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Research Article

The effect of communication on construction project management processes during the covid-19 pandemic period: a case study in Türkiye

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ABSTRACT

The construction industry has had to struggle with the impacts of the COVID-19 pandemic in all sectors. In this process, effective communication has become more significant. This study is aimed to evaluate the significance of effective communication in the COVID-19 process in the Turkish construction industry. Moreover, the causes of communication problems during the project management process and the communication problems among the project stakeholders were investigated. A survey study was applied and the data suitability to the normal distribution was examined using the Kolmogorov-Smirnov test. The significance relations between the seven different demographic characteristics of the sample and the answers were determined using the Mann-Whitney U and Kruskal-Wallis H tests. The relative importance index (RII) method was used to determine the participants' perceptions regarding relative importance. This study contributes to the literature by highlighting the views of architects and engineers on the significance of communication in the construction industry as well as investigating the impact of the COVID-19 pandemic period. This study provides a basis for construction practitioners and scientists who aim to examine the significance of effective communication in the construction industry and the communication problems experienced under the impact of the pandemic. Moreover, it will contribute to the elimination or minimization of communication-related issues. It will help managers and stakeholders in the construction industry develop strategies to avoid what may occur in ensuring effective communication due to any pandemic such as COVID-19.

1. Introduction

The construction industry plays a major role in the social and financial development of emerging countries. Nevertheless, it is a project-oriented industry, in which complexities and unique conditions are experienced [1]. The construction industry is based on an intensive labor force. The ongoing global change is making construction sites multicultural workplaces [2]. The efficiency of the construction process and the project performance largely depend on the quality of communication [3,4]. Participants need to work together to share, collate and integrate a significant amount of information to achieve the project objectives [5].

Effective communication among project participants is essential to the success of the project. Poor communication is one of the most experienced project risks [5]. Effective communication should be aimed and provided during the project lifecycle, as its role in project success cannot be underestimated. Since technical skills and experience alone are not sufficient methods, communication skills are significant for effective communication. Poor communication, defined as an unsuccessful interaction between project participants, is a prevalent problem in the construction industry. Project failure is clearly related to poor communication and is recognized as one of the major challenges in the construction industry [1]. The hypothesis model that should be in terms of communication effectiveness is presented in Figure 1.

Since the World Health Organization (WHO) announced the COVID-19 outbreak as a pandemic, the construction industry, which is an important growth factor in the economy, has also been affected by this situation [6]. The industry has had to contend with the effect of COVID-19 on operations due to supply chain disruptions, cost overruns, delays, reduction of the labor force, decline in productivity, and health & safety measures on-site [7].

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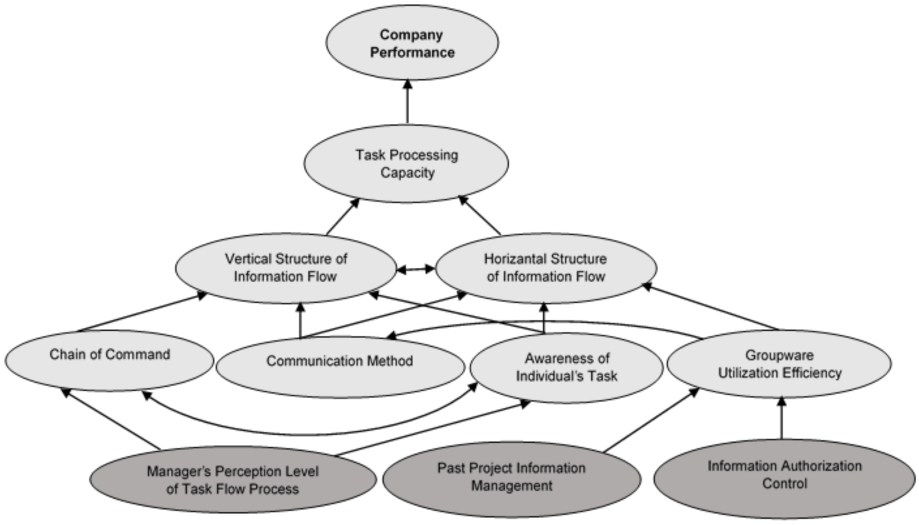

Figure 1. Internal Communication Effectiveness Hypothesis Model [4]

Effective communication has become more significant during the COVID-19 pandemic. Therefore, providing a strong communication strategy is critical for business continuity [8]. The concept of effective communication has always been one of the components of a successful construction project. Since a project can have multiple contractors, suppliers, and stakeholders; project managers need to be able to appropriately coordinate the activities of the participants via an incessant flow of information [7]. On the other hand, previous studies indicate that remote workers feel more excluded than those working on-site. In a study with 1,153 participants, 64% of remote workers stated that their colleagues on-site have made changes to the project without communicating [9].

