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Study the impact of the COVID-19 pandemic on the construction industry in Egypt

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ABSTRACT

This paper attempts to quantify the impact of the COVID-19 pandemic on the construction industry under different investment and economic scenarios in Egypt. The survey was conducted to assess the cost impact of the ongoing COVID-19 pandemic on the construction industry, considering essential aspects, such as manpower, plant and machinery, and material, and their net effect on overall construction cost. The recommendations covered in this paper address many such measures under short, medium, and long-term categories. These measures underline the need to improve systems and processes for adequately responding to the current changing environment and effectively confronting such disruptions in the future. In addition, the paper serves as a start to thinking about the study of procedures during a future pandemic to inhibit any impact on the project timeline or personnel health.

1. Introduction

The novel human coronavirus disease COVID-19 has become the fifth documented pandemic since the 1918 flu pandemic. It was first reported in Wuhan, China, and subsequently spread worldwide. The Coronavirus is highly contagious; it rapidly spreads and continuously evolves in the human population. COVID-19 is a unique event that has impacted not just construction but also halted all major businesses linked within the project value chain. As with most parts of the world, Egypt is also trying to respond to the challenges of the post-COVID-19 reality, which has come to define a new normal for our economy and society. This paper attempts to quantify the impact of the COVID-19 pandemic on the construction industry under different investment and economic scenarios. The methodology uses income and employment multipliers based on input–output analysis. To achieve this, a literature review and online interviews were conducted to find the initial list of impact factors. A questionnaire survey was used to collect data; the most critical data were identified and ranked.

2. A comprehensive analysis of the construction industry in Egypt before Covid 19.

These are some examples of increased activities in the construction sector in the upcoming period, which will eventually translate into increased sector growth. A questionnaire survey comprised 18 financial causes conducted with Egyptian engineers from the big-sized contracting firms to appraise their importance. The most critical factors affecting positively (decreasing transaction cost value) on transaction cost value in construction projects in Egypt are: the financial position of the contractor claims filed by the contractor, material substitutions by the contractor, contractor experience in a similar type of projects, contractor’s relationship with previous clients, contractor qualification to do the job, and procurement method [1]. In addition, national downturns in the economy, high prices of building materials during construction, poor estimating practice, delayed progress payments from the client, and non-payment of interest on delayed certificates had been identified as the top five critical financial causes of contracting firms failure in Egypt [2].

3. Literature review and background

Construction work can pose significant risks to public health due to the COVID-19 pandemic. This Directive applies to all construction projects, but the restrictions vary by the size of the project. Businesses and individuals performing and overseeing construction projects must take extra precautions to reduce the risk [4]. Controlling infection to prevent
the spread of SARS-CoV-2 is the primary intervention. Public health authorities should keep monitoring the situation closely. The more we learn about this novel virus and its associated outbreak, the better we can respond [8]. The evidence suggested very different impacts of the coronavirus crisis on businesses, as shown in Fig. 1. Understanding these differences is essential for strategizing during the crisis and navigating successfully into the future [12]. Coronavirus pandemic named COVID-19 has disrupted the world economy and is spreading globally. The evolution of the disease and its impact on the construction industry is highly uncertain [15]. A study has been proposed to explore the potential impact of the pandemic on construction projects.

The approach is evaluated and compared with other well-known regression models on standard available datasets [14]. The study documents the design and construction of Leishenshan Hospital. It is expected that the lessons learned from the design, construction, and commissioning of the hospital can provide a valuable reference to the development of specialty fields hospitals in other countries and regions [9]. The theoretical commentary focused on the present and long-term impact of COVID-19 on transportation in Lagos State, Nigeria. Adopting the ‘avoid-shift-improve’ framework, practical implications for public and private sector policymakers were presented [10].

