming models and genetic algorithms [7]. Based on the heuristic methods, Siemens (1971) established a time-cost trade-off curve showing the relationship between project duration and cost under different decisions as well as the selection of construction methods that provide the optimal balance of project duration and cost [25]. The mentioned curve is presented in Figure 1.

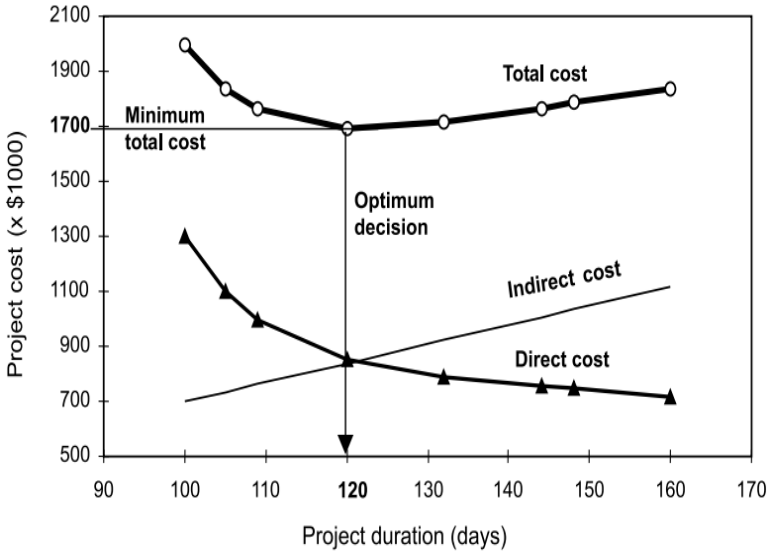



**Figure 1.** Project time-cost trade-off curve [25]

Hegazy (1999) on the other hand developed a genetic algorithm procedure to provide a practical optimization model for time–cost trade-off analysis [7]. Lova et al. (2009) also proposed a hybrid genetic algorithm to solve the resource constrained case [26]. In this study, regression analysis has been carried out to establish a relationship between project time and cost. Regression analysis (RA) is defined as *"the process of relationship between one or more independent variables and one dependent variable, which is described by a mathematical equation"* [27]. By using RA, the model of the cause-and-effect relationship between the dependent variable and independent variable(s) can be determined and the prediction can be performed [28]. RA is considered as one of the most widely used techniques among statistical methods due to its high estimating capacity [29]. Although different methods have been used for scientific researches in recent years, RA is still one of the most used statistical approaches. RA is divided into two groups as linear regression analysis and nonlinear regression analysis. The purpose of linear regression is to find the line that comes closest to the data, while nonlinear regression is a general technique to fit a curve by using the data. Linear regression is divided into two groups as simple linear regression analysis (SLRA) and multiple linear regression analysis (MLRA). SLRA achieves to estimate the dependent variable ($y$) with only one independent variable ($x$) while MLRA achieves to estimate the dependent variable ($y$) by using two or more independent variables ($x_i$ ,....., $x_n$).

$$\begin{aligned} &SLRA\ ;\ y = a + bx \\ &MLRA;\ y = a + b_i x_i + .....+ b_n x_n \end{aligned} \qquad (1)$$

The general equations of SLRA and MLRA are figured in Eq. (1), where $a$ = The intercept point of the regression line and the $y$ axis, $b$ = The slope of the regression line and $b_{i...n}$= The slope of $x_{i...n}$ respectively [30].

## III. Results

The contracted and actual duration data and cost data of past projects undertaken and completed by Turkish Ministry of Environment and Urbanism as the client were considered for the application stage. The project data for the analysis were collected from a total of 518 projects from different geographic regions, e.g. 208 of which had been completed in Adana, 130 in Ankara, and 180 in Gaziantep. Distribution of the total projects data based on the Procurement Law is shown in Figure 2.

