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Investigating the Impact of the Coronavirus Crisis on the Time Management of Construction Projects

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Abstract
Coronavirus (Covid-19) affected the most significant political, social, cultural, and economic systems in the world and caused a severe crisis in 2019. Given the unknown characteristics of the virus and the conditions of great uncertainty, it is not possible to consider an exact time for the end of this crisis. It has had various and severe impacts on all sectors, especially the economic system of the world. It has also caused great damage in terms of cost, time, economic growth, etc. The Coronavirus crisis has had very destructive and negative impacts on the construction industry (construction projects), as one of the most significant economic sectors in the world. The present study investigated the construction industry and construction operations to identify the causes of the damage caused by the outbreak of this disease. For this purpose, after library studies and a review of the study literature and background, interviews were performed with 30 experts and experienced managers, and the opinions of these experts were obtained. Finally, the factors of differences and disputes in construction projects were analyzed. A questionnaire consisting of 53 questions was designed according to the opinions of the interviewees. These factors were categorized into 4 primary categories: 1- People's characteristics 2- Factors affecting time 3- Factors affecting cost 4- Questions about the general impacts of Coronavirus on the project. Correlation analysis of the factors affecting its time and cost was done using Kolmogorov-Smirnov, Friedman, parametric, and non-parametric tests in SPSS Software. To identify the causes of the damages caused by the outbreak of the disease to control this crisis, to determine the damages and prevent the increase of costs, prioritizing the damages and classifying the problems were studied. Also, the results related to time showed that delay in payment was ranked first, banking formalities and closures were ranked second, and Coronavirus public holidays were ranked third. Since the level of significance in the variables of public holidays due to coronavirus (with a correlation coefficient of 0.344), prohibition of intercity traffic (with a correlation coefficient of 0.435), and delay in payments (with a correlation coefficient of 0.347) is less than 0.05, these variables increase the project time.

Key words; Coronavirus crisis (Covid-19), Construction industry, Construction projects, Time management, Cost management

Introduction

Large sums of money are spent on projects in Iran annually. However, owing to the problems, these projects are completed by spending more time and cost than their approved time and cost. A better view and attitude toward the control of project costs can be obtained by identifying and accurately evaluating the factors that affect the cost in each of the work areas of the project. It is possible to prevent the cost increase in the projects, the deficit in the project budget, the possible stoppage of the project, and the failure of the project goals by prioritizing the factors affecting the cost and considering the corrective solutions timely. Prioritizing factors will facilitate the speed of reaction to possible risks and the management of changes timely [1]. The best crisis management method is planning for better communication with people and coordinating with the hospital to take the

necessary steps [2, 3]. The second step is acceptance of unknown conditions and uncertainty, which is one of the primary characteristics of critical conditions and risk [4]. In this situation, it is not possible to access all the facts and this situation is temporary. In this situation, the best advice when facing such a situation is not to use sentences that indicate certainty and full knowledge of the current situation. “There is nothing to worry about” or “You are completely safe” are such sentences. Finally, careful communication and trust is an effective way to manage the situation. The situation can be improved in the light of sufficient knowledge and reliable sources. Time plays a vital role in crisis management, especially in hospitals. The appropriate time frame for critical situation response is 10 minutes. The 10-minute rule means that you should react to critical situations within ten minutes [5].

Crisis management is a practical and applied knowledge. By carefully examining past crises and with the help of data collection science, it finds an appropriate solution or a precise tool to cope with and prevent it [6]. According to Mohammadzadeh, it is generally a situation in which a person is unable to manage the situation by using common methods. Crisis management, as an effective and practical method, helps to control possible risks. The lack of proper and accurate management of disasters is associated with human and financial losses [7]. Jahangardi et al. examined the increase in population in big cities and the growing trend of construction. They found that the prevention of factors caused by natural disasters and crises was ranked first. They also found that solving the mentioned problem requires an investigation and attitude in crisis management in buildings [8]. In a study entitled “Crisis management in biological and bioterrorist”, Karami examined the impact of education and attention to personal and public health in controlling and reducing the possibility of damage to this group of diseases.

