buildings

MDPI

Article

Impact of COVID-19 on Construction Projects: The Case of India

Hafnidar A. Rani [1], Abdelrahman M. Farouk [2], K. S. Anandh [3], Saud Almutairi [4,*] and Rahimi A. Rahman [2,5,*]

[1] Department of Civil Engineering, Engineering Faculty, University of Muhammadiyah Aceh, Bantul 23123, Indonesia; hafnidar.ar@unmuha.ac.id
[2] Faculty of Civil Engineering Technology, Universiti Malaysia Pahang, Pekan 26600, Malaysia; abdelrahman.mfarouk@gmail.com
[3] Department of Civil Engineering, College of Engineering and Technology, SRM Institute of Science and Technology, Chennai 603203, India; anandhk@srmist.edu.in
[4] Unaizah College of Engineering, Qassim University, Buraydah 52571, Saudi Arabia
[5] Department of General Educational Development, Daffodil International University, Dhaka 1341, Bangladesh
* Correspondence: sa.almotiry@qu.edu.sa (S.A.); arahimirahman@ump.edu.my (R.A.R.)

Abstract: The COVID-19 pandemic has affected the whole world, including India, especially in the construction sector. The study aims to identify, compare, and analyze the critical pandemic impacts (CPI) on construction projects in India. To achieve this, 40 interviews with industry professionals, are followed by a systematic review to identify the CPI. The data collected was used to develop a survey, sent to industry professionals all over India, with a return of 92 valid responses. The data were analyzed using reliability analysis, mean score ranking, overlap analysis, agreement analysis, and correlation analysis. The overall critical pandemic impact includes 'labor scarcity,' 'supply chain disruption,' 'decreased construction productivity,' 'increased project financing rejection rate,' and 'reduced foreign investment in the construction industry.' The findings could aid authorities and policymakers in taking suitable actions toward solving the current CPI in India. Project managers and owners could consider the current CPI in order to formulate better plans. Overcoming CPI could lead to an economic leap in India.

Keywords: critical pandemic impact (CPI); COVID-19; construction projects; India

Citation: Rani, H.A.; Farouk, A.M.; Anandh, K.S.; Almutairi, S.; Rahman, R.A. Impact of COVID-19 on Construction Projects: The Case of India. *Buildings* **2022**, *12*, 762. https://doi.org/10.3390/buildings12060762

Academic Editor: Kirsi Aaltonen

Received: 3 May 2022
Accepted: 27 May 2022
Published: 4 June 2022

1. Introduction

The construction industry in India has become the second-largest employer and foreign direct investment (FDI) recipient in 2020–2021, and the third-largest market globally. India's construction industry attracted nearly five billion USD of investment in 2020, leading to predicted average growth of 7% every year until 2025 [1]. In March 2020, the COVID-19 pandemic hit the world. In India, COVID-19 affected all sectors, including the construction industry. Resuming construction work became a significant challenge to all organizations in India, resulting in a major crisis in the industry [2]. Construction industry professionals, including civil engineers, architects, and contractors, could not resume work due to the consequences of lockdowns. COVID-19 also affected the nation's human resources, with the construction industry being hit harder than other sectors. The pandemic increased the demand for the local workforce to replace migrant construction workers that returned to their home countries. In other words, a pandemic situation can have a major impact on India's construction industry, as it depends on people [3].

The three dimensions of effective crisis management for the construction industry are: respond, recover, and thrive. Leaders and top-level management in organizations should focus on and understand these dimensions for resilient leadership [4]. The Centre for Monitoring Indian Economy (CMIE) states that COVID-19 has led to a spike in the national

unemployment rate to 27.11% [5]. Furthermore, this unemployment rate is elevated in urban compared to rural areas [5]. The restrictions executed by the national government, state governments, and local authorities to control the virus have curtailed many construction projects and negatively impacted resources, including humans, machinery, and materials. Postponements, interruptions, and closure of projects are unavoidable when construction projects are associated with increased cost and risk of losses [6]. Adopting construction technology, such as 3D printers and modular construction, can assist construction projects [7]. However, identifying the critical pandemic impacts on construction projects is necessary to respond effectively [7].

