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Impact of Corona Virus on Constriction Projects

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Abstract:
Construction Industry has a vital role in the economic development of any country. Construction time serves as a benchmark for assessing the performance of the construction projects. Due to unforeseen problems encountered during Conception, designing and construction phase often led to unwanted delay in projects completion.
Corona COVID-19 continues to spread around the world; it has an impact on construction projects performance. Parties of construction projects should keep in mind as they evaluate their response to project delays and closures, safety concerns and workforce unavailability. The paper illustrates brief guidance for Covid-19 Workforce Protection. It also highlights the impact of corona precautions on economics and construction projects. It also discusses delay in construction projects regarding corona spread. Through the results of the questionnaire and interviews with experts, recommendations are offered to minimize corona COVID-19 effects. According to the questionnaire results, the top causes of delay are cleared.

Keywords: *Pandemic, coronaviruses, Covid-19, gross domestic production, delay, workforce, construction sector.*

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I. Introduction

Services are of the most crucial sectors in gross domestic product GDP. It is around 50% of total GDP in Egypt, which is one of the largest economies in the Arab world. Some sectors will be severely affected by the crisis such as tourism, restaurants and the entertainment industry .

The economy of Egypt developed 5% year-on-year in the first quarter of 2020, below a 5.6% growth in the previous period.The Gross Domestic Product in Egypt reach 303.20 billion US dollars in 2019.This value represents 0.25 percent of the world economy.The global pandemic and containment measures the Egyptian authorities began imposing in March caused a slowdown[1] in economic activities, including tourism, manufacturing, and wholesale & retail trade, according to a preliminary report issued by the Ministry of Planning and Economic Development.Fig.1 illustrate the development of Egyptian economy[1] for the period 2017-2020 .

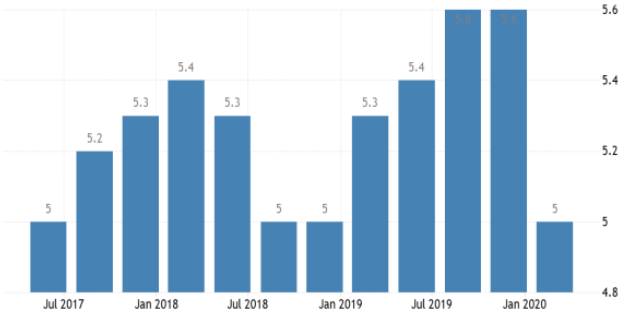

Fig.1: Development of Egyptian economy[1] for the period 2017-2020

II. Background

COVID-19 is a family of viruses that cause illness in animals or humans. The known coronaviruses cause infections ranging from cold to more severe diseases such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). This virus COVID-19 began to spread in China in December 2019. It is now a pandemic affecting many countries around the world.

People catch COVID-19 from others who have the virus. It spreads primarily from person to another through droplets from the nose or mouth. Therefore, it is possible to catch COVID-19 if anyone breathes these droplets from a person infected with the virus. For this, it is important to keep a distance of at least 1 meter or more away from others. Also, these droplets can land on objects and surfaces around the person such as tables, doorknobs and handrails and People can become infected by touching these objects or surfaces, then touching their eyes, nose or mouth.

III. Covid-19 Workforce Protection Guidance

As corona spread, the construction sector is affected due to the application of government regulations for safety. Construction authorities and construction companies have published guidance to assist companies in the Construction sector to access safety for workers. The instructions in this guide aim to give advice and instructions to be considered. It includes recommendations on the information that should be adopted. The main items of the guidance include the following[2]:

1. Construction sites operating during the Coronavirus (Covid-19) pandemic need to ensure they are protecting their workforce and minimizing the risk of spread of infection.
2. The social distancing of One-meter plus is required between workers when work. This is especially important if you are standing by someone who is coughing or sneezing.
3. The latest peak times for public transport should be considered to fix the working hours
4. People can work from home as it is possible.
5. If it is impossible to work from home, workers(including construction workers, manufacturing, etc...), should travel to their workplace in the open space.
6. If the work cannot be done safely, it should be stopped and terminated.
7. Any worker sense a high temperature, cough, change in the typical taste or smell while working, they should immediately return home and get a COVID-19 test and follow the health instructions

Therefore, as COVID-19 spread 'the construction sector is affected due to the application of government regulations for safety and this results in shortages of labor, shortages of plant and materials arise due to delays in their importation or transportation, or the closure of the plant and the contractor may not be able to carry out the works as a result of action by governments to minimize the spread of the COVID-19.