Communication & technical details, and worksite management instructions can often be misunderstood or misinterpreted, which can lead to many problems on worksites such as delays in decision-making, resource shortages, frequent design changes, errors, and rework [10]. Poor communication, for this reason, has many effects and consequences in the construction industry; for example cost and/or time overruns, conflicts, and project failure. While unsuccessful communication leads to unproductive work, effective communication can provide more effective time & cost management in producing successful projects [11]. Furthermore, effective communication facilitates the correct planning and scheduling of construction works, directs customers to appropriate financial planning, and ensures the effective usability of materials and labor force as required [12]. However, poor communication is a major problem in the global construction industry, and therefore, successful communication in the construction industry is a major challenge due to the diversity & changing nature of construction projects [11]. Project managers are also aware of the situation, 55% of project managers define effective communication as the most significant parameter for project success. Consequently, there is a great need to direct and arrange the transfer of this information between the stakeholders [13].

This study will contribute to the literature on possible pandemic situations by determining the impact of communication on project management processes during the COVID-19 pandemic from the perspective of the construction industry stakeholders in Türkiye.

2. Literature Review

Although the communication topic in the construction industry was researched specifically in the developed economies, the number of studies conducted in developing countries like Türkiye is limited. The literature review in this study has been presented under three titles: *(i)* National literature, *(ii)* International literature, and *(iii)* Communication in the construction industry during the COVID-19 pandemic process.

(i) In the scope of limited studies on the national level; Kaya [14] applied a survey to the employees of a contractor firm, in order to determine interpersonal communication styles and to observe the effect of individualism and collectivism on communication styles. It has been concluded that project managers can minimize conflicts & communication problems by gathering compatible professionals, who can meet the expectations of the project. Öcal and Keleş [15] identified communication problems between individuals, units, institutions, and organizations. Özdemir [16], using a sample of 99 experts working in various positions in different firms in the construction industry, determined that the professionals working in the Turkish construction industry require a communication management plan and communication management during the project process.

(ii) At the international level, more specific studies have been performed on the construction industry, especially in recent years. Tai *et al.* [17] aimed to comprehend the state of communication in large-scale construction projects and to provide a basis for further research on project communications in China. They concluded that communication problems were caused by the lack of effective communication mechanisms, and weak organizational structures of project teams. Zulch [18] applied a survey of the main stakeholders of the construction industry, such as engineers and architects, within the scope of effective communication. It has been concluded that the communication skills of project managers have more impact on time, quality, cost, and communication management. Priyadharshini and Sashara [19] presented the results of a literature study and indicated that poor communication management negatively influences organizational performance and project success. Senaratne and Ruwanpura [20] investigated how construction project teams manage the different phases of the project communication process. They suggested that the construction project teams recognize and implement each step of the communication process using appropriate communication tools. Ejohwomu *et al.* [21] aimed to identify and evaluate the reasons that prevent effective communication in the Nigerian construction industry. It was found that the most critical barriers were vague project goals, ineffective reporting systems, and poor leadership. Gamil and Rahman [11] aimed to determine the causes and effects of poor communication in the construction industry; they concluded that the main reasons are poor communication skills and a lack of effective communication between the stakeholders. Olanrewaju *et al.* [12] applied a survey of 80 construction workers within the scope of the lack of communication at the construction worksites. It has been concluded that performance decreases if communication problems are not addressed. Taleb *et al.* [13] emphasized the importance of establishing a ‘communication management plan’ for construction projects to identify communication barriers. Hussain *et al.* [1] examined the causes and effects of poor communication in the construction industry and presented a case study that could help identify and resolve the problem. Gamil *et al.* [22] interviewed six expert managers, who have experience in the construction industry for at least 10 years. It was stated that the effects of poor communication change on a country basis, and effective communication between practitioners is essential for the projects. Akunyumu *et al.* [23] conducted a survey of construction managers in order to identify communication problems at construction worksites. They identified the problems as lack of access to information, cultural difficulties, delay in information distribution, technical language difficulties, lack of feedback & lack of teamwork. Rahman and Gamil [24] stated that poor communication in the construction industry is a problem that researchers should focus more on, in order to increase project performance. Chi [4] provided 317 survey data from 15 companies and investigated the relationship between communication efficiency and firm performance for different stakeholders of the construction industry such as employers, contractors, and architects/engineers. It has been concluded that vertical information flows are more effective than horizontal in organizational performance.

(iii) Within the scope of communication in the construction industry during the COVID-19 pandemic process, Nyandongo and Davids [25] aimed to examine and evaluate the relationship between communication and project management performance. They concluded that project managers, who see communication as one of the most significant factors contributing to the success of projects, achieve higher success rates in their projects than other participants. Encinas *et al*. [26] examined how changes due to the COVID-19 pandemic requirements affect the construction industry in the United States. The results include data on changes in meeting attendance, positive and negative consequences of virtual communication, and suggestions for improving virtual communication. Subramaniam *et al*. [27] investigated communication management barriers and potential remediation measures during the COVID-19 pandemic that is affecting the Malaysian construction industry. They concluded that project communication management plans, particularly on-site review meetings and team meeting discussions, and project reports should place great importance.