This study aims to identify, compare, and analyze the critical pandemic impacts (CPI) on construction projects in India. The objectives of the study are to: (a) Identify the critical CPI on construction projects in India; (b) Compare the CPI between different organizations and project characteristics; and (c) Analyze the interrelationships between the CPI. To achieve this, a survey was developed from a systematic review and semi-structured interviews aim to identifying the factors of COVID-19's impact on the construction industry. After conducting interviews and reviewing papers, the survey was finalized and sent to architecture, engineering, and construction (AEC) professionals. The data was analyzed using reliability analysis, overlap analysis, agreement analysis, and correlation analysis. The study findings will assist policymakers and researchers in understanding better and overcoming the CPI of COVID-19 in India. Dealing with CPI could avoid economic downturns in India.

2. Background Information

2.1. Construction Work Practices Post-COVID-19

Generally, the new guidelines and protocols were rigid for everyone during the COVID-19 pandemic. There are many rules and regulations: Standard Operating Procedures (SOP) at the workplace advised by the World Health Organization (WHO), social distancing, wearing masks, and usage of sanitizers all came to be considered and were well maintained to prevent the spread of COVID-19 [8]. Apart from this, guidelines were prepared for practice on the job, for workers, professionals on the site and in offices, and skilled and unskilled persons in construction projects, and implemented to avoid and control the spread of COVID-19. Specific recommendations were also given to construction professionals and workers based on the exposure risk categorization [9]. Work practice, workplace, supply chain and purchase, legal and contractual aspects adopted significantly new practices. In other words, governments have instigated strict statutory laws for this new normal in construction work environment practice globally [10].

2.2. COVID-19 Impacts on Construction Projects

2.2.1. Increased Project Financing Rejection Rate

COVID-19 paved the way towards subsequent nationwide lockdowns, resulting in a rise of loans or credit applications from financial institutions as the prime source of project financing. However, financing institutions are becoming cautious as current, short-term, and long-term economic growth is still uncertain. Therefore, financial institutions opt to reduce the approval rate for financing, including for construction projects, by implementing additional evaluation processes [11]. As a result, financing rejection rates in India have gone up from 20–25% to 30–35%, with most proposals above INR10,000,000 (approximately USD 130,000) being scrutinized [11].

2.2.2. Labor Scarcity

The COVID-19 crisis has a significant impact on labor-intensive sectors. In the construction industry, migrant workers comprise a large part of the workforce and typically stay in temporary housing at construction sites. According to the Confederation of Real Estate Developers' Associations of India (CREDAI), India has an average of 20,000 ongoing construction projects and 18,000 sites across the country. The 40-day lockdown from

25 March until 17 May 2020 has led to reverse migration, with workers leaving cities and returning to their hometowns. It is estimated that approximately 600,000 workers walked on foot to their hometowns, and 1,000,000 workers are in relief camps across multiple sectors [12,13]. As a result, more than 30% of construction workers did not return to their sites after the lockdown.

2.2.3. Decreased Number of Public Projects

The need for government responses (e.g., public health measures, public projects, lockdowns, emergency economic and social measures) to address COVID-19 impacts has significantly impacted government funds. COVID-19 has also impacted stock markets, affecting assets owned by governments. Local public companies are also exposed to the COVID-19 crisis. Some categories suffered from the cessation or slowdown of activity, particularly in the tourism, culture, leisure, and transport sectors, affecting the government as shareholders. A decrease in state and local government funds hamper the ability to finance public projects in the short and long term [14]. As a result, the Indian government faces intense pressure on expenditure and reduced revenue. Therefore, local governing authorities in India have refrained from allocating funds for public projects. Following this, there is a declining trend of approval and execution of public construction projects, except for those that handled the pandemic successfully [15,16].

