



## The Impact of COVID-19 on Contracts and Claims for Infrastructure Projects

**Mona Adam**

Sudan University of Science and Technology, Khartoum, Sudan  
monaadam2004@yahoo.com

**Amani Mohammed**

Redes Company, Khartoum, Sudan  
amanimohamed5449@gmail.com

### Abstract

Infrastructure projects have greatly affected the economy of countries, as they have contributed to supporting all economic sectors by providing them with many executive and operational projects. Despite the important role of infrastructure projects in Khartoum State, they are exposed to problems at various stages due to the Covid-19, which led to the failure to complete these stages. This study aimed to identify the extent of the impact of the Covid-19 on infrastructure projects in the Khartoum state and its relationship to claims and construction contracts in terms of costs, time and risks, and who bears and how to distribute the burden of additional costs and losses resulting from this pandemic, and how to contain and overcome the crisis and how to avoid the emergence of conflicts. The survey's descriptive approach was adopted by designing a questionnaire and distributing it to the affected sample. The questionnaire was collected and analyzed using the statistical analysis program and Excel. The results showed revenue losses for the public and private sector by 63.1%, and the Covid-19 also affected infrastructure projects in financial terms by 55%, and the prices of construction materials and direct and indirect costs by 50%, and the cash flow of projects by 49.2%. Based on these results, proposed solutions have been developed to improve the current situation, by standardizing the project cost in dollars to avoid exchange rate hesitation and following FIDIC contracts and formulating it to redress the damage in all sectors, which helps in improving the performance of projects in Khartoum state, which is trying to pass this unprecedented period.

**Keywords:** Contracts; Claims; Disputes; Costs; Time; Covid-19 and risks

### 1 Introduction

The construction industry is one of the important industries in the economies of any country, as the building and construction sector is defined as the sum of activities related to the planning, design and implementation of construction projects for various social and economic sectors in the country of all kinds, as well as private sector buildings and infrastructure such as roads, bridges, tunnels, ferries, sewage networks and all similar facilities. Infrastructure has significantly affected the economy of countries, as it has contributed to supporting all economic sectors by providing them with many executive and operational projects, which have contributed to supporting individual and industrial production and increasing the provision of employment opportunities for individuals. It also saved from public domestic spending, especially after it was able to establish roads that helped transportation to move correctly and at high speed, and it also

worked on the construction of railways, which linked many cities, saving transportation expenses, and encouraging the role of investment projects in the advancement of society.

The outbreak of the new Covid-19 has affected many sectors and industries in the world, including the construction industry, as many engineering companies have been forced to reduce their operations, and follow new practices in order to deal with the decline in demand for real estate, as well as the presence of new safety standards, and the increase in the number of employees working from home. Construction projects are likely to move at a slower pace than usual during the Covid-19, due to challenges and new practices across the supply chain, and suppliers may face challenges represented by re-lockdown, reducing operations. On the other hand, engineering companies will continue to adhere to practices imposed by the pandemic, such as social distancing, sterilization, and other changes that companies in various industries have been forced to adhere to.

The impact of Covid-19 included basic elements of construction projects, including environmental. We hope this paper provides an overview of the processes for managing the completion time and managing the time of the session, which includes: Identification of activities, sequence of activities, estimation of activity responses, estimation of periods timeline for activity, set the schedule of, monitor the schedule in addition to risk, as it has a negative impact on at least one of the project's goals, such as scheduling, cost, quality and occupational safety.

## **2 Data Collection Methods**

The descriptive analytical method was used, due to its suitability for this type of study. The data was collected through secondary and primary sources. Secondary sources have included many previous studies in this area, as well as numerous references, reports, scientific papers and some related websites on the Internet. As for the primary data, it was obtained through the design of a questionnaire distributed to a random sample of consulting offices and construction companies.

## **3 Questionnaire Design**

The questionnaire was designed to identify the most important problems facing contracting companies, institutions and consulting companies from the impact of the Covid-19 on infrastructure projects in Khartoum State, where the questionnaire consists of two parts:

Part I: General information, academic qualification, nature of work, type of work, years of experience and average projects implemented annually.

Part II: Questions about the impact of the Covid-19 on infrastructure project claims and contracts in Khartoum State from the design stage to the final delivery of the project and how to resolve disputes resulting from contracts and claims in terms of costs, time and risks.

After receiving the questionnaire forms after filling them out, the statistical analysis of the results of the questionnaire was carried out, where the statistical program for social sciences was approved.