IV. Impact of corona precautions on economics and construction projects

Construction is one of the riskiest industries as it is affected by foreseeable and unforeseeable circumstances. These circumstances may lead projects to turn from a profitable to unprofitable status and vice versa

Since the World Health Organization (WHO) announced COVID-19 outbreak as a pandemic, many countriesdeclare a complete national lockdown after many remarkableCOVID 19 cases. These decisionsrestrict the movement of people and result in a complete shutdown of many businesses across many sectors. The construction projects suffer from the impact of Corona covid,19

These impacts are mainlyeconomic impact and human resources impact. Millions of people in the different economic sectors around the world have lost their jobs as result of COVID-19 crisis.

The construction contracts can reduce the effects of such circumstances to a great extent by nominating many potential risks as possible in the contract. For this, different international institutions have formulated standard forms and conditions for construction contracts.

V. Corona Virus and construction contracts

Many standard forms of construction projects contracts[13,14]that are used worldwide of which are:

- Institution of Civil Engineers (ICE).
- The Joint Contracts Tribunal (JCT).
- FédérationInternationale des Ingénieurs – Conseils FIDIC; and
- The New Engineering Contract (the NEC3).

These standard forms of contracts proved their success worldwide as they have a positive impact on managing the time and the cost of construction projects. In Egypt, it is not common to use standard forms, but for large construction projects, FIDIC conditions are employed. Whether operating under FIDIC [Red book], JCT or NEC, claims for time and money related to COVID-19 will be subject to the usual standards by which such claims are measuredand governed by the Egyptian low and civil code for buildings construction.

As impact of corona, we have the following alternatives:

1. Extension of project time with no cost for this extension..
2. Extension of time plus additional cost for material damage.

3. Suspension of work for short period for the whole activities and compensation forlaboers.
4. Termination of work activities.
According to Corona severityand the project nature one of the mentioned alternatives is adopted.

VI. Delays in Construction Projects

Delay as one of the biggest problems facing the construction industry. It results in failure of one or more of the contract parties of the project in achieving their responsibilities in the contract within the project specified period. It is important to study the reasons associated with a delay with respect to the contractor, consultant, or owner.

Delay is defined[4,5]as anact or event which extends the required time to perform or complete work of the contract manifests itself as additional days of work.
Delay is also defined[6]as a situation in which a project due to some causes related to the contractor, consultant, and client or other causes has not been finished in (contractual or agreed) period.

While others defined delay[7]as the contractor's failure to complete the work within the period specified in the contract and not have to complete the work in accordance with the specifications prepared by the employer.

Classification of Delay

Delay as one of the biggest problems facing the construction industry. It results in failure of one or more of the contract parties of the project in achieving their responsibilities in the contract within the project specified period. It is important to study the reasons associated with a delay with respect to the contractor, consultant, and owner. According to[8,9,10]there are twocategories of delays used in determining delay damages.

Non-Excusable Delay

This kind of delay is caused by the contractors or its suppliers. The contractor is generally not entitled to relief and must either make up the lost time through acceleration or compensate the owner. This compensation may come about through either liquidated damages or actual damages.

Excusable Delays

Excusable delays can be divided into non-compensable delays and compensable delays.

Non-Compensable Delays

These are caused by third parties or incidents beyond the control of both the owner and the contractor. This includes acts of God, unusual weather, strikes, fires,etc. In this case, the contractor is normally entitled to a time extension but no compensation for delay damages.