2.2.4. Existing Projects

As the country grapples with the pandemic and subsequent lockdowns, real estate has resorted to layoffs and pay cuts to lower operation costs, as sales are expected to be muted in the near future. The construction industry has faced headwinds for the past three to four years due to government policies and approval delays. The COVID-19 crisis had an even greater impact on market sales. Approximately 7 million people are employed in the sector, including 300,000 white-collar workers. Most developers deal with liquidity by laying off employees, closing offices, and centralizing their work and workforce. Companies with more extensive reserves have offered a temporary pay cut with the promise of returning the money once sales improve. As revenues have dropped significantly and sales have slowed, companies downsize and eliminate unnecessary costs. Overall, the lockdown has pushed the entire industry back by at least five years [17].

2.2.5. Decreased Morale within Project Team Members

Over the past two years, the COVID-19 virus has spread to all countries, infecting people worldwide. As the virus spreads, it impacts societies, businesses, and economies. Top management is often lacking on business trips. The presence of all employees is at risk; occasionally, there is an absence of members of the workforce due to illness or quarantine. Therefore, effective decision management with positive effects on morale is overruled. Lack of communication and interaction from the company manager with employees degrades morale in the work environment. Due to this lack of morale due to the pandemic impact, employee absenteeism rates have increased [15].

2.2.6. Supply Chain Disruption

Supply chain disruptions arise from a "combination of an unintended and unexpected triggering event that occurs somewhere in the upstream supply chain (the supply network), the inbound logistics network, or the purchasing (sourcing) environment, and a consequential situation, which presents a serious threat to the normal course of business operations of the local firm" [16]. The COVID-19 pandemic is causing unprecedented disruption, putting global supply chains to the test [18,19].

2.2.7. Existing Project Termination

Some private and public construction projects have been suspended due to the government or owner-imposed shutdowns, disrupting progress payments needed to support

overall operations. Obligees may choose to cease construction on a bonded project until the severity of COVID-19′s effects has passed rather than deal with the cost of continued project delays caused by COVID-19′s impacts. Almost every construction contract includes a stipulation signifying "time is of the essence" and a completion date. Failure to meet the completion deadline may result in contract termination for default (usually accompanied by a demand on the performance bond surety to complete the work), payment of the obligee's costs to supplement the principal's labor force to mitigate delays, and/or the assessment of liquidated damages or actual delay damages if there is no justifiable excuse [20]. The inability to deliver supplies or the scarcity of even one key component might put a project on hold [21]. The financial impact of the state's economic downturn results in the termination of existing projects [22].

2.2.8. Shortage of Materials

Although it is practically difficult to estimate the exact impact of the COVID-19 epidemic, any sustained slowdown in economic and manufacturing activity is likely to have substantial implications for material pricing. Reduced construction activity due to virus containment measures may result in a significant drop in demand for materials, which can significantly impact material pricing. Materials trending lower in the last year are likely to continue on that path, with another 5% to 10% drop. In comparison, materials that have been growing may see a minor increase in the range of 1% to 3% [12].

Growing demand in Asia and Europe is the key factor for pushing higher raw material prices. China's industrial production, mostly recovered from the COVID-19 epidemic, has accelerated to full capacity, resulting in a dramatic increase in raw material demand. As a result, there were shortages on the market [23]. As a result of worldwide manufacturing shutdowns (e.g., goods created in China), port closures, and general material transit delays within the United States, materials may be more expensive to obtain on time. Even if a bonded principle survives the storm, a bonded project may suffer because lower-tier subcontractors and suppliers also face problems [20]. Construction activities have been progressively impacted by the pandemic and its disruption of global supply chains, with shortages of raw materials and other inputs, contractors and subcontractors, and labor [24].

2.2.9. Decreased Number of Private Projects

The financial impact affected the number of private projects ongoing in India. Companies struggled to attract new projects due to the limited number available. Another problem companies face in attracting new projects is the higher competitiveness level because of the COVID-19 pandemic [20]. These problems have resulted in many construction contracts having minimal profit margins. Therefore, many contractors cannot withstand the financial impact of COVID-19.

2.2.10. Decreased Construction Productivity

In general, informal businesses have low productivity, savings and investment rates, and little capital accumulation. This renders them exposed to crises and shocks [24]. The construction industry is under a financial strain, and productivity has dropped due to a workforce shortage.