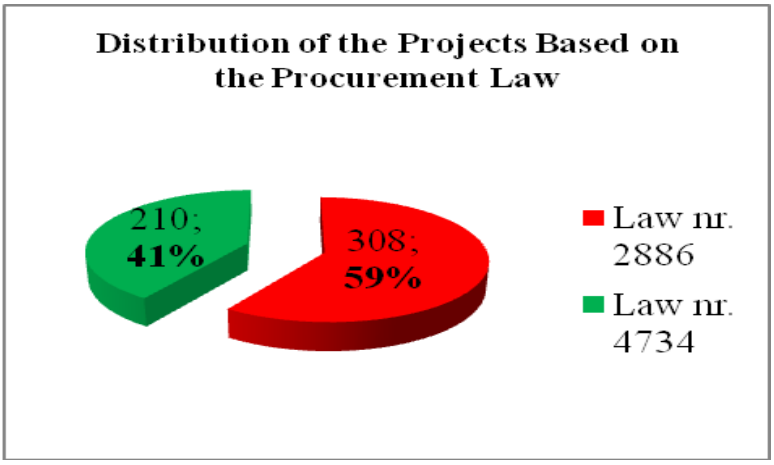



**Figure 2.** Distribution of the projects based on the procurement law, N=518

The 308 projects, which were procured in accordance with the State Procurement Law, nr. 2886 were completed between 1995 and 2002 years while the remaining 210 projects of the Public Procurement Law, nr. 4734 were completed between 2003 and 2011 years. The evaluation of the Provincial Directorates indicate that 53% of the 308 data (e.g. 162) were collected from Adana based on the previous Law, *nr. 2886* while 54% of the 210 data (e.g. 114) were collected from Gaziantep based on the current Law, *nr. 4734*. The details are provided in Figure 3.

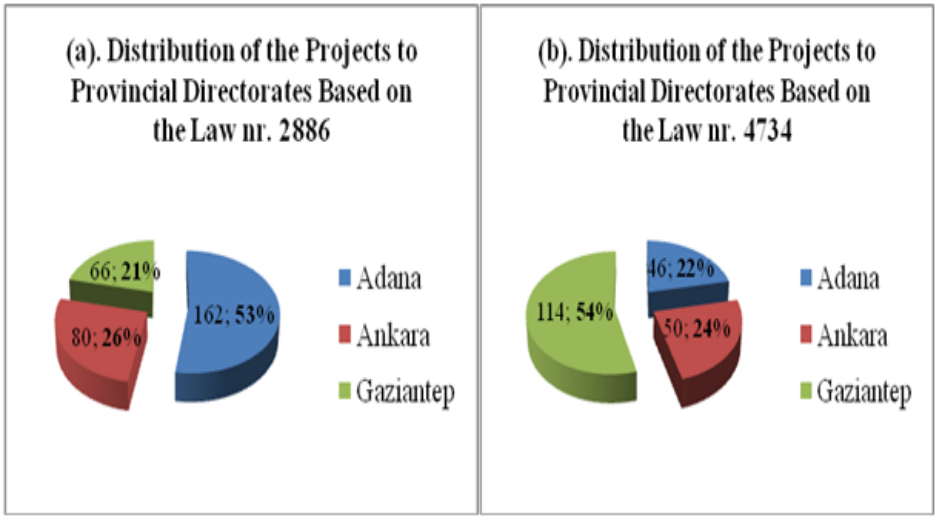



**Figure 3**. Distribution of the projects to provincial directorates; **a)** N=308, **b)** N=210

A total of 518 collected projects which were completed according to both procurement laws are all public buildings, including; educational (kindergarten, elementary, secondary and high schools), health service (district hospitals, community and dental clinics and emergency services), governmental (government offices in towns), security (gendarmerie regional command buildings and guardhouse) and social service (provincial social services directorates, social assistance and solidarity foundations) types. Details of the project types based on aforementioned three metropolitans are presented in Table 1.

**Table 1.** Collected project types

| Project Type | ADANA | | ANKARA | | GAZIANTEP | |
|---|---|---|---|---|---|---|
| | Law nr. 2886 | Law nr. 4734 | Law nr. 2886 | Law nr. 4734 | Law nr. 2886 | Law nr. 4734 |
| Educational | 121 | 44 | 27 | 40 | 41 | 89 |
| Governmental | 11 | 1 | 21 | 1 | 8 | 13 |
| Health service | 20 | 0 | 13 | 1 | 4 | 5 |
| Security | 4 | 1 | 17 | 5 | 11 | 2 |
| Social service | 6 | 0 | 2 | 3 | 2 | 5 |
| **TOTAL** | **162** | **46** | **80** | **50** | **66** | **114** |