Compensable Delays

Generally, a compensable delay is caused by the owner. These delays can occur under different situations such as the late release of drawings from the owner's architect. This usually leads[7,8,9] to a schedule extension and exposes the owner to financial damages claimed by the contractor**.**

VII. Causes of delay

Delays can be minimized only when their causes are identified. Knowing the cause of any particular delay in a construction project would help to avoid it. The literature review identified more than 80 delay factors (general and applicable to most projects), grouped undermajor categories ofwhich are:project-related; client-related; design team-related; contractor-related;materials; labor; plant/equipment; and external factors.

Data Collection

In this paper,questionnaire was used as the method to collect the data. The questionnaire method was chosen because the method was considered as the best and easiest method to collecting the data needed. In addition, interviews are made with experts, owners and contractors are made fordiscussions. Through the use of questionnaire results and interviews, information can be readily obtained.
The questionnaire contents
The questionnaire was divided into major parts as follow:
The first partfocuseson questions to determine the respondent's information.
The second part includes questions about the respondent's background andknowledge about Covid19.
The third part was designed to have the impact of corona on construction projects and delay causes.
The fourth part was to design to get the opinions of construction stakeholders regardingcauses of construction delay.
The last partillustratesquestions for the opinion to minimize the effect of Covid,19.

Sample Size

Before sendingthe questionnaire to respondents,a pilot study was conducted to ensure that the celerity of the questionnaire questions.Then, the questionnaire is electronic mailed to 89 owners, contractors or, consultants,…..etc.

The questionnaire isdesigned and basedon the 5 pointsLikert Scale that measures from 1-5 according to the level ofcontribution and impact of each factor as illustrated in table 1:

Table 1: Measure for questionnaire answers

	Strongly Agree	**Agree**	**Moderate**	**Disagree**	**Strongly Disagree**
Degree	85-100	60-84	45-59	30-44	Less than30

Cronbach Alpha Test

Before the results obtained from the questionnaires received were being analyzed, aCronbach analysis was carried out to ascertain the reliability of the questions. This is a testof reliability that measures the internal consistency of the questions using the Likertscale. That is the questions were correlated to each other as a group. This reliability testwas conducted for the four different sections, as indicated on the research objectives. Theresults were represented on the table below.The results from the Cronbach analysis indicate that all the items for the sections arecorrelated. There are internal consistency and the item's functions as a group for eachsection. This is because the Cronbach Alpha coefficient for each group of questions ishigh and close to 1.Therefore we concluded that our test and questions were reliable.

Analysis of Questionnaire Answers

From the analysis of questionnaire answersand using Statistical Package for Social Science-SPSS 22 and according to the following indices:

i. Frequency Index:

Frequency Index (F.I) (%) =Σa (n/N) ∗1\100(1)

Where:

F.I Frequency Index .

aweight of each choice

n :member of answers for each factor

N : Total number of answers

ii.Severity Index

Which is a measure of severity degree :

Severity Index: (S.I) (%) =Σa (n/N) ∗1\100(2)

Where:

(S.I) :Severity Index:

a :Weight of each factor.

n :Number of respondents

N : Total number of answers

iii.Importance Index

Importance Index (IMP.I.)(%) = [F.I (%) ∗S.I (%)]/100.(3)

Where:

(IMP.I) :Importance Index .

(F.I): Frequency Index .

(S.I): Severity Index .

Distribution of respondents answers according to position

Table2, Figure 2aillustrate the distribution of respondents according to position

Table2: Distribution of respondents according to position

	Owners and owners team	Contactors and contractors team	Consultant and consultant team	Project managers	Engineers	Total
No.	9	12	7	10	23	61
Percentage	14.75	19.67	11.48	16.4	37.6	100