## **4 Study Population and Sample Selection**

The research sample is a subset of the study population and represents the basic characteristics of the community, so it is selected in an appropriate way to obtain accurate results on the subject of the study and thus circulate it to the study community as a whole, the researcher saw that the research sample within a group of consultants and contractors in various fields of construction and the study community is represented in the registered membership in the council of organizing houses of expertise for consulting services and the council for the regulation of engineering contractors, and the sample was randomly selected scientifically so that it represents the study community in a Correct way.

## 5 Data Analysis

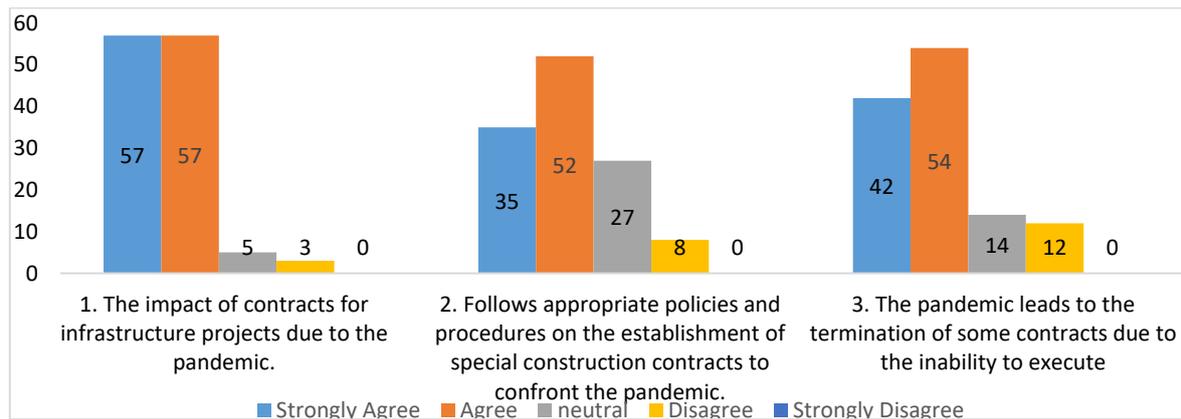
To achieve the objectives of the study and verify its hypotheses, the following statistical methods were used:

Graphs, frequency distribution of answers, percentages, Cronbach's alpha coefficient to calculate the stability coefficient, arithmetic mean, standard deviation and median, relative importance coefficient, chi-square test to indicate differences between answers. To obtain as accurate results as possible, the statistical program SPSS was used and the Excel program was used to implement the graphs required in the study.

## 6 Analysis and Discussion f Results

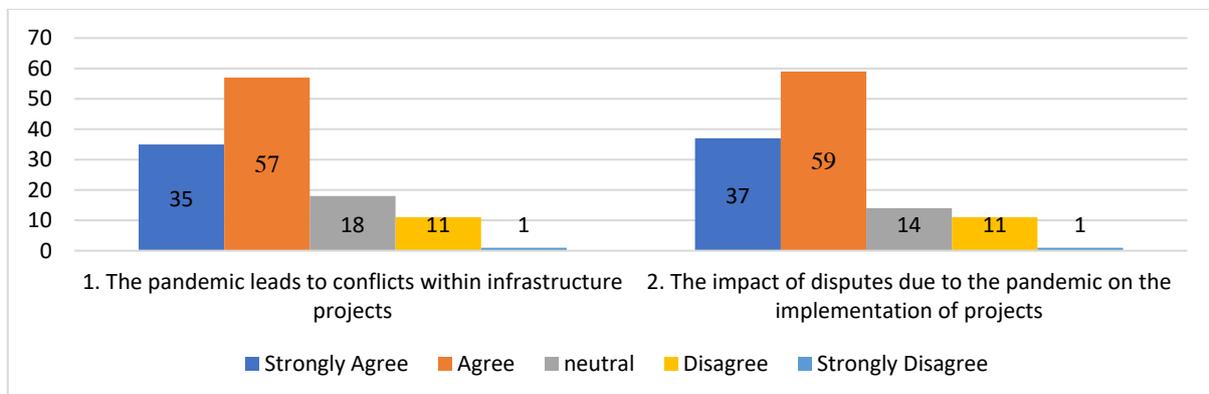
- **Academic Qualification:** 11 Diploma, 73 Bachelor, 32 Master and 6 Doctorate.
- **Nature of work:** 49 Owner, 44 Contractor and 29 Consultant.
- **Type of Work:** 116 Public Sector and 6 Private Sector.
- **Years of work experience:** 24 Less than 5 years, 35 between 5-10 years, 31 between 11-15 years, 20 between 16-20 years and 12 more than 20 years.
- **Average Number of Projects Implemented Annually:** 43 Less than 5, 41 from 5-10, 10 from 11-15, 11 from 16-20 and 17 more than 20.