The literature review indicates that the studies on the topic of communication in the construction industry are an increasing global trend. Studies on the COVID-19 pandemic indicated that communication is a critical component that needs to be further examined. Although some studies were conducted on the COVID-19 pandemic and the construction industry worldwide, there is no study investigating the effect of communication during the pandemic process on construction project management processes in Türkiye. The aim of this paper is to investigate the current situation of communication in the construction industry during the COVID-19 pandemic process, to define the effect of communication problems between the stakeholders, and to determine the causes of communication problems in the project management process. In the last ten years, the number of companies operating in the construction industry in Türkiye has increased by 43.2% to 127,050. This situation causes the construction works to fail to reach the line of the professional project management structure. The concept of chain of command is also an important indicator of the communication dimension of project management.

However, this dimension is a parameter that is not considered in Türkiye. Therefore, Türkiye was selected as a case study, since it is a suitable emerging country for the aforementioned perspective.

3. Method

Within the scope of the study, a survey study, which is one of the data collection methods, was performed. The Likert scale, one of the most useful questionnaire forms, was developed by Rensis Likert. The Likert scale is a series of sentences prepared about an individual's attitude towards a single object [28]. Some researchers reported higher reliability for five-point Likert-type scales [29]; and stated that as the number of categories in the scale of *agree-disagree* increases, the data quality decreases. Thus the best scale of *agree-disagree* is the five-point Likert-type scale [30]. Besides, the researchers stated that the use of five-point and seven-point Likert-type scales rather than two or three-point Likert-type scales increases the reliability and validity [31]. Since it is the most practical scale method, the survey questions of this study were prepared using a five-point Likert-type scale. The sample of the survey study consists of architects, civil engineers, electrical-electronics engineers, and mechanical engineers, who are actively working in the Turkish construction industry. The reason for the selection of these professions is that only these can legally work as site supervisors in Türkiye.

The survey study was composed of four main sections, and a total of 44 questions were asked of the participants. In the first section, seven questions were asked related demographic characteristics of the participants. In the second section, 10 questions related to communication in the construction industry were included, and in the third section, 15 questions were prepared for project-based communication. In the fourth and last section, 12 questions were prepared to identify management-based communication problems. A research flowchart of this study is presented in Figure 2.

Statistical tests can be classified as parametric (t-test, analysis of variance, Pearson correlation, ANOVA, etc.) and non-parametric tests (Mann-Whitney U, Kruskal-Wallis H, Wilcoxon, Spearman correlation analysis, etc.). Non-parametric tests are used in cases where the data cannot provide the strict assumptions of parametric tests (such as normal distribution) and/or the number of samples is small [32]. It is ideal for use when non-parametric tests are data from classification and ranking scales [33]. In addition, non-parametric tests do not have strict requirements and do not make assumptions about population distribution. The general information about the tests/methods used in this study is provided below.