**Table 1**

| RII Scale | Impact               |
|-----------|----------------------|
| 0.00–0.20 | Not critical (NC)    |
| 0.21–0.40 | Fairly critical (FC) |
| 0.41–0.60 | Average critical (AC)|
| 0.61–0.80 | Very critical (VC)   |
| 0.81–1.00 | Extremely critical (EC)|

**Fig. 1.** Revenue development (customer × value proposition alignment) [12].

**Fig. 2.** Details for the job designation.

**Fig. 3.** Details for the organization classified in any category of Construction Company.

**Fig. 4.** Details for the full-time employees in the company.
consequences of the Coronavirus outbreak on domestic construction projects were explained. (i) Delay of the construction period and implications for liability and cost, and (ii) Increases in the cost of equipment and materials. Also, the recommendations for Chinese contractors of overseas construction projects were presented; Pay close attention to the control measures implemented by the host country, evaluate and adjust implementation plans promptly based on the local situation, engage in timely and effective communication with the employer, initiate appropriate and timely force majeure notices and claims, and take necessary mitigation measures and increase Environment, Health and Safety management capability [13]. An engineering design thinking and making course was introduced that has been taught at Beijing Normal University since 2019. This year because of the Covid-19, the innovative approach changed to online teaching. Students learn to dance with ambiguity, collaborate in teams, build to think and make ideas real. The course focuses on people’s basic needs, including study, fitness, shopping, entertainment, and long-stance relationships [6].

There is increased pressure by federal, state, and local governments to minimize gatherings. Many businesses encourage telecommuting in situations such as this, but that is not feasible on a construction project. Commercial lenders are concerned about the impact that the downturn in the economy has had on the viability of projects. Manufacturers have to take precautions within their industrial facilities, which in turn will slow delivery times. It is anticipated that two of the more prevalent issues will be the applicability of force majeure [5]. Three risk communication themes related to the pandemic were reflected on: trust, tradeoffs, and preparedness. Trust is critically important during such a rapidly evolving event characterized by scientific uncertainty. Reflections focus on uncertainty communication, transparency, and long-term implications for trust in government and science [3].

Fig. 5. Shows the details for the main business sector in the company.

Fig. 6a. What impact do you expect your organization to work this year due to the emerging Coronavirus (Covid 19)?

Fig. 6b. Have you adopted any of the following strategies to deal with the crisis?
4. Research methodology

A thorough review of the existing literature was performed in this study to identify existing techniques and uncover Key cases relevant to evaluate the impact of the new Covid-19 on the construction sector in Egypt. The proposed methodological approach of this study has three phases.

**Phase 1:** Critical review and analysis of extant literature, coupled with a series of focus group interviews with construction professionals in the construction industry, are performed.

**Phase 2:** Design a questionnaire and survey by expert judgment in the construction industry, and then conduct 63 structured interviews with some construction experts to collect data.

**Phase 3:** Use scientific analysis statistical analysis tools.

### 4.1. Phase 1: Key cases for the impact of the new Covid-19 on the construction sector

By conducting a comprehensive review of relevant published literature, coupled with some interviews, sixteen critical cases that influence the new Covid-19 on the construction sector in Egypt are shown in Table 1. In addition, the evaluation system adopted to evaluate the impact of the new Covid-19 on the construction sector is displayed in Appendix 1.

### 4.2. Phase 2: Data collection

To identify the key causes that affect the new Covid-19 on the construction sector in Egypt throughout the life cycle costing, a comprehensive questionnaire survey was developed as the primary data collection instrument to study further 16 key causes identified from the expert’s survey.

#### 4.2.1. Questionnaire

The questionnaire for the survey is comprised of four sections and twenty questions. The first section includes the introduction (Essential Question, Background, and Expected Outcomes) about the survey and its purpose. The second section contains questions about the general information of the respondents and the project characteristics. The third section involves detailed information about the ranking causes. The fourth section involves complex questions about the new Covid-19 on the construction sector, as shown in the appendix. A Paper-pencil-questionnaire combining with a web-based questionnaire is used in this study to collect the respondents’ judgment.