### *The First Axis: The Impact of Covid-19 in Terms of Contracts*



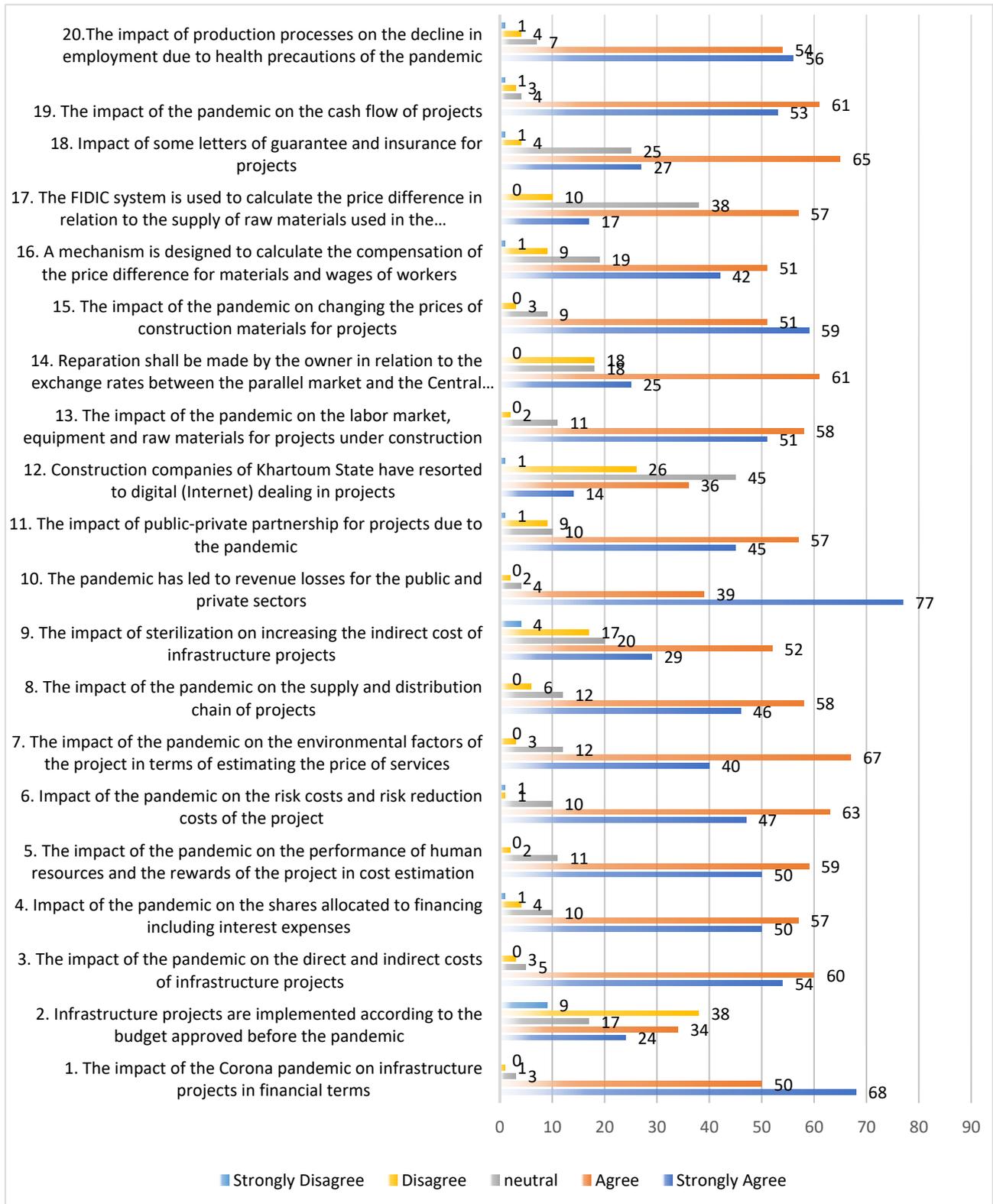
**Fig. 1:** Shows the Frequency Distribution of the Responses of the Study Members to the Statements of the First Axis