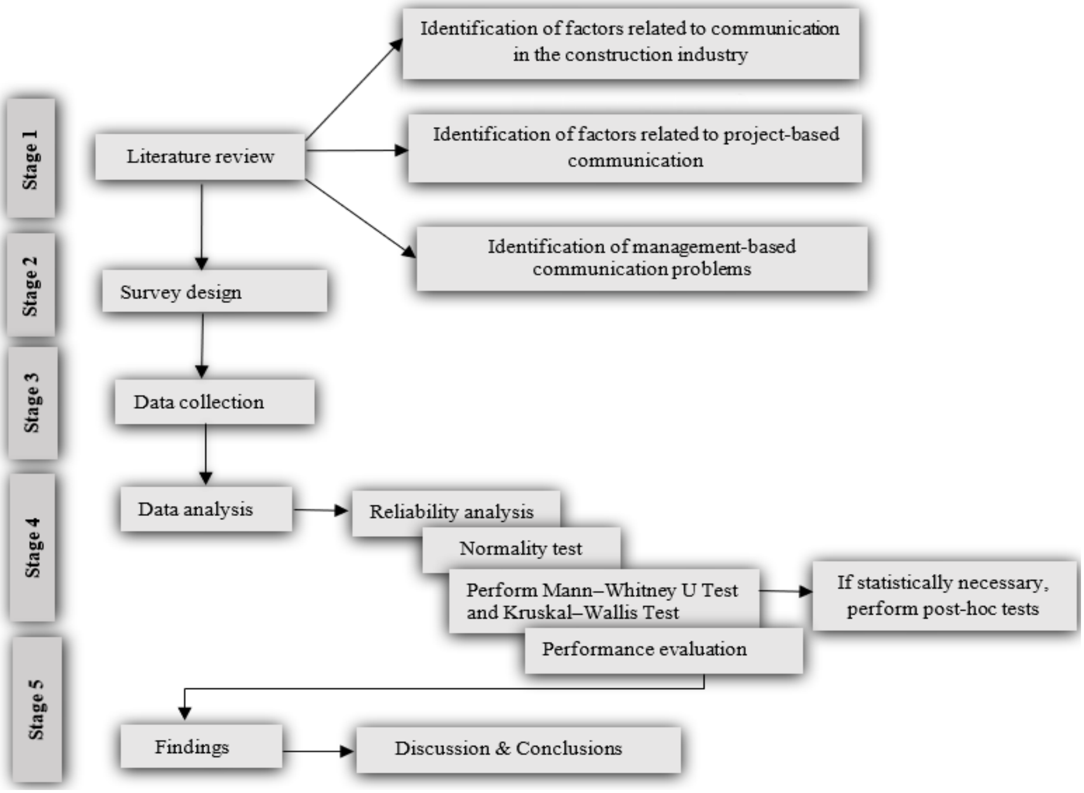

Figure 2. Research Flowchart

3.1. Normality Test

It is significant to determine whether the data have a normal distribution in determining the analysis method of the data. There are several approaches for testing the normality of data, and the most common methods are the Shapiro-Wilk test, Kolmogorov-Smirnov test, skewness/kurtosis, histogram, boxplot, P–P graph, Q–Q graph, standard deviation, and arithmetic mean. The Kolmogorov-Smirnov test and the Shapiro-Wilk test are the most commonly used methods to test the normality of the data. While the Shapiro-Wilk test is generally used in small samples (N<50), the Kolmogorov-Smirnov test is used for N≥50 [34]. In the study, the Kolmogorov-Smirnov test was applied to determine the suitability of the data to the normal distribution, and the skewness/kurtosis values were evaluated.

3.2. The Mann-Whitney U Test

The Mann-Whitney U test is used to determine whether the data of two independent groups differ significantly from each other [35]. Mann-Whitney U statistic and Z value are calculated by using the following formulas [36].

$$U = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1 \quad (1)$$

$$E(U) = \mu_u = \frac{n_1 n_2}{2} \quad (2)$$

$$Var(U) = \sigma_u^2 = \frac{n_1 n_2 (n_1 + n_2 + 1)}{12} \quad (3)$$

Following, the sample sizes of at least 10, the distribution of the random variable is approximated with the normal distribution.

$$Z = \frac{U - \mu_u}{\sigma_u} \quad (4)$$

Where n_1*: the size of the first sample,* n_2*: the size of the second sample,* R_1*: the sum of the ranks of the first sample,* σ_u^2*= the variance of the Mann–Whitney U, and* μ_u*= the mean of the Mann-Whitney U.* After calculating the Z value, it can be decided whether to reject the null (zero) hypothesis or not, according to the chosen significance level (e.g. α = 0.05).

It was observed that the data obtained in this study does not fit the normal distribution, and the analysis was continued using non-parametric tests. Rankings of the determined groups were analyzed via non-parametric statistical tests. Therefore, the Mann-Whitney U test was only used to make comparisons according to the 'gender' variable from demographic characteristics.

3.3. The Kruskal-Wallis H Test

The Kruskal-Wallis H test compares the mean rank of three or more independent groups and is used to determine whether there is a significant difference between the scores of the groups. It is similar in nature to the Mann-Whitney U Test, however, allows us to compare more than two groups. The scores are converted into rankings and the average ranking for each group is compared [32]. The Kruskal-Wallis test formula is as follows.

$$W = \frac{12}{n(n+1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} - 3(n+1) \quad (5)$$

Where n_i*: the sample sizes in the K groups, n: the total number of sample, k: the number of computation groups, and* R_i*: the sum of the ranks in the K groups* [36].

The Kruskal-Wallis H test does not specify which groups are statistically significantly different from each other if a statistically significant result is obtained. Mann-Whitney U tests should be performed as a posthoc test between group pairs in order to determine this parameter. Besides, Bonferroni correction was applied to the alpha significance level, which is used to evaluate the statistical significance. Bonferroni correction is a method of using the revised alpha significance level obtained by dividing the alpha significance level of 0.05 by the number of tests to be compared [37]. In this study, the Kruskal-Wallis H test was used to make comparisons according to demographic characteristics, such as profession, sector, workplace, experience, city, and COVID-19 history.

3.4. Performance Evaluation

The relative importance index (RII) is a statistical method that more precisely determines the relative weight of each variable among the total variables [38]. RII can be calculated as follows [39].

$$RII = \frac{\sum W}{AxN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5xN} \quad (6)$$

Where *W: weight value of the answers to each question (from 1 to 5 in this study), A: highest weight coefficient (5 in this study), and N: total number of participants.* The relative importance degree ranges based on the RII values were defined in the literature as follows; high (H) (0.8 < RII ≤ 1.0), high-medium (H–M) (0.6 < RII ≤ 0.8), medium (M) (0.4 < RII ≤ 0.6), medium-low (M-L) (0.2 < RII ≤ 0.4) and low (L) (0.0 ≤ RII ≤ 0.2) [40]. The RII method was used in the application of this study to determine the perceptions of the participants regarding communication in the construction industry (2nd section), project-based communication (3rd section), and management-based communication problems (4th section).