Crisis management of biological incidents requires proper planning and coordination between all organizations involved in the incidents, including emergency services, Red Crescent, police force, fire station, and healthcare system, and in acute conditions, cooperation of the military and mobilization forces to minimize the losses and damages [9]. In his study entitled "Nature's Crisis Disciplines: Does Environmental Communication Have an Ethical Duty?” Cox referred to the significance of ethical issues in coping with crisis management in nature [10]. Crisis management has a special impact on various aspects of a construction project, such as the safety of people's lives and controlling the time and costs of projects. Conducting studies to prioritize the damages caused to construction projects due to the Coronavirus crisis in terms of time is necessary since it is not possible to close some projects under construction. This study investigated the impact of the Coronavirus crisis on construction projects and provided solutions to cope with such crises. One of the primary parts of construction project management is project time management. The process of time management and estimating unpredicted costs is one of the primary solutions for the management of construction projects.

One of the primary characteristics of crisis management in the project is to reduce the overall execution and implementation time and increase the profit of the project. A major part of the capital of every country, especially developing countries, is allocated to its construction and infrastructure projects and one of the factors of economic growth and development of any society is the success in the implementation of its construction projects. Coronavirus has affected the most significant political, social, cultural, and economic systems in the world and caused a severe crisis. Given the unknown characteristics of the virus and the conditions of great uncertainty, it is not possible to consider an exact time for the end of this crisis. Hence, it is very valuable to examine the impact of this crisis management. Since there is no specific time for the end of this crisis, and time and cost management of these projects is considered one of the most significant factors, the present study sought to examine the impact of the Coronavirus crisis on construction projects and to prioritize the ways to cope with this crisis to minimize the damage to the projects.

Methods

The present study is applied in terms of aim, descriptive and survey in terms of method, and cross-sectional in terms of time. The statistical population of this study included the companies that have a portfolio of construction projects with a budget of over 2000 billion Rials. Based on the number of construction projects in the province, and based on the stratified sampling type, 30 projects were selected from interurban, center, and suburban of Isfahan province. A questionnaire was used to collect the data in this study. To confirm the face and content validities, an interview was conducted with 6 experts and professors of the construction project management group to get their expert opinions on how to write the questions, the number of questions, the content of the questionnaire, the relationship between the questions and the options, and the consistency of the questions with research objectives.

After reviewing and considering the opinions and suggestions, the final questionnaire was developed and submitted to the statistical sample of the study. To determine the reliability (internal consistency) of the questionnaire, the reliability of the questionnaire was calculated at 0.795 using Cronbach's alpha formula. In this study, two library and field methods were used to collect data. The library method was used to write the literature and theoretical sections of the thesis. In the field method, 30 construction projects in Isfahan province were used to collect the required data from the statistical population. Based on the statistical population, 30 questionnaires were collected for analysis to collect the data needed to analyze the research hypotheses. Calculations and analysis were done using Spss Software and the level of significance for all tests was considered at the $p > 0.95$.

Results

The results revealed that the frequency of the subjects aged 25 and 30, 30 and 40, between 40 and 50, and above 50 years is 7, 11, 6, and 6, respectively. The frequency of subjects with bachelor's, master's, and Ph.D. degrees is 17, 10, and 3, respectively. The frequency of the subjects with an employment history of below 5, between 5 and 10, between 10 and 20, between 20 and 30, and between 30 and 40 years, is 1, 9, 10, 7, and 3, respectively. The frequency of subjects with project manager, workshop manager, CEO, contractor, technical expert, supervisor, and employer is 5, 4, 4, 1, 6, 2, and 8, respectively. The frequency of subjects with direct construction and indirect construction operations and activities is 28 and 2, respectively. The frequency of subjects with government, semi-government, and private projects is 8, 8, and 14, respectively. Regarding the project site, 15, 3, and 12 subjects, respectively, were working in intercity, central, and suburban areas. The frequency of subjects who are responsible for project management is 20 with a percentage of 66.7 and the frequency of people who are not responsible for project management is 10 with a percentage of 33.3. The frequency of subjects who have low, moderate, high, and very high knowledge of project time is 1, 7, 11, and 11, respectively.

Table 1: Descriptive statistics of the impact of the coronavirus on increasing the time of construction projects

	Sample size	Mean	SD	Min	Max	Rank
Delay in payments	30	3.97	0.85	2	5	5.23
Banking and administrative formalities and closures	30	3.73	0.91	2	5	4.78
Public holidays due to coronavirus	30	3.7	0.95	2	5	4.75

The involvement of forces in the corona disease	30	3.57	1.04	2	5	4.47
Prohibition of intercity traffic	30	3.17	1.05	1	5	3.92
Implementation of night projects	30	2.43	1.30	1	5	2.67
The impact of predicting corona peaks on project time	30	3.22				
Approximate percentage of increase in project time	30	3.44				