2.2.11. Less Demand for Construction-Related Work

The current level of uncertainty, poor business sentiment, reduced operational surpluses and revenues, diversion of funds for COVID-19 management, and credit and liquidity issues are expected to have a significant impact on the construction industry, and the demand for construction projects has already decreased [12]. The extent of the economic downturn's impact on existing and planned construction projects, future demand, and the sector at large remains uncertain [24].

2.2.12. Reduced Foreign Investment in the Construction Industry

India was the tenth-largest importer and nineteenth-largest exporter in 2018. Foreign direct investment (FDI) inflows into India totaled 4 trillion Indian Rupee in 2018–2019, with the service sector, computer, and telecom industries continuing to be the dominant sectors for FDI inflows [25]. FDI plays an important role in supporting economies during the recovery following the pandemic. Sectors that the pandemic has badly hit, such as agriculture and manufacturing, account for a higher share of FDI in developing economies than in developed ones. Therefore, FDI flows to developing countries are expected to drop even more. FDI might play a significant role in strengthening economies during and after the crisis through monetary support to their affiliates, assisting governments in combating the epidemic, and linkages with local firms. FDI flows have been continuously declining over the last five years. They may continue to fall below pre-crisis levels beyond 2021 if public health and economic assistance initiatives are ineffective [26].

2.3. COVID-19 Impacts on Construction Projects in India

COVID 19 highly impacts people, the environment, and the economy. The Indian construction sector employs more than 51 million people, including construction professionals and skilled and unskilled workers. COVID 19 has caused a massive shock, i.e., income loss, the panic situation relating to the disease, and lack of food, all significant issues for migrant workers. Moreover, temporary closures in some sectors lead to significant revenue loss [27]. In the Indian construction sector, widespread COVID-19 created unpredicted sequences of issues such as financial loss, unforeseen obstacles, and unexpected conditions during the pandemic situation. All these circumstances prompted the blow of global and national recession and economic depression [28].

The construction industry has experienced the full impact due to slowing demand, delayed projects, and the extension of lockdown effects on supply chain management and the movement of manual labor. More than 30% of the workforce moved out of construction sites due to fear of disease, reflecting highly on the work completion level. The Indian construction sector is considered among the worst affected sectors. Government bodies should take stimulus actions that are deserved and beneficial and can improve the national economy [7].

3. Methodology

3.1. Survey Development

A survey is a way of gathering quantitative data from a random sample using a systematic approach [29]. This study aims to determine the criticality of COVID-19′s influence on the construction industry using such a survey. The framework for the investigation is shown in Figure 1.

The study adopts the systematic literature review approach (SLR) to view the contributing factors of COVID-19 impact on the industry. The search consisted of two steps; the first step is to search under title/abstract/keyword. Scopus was used as the search engine to conduct the SLR as it covers more databases and is usually used to review literature [30–33]. The first search involved keywords: 'COVID' AND (2) 'construction industr*' OR 'construction management' OR 'project management' OR 'construction engineering' OR 'construction project*. 'The second stage was to find other COVID-19 papers unrelated to the construction management sector. The search was filtered to related subject areas, including 'business, management, and accounting' and 'economics, econometrics, and finance.' The search was performed on 30 November 2020, resulting in 519 papers. The identified documents passed through two screening processes: the title/abstract visual examination and the full-text visual examination. The screening resulted in a total of 53 papers for analysis.