4. Results

The sample of the study consists of a total of 157 faculty graduates, who are actively working in the Turkish construction industry. Feedback was received from the participants through a survey study prepared on Google forms due to the COVID-19 pandemic. The survey form was published for approximately two months from April 2021 to June 2021. Please note that Türkiye moved up to fifth place with the highest number of cases as of April 2021. This is where the survey came published. Therefore, the survey was conducted during the most effective period of the pandemic.

Since one of the participants answered the question of the city he/she is working as ‘Algeria’ and the other answered the same question as ‘I don't work’; the answers of these two participants were not considered. Therefore, the questionnaire form of a total of 155 (100%) participants was evaluated. IBM SPSS Statistics Version 26 software was used in the analysis of the obtained data. The seven demographic characteristics were considered as; profession, gender, sector, workplace, experience, city, and COVID-19 history. The demographic properties of the sample are presented below.

- The sample consists of 92 (59%) civil engineers, 34 (22%) architects, 15 (10%) electrical-electronics engineers, and 14 (9%) mechanical engineers.
- 68% (106) of the participants are male and 32% (49) are female.
- 19% (29) of the participants are working in the public sector, 63% (98) in the private sector, 9% (14) at university, and 9% (14) as employers.
- 11% (17) of the participants work at the construction worksite, 27% (41) work in the office, and 62% (97) work both at the construction worksite and in the office.
- The occupational experience of 34% (52) of the participants is up to three years, 23% (36) is 4 to 7 years, 21% (33) is 8 to 11 years, 5% (7) is 12 to 15 years, and 17% (27) is more than 15 years.
- Participation in the survey study was provided from 32 cities of 81 (40%) from Türkiye. 48% (75) of the participants were from Kayseri, 8% (13) from Istanbul, 8% (12) from Ankara, and 5% (7) from Adana. A frequency of 31% (48) was obtained as ≤5 from the remaining 28 cities.
- 16% (25) of the participants stated that they experienced COVID-19, 69% (107) did not, and 15% (23) did not know whether they experienced it or not.

The reliability of the scales was evaluated for a total of 37 questions defined with a five-point Likert scale within the scope of the second, third and fourth sections of the study. In order to determine the reliability of the scales, Cronbach's Alpha (α) coefficients, which are used to define the internal consistency of the answers given by the respondents to the questions, were calculated. The questions of the previous studies, mentioned above, were revised and adapted, as well as the previous experiences of the authors, in preparing the survey questions.

The previous studies stated that the scale is ‘highly reliable’ in case of the calculated (α) coefficient is higher than 0.800 [41]. The results of the reliability analysis indicate that the scale reliability of all sections of the survey study was ‘high’. The suitability of the data to the normal distribution was initially examined using the Kolmogorov-Smirnov test. The significance level (p) values for all questionnaire sections of the study were calculated as 0.000 using IBM SPSS Statistics Version 26 software. It was observed that the data ‘does not fit’ the normal distribution since the test results were obtained as $p<0.05$. As an alternative approach, the skewness/kurtosis values were evaluated. The skewness and kurtosis values for the second section (communication in the construction industry), the third section (project-based communication), and the fourth section (management-based communication problems) were obtained as -1.696 to +2.296, -1.808 to +3.369, and -1.058 to +2.387 respectively. The previous studies indicate that the skewness/kurtosis values in the range of ±2 indicates a normal distribution [42, 43]. The obtained skewness/kurtosis values confirm that these data do not fit the normal distribution.

In the next step, the significance between the demographic characteristics of the sample and the responses to the survey questions was analyzed. Within the scope of non-parametric analysis, the Mann-Whitney U test was used for the ‘gender’ variable. The Kruskal-Wallis H test on the other hand was used for profession, sector, workplace, experience, city, and COVID-19 history variables. The results of the analysis for all seven demographic properties were separately presented in Tables 2 to 8. At the 0.05 significance level for the Mann-Whitney U test results, no significant difference was observed in the opinions on communication in the construction industry ($p=0.089>0.05$), project-based communication ($p=0.057>0.05$), and management-based communication problems ($p=0.161>0.05$) according to the gender variable.

Table 1. Reliability analysis results of the survey questions

Category	Cronbach’s Alpha (α)
Communication in the Construction Industry (2nd section)	0.932
Project-Based Communication (3rd section)	0.956
Management-Based Communication Problems (4th section)	0.917

Table 2. Mann-Whitney U analysis for gender

Factor	Gender	N	Mean Rank	Sum of Ranks	U	p
2-Communication in the Construction Industry	Male Female	106 49	73.83 87.01	7826.50 4263.50	2155.500	.089
3-Project-Based Communication	Male Female	106 49	73.84 88.07	7774.50 4315.50	2103.500	.057
4-Management-Based Communication Problems	Male Female	106 49	74.58 85.41	7905.00 4185.00	2234.000	.161