#### 4.2.2. Background of respondents

After the questionnaire was conducted, the survey was established. Initially, “Two Hundred” potential respondents across the industry in Egypt were identified through the snowball sampling technique and circulated through the web-linked survey questionnaire. This selection was based on their careers associated with the construction industry. Regarding the adequacy of the sampling population, the sampling theorem was used as the guide. It was considered important for the research inquiry to determine whether a normal distribution can be assumed. Finally, 144 respondents responded to the questionnaire survey. Thus, considering the 144 eligible respondents, the response rate was just approximately (144/200) 72%. The respondents’ subjective judgment plays a critical role in seeking key causes for decision making; so respondents’ occupational characteristics and affiliations should be considered in the questionnaire survey [7]. The backgrounds of these respondents are shown in the tables from Fig. 2 to Fig. 5. According to
the job designation, the respondents come from, 72.2% of respondents are project managers, 11.1% are sector heads, 9% are Branch heads, and 7.6% are members of the board of directors, as shown in Fig. 2. The occupation of respondents covers almost all fields related to project construction which makes the data more representative. So the personnel structure of this survey is reasonable which makes the data more credible.

60.4% of respondents are from a first category company, 13.9% come from a Second category company, and 13.2% are a third category company, as shown in Fig. 3. The occupation of respondents covers almost all fields related to project construction which makes the data more representative. A 54.2% of respondents are from a large company with more than 250 employees, as shown in Fig. 4.

4.3. Phase 3: Statistical analysis

After data was collected from respondents, the questionnaire is analyzed further for relative importance index methods and dispersion analysis.

4.3.1. Relative importance index (RII)

To measure the impact of the new Covid-19 on the construction sector in Egypt, the relative importance index technique is introduced. The relative index technique has been more used in construction research studies to measure attitudes regarding questionnaires factors and items under the research study. RII ranges from 0 to 1 [11] which is shown in Table 1.

4.3.2. Dispersion analysis

The coefficient of variation is used to test the degree of diffusion to observe the dispersion of survey data. The formula is:

\[ CV = \frac{\sigma}{\bar{X}} \]  
\[ \bar{X} = \frac{\sum_{i=1}^{N} x_i}{N} \]
\[ \sigma = \sqrt{\frac{\sum_{i=1}^{N} (x_i - \overline{x})^2}{N}} \]  

(3)

Where CV is the coefficient of variation; \( \sigma \) is the standard deviation; \( x_i \) is the \( i \)th data point; \( \overline{x} \) is the mean of all data points; \( N \) = the number of data points. Thus, the bigger the CV, the dispersion degree is higher, vice versa.

5. Results and discussion

As shown from the survey result, as shown in the below figures (Figs. 6a–6n).
5.1. Critical impact key causes identified from RII

Through the collection of statistical data, the RII can be calculated. Take phrase no. 1 as an example, 17 respondents think, “Institution’s projects have been delayed due to the emerging Coronavirus (Covid 19)” are the projects have been very low delayed due to the emerging Coronavirus and marked it as “10” points. On the other hand, nine respondents score it as “100” Points. So RII = (17 × 10 + 17 × 20 + 25 × 30 + 17 × 40 + 25 × 50 + 12 × 60 + 11 × 70 + 9 × 80 + 2 × 90 + 9 × 100)/(100×144) = 0.45, which is more significant than 0.41, “Institution’s projects have been delayed due to the emerging Coronavirus (Covid 19)” is an average critical impact to the new Covid-19 on the construction sector. According to the value of RII, as shown in Table 2. Institution’s projects that have been paused due to the emerging Coronavirus (Covid 19) are fairly critical. The coefficient of variation CV of fundamental causes is 0.56 and 0.7.

As shown from the survey result, only 47.3% of respondents have a more than 50% probability of expecting that institutions’ projects have been delayed due to the emerging Coronavirus (Covid 19). On the other hand, about 34.9% of respondents have more than 50% probability of expecting that the institution’s projects have been paused due to the emerging Coronavirus (Covid 19).