Since all the collected projects are building type, the project construction technique is similar as reinforced concrete. Table 1 indicates that 61% (e.g. 189) of the total 308 projects procured according to the previous Law, *nr. 2886* are educational building projects. Educational projects on the other hand constitute 82% (e.g. 173) of the total 210 projects procured according to the current Law, *nr. 4734*. Key statistical analysis of the projects is shown in Table 2 to make a more detailed assessment. Each project was completed at different times and in different economic conditions. Therefore the contract sum and the actual cost (in Turkish Liras, TL) of all the projects have been updated to 2016 year based on the 'evaluation coefficients' related to work compliance used in construction [31]. Note that USD($)1 is equal to TL(₺)3.02 on average in the year 2016.

The key parameters of the projects indicate that; the average contract and actual duration were 252 and 407 calendar days based on the Law, *nr. 2886* while they were 248 days and 271 days based on the Law, *nr. 4734*. Although the average contract sum of the current Law, 4734 was higher than those of previous Law, 2886, the average actual cost of the previous Law was higher. Coefficient of variation (%) values of the contract duration, actual duration, contract sum and actual sum of the previous Law were also higher than those of the current Law.

**Table 2.** Key statistical analysis for the projects

| **Parameter** | **Law *nr. 2886*, N=308** | | | | **Law *nr. 4734*, N=210** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Contract Duration (days)** | **Actual Duration (days)** | **Contract Sum (TL)** | **Actual Cost (TL)** | **Contract Duration (days)** | **Actual Duration (days)** | **Contract Sum (TL)** | **Actual Cost (TL)** |
| Lowest Value | 100 | 100 | 20,373 | 68,036 | 100 | 100 | 141,527 | 150,505 |
| Highest Value | 1,148 | 2,504 | 33,693,986 | 57,182,349 | 1,210 | 1,208 | 7,997,872 | 8,373,490 |
| Arithmetic Mean | 251.73 | 407.17 | 1,039,983.84 | 2,317,996.48 | 247.54 | 271.25 | 1,565,777.40 | 1,622,383.55 |
| Standard Deviation | 189.27 | 444.17 | 2,878,838.71 | 6,687,126.72 | 130.71 | 144.61 | 1,136,904.15 | 1,184,440.49 |
| Coef. of Variation (%) | 75.19 | 109.09 | 276.82 | 288.49 | 52.81 | 53.31 | 72.61 | 73.01 |

The procurement Laws were also compared based on the obtained total cost and total duration data. Comparison of the total cost data is presented in Fig. 4 while Fig. 5 presents comparison of the total duration data.

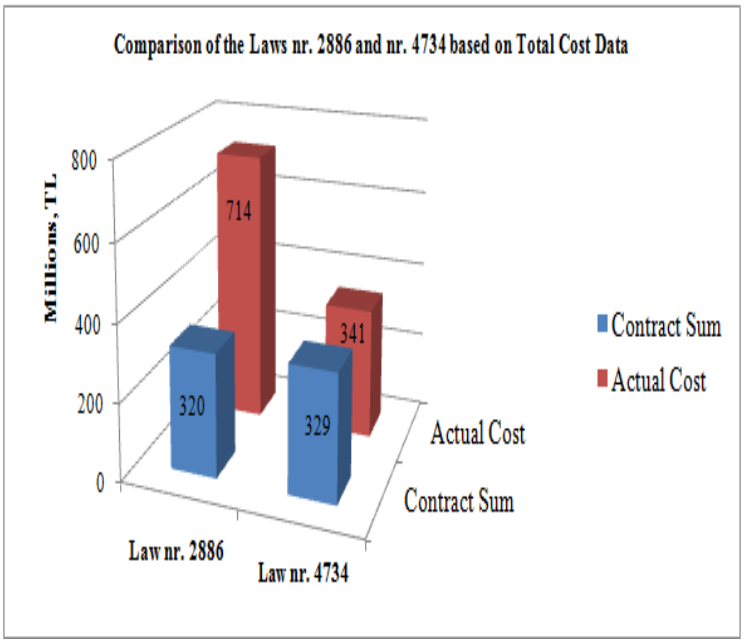



**Figure 4.** Comparison of the Laws nr. 2886 and nr. 4734 based on total cost data

The updated contract sums and the actual costs to 2016 year shows that contract sum is similar for both procurement Laws. However, there is a great difference between the actual costs.