Based on Table 2, a delay in payment with a mean rank of 5.23 was ranked first, banking and administrative formalities and closures with a mean rank of 4.78 was ranked second, public holidays due to coronavirus with a mean rank of 4.75 was ranked third, involvement of forces in coronavirus with a mean rank of 4.47 was ranked fourth, prohibition of intercity traffic with a mean rank of 3.92 was ranked fifth, and the implementation of night projects with a mean rank of 2.67 was ranked sixth in terms of importance. Given the mean of 3.44 for the approximate percentage of project time increase and questionnaire, a 60-200% increase in project cost is estimated. Given the mean of 3.22 for the impact of coronavirus peak production on project time, coronavirus peak production has a moderate to high impact on project time.

Table 2: Summary of Friedman's non-parametric test results related to the time of construction projects

N	30
Chi-square	64.289
Degree of freedom	6
Sig	0.001

Table (2) shows that the significance level is 0.001 and is less than 0.05. Thus, the order of importance for the components has a significant difference.

Table 3: Descriptive statistics of the impact of the coronavirus on increasing the time of construction projects inside and in the center of the city

	Sample size	mean	Median	SD	Min	Max
Delay in payments	18	3.89	0.9	2	5	4.89
Public holidays due to coronavirus	18	3.83	1.06	1	5	4.75
The involvement of forces in the corona disease	18	3.72	1.08	2	5	4.5
Prohibition of intercity traffic	18	3.38	1.07	1	5	4.25
Banking and administrative formalities and closures	18	3.72	1.04	2	5	3.61
Implementation of night projects	18	2.83	1.38	1	5	3.06
The impact of predicting corona peaks on project time	18	3.5				
Approximate percentage of increase in project time	18	2.05				

Based on Table 3, the delay in payment with a mean rank of 4.89 was ranked first, the public holidays

due to coronavirus with a mean rank of 4.75 was ranked second, the involvement of forces in Coronavirus with a mean rank of 4.5 was ranked third, the prohibition of intercity with a mean rank of 4.25 was ranked fourth, banking and administrative formalities and closures with a mean rank of 3.61 was ranked fifth, and the implementation of night projects with a mean rank of 3.06 was ranked sixth in terms of importance. Given the mean rank of 0.52 for the approximate percentage of time increase of projects, a 30-100% increase in project cost is estimated. Given the mean of 3.5 for the impact of predicting coronavirus peaks on the project time, this impact is at moderate and high levels.

Table 4: Summary of Friedman's non-parametric test results related to the time of intercity projects

N	18
Chi-square	36.704
Degree of freedom	6
Sig	0.001

Table (4) shows that the significance level is 0.001 and is less than 0.05. Thus, the order of importance for the components has a significant difference.

Table 5: Descriptive statistics of the impact of the coronavirus on increasing the time of construction projects in suburban areas

	Sample size	Mean	SD	Min	Max	Rank
Delay in payments	12	4.08	1.34	1	5	5.75
Banking and administrative formalities and closures	12	3.75	0.96	2	5	5.04
Public holidays due to coronavirus	12	3.5	0.78	2	5	4.75
The involvement of forces in the corona disease	12	3.33	1.14	1	5	4.42
Prohibition of intercity traffic	12	2.83	1.07	1	5	3.42
Implementation of night projects	12	1.83	0.87	1	5	2.08
The impact of predicting corona peaks on project time	12	3.5				
Approximate percentage of increase in project time	12	2.42				

Based on Table 4, the delay in payment with a mean rank of 5.75 was ranked first, the variable of banking formalities and closures with a mean rank of 5.04 was ranked second, and the public holidays due to coronavirus with a mean rank of 4.75 was ranked third, the involvement of forces in coronavirus with a mean rank of 4.42 was ranked fourth, prohibition of intercity traffic with a mean rank of 3.42 was ranked fifth, and the implementation of night projects with a mean rank of 2.08 was ranked sixth. Given the mean of 42.2 for the approximate percentage of increase in project time, a 30-100% increase in project cost is estimated. Given the mean of 3.5 for the impact of predicting coronavirus peaks on the project time, this impact is estimated at moderate and high levels.

Table 6: Summary of Friedman's non-parametric test results related to the time of suburban projects

N	12

Chi-square	32.509
Degree of freedom	6
Sig	0.001

Table (6) shows that the significance level is 0.001 and is less than 0.05. Thus, the order of importance for the components has a significant difference.