Table 3. Kruskal-Wallis H analysis for profession

Factor	Profession	N	Mean Rank	χ^2	p	Significant Difference
2-Communication in the Construction Industry	Civil Engineer Architect Electrical-Electronics Engineer Mechanical Engineer	92 34 15 14	75.54 79.26 86.23 82.25	.937	.817	-
3-Project-Based Communication	Civil Engineer Architect Electrical-Electronics Engineer Mechanical Engineer	92 34 15 14	76.15 79.74 80.77 83.00	.439	.932	-
4-Management-Based Communication Problems	Civil Engineer Architect Electrical-Electronics Engineer Mechanical Engineer	92 34 15 14	77.57 75.75 80.40 83.71	.365	.947	-

Table 4. Kruskal-Wallis H analysis for sector

Factor	Sector	N	Mean Rank	χ^2	p	Significant Difference
2-Communication in the Construction Industry	Public Private University Employer	29 98 14 14	54.33 84.96 90.21 66.11	12.496	.006*	2>1
3-Project-Based Communication	Public Private University Employer	29 98 14 14	53.38 85.23 92.04 64.36	13.953	.003*	2>1
4-Management-Based Communication Problems	Public Private University Employer	29 98 14 14	71.16 77.57 88.93 84.25	1.792	.617	-

At the 0.05 significance level for the Kruskal-Wallis H test results, no significant difference was observed in the opinions on communication in the construction industry ($p=0.817 > 0.05$), project-based communication ($p=0.932>0.05$), and management-based communication problems ($p=0.947>0.05$) according to the profession variable. At the 0.05 significance level for the Kruskal-Wallis H test results, significant differences were observed in the opinions on communication in the construction industry ($p=0.006 < 0.05$), and project-based communication ($p=0.003<0.05$) according to the sector variable. In order to determine between which sectors the difference occurs, multiple comparisons were performed using the Mann-Whitney U test and Bonferroni correction. It was determined that this difference occurred between the public and private sectors at $p<0.0083$ significance level. On the other hand, there was no significant difference in the opinions on management-based communication problems ($p=0.617>0.05$) according to the sector variable.

Table 5. Kruskal-Wallis H analysis for workplace

Factor	Workplace	N	Mean Rank	χ^2	p	Significant Difference
2-Communication in the Construction Industry	Site Office Site+Office	17 41 97	84.53 79.98 76.02	.631	.730	-
3-Project-Based Communication	Site Office Site+Office	17 41 97	97.38 77.12 74.97	3.632	.163	-
4-Management-Based Communication Problems	Site Office Site+Office	17 41 97	85.18 67.44 81.21	3.213	.201	-

Table 6. Kruskal-Wallis H analysis for experience

Factor	Experience	N	Mean Rank	χ^2	p	Significant Difference
2-Communication in the Construction Industry	0-3 years 4-7 years 8-11 years 12-15 years 16 years and above	52 36 33 7 27	81.76 72.81 73.88 81.43 81.83	1.369	.850	-
3-Project-Based Communication	0-3 years 4-7 years 8-11 years 12-15 years 16 years and above	52 36 33 7 27	81.71 76.56 70.58 58.14 87.00	3.757	.440	-
4-Management-Based Communication Problems	0-3 years 4-7 years 8-11 years 12-15 years 16 years and above	52 36 33 7 27	74.41 75.22 74.50 92.29 89.19	3.069	.546	-

Table 7. Kruskal-Wallis H analysis for city

Factor	City	N	Mean Rank	χ^2	p	Significant Difference
2-Communication in the Construction Industry	Adana Ankara İstanbul Kayseri Other	7 12 13 75 48	100.57 72.67 55.69 83.21 73.94	6.584	.160	-
3-Project-Based Communication	Adana Ankara İstanbul Kayseri Other	7 12 13 75 48	105.29 69.50 60.50 78.83 79.59	5.088	.278	-
4-Management -Based Communication Problems	Adana Ankara İstanbul Kayseri Other	7 12 13 75 48	88.14 92.13 46.19 82.25 74.97	9.003	.061	-

At the 0.05 significance level for the Kruskal-Wallis H test results, no significant difference was observed in the opinions on communication in the construction industry ($p=0.730 > 0.05$), project-based communication ($p=0.163>0.05$), and management-based communication problems ($p=0.201 > 0.05$) according to the workplace variable.

Table 8. Kruskal-Wallis H analysis for COVID-19 history

Factor	COVID-19 History	N	Mean Rank	χ^2	p	Significant Difference
2-Communication in the Construction Industry	Yes No I don't know	25 107 23	79.68 77.96 76.37	.066	.968	-
3-Project-Based Communication	Yes No I don't know	25 107 23	74.46 78.81 78.07	.191	.909	-
4-Management-Based Communication Problems	Yes No I don't know	25 107 23	76.02 78.98 75.59	.167	.920	-

At the 0.05 significance level for the Kruskal-Wallis H test results, no significant difference was observed in the opinions on communication in the construction industry ($p=0.850 > 0.05$), project-based communication ($p=0.440>0.05$), and management-based communication problems ($p=0.546>0.05$) according to the occupational experience variable. At the 0.05 significance level for the Kruskal-Wallis H test results, no statistically significant difference was observed in the opinions on communication in the construction industry ($p=0.160>0.05$), project-based communication ($p=0.278>0.05$), and management-based communication problems ($p=0.061>0.05$) according to the city variable.