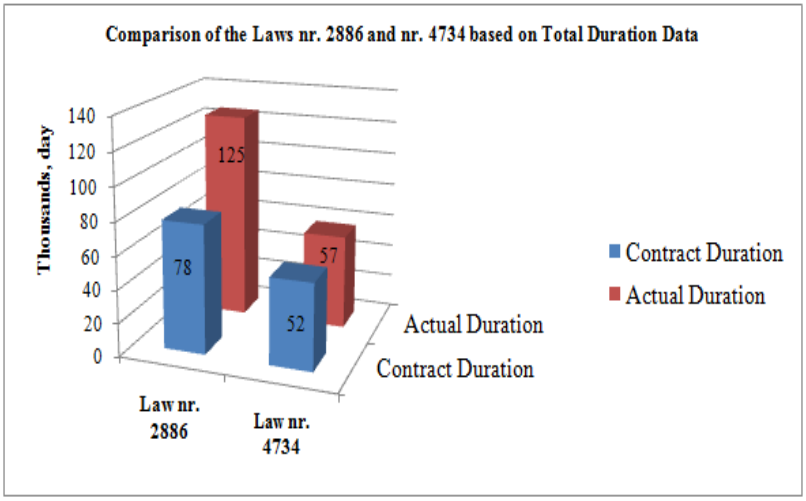



**Figure 5.** Comparison of the Laws nr. 2886 and nr. 4734 based on total duration data

Based on the total duration data, the previous Law, 2886 causes more significant differences for the contract duration and actual duration. Another comparison between the procurement Laws was also performed based on the obtained 'average' cost overruns (%) and duration overruns (%) as seen in Fig. 6.

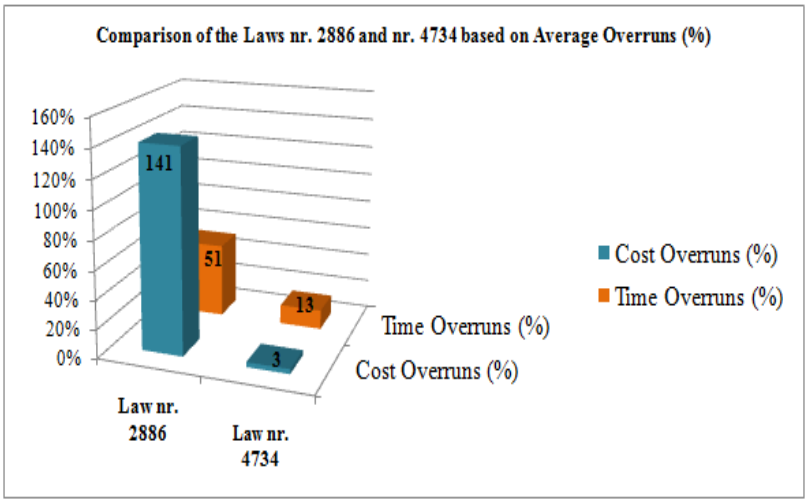



**Figure 6.** Comparison of the Laws nr. 2886 and nr. 4734 based on total duration data

It is clear that based on the previous Law, 2886, the average cost overrun was determined as 141% while the average duration overrun was 51%. For the current Law, 4734 on the other hand, the average cost and duration overruns were obtained as 3% and 13% respectively.

The simple linear regression analysis (SLRA) was also performed by Minitab statistical software, Version 17. Analysis of variance (ANOVA) was used to determine the significance level between the variables considered for the contract and actual conditions of each procurement Law. The hypotheses tested at five% significance level as;

- $H_0$: There is no significant relationship between the dependent variable (duration) and independent variable (cost),
- $H_1$: There is a significant relationship between the dependent variable (duration) and independent variable (cost).

The regression results were individually provided in Table 3. When F-value is higher than F-critical, the $H_0$ hypothesis is rejected and the $H_1$ hypothesis is accepted, which implies a valid model. Also a two-tailed t-test was applied on the samples. Since P-value higher than P-critical, a negligible statistical significance can be discussed and $H_0$ is not rejected as the sample does not provide enough evidence. It is therefore concluded that the duration-cost relationship of the three samples excluding the contract data of the previous Law (shown in red color in the table), *nr. 2886* can be expressed using SLRA.