Table 2
Results of statistical analysis.

| Phrase                                                                 | (10 Point Likert Scale) | \[\sum n_i\] | RII | Critical | CV |
|------------------------------------------------------------------------|-------------------------|--------------|-----|----------|----|
| Institution’s projects have been delayed due to the emerging Coronavirus | 17 17 25 17 25 11 9 2 9 | 6480         | 0.45| AC       | 0.56 |
| (Covid 19)                                                             |                         |              |     |          |     |
| Institution’s projects that have been paused due to the emerging       | 38 20 24 12 18 7 8 7 4 6 | 5380         | 0.37| FC       | 0.7  |
| Coronavirus (Covid 19)                                                 |                         |              |     |          |     |

6. The recommendations and fill the knowledge gaps

There are some recommendations, which are introduced from the researcher:

1. Infrastructure and COVID-19
   - Infrastructure impacts will be volatile and interrelated.
   - Extreme events change society’s behavior, and infrastructure providers must be ready to respond quickly.

2. Rapid response requires robust planning of flexibility
   - Infrastructure providers are well versed in preparing for unexpected and extreme events and implementing robust resilience plans to help them design and respond effectively. While the virus itself does not affect the physical assets of the infrastructure, there may be repercussions for maintenance, and back and front office personnel may, in turn, limit service delivery.

3. Giving priority to basic maintenance procedures only and running reduced services at peak and work times to ensure continued health and safety of workers will ensure operators provide critical services. But, at the same time, it may not be the best service.

4. The role of digital empowerment
   - Companies that have taken steps to adopt digital technologies will face less disruption than those that still rely on traditional and manual methods. For example, intelligent scheduling/supply of service technologies and front and back-office digital solutions will help minimize disruptions in the collection of services.

5. As we increasingly face threats in the form of weather disruption, epidemics, and overpopulation, we see infrastructure operators putting risks, resilience, and digital empowerment at the center of their strategies and adopting thinking systems to ensure service delivery in extreme events throughout the infrastructure ecosystem.

4- Best practices for real estate leaders
   - Intense driving is critical.
   - Flexibility in changing circumstances.
   - Explore immediate cost-saving measures.
   - Strengthening stability amid volatility.
   - Give back to the community.

The New Normal: Ways to Change a Construction Coronavirus Crisis

- Job sites will be cleaner and safer.
- Discrimination will be the norm through technology.
- Projects will take longer.
- Teleworking will become more common.
- The demand for project types will change.

7. Conclusion

COVID-19 is a unique event that has impacted not just construction but also halted all major businesses linked within the project value chain. As with most parts of the world, Egypt is also trying to respond to the challenges of the post-COVID-19 reality, which has come to define a new normal for our economy and society. This paper attempts to quantify the impact of the COVID-19 pandemic on the construction under different investment and economic scenarios in Egypt. The survey was conducted to assess the cost impact of the ongoing COVID-19
pandemic on construction projects, considering essential aspects, such as manpower, plant and machinery, and material, and their net effect on overall construction cost. As per survey findings, labor costs for skilled workers are expected to rise by 20%–25%, while semi-skilled and unskilled workers are expected to increase by 10%—15%. As shown from the survey result, only 47.3% of respondents have a more than 50% probability of expecting that institutions’ projects have been delayed due to the emerging Coronavirus (Covid 19).

On the other hand, about 34.9% of respondents have more than 50% probability of expecting that the institution’s projects have been paused due to the emerging Coronavirus (Covid 19). Although it is noted that the survey respondents have different professional and organizational backgrounds, there are inevitably differences in the perspective of evaluation. So the data collected in this study can be considered credible at the dispersion degree. The recommendations covered in this paper address many such measures under short, medium, and long-term categories. These measures underline the need to improve systems and processes for adequately responding to the current changing environment and effectively confronting such disruptions in the future.

Data Availability Statement

All data, models, and code generated or used during the study appear in the submitted article.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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