### *The Second Axis: The Impact of the Covid-19 in Terms of Conflicts*



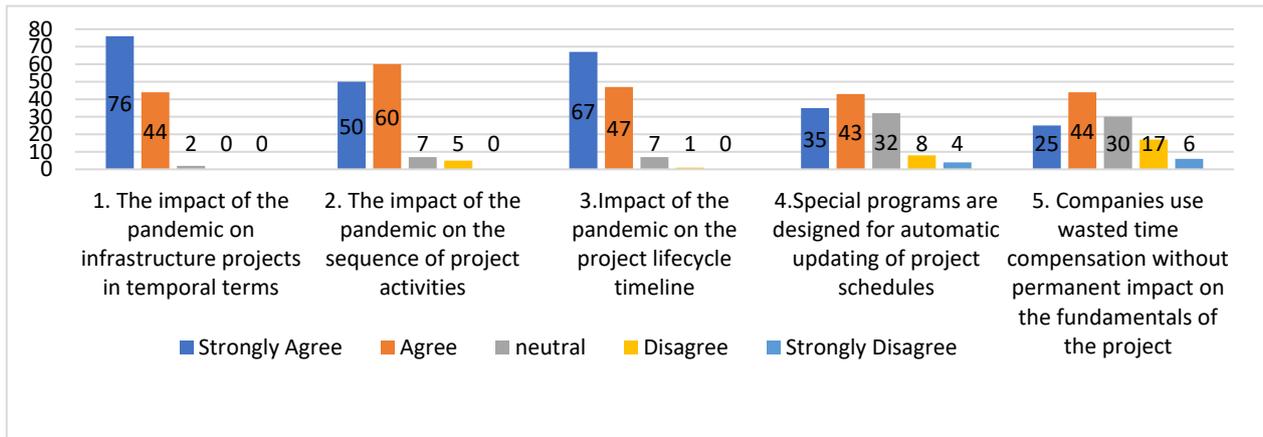
**Fig. 2:** Shows the Frequency Distribution of the Responses of the Study Members to the Statements of the Second Axis

**The Third Axis: The Impact of the Covid-19 in Terms of Costs and Claims**



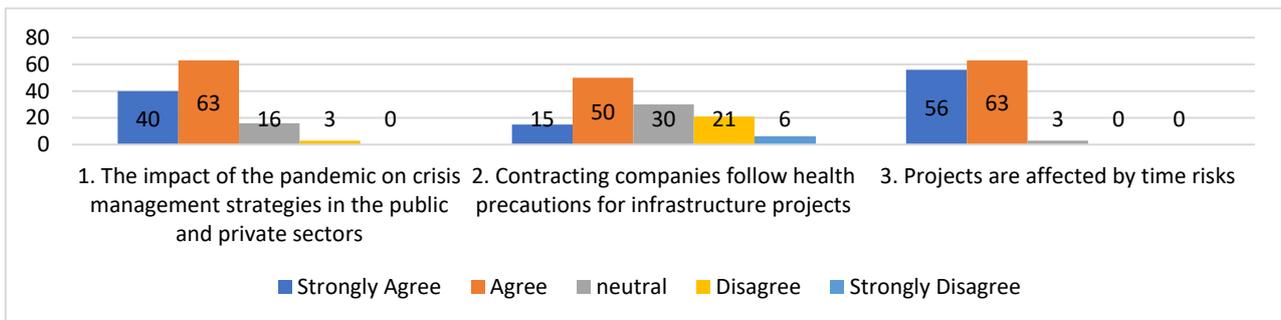
**Fig. 3:** Shows the Frequency Distribution of the Responses of the Study Members to the Statements of the Third Axis

**The Fourth Axis: The impact of the Corona Pandemic in terms of Time**



**Fig. 4:** Shows the Frequency Distribution of the Responses of the Study Members to the Statements of the Fourth Axis

**Fifth Theme: The Impact of the Covid-19 in terms of Risks**



**Fig. 5:** Shows the Relative Distribution of the Responses of the Study Members to the Statements of the Fifth Axis

**Hypothesis testing**

**The first hypothesis** (there is an impact of the Covid-19 on infrastructure project contracts and claims in terms of costs, time, risks and their direct and indirect effects) The chi-square test was used to indicate the differences between the answers to each of the questionnaire statements, the following table summarizes the test results for these statements.