**Table 3.** Regression analysis of the data

| Variable | Law nr. 2886, N=308 | | Law nr. 4734, N=210 | |
|---|---|---|---|---|
| | Contract | Actual | Contract | Actual |
| $R^2$ (%) | 0.46 | 2.21 | 38.93 | 30.74 |
| F-Value | 1.42 | 6.92 | 132.57 | 92.30 |
| F-Critical | 3.92 | 3.92 | 3.92 | 3.92 |
| P-Value | 0.234 | 0.009 | 0.000 | 0.000 |
| P-Critical | 0.050 | 0.050 | 0.050 | 0.050 |

The coefficient of determination ($R^2$) was also calculated to determine the goodness of fit between the variables of the contract data and the actual data. $R^2$ value is closer to one, the more accurate the model's predictions are. It was calculated using Eq. (2).

$$R^2 = 1 - \frac{\sum_{i=1}^{n}(y_{model,i} - y_{real,i})^2}{\sum_{i=1}^{n} y_{real,i}^{\ 2}}, \quad 0 \le R^2 \le 1 \qquad (2)$$

Where, $y_{model,i}$ and $y_{real,i}$ represent the model predictions and actual values respectively, and n represents the number of data. The obtained $R^2$ values show that there is a stronger correlation between the variables of the current Law, 4734.

The regression equations of the dependent variable, duration (days) and independent variable, cost (Turkish lira, TL) for the projects completed based on the Law, *nr. 2886* are provided in Eq. (3) and (4) respectively.

Contract data; $y = 247.1 + 0.000004\ x$ (3)

Actual data; $y = 384.3 + 0.000010\ x$ (4)

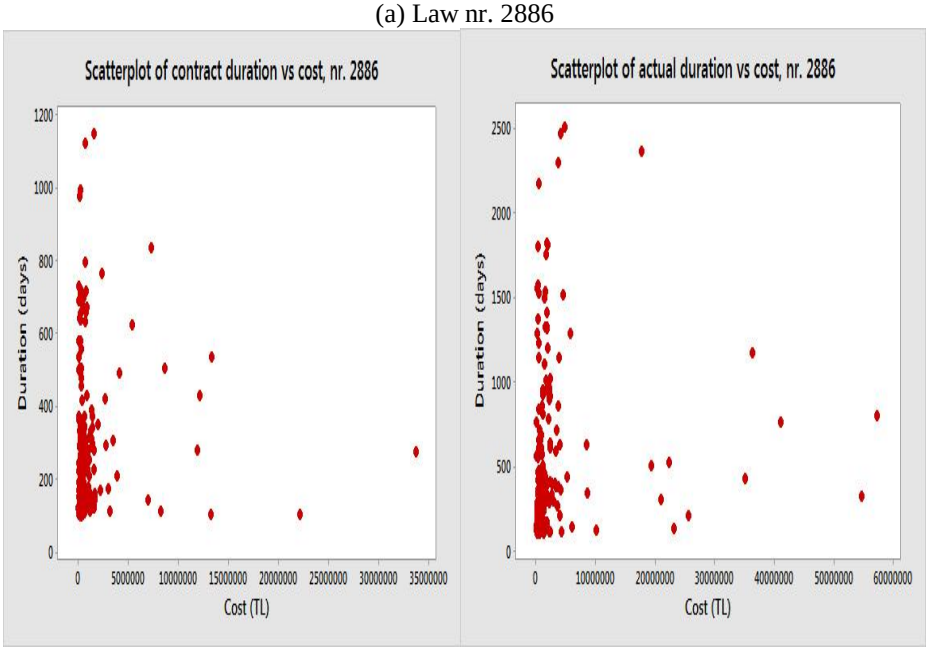
The regression equations of the dependent variable, duration (days) and independent variable, cost (Turkish lira, TL) for the projects completed based on the Law, *nr. 4734* are provided in Eq. (5) and (6) respectively.

Contract data; $y = 135.2 + 0.000072\ x$ (5)

Actual data; $y = 161.4 + 0.000068\ x$ (6)

Scatter diagrams for the correlation of duration and cost values were obtained from Minitab software and presented in Fig. 7.