Table 7: Descriptive statistics of the impact of the coronavirus on increasing the time of government construction projects

	Sample size	mean	Median	SD	Min	Max	Rank
The involvement of forces in the corona disease	8	4.14	4	1.36	1	5	5.44
Delay in payments	8	4	4	1.13	1	5	5.38
Public holidays due to coronavirus	8	4	3.5	0.53	2	5	5.25
Banking and administrative formalities and closures	8	3.88	3.5	0.89	2	5	4.56
Prohibition of intercity traffic	8	2.75	3	1.55	1	5	3.5
Implementation of night projects	8	1.75	1.5	0.89	1	5	1.75
The impact of predicting corona peaks on project time	8	4.24					
Approximate percentage of increase in project time	8	2					

Based on Table 7, the involvement of forces in Coronavirus with a mean rank of 5.44 was ranked first, a delay in payment with a mean rank of 5.38 was ranked second, public holidays due to coronavirus with a mean rank of 5.25 was ranked third, banking formalities and closures with a mean rank of 4.56 was ranked fourth, prohibition of intercity traffic with a mean rank of 3.5 is ranked fifth, and the implementation of night projects with a mean rank of 1.75 was ranked sixth, respectively, in terms of importance. Given the mean of 2 for the approximate percentage of increase in project time, a 30-100% increase in project cost is estimated. Given the mean of 4.24 for the impact of predicting coronavirus peaks on project time, this impact is at a high and very high level.

Table 8: Summary of the results of Friedman's non-parametric test related to the time of government projects

N	8
Chi-square	29.328
Degree of freedom	6
Sig	0.001

Table (8) shows that the significance level is 0.001 and is less than 0.05. Thus, the order of importance for the components has a significant difference.

Table 9- Descriptive statistics of the impact of the coronavirus on increasing the time of semi-governmental construction projects

	Sample size	mean	Median	SD	Min	Max	Rank

Prohibition of intercity traffic	8	3.88	3.5	1.55	1	5	4.88
Delay in payments	8	3.88	4	1.13	1	5	4.75
Banking and administrative formalities and closures	8	3.75	3.5	0.89	2	5	4.44
Public holidays due to coronavirus	8	3.62	3	0.53	2	5	4.19
The involvement of forces in the coronavirus disease	8	3.5	3.5	1.36	1	5	3.88
Implementation of night projects	8	3.25	3.5	0.89	1	5	3.5
The impact of predicting corona peaks on project time	8	2.75					
Approximate percentage of increase in project time	8	2.38					

Based on Table (9), the prohibition of intercity traffic with a mean rank of 4.88 was ranked first, a delay in payment with a mean rank of 4.75 was ranked second, banking formalities and closures with a mean rank of 4.44 was ranked third, public holidays due to coronavirus with a mean rank of 4.19 was ranked fourth, the involvement of forces in coronavirus with a mean rank of 3.88 was ranked fifth, and the implementation of night projects with a mean rank of 3.5 was ranked sixth. Given the mean of 38.2 for the approximate percentage of increase in project time, a 30-100% increase in project cost is estimated. Given a mean of 2.75 for the impact of predicting coronavirus peaks on the project time, this impact is between moderate and low levels.

Table 10: Summary of Friedman's non-parametric test results related to the time of semi-government projects

N	8
Chi-square	11.344
Degree of freedom	6
Sig	0.001

Table (10) shows that the significance level is 0.001 and is less than 0.05. Thus, the order of importance for the components has a significant difference.

Table 11: Descriptive statistics of the impact of the coronavirus on increasing the time of private construction projects

	Sample size	mean	Median	SD	Min	Max	Rank
Delay in payments	14	3.93	4	0.99	2	5	5.43
Banking and administrative formalities and closures	14	3.64	4	1.08	2	5	5.11
Public holidays due to coronavirus	14	3.57	3	0.93	2	5	4.79
The involvement of forces in the corona disease	14	3.35	3	1.03	1	5	4.25
Prohibition of intercity traffic	14	3	3	0.78	1	5	3.61
Implementation of night projects	14	2.36	2	1.22	1	5	2.71

The impact of predicting coronavirus peaks on project time	14	3.57					
Approximate percentage of increase in project time	14	2.21					

Based on Table 11, a delay in payments with a mean rank of 5.43 was ranked first, banking formalities and closures with a mean rank of 5.11 was ranked second, public holidays due to coronavirus with a mean rank of 4.79 was ranked third, the involvement of forces in coronavirus with a mean rank of 4.25 was ranked fourth, prohibition of intercity traffic with a mean rank of 3.61 was ranked fifth, and the implementation of night projects with a mean rank of 2.71 was ranked sixth. Given a mean of 21.2 for the approximate percentage of increase in project time, a 30-100% increase in project cost is estimated. Given a mean of 3.57 for the impact of predicting coronavirus peaks on the project time, this impact is between moderate and high levels.