**Table 1:** Results of the Initial Hypothesis Test

Axis	Ferry	Arithmetic mean	Standard deviation	Phrase measurement		Kai's moral value
				Weight	Grade	
The impact of the Covid-19 in terms of costs and claims	The impact of the Covid-19 on infrastructure projects financially	4.52	.592	5	Strongly agree	.000
	Infrastructure projects are implemented according to the budget approved before the Covid-19	3.21	1.281	3	neutral	.000
	The impact of the Covid-19 on the direct and indirect costs of infrastructure projects	4.35	.679	4	Ok	.000

The impact of the Covid-19 on the shares allocated for financing, including interest expenses	4.24	.803	4	Ok	.000
The impact of the Covid-19 on the performance of human resources and rewards for the project in estimating the cost	4.29	.698	4	Ok	.000
The impact of the Covid-19 on risk costs and risk reduction costs for the project	4.26	.714	4	Ok	.000
The impact of the Covid-19 on the environmental factors of the project in terms of estimating the price of services	4.18	.704	4	Ok	.000
The impact of the Covid-19 on the supply and distribution chain of projects	4.18	.803	4	Ok	.000
The effect of sterilization on increasing the indirect cost of infrastructure projects	3.70	1.082	4	Ok	.000
The Covid-19 led to revenue losses for the public and private sectors	4.57	.643	5	Strongly agree	.000
The impact of public-private partnership for projects due to the Covid-19	4.11	.902	4	Ok	.000
Construction companies in Khartoum State resorted to digital dealing (Internet) in projects	3.30	.959	3	neutral	.000
The impact of the Covid-19 on the labor market, equipment and raw materials for projects under construction	4.30	.701	4	Ok	.000
The damage is repaired by the owner for the exchange rates between the parallel market and the Central Bank of Sudan in the supply of imported raw materials and foreign labor	3.76	.945	4	Ok	.000
The impact of the Covid-19 on changing the prices of construction materials for projects	4.36	.728	4	Ok	.000
A mechanism is designed to calculate the price difference compensation for materials and workers' wages	4.02	.936	4	Ok	.000
FIDIC system is used to calculate the price difference for the supply of raw materials used in the implementation of projects	3.66	.819	4	Ok	.000
The impact of some letters of guarantee and insurance for projects	3.93	.794	4	Ok	.000
The impact of the pandemic on the cash flow of projects	4.33	.732	4	Ok	.000
The impact of production processes on the decline in employment due to the health precautions of the pandemic	4.31	.793	4	Ok	.000
Total	4.07	0.376	4	Ok	.000

The impact of the Corona pandemic in terms of time	The impact of the pandemic on infrastructure projects in terms of time	4.61	.523	5	Strongly agree	.000
	The impact of the pandemic on the sequence of project activities	4.27	.750	4	Ok	.000
	The impact of the pandemic on the project lifecycle timeline	4.48	.646	5	Strongly agree	.000
	Special programs are designed for automatic updating of project schedules	3.80	1.036	4	Ok	.000
	Companies use lost time compensation without a lasting impact on the fundamental factors of the project	3.80	1.115	4	Ok	.000
	Total	4.14	0.536	4	Ok	.000
The impact of the Corona pandemic in terms of contracts	Impact of Infrastructure Project Contracts Due to the Pandemic	4.38	.684	4	Ok	.000
	Follows appropriate policies and procedures on the establishment of special construction contracts to confront the pandemic	3.93	.879	4	Ok	.000
	The pandemic leads to the termination of some contracts due to lack of implementation	4.03	.927	4	Ok	.000
	Total	4.11	0.622	4	Ok	.000
The impact of the Corona pandemic in terms of conflicts	The pandemic leads to conflicts within infrastructure projects	3.93	.934	4	Ok	.000
	The impact of disputes due to the pandemic on the implementation of projects	3.98	.927	4	Ok	.000
	Total	3.95	0.873	4	Ok	.000
The impact of the Corona pandemic in terms of risks	The impact of the pandemic on crisis management strategies in the public and private sectors	4.15	.735	4	Ok	.000
	Contracting companies follow health precautions for infrastructure projects	3.39	1.064	4	Ok	.000
	Projects are affected by time risks	4.43	.545	4	Ok	.000
	Total	3.99	0.550	4	Ok	.000
Total all Ferries		4.06	0.445	4	Ok	.000