(a) Law nr. 2886



(b) Law nr. 4734

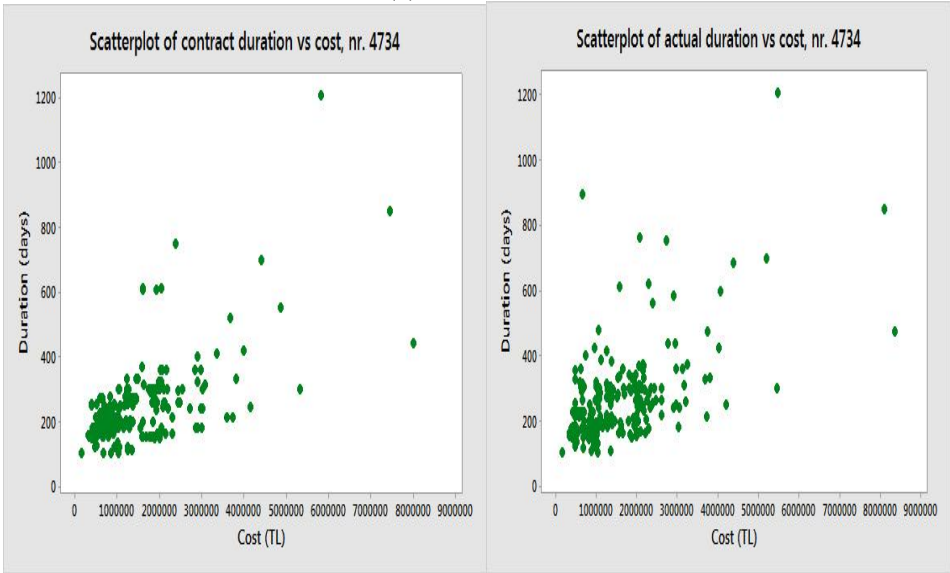



**Figure 7**. Scatterplot of contract/actual duration and cost

The horizontal axis shows the cost while the vertical axis shows the duration. Fig. 7 refers to discrepancies between the costs and durations of the projects based on both procurement laws. Specifically the intersection points of the higher-valued data indicate abnormal distribution. The duration/cost distributions of the projects based on the current Law, 4734 are significantly more respectable.

## IV. Discussion

Since the considered number of projects were different for the procurement Laws of 2886 and 4734, more realistic comparison can be made over the average of data. For instance; the average contract and actual duration were obtained as 252 and 407 days based on the previous Law, 2886 while 248 and 271 days based on the current Law, 4734. This can be interpreted that a completed public building project according to the previous Law caused 62% duration overrun on average while this was only 9% based on the current Law. For the cost data on the other hand, a similar situation was observed. The average contract sum and the actual cost were obtained as TL1,039,983.84 and TL2,317,996.48 based on the previous Law while these were TL1,565,777.40 and TL1,622,383.55 for the current Law. These costs also indicate that a completed public building project according to the previous Law caused 123% cost overrun on average while this was only 4% based on the current Law. These data indicate that there is a perfect improvement from the State Procurement Law, *nr. 2886* to Public Procurement Law, *nr. 4734*. Coefficient of variation (CV) values also supports this situation. CV is a measure of risk per unit of return, predicts choices far better than outcome variance, the risk measure of normative models [32]. There is a range of CV between 52.81% and 288.49% for the duration and the cost data while all the CV values of the projects by the current Law are lower than those of the previous Law, which implies more homogeneous data.

Although the considered number of projects based on the previous Law was greater than the current Law (e.g. 308>210), a comparison was examined based on the total duration and total cost data. The contract duration was 78,000 and 52,000 days while the actual duration was 125,000 and 57,000 days for the previous Law and current Law respectively, which implies a 60% and a 10% duration overrun in total. The situation can be interpreted that based on a 10% duration overrun, the previous Law, 2886 wasted 39,200 days in total. For the updated total cost data on the other hand, the contract sum was TL320,000,000 and TL329,000,000 while the actual cost was TL714,000,000 and TL341,000,000 for the previous Law and current Law respectively, which implies a 123% and a 4% cost overrun in total. The situation can be interpreted that based on a 4% cost overrun, the previous Law, 2886 wasted TL381,000,000 ($126 million) in regard to 2016 year in total.