Table 12: Summary of the results of Friedman's non-parametric test of private projects for the project time

N	14
Chi-square	33.374
Degree of freedom	6
Sig	0.001

Table (12) shows that the significance level is 0.001 and is less than 0.05. Thus, the order of importance for the components has a significant difference.

Table 13: Correlation coefficient of the impact of Coronavirus on the cost of projects

		The percentage increase in the materials during the coronavirus outbreak	Approximate percentage of increase in the project cost
Delay in payments	The correlation coefficient	0.551	0.324
	Significance level	0.002	0.018
Banking and administrative formalities and closures	The correlation coefficient	0.377	0.506
	Significance level	0.04	0.004
Public holidays due to coronavirus	The correlation coefficient	0.364	0.446
	Significance level	0.048	0.014
Implementation of night projects	The correlation coefficient	-0.238	0.008
	Significance level	0.206	0.966
Prohibition of intercity traffic	The correlation coefficient	0.075	0.315
	Significance level	0.694	0.09

Personnel commuting costs	The correlation coefficient	0.295	0.064
	Significance level	0.114	0.738
Observing the protocols	The correlation coefficient	0.428	0.484
	Significance level	0.018	0.007

Based on Table 13, the level of significance in the variables of delay in payments, banking formalities and closures, public holidays, and observing the protocols is less than 0.05. Thus, these variables increase the cost of projects. However, the variables of implementation of night projects and prohibition of intercity traffic, and personnel commuting costs do not increase the cost of projects.

Table 14: Correlation coefficient of the impact of Coronavirus on the project time

		Approximate percentage of increase in project time
Delay in payments	The correlation coefficient	0.347
	Significance level	0.041
Banking and administrative formalities and closures	The correlation coefficient	0.188
	Significance level	0.320
Public holidays due to coronavirus	The correlation coefficient	0.344
	Significance level	0.047
Implementation of night projects	The correlation coefficient	0.027
	Significance level	0.889
Prohibition of intercity traffic	The correlation coefficient	0.435
	Significance level	0.016
The involvement of forces in the coronavirus disease	The correlation coefficient	0.321
	Significance level	0.052

Based on Table 14, the level of significance in the variables of public holidays due to coronavirus, prohibition of intercity traffics, and delay in payments due to coronavirus is less than 0.05. Thus, these variables increase the project time. However, the variables of banking formalities and closures, the implementation of night projects, and the involvement of forces in coronavirus do not increase the project time.

How different factors affect the project time

Based on the answers of the experienced managers, the following factors are mentioned:

1. 1-Closures and holidays directly 2- Delay in purchasing materials due to delay in financing 3-Conflict between employer and personnel 4- Due to non-payment by the employer and non-payment of salaries (being affected with coronavirus 2 times and more times caused the closure of the workshop for 5 weeks) 5-Due to the prohibition of intercity traffic and strikes, raw materials were not provided for the project 6-Difficulty in commuting of some personnel and contractors who were from nearby cities 7-The closure of banks and gas and electricity departments.
2. The absence of key people in the project due to the Coronavirus caused a delay in project decisions and activities.
3. Every person in the project will be quarantined for 15 days due to the disease. Thus, if the person is