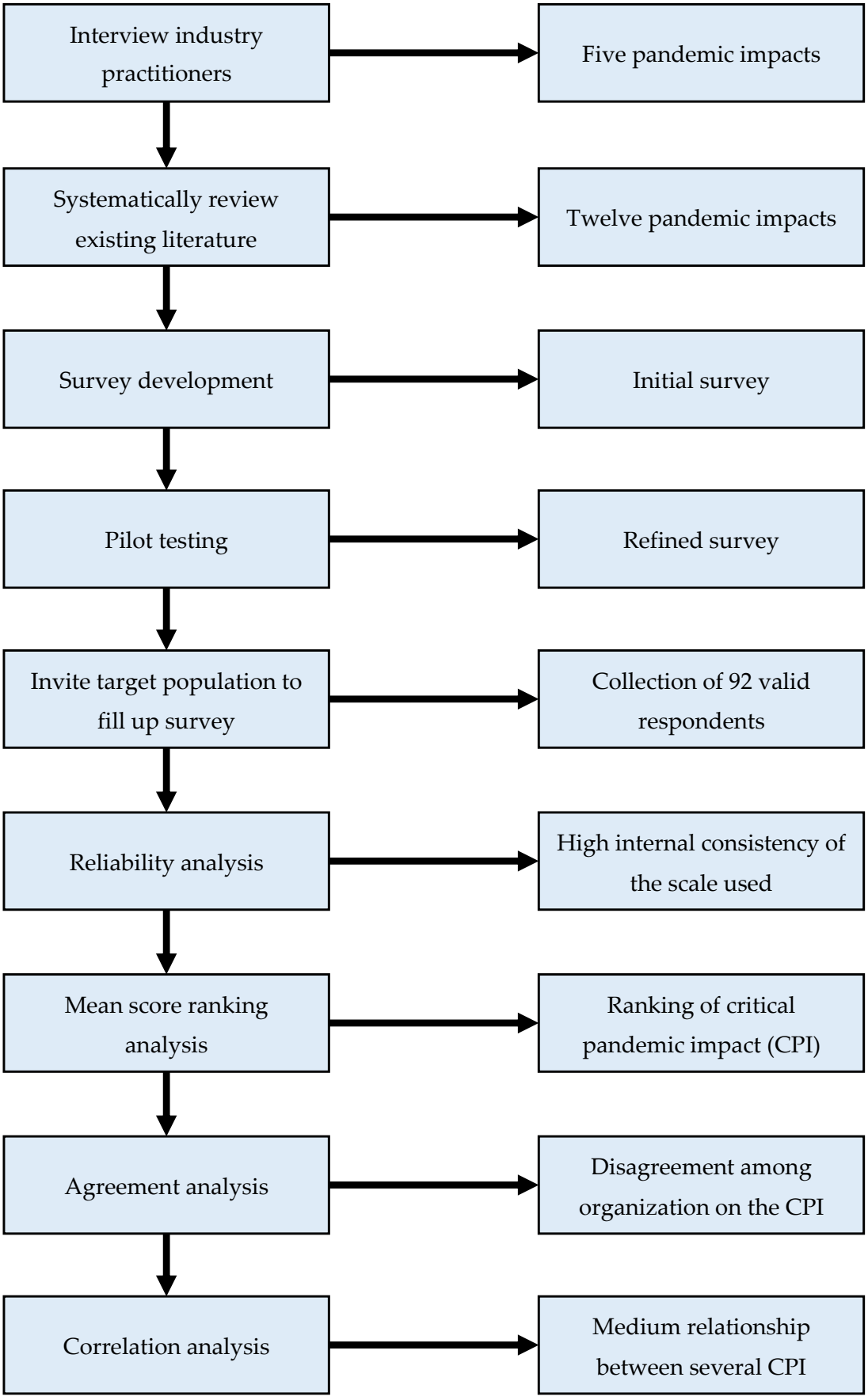

Figure 1. Research framework for this study.

The survey development process involved two additional steps, ensuring both validity and coherence. The first step is the semi-structured interview with open-ended questions to measure the impact of COVID-19 on the construction industry and to add any impacts missing from the systematic review. This step involved interviewing 40 industry participants with working experience in the field. Then, finally, the survey was developed based on SLR and interview data. Thematic analysis was conducted on the data results, and themes were identified. Table 1 lists the 12 impact factors identified. Second, the aspects of the survey were tested for more reliability. The survey validity, response time, question design, and ease of understanding were reviewed by four academics with more than ten years of experience in construction management. This process ensures that the survey is valid at the technical and academic levels. Feedback on the survey's content, grammar, and wording was received, and the survey was reformatted accordingly.