At the 0.05 significance level for the Kruskal-Wallis H test results, no statistically significant difference was observed in the opinions on communication in the construction industry ($p=0.968>0.546$), project-based communication ($p=0.909>0.546$), and management-based communication problems ($p=0.920>0.546$) according to the COVID-19 history variable. Moreover, the RII values for each question in terms of the profession were calculated, and the results were presented in the next section.

5. Discussion

Within the scope of this study, a survey study consisting of four sections and a total of 44 questions was applied. The seven demographic characteristics obtained from the sample can be summarized as; the sample is predominantly composed of civil engineers and architects (81%), the majority of the sample consists of; male participants (68%), working in the private sector (63%), and working both at the construction worksite and the office (62%). Besides, it is critical that more than half of the sample (57%) has less than eight years of occupational experience, and the majority of the sample work in Central Anatolia. Finally, a little of the sample (16%) stated they have a history of COVID-19.

The data of the Union of Chambers of Turkish Engineers and Architects (UCTEA) [44] indicate that there are a total of 380,933 registered engineers/architects of four occupational groups; including 130,760 civil engineers (34%), 119,202 mechanical engineers (31%), 67,343 electrical-electronics engineers (18%), and 63,628 architects (17%), as of 2021. Although the stated numbers do not reflect the number of active working conditions in the construction industry, the population of the study was considered 380,933 since it is not known how many of them are actively working in the construction industry. Therefore, the sample size from this population can be obtained as 155, with a 95% confidence interval and a 7.87% margin of error.

Since the data obtained from the survey study did not fit the normal distribution, the significant relations between the seven different demographic characteristics of the sample and the responses to 37 questions in three sections (including communication in the construction industry, project-based communication, and management-based communication problems) were determined using the non-parametric Mann-Whitney U and Kruskal-Wallis tests. The findings indicate that there are no significant differences in the opinions according to variables of the profession, gender, workplace, experience, city, and COVID-19 history. In other words, it is clear that the participants classified within the scope of these demographic variables have similar responses. On the other hand, significant differences were observed for the sector variable. It has been determined that the differences of opinion are experienced mostly between the public sector and the private sector in the sections of 'communication in the construction industry' and 'project-based communication'. The private sector has a more dynamic structure than the public sector due to job turnover, lack of job guarantees, no selection exam, low salaries, etc. [45]. Therefore, it is thought that the main reason for sectoral disagreements is the dynamic and solution-oriented structure of the private sector, despite the slowly working procedural mechanism of the public sector. The following findings were obtained from the relative importance index (RII) values calculated in order to determine occupational perceptions.

Table 9. Highest obtained RII values in terms of occupation

Category	Questions	Rank for Civil Eng.	Rank for Mechanical Eng.	Rank for Electrical Eng.	Rank for Architects
Communication in the Construction Industry (2nd section)	2.2 Communication skills are as important as technical skills for construction industry workers.	(1) RII=0.813	(1) RII=0.871		
	2.3 Effective communication ensures cooperation and coordination of stakeholders.	(2) RII=0.811	(2) RII=0.857	(2) RII=0.878	(2) RII=0.847
	2.4 Effective communication between stakeholders during the construction process ensures quality and reliable information flow.				(1) RII=0.859
	2.6 Effective communication trainings help to overcome communication barriers between stakeholders.			(1) RII=0.880	
Project-Based Communication (3rd section)	3.4 For effective communication in the construction industry, the hierarchical organizational structure should be determined at the beginning of the project.		(2) RII=0.900		
	3.5 The communication ability of the project manager affects the success of the project.	(1) RII=0.828	(1) RII=0.914	(1) RII=0.867	(2) RII=0.829
	3.8 Failure to clearly define duties, authorities, and responsibilities causes construction projects to fail.	(2) RII=0.807		(2) RII=0.867	(1) RII=0.853
Management-Based Communication Problems (4th section)	4.1 Not assigning the right person as project manager	(1) RII=0.848		(1) RII=0.853	
	4.5 Lack of regular communication/meeting				(1) RII=0.882
	4.6 Not being detailed enough about the scope of the project/allowing it to change frequently	(2) RII=0.846	(1) RII=0.900		(2) RII=0.880
	4.12 Not having criteria to define success		(2) RII=0.900	(2) RII=0.852	

The items in Table 9 have a high (H) degree of importance as mentioned in Section 3.4. The priorities of the professions were focused on four main items for the 2nd section, emphasizing communication skills and effective communication. These findings are consistent with the findings of Gamil and Rahman [11] that poor communication skills are the main cause of poor communication in the construction industry. Moreover, item (2.3), namely 'Ensuring cooperation and coordination of stakeholders with effective communication', has the highest secondary relative importance for all occupational groups. However, the primary relative importance differs. One obvious similarity between civil engineers and mechanical engineers is item (2.2), namely 'Importance of communication skills as well as technical skills for employees'. However, technical skills (the ability to use AutoCAD, SAP2000, Primavera, or similar software, the ability to prepare a quantity/cost/schedule, etc.) are always prioritized when recruiting in the Turkish construction industry. Communication skills are generally underestimated. While civil engineers and mechanical engineers consider communication skills as important as technical skills, architects prioritize communication between industry stakeholders, and electrical-electronics engineers prioritize effective communication training. These results indicate that there is no general consensus on sectoral communication among the main occupational groups of the construction industry.