not technical and replaceable and more people are infected, the project will be delayed.
4. The impossibility of intercity traffic of executive forces living outside of Isfahan city to the project due to the prohibition of traffic and exit from the city and thus the need to use alternative solutions for the lack of supply of concrete required by the Coronavirus Disease Headquarters, resulting in a delay in the concrete pouring dates and partial closure of the workshops at the mentioned times.
5. The coronavirus epidemic has had a significant impact on the time and costs of the project due to the restrictions imposed on traffic, and the increase in current costs (including the procurement of materials and wages).
6. The lack of presence of contractors due to traffic restrictions increases the project time.
7. 1-Provincial quarantines 2-Labor force shortage 3-Arrangement of forces based on observing the protocol.
8. Given the restrictions imposed by the headquarters for coping with the coronavirus, the lack of timely access to the necessary materials due to the impact of the coronavirus epidemic on the economy, and the intervening of some agents involved in the implementation under the pretext of the coronavirus and similar cases.
9. 1- The labor force has the greatest impact. Due to the chain-like nature of the works, a cycle will stop due to the absence of a force. 2-Contracts do not include public holidays. 3-Subcontractors delayed the project due to Coronavirus 4-Closure of factories
10. 1- Delay in delivery time by contractors 2- The work process has been delayed due to a delay in payment and procurement of raw materials. 3- The lack of providing cash timely by the employer.
11. 1- Non-presence of the employees of the project implementing companies at the project site 2- Impossibility of holding face-to-face meetings 3- Impossibility of intercity travel for the presence of experts of the implementing companies from other cities
12. Taking leave by personnel due to coronavirus.
13. Changes in prices and the lack of raw materials for the project at different times.
14. 1- Lack of cash (bank closure, disease of managers, etc.) 2-Contractors' inefficiency 3-Not supplying raw materials timely
The results related to the causes of the increase in the time of construction projects revealed that a delay in payments, banking, and administrative formalities and closures, public holidays due to coronavirus, involvement of forces in coronavirus, prohibition of intercity traffic, and implementation of night projects were ranked first to the eighth, respectively, in terms of importance. The time of these projects has increased by approximately 60-200%.
The results related to the causes of the increase in the time of construction projects inside and in the center of the city showed that a delay in payments, public holidays due to coronavirus, involvement of forces in coronavirus, prohibition of intercity traffic, banking, and administrative formalities and closures, and implementation of night projects were ranked first to eighth, respectively, in terms of importance. The time of these projects has increased by approximately 30-60%.
The results related to the causes of the increase in the cost of construction projects in suburban areas revealed that a delay in payments, banking, and administrative formalities and closures, public holidays due to Coronavirus, the involvement of forces in Coronavirus, prohibition of intercity traffic, and implementation of night projects were ranked first to eighth, respectively, in terms of importance. The time of these projects has increased by approximately 30-100%.
The results related to the causes for the increase in the time of government construction projects revealed that the involvement of forces in Coronavirus, a delay in payments, public holidays due to Coronavirus, banking, and administrative closure and formalities, prohibition of intercity traffic, and the implementation of night projects were ranked first to eighth, respectively, in terms of importance. The time of these projects has increased by approximately 30-100%.

The results related to the causes of the increase in the time of semi-government construction projects, prohibition of intercity traffics, a delay in payments, banking, and administrative formalities and closures, public holidays due to Coronavirus, the involvement of forces in coronavirus, and the implementation of night projects were ranked first to eighth, respectively, in terms of importance. The time of these projects has increased by approximately 30-100%.
The results related to the causes of the increase in the time of private construction projects, a delay in payments, banking, and administrative formalities and closures, public holidays due to Coronavirus, the involvement of forces in Coronavirus, prohibition of intercity traffic, and the implementation of night projects were ranked first to eighth, respectively, in terms of importance. The time of these projects has increased by approximately 30-100%.
Given the level of significance in the variables of public holidays due to Coronavirus, prohibition of intercity traffic and a delay in payments due to Coronavirus is less than 0.05; these variables increase the project time. However, the variables of banking, and administrative formalities and closures, the implementation of night projects, and the involvement of forces in coronavirus do not increase the project time.
According to the answers of the managers, these factors can increase the project time: 1- Direct closures 2- A delay in the purchase of materials 3- prohibition of traffic and strikes cause a delay in providing materials for the project 4- The problem of commuting the personnel and contractors, especially projects implemented in suburban areas 5-banking and administrative formalities and holidays 5-absence of key people in the project 6-labor shortage 7-Provincial quarantines 8-contracts that do not include holidays 7-Closure of factories 9-The lack of providing cash on time 10-Leaves taken during coronavirus due to fear or disease of oneself or family members
The solutions that prevent the increase in project time according to the answers of managers are: 1-Supplying similar technical forces 2-Having a suitable plan in case of lack of force supply to different departments 3-Observing the protocols and trying to minimize the affected people 4-Providing surplus and cash timely 5-Purchasing and depot of materials 6-Training of personnel 7-Increasing working hours (adding shifts) 8-Increasing contractor teams 9-Dividing forces in different shifts
General solutions to deal with this crisis based on the managers' answers can be mentioned as follows: 1-Complete vaccination 2-Personnel training 3-observing health protocols 5-Prioritizing people's lives over money and work 6-Having alternative forces 7-Utilizing new technologies and working industrially instead of traditionally (utilizing machines instead of people, using prefabricated, etc.).

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