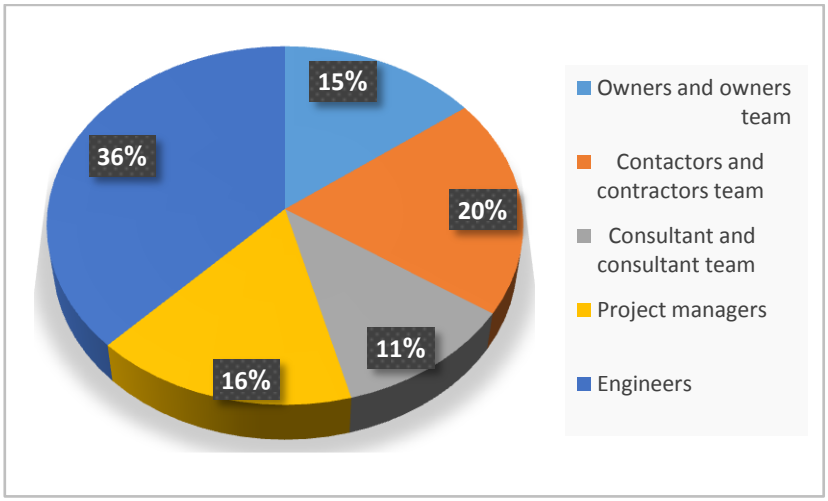

Fig.2a: Distribution of respondents according to position

Distribution of respondents according to education.

Table3, Figure2b illustrate thedistribution of respondents according to education.

Table3: Distribution of respondents according to education

Education	Ph.D.	M.Sc.	B.Sc.	Others	Total
No.	3	2	39	17	61
percentage	4.92	3.28	63.93	27.87	100

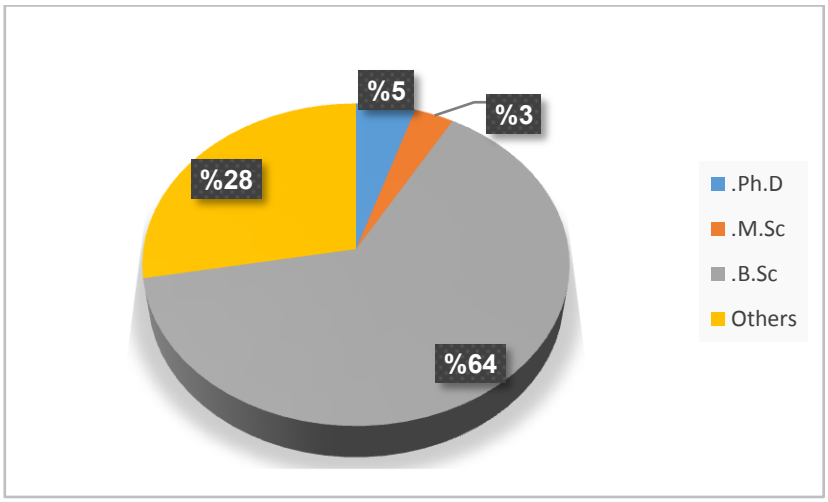

Fig.2b: Distribution of respondents according to education.

Distribution of respondents according to years of experience

Table 4, Figure2c illustrates thedistribution of respondents according to years of experience.

Table 4: Distribution of respondents according to years of experience

years	1-5years	More than5-10	More than10-20	More than15-20	More than20	Total
Frequency	6	8	11	19	17	61
Percentage	9.83	13.12	18.03	31.15	27.87	100