From the results in the Table 1, we notice that the arithmetic means of all hypothesis statements range between (3.95-4.14), the standard deviation of these phrases ranges between (0.873-0.376) and this indicates the homogeneity of the respondents' answers towards the phrases (whenever the standard deviation is small, this indicates the homogeneity of the answers of the study members). (There is an impact of the Corona pandemic on the contracts and claims of infrastructure projects in terms of costs, time, risks and their direct and indirect effects), and the table above indicates that the value of the Kai-squared probability to indicate the differences between the answers of the study members were (0.000) and this value is less than the level of significant (0.05), and this indicates that there are statistically significant differences between the answers and in favor of the approvers, meaning that there is an impact of the Covid-19 on contracts and claims of infrastructure projects in terms of costs, time, risks and their direct and indirect effects.

**The second hypothesis** (there are treatments for conflict resolution in infrastructure projects according to the existing variables and the effects of the Covid-19 on them).

**Table 2:** Second Hypothesis Test Results

Ferry	Arithmetic mean	Standard deviation	Phrase measurement		Level of significance
			Weight	Grade	
Reparation is made by the owner in relation to the exchange rates between the parallel market and the Central Bank of Sudan in the supply of imported raw materials and foreign labor	3.76	0.945	4	Ok	.000
A mechanism is designed to calculate the price difference compensation for materials and workers' wages	4.02	0.936	4	Ok	.000
FIDIC system is used to calculate the price difference for the supply of raw materials used in the implementation of projects	3.66	0.819	4	Ok	.000
Companies use lost time compensation without lasting impact on the fundamental factors of the project	3.53	1.115	4	Ok	.000
Follows appropriate policies and procedures on the establishment of special construction contracts to confront the pandemic	3.93	0.879	4	Ok	.000
Total	3.78	0.608	4	Ok	.000

From the results in Table 2, we note that the arithmetic means of all hypothesis statements range between (3.53-4.02), while the standard deviation of these statements ranges between (0.819-1.115) and this indicates the homogeneity of the respondents' answers towards the statements (whenever the standard deviation is small, this indicates the homogeneity of the answers of the study members). (There are treatments for conflict resolution in infrastructure projects according to the variables currently present and the effects of the pandemic on them), we note that the value of the Kai-square probability to indicate the differences between the answers of the study members was (0.000) and this value is less than the level of significance (0.05) and this indicates that there are differences statistically significant between the answers and in favor of the approvers, that is, there are treatments for conflict resolution in infrastructure projects according to the variables currently present and the effects of the Covid-19 on them.

## 7 Conclusion

The study presented in this paper showed the reality of the impact of the Covid-19 on the contracts and claims of infrastructure projects in Khartoum State and the obstacles facing local and foreign construction companies to confront the Covid-19 in terms of costs, time, risks and how to resolve disputes, the results of the survey and analysis of the results of the questionnaire showed the order of problems in terms of importance. The order of problems will be from the most important to the least important.

- As for costs and claims, the Covid-19 led to revenue losses of 77% for the public and private sectors, and affected infrastructure projects financially by 68%. Covid-19 also affected the changing prices of construction materials by 59.0% and 54.0% on direct and indirect costs and also affected the cash flow of projects by 53.0%.

- In terms of **time** impact, Covid-19 affected infrastructure projects by 76.0%. Covid-19 affected the project lifecycle timeline by 67.0%, and by 50.0% on the sequence of activities of the project.
- Conflicts affected the implementation of some projects by 59.0%; Covid-19 lead to conflicts within infrastructure projects by 57.0% for infrastructure projects.
- As for the risks of the Covid-19 affecting crisis management strategies in the public and private sectors by 63.0%, construction companies follow health precautions by 50.0% for infrastructure projects.

## Recommendations

- It is necessary for institutions and companies operating in the construction industry to unify the cost of the project in dollars to avoid exchange rate hesitation.
- Follow the FDIC formula to compensate for damage in all sectors, design a special contract formula to combat the epidemic and similar force majeure, adopt FIDC contracts instead of standard contracts followed, make epidemic safety measures for construction projects, resort construction companies to deal digitally in projects.

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**Cite as:** Adam M. & Mohammed A., "The Impact of COVID-19 on Contracts and Claims for Infrastructure Projects", *The 2<sup>nd</sup> International Conference on Civil Infrastructure and Construction (CIC 2023)*, Doha, Qatar, 5-8 February 2023, DOI: <https://doi.org/10.29117/cic.2023.0031>