The survey consisted of two sections. Firstly, the study details, including study objectives and contact information, were included on the cover page. The first section included questions on respondents' characteristics and their organizations. This section is crucial in order to filter the available respondents for the study. The second section involved the evaluation of the criticality of the twelve COVID-19 impacts based on a 5-point Likert scale. This five-point Likert scale is commonly used in this field and can produce explicit results [34,35]. Additional spaces were provided for the respondents to add new impacts and rate them accordingly.

Table 1. List of the 12 pandemic impacts identified from the SLR and interviews.

Code	Impact	References
P01	Increased project financing rejection rate	[11,36–40]
P02	Labor scarcity	[12,13,24,25,41–52]; Interview
P03	Decreased number of public projects	[7,14,15,48,53–56]
P04	Existing project downsizing	[17,42,57–61]; Interview
P05	Decreased morale within project team members	[15,58,60,62–65]
P06	Supply chain disruption	[19,48,54,56,66,67]; Interview
P07	Existing project termination	[20–22,68,69]; Interview
P08	Materials shortage	[12,20,23,24,43,48,70]
P09	Decreased number of private projects	[7,20,48,53–56]
P10	Decreased construction productivity	[24,71–75]; Interview
P11	Less demand on construction-related works	[12,24,50,51,55,76–78]
P12	Reduced foreign investment in the construction industry	[25,26,77,79–81]

3.2. Data Collection

To acquire a balanced perspective on the topic, the targeted population included AEC professionals (clients, contractors, and consultants). Additionally, the individuals must have worked for companies specializing in building and civil construction. Finally, responses must be from SMEs (companies with between five and fifty full-time employees) or LEs (have more than 50 full-time employees).

Due to the lack of a sampling frame, the nonprobability sampling technique was used to generate a representative population sample [82,83]. Furthermore, nonprobability sampling enables the selection of respondents wanting to engage in a study [84]. Among the first participants, a snowball sampling technique was used to identify potential respondents [85]. Prior construction management research has often adopted this strategy to collect and distribute information and responders over referral or social networks [86].

As initial respondents, AEC professionals directly involved in India's construction industry were approached. The initial respondents were then asked to share information about other knowledgeable participants as subsequent respondents. Finally, subsequent respondents were asked to complete the survey. To maximize the probability of success, follow-ups were sent to all respondents after two weeks. The data collection began on 20 July 2021, and ended on 19 August 2021. Table 2 shows that 92 valid responses

were collected. Although the sample size is small, scholars generally agree that a sample size of 30 is sufficient for statistical data analysis and the drawing of meaningful conclusions [87]. Furthermore, rather than showing the population's overall assessment of the factors, the purpose of this study was to highlight the key results of the 12 impacts. This objective is consistent with previous work, such as [88,89]. As a result, the sample size is declared appropriate.

Table 2. Profiles of the respondents.

Characteristics	Frequency	Percent	Years of Experience			
Organization size			<2	2–5	6–9	>10
Large enterprises	45	48.91%	10	14	10	11
Small-medium enterprises	47	51.09%	19	17	6	5
Subtotal	92	100.00%	29	31	16	16
% by year	-	-	31.5	33.7	17.4	17.4
Work specialization						
Building construction	52	56.52%	21	18	8	5
Civil construction	40	43.48%	5	15	10	10
Subtotal	92	100.00%	26	33	18	15
% by year	-	-	29.90%	26.00%	12.60%	31.50%
Organization type						
Client	29	31.52%	9	10	4	6
Consultant	23	25.00%	4	8	8	3
Contractor	40	43.48%	15	14	6	5
Subtotal	92	100.00%	28	32	18	14
% by year	-	-	29.90%	26.00%	12.60%	31.50%

3.3. Data Analysis

3.3.1. Reliability Analysis

The reliability analysis is crucial in establishing the survey's consistency and dependability. Cronbach's alpha is a well-known and widely used technique for assessing the reliability of surveys. Cronbach's alpha measures the average correlation or internal consistency between variables. The Cronbach's alpha value ranges between 0 and 1, with 0 indicating no reliability and 1 indicating consistency across all survey variables [90]. However, for the survey to be reliable, it must have a score of at least 0.70 [91]. Cronbach's alpha value was 0.874, indicating that the five-point Likert scale measurements were reliable at the 5% level of significance. Thus, the survey data is suitable for conducting further analysis.