The priorities of the professions were focused on three main items for the 3rd section, emphasizing hierarchical organization, communication skills of project managers, and non-definition problems. These findings are consistent with the findings of Kaya [14] that project managers play a critical role in effective communication. The results obtained are also consistent with the findings of Nyandongo and Davids [25] that project managers, who think that communication is one of the most essential factors affecting project success, are more successful. The priorities of the occupational groups for this section are more similar. For all occupational groups; while the role of the project manager is seen as critical for effective communication, the fact that duties and responsibilities are not clearly defined at the beginning of the project in the project-based construction industry is seen as one of the most important project-based communication problems. Moreover, it can be stated according to these findings that communication is important in the completion of the project in the desired time, quality, and budget that is, in determining the performance of the project.

The priorities of the professions were focused on four main items for the 4th section, emphasizing project manager selection, meeting absence, scope, and success determination. These findings are consistent with the findings of Özdemir [16] that communication management is required in the project process, and Taleb et al. [13] that a communication management plan is required. The findings also support the findings of Gamil and Alhagar [6] that regular video meetings are essential. The findings are also consistent with the findings of Subramaniam et al. [27] that project communication management plans and meetings should be given importance. In the 6th article of the regulation named ‘Regulation on Construction Site Managers’ published in Türkiye in the 2019 year; although architects, civil engineers, mechanical engineers, or electrical-electronics engineers are required to be site managers, mechanical engineers and electrical-electronics engineers mostly contribute to the construction process on the basis of installation/insulation projects. This situation may limit the dominance and contribution of these occupational groups to the construction project processes. Therefore, it is thought that this situation is the main reason why the importance/priorities of civil engineers & architects & electrical-electronics engineers & mechanical engineers are different.

6. Conclusions

This study concluded that the main reason why the differences in the responses within the scope of the sector, experienced between the public and private sectors, is the working culture between these two sectors. It has been determined that four (skill, cooperation/coordination, quality/reliable information flow, barriers) of the 10 sub-dimensions of the ‘communication in the construction industry’ perspective are of high (H) importance. In terms of high-medium (H-M) importance reflecting a more minimal point of view, it is the general opinion that the construction industry is not affected much by the COVID-19 pandemic and that the pandemic process does not increase the use of technology (to facilitate communication) in the construction industry.

Moreover, it has been determined that three (hierarchical organizational structure, communication skills of the project manager, defining of duty-authority-responsibilities) of the 15 sub-dimensions of the ‘project-based communication’ perspective are of high (H) importance. In terms of high-medium (H-M) importance, it is the general opinion that the COVID-19 pandemic does not negatively affect the projects in the construction industry and does not cause irregular workflow. These findings support the minimal results previously obtained within the scope of communication in the construction industry. Therefore, the employees of the Turkish construction industry do not attribute the negativities experienced by the industry to the COVID-19 pandemic.

Finally, it has been determined that four (wrong project manager selection, lack of regular meetings, lack of comprehensive content, lack of success criteria) of the 12 sub-dimensions of the ‘management-based communication problems’ perspective compiled from the literature are high (H) importance. In terms of high-medium (H-M) importance, the inflexibility of the project manager and the fact that more than one project is carried out together are not considered significant. Comparing the results obtained from the study with the results of the national and international literature can be interpreted as the effects of poor communication do not show great differences on the basis of country and appear as similar problems. However, integrating the COVID-19 pandemic process in different dimensions into communication-oriented studies, which are limited, and examining it in terms of participants at different education levels will allow clearer comparisons to be made.

This study, which contributes to the determination of the effect of communication on project management processes in the construction industry during the COVID-19 pandemic process, has some limitations. The study has been limited in terms of geography and does not make any comparisons between countries or regions. Comparisons between developed and developing countries can be valuable for future studies, in order to understand the lessons learned. The survey of this study was applied to civil engineers, architects, electrical-electronics engineers, and mechanical engineers of construction sites and offices from Türkiye. The participation of different stakeholders such as occupational safety specialists, technicians, workers, material suppliers, etc. can also be ensured. Finally, the sample size of this study was obtained with a 95% confidence interval and a 7.87% margin of error. Therefore, these results may have been negatively/positively affected by the limited sample.

Declaration

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. The authors also declared that this article is original, was prepared in accordance with international publication and research ethics, and ethical committee permission or any special permission is not required.

Author Contributions

G. Yalçın collected the data of the survey study and wrote the manuscript. S. Bayram improved the study and made the proofreadings of the manuscript.

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