The statistical F-test and t-test analyses proved that a statistical relationship between the dependent variables (duration) and independent variables (cost) for the sample of contract data of the previous Law cannot be expressed. The other samples; actual data of the previous Law as well as the contract and the actual data of the current Law statistically found to be significant. It was also clear that the $R^2$ values of the variables based on the current Law were higher, which means a stronger correlation, e.g. 38.93% and 30.74% for the contract variables and actual variables respectively. These were only 0.46% and 2.21% for the previous Law. The author opines

that a general suggestion for the ranges of $R^2$ in terms of 'bad' or 'good' is not logical since a $R^2$ of 10% may be acceptable for many uncontrollable and unknown factors influencing the response as well as a $R^2$ of 90% may be non-acceptable in a well controlled experiment.

The aforementioned regression equations of the variables indicate that for the previous Law for example; a project cost TL1 million, contract duration is 251 days while the actual duration 394 days. This means that if there will not be a cost overrun, in other words TL1 million is valid for both contract sum and the actual cost, a duration overrun of 57% is possible. For the current Law for example, for a project cost TL1 million, contract duration is 207 days while the actual duration 229 days. This means that if there will not be a cost overrun, in other words TL1 million is valid for both contract sum and the actual cost, a duration overrun of 11% is possible. Although it is clear that the current procurement system for the construction works reduce risks based on the delays as against the previous system, these results can also be a guide for the bidders and the employers of the construction sector. For instance, the probable risk of delay of 11% (22 days for a cost of TL 1 million) can be criticized and considered by the bidders in case of probable penal sanctions. The currently applied daily sublimit is 0.03% and the daily upperlimit is 0.06% of the contract sum. This means that a daily amount between TL300 and TL600 would be deducted from the progress payment. Thus the penal sanction of a 22 days of delay would be TL13,200. Besides, a bidder, bidding TL1 million to a public project should check whether the project duration in the tender document is close to probable actual duration, 229 days instead of suitable contract duration, 207 days. The bidder also should be aware of for instance 200 days of employer's project duration will probably lead 29 days of delays. As a different example, a bidder, bidding TL2 million to a public project should pay attention whether the project duration is close to probable actual duration, 297 days. In terms of employers, these results can also create awareness since delay/non-completion would be undesirable. A public employer should determine more realistic project duration based on the most advantageous bid.

## V. Conclusion

This study is an attempt to investigate the procurement system, more than 30 years from past to present, based on construction works in Turkey considering State Procurement Law, *nr. 2886*, which was prevailed between 1984 and 2003 years (in some cases still prevailed) and Public Procurement Law, *nr. 4734*, which is valid since 2003 year. In this context, the public construction building projects completed based on these Laws were examined and the time-cost relationships of these different-procured projects were compared.

Although there was no clearly identified purpose for the previous Law, 2886, *"it was essential that the needs are met in the best possible way, in the right conditions and on time, and that openness and competition are provided"*. The purpose of the current Law, 4734 is *"to establish the principles and procedures to be applied in any procurement held by public authorities and institutions governed by public law or under public control or using public funds"*. There are a number of differences between the provisions of both Laws. For instance, 4734 is extremely wide in scope. Besides, contracting authorities are responsible for ensuring, transparency, competition, equal treatment, reliability, confidentiality, public supervision, appropriate and prompt fulfillment of needs and efficient use of resources. Therefore it is clear that the current Law was published with high expectations, including prevention of the National wealth losses. On the other hand the current Law is not considered perfect as mostly criticized for making discrimination between domestic and foreign bidders.

Within this study, the statistical relationship between time and cost of the completed construction building projects has been determined on the basis of aforementioned procurement Laws. Important findings have been obtained that the current procurement Law, *nr. 4734* contribute to the prevention of the National wealth losses. Furthermore different regression equations, which can be easily used by the contractors/employers to forecast the project duration for the upcoming projects have been individually presented for contract and actual conditions. The obtained results are limited with the analysis of the public building projects which were completed in Adana, Ankara and Gaziantep metropolitans of Turkey. Data collection is a rather difficult process since there is no central archiving system for the public institutions. In this case the only remaining path is to review the files in the archives of the institutions. The findings of this study provide requisite knowledge to the stakeholders to take more informed decisions regarding project duration, which is believed as one of the key aspect for a 'successfully completed project' in the construction industry.

## Acknowledgements

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