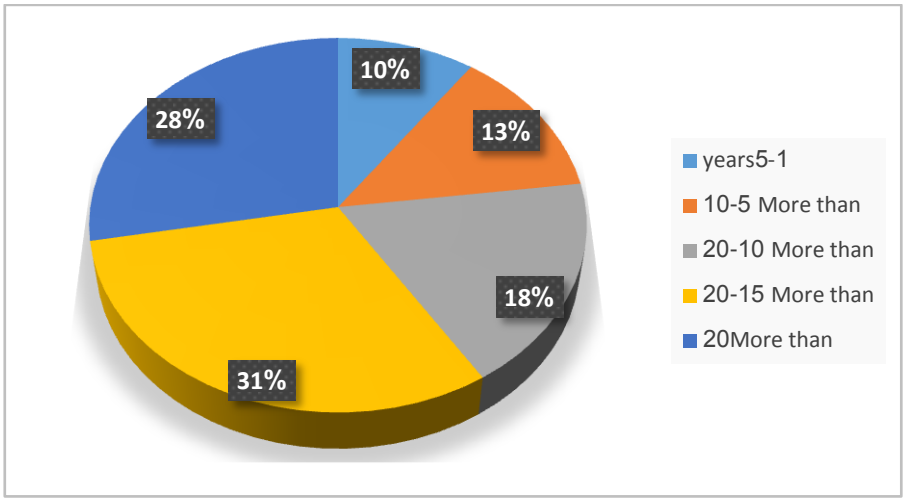

Fig.2c: Distribution of respondents according to years of experience

From the above questionnaire analysis, Table 5illustrates the top15causes leading to delay in construction projects.

Table (5): The severity of the main fields of the delay of the construction projects.

No	The field	Mean
1	Insufficient knowledge about the guidance for workingwith covid,19 spread	4.31
2	Shortage in knowledge about the period of spread of corona	4.06
3	Duties, responsibilities, and rights of the parties undefined accurately in the contract.	4.02
4	The owner's financial matters and lack of sufficient Cash for project implementation (financial difficulties	4.2
5	Contractor failure to regulate the cash flow of the projectwith covid-19 spread	3.92
6	Lack in the coordination with the. Subcontractorsfor cash flow	3.85
7	Deficiency and weakness in productivity of workers.Low productivity of workers	3.7
8	Limitations on the daily working hours	3.63
9	Weakness in the institution's management. During crisis	3.5
10	Materials prices change rapidly during the implementation of the project	3.43
11	Causes Related to Contract Documents	3.35
12	Economic no stability during the unforeseen circumstances.	3.23
13	Causes related to the project	3.02
14	Insufficient procedures- in the contracts- needed to be taken to settle dispute if they occur.	2.85
15	Other Causes (External)	2.8

Interviews

Interviews were conducted with a number of representatives of the research sample includes contractors, consultants and owners or their representative, including a numberof experts, academics, project managers, engineers, owners of companies and offices.Regarding Corona Covid-19 Open conversations were held with interviewees, discussionsabout the followingare made:

a. Their knowledge about corona covid,19 spread and its effect on the construction sector.
b. Precautions to be made to limit the spread of covid,19.
c. Questionnaire questions.
d. Reasons for the delay in construction projects
e. Effects were resulting from the delay in construction projects.
f. Suggestions that lead to reduce the occurrence of a delay inconstruction projects.

Interviews Analysis

Thematic analysis method is defined[11,12]as the most common way in the analysis of qualitative research.
From interviews discussions and using thematic analysis method in the analysis,the importance of the following items is cleared,and its necessity of inclusionin construction contracts is cleared:

i. Regulations for work suspension in crisis.
ii. Regulations for work termination due to crisis
iii. Cash flow in crisis conditions
iv.Contract items prices regarding crisis such as covid19 must be studied.
V .working hours during covid-19 period should be regarded.

In addition, table6 illustrates the General Factors reduce the delay of the project as a result of the questionnaire made and interviews discussions.

Table (6): General Factors reduce the delay of the project

Rank	Factors
1	Awarded the contract to the contractor with competence and not to the least price tender
2	Constant follow-up with the main contractor and subcontractors.
3	Identification of the specialized project Manager to manage the project.
4	Speed in the decision-making process
5	Staff training to get skilled workers knowing how to work in cases of such crisis.
6	The continuous use of monitoring systems for the project
7	The use of monitoring and follow-up system

VIII. Conclusion

It could be concluded regarding spread that the main top causes leading to delay in construction projects. Irregular cash flow for the project on the owner's side,contractor failure to regulate the cash flow of the project regarding corona and inflation/price fluctuations of materials required. Therefore, It is important toreview the terms of contracts regarding the crisis in order to determine the rights and obligations of contract parties in relation to extensions of project time, to additional payment as well as the obligations of the parties in the event of work suspension or site closure as a result of COVID-19 spread.Therefore, the duties responsibilities and rights of the parties should be defined accurately in the contract.

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