3.3.2. Mean Score Ranking

The first analysis was to rank the 12 pandemic impacts. The mean score ranking technique (MS) was used, where a minor standard deviation (SD) usually means smaller differences between responses and is more likely to be valid [92]. If this occurs and more than one impact has the same mean, the impact with the lowest standard deviation (SD) is ranked first in this study. The CPI was then calculated using the normalized mean values. Only values greater than 0.5 were considered. The CPI for each group was determined by calculating the normalized mean scores based on the organizational characteristics. Other researchers have used this method, for example, to identify critical success factors for design-build implementation [93] and affordable housing [89].

3.3.3. Overlap Analysis

This study used overlap analysis to determine which CPIs are overlapping and distinct across related groups. Overlap analysis compares two or more groups to see if there are any similarities or differences [94]. This method has previously been used to identify overlapping variables [95,96]. This technique makes use of circles to represent the overlap results. Variables that overlap in at least two groups are represented in the overlap, and a unique technique shapes the non-overlapping part. This study compared the CPIs of SMEs

and LEs to identify the overlapping CPI for both organization sizes and the unique CPI for SMEs and LEs.

3.3.4. Agreement Analysis

Following overlap analysis, differences in criticalities may exist among organizations. Because this study aims to discover any quantitative variations, the Kruskal-Wallis test was used to determine any differences in mean scores between respondent groups [97]. The analysis looked for significant differences in organization sizes, types, and work specialization.

3.3.5. Correlation Analysis

Finally, Spearman's rank-order correlation analysis was used to investigate the relationship between the 12 COVID-19 impacts. The approach evaluates the strength and direction of connections between two variables. Spearman's correlation was applied to extract the correlation coefficients in this study between the 12 COVID-19 impacts. The coefficients' strength was then interpreted as follows: 0.00 to 0.29 denotes no correlation; 0.30 to 0.49 indicates a low correlation; 0.50 to 0.69 represents a moderate correlation; 0.70 to 0.89 reflects a high correlation; and 0.90 to 1.00 expresses a very high correlation [98].

4. Results

4.1. Results for Mean Score Ranking

Table 3 displays the findings of the ranking analysis of the COVID-19 impacts. The findings suggest that the criticality of the effect has a range of mean scores ranging from 2.978 to 3.713. Only impacts with normalized mean values larger than 0.50 are evaluated. The findings reveal that five impacts had normalized values of more than 0.50, fulfilling the CPI. The CPI with the highest mean score is 'labor scarcity.' The other CPIs are 'supply chain disruption,' 'decreased construction productivity,' 'increased project financing rejection rate,' and 'reduced foreign investment in the construction industry.'

Table 3. Ranking of COVID-19 impacts according to organization size.

Code	Impact	Overall			SME			LE			Kruskal-Wallis Test	
		Mean	SD	NV [a]	Mean	SD	NV [a]	Mean	SD	NV [a]	Chi-Square	*p*-Value
P02	Labor scarcity	3.713	1.141	1.00 [b]	3.638	0.965	0.970 [b]	3.933	1.214	1.000 [b]	4.670	0.031 [c]
P06	Supply chain disruption	3.662	1.034	0.93 [b]	3.596	1.097	0.909 [b]	3.756	1.171	0.830 [b]	1.690	0.194
P10	Decreased construction productivity	3.581	1.086	0.82 [b]	3.660	1.185	1.000 [b]	3.556	1.119	0.638 [b]	0.360	0.547
P01	Increased project financing rejection rate	3.529	1.011	0.75 [b]	3.532	0.975	0.818 [b]	3.556	1.216	0.638 [b]	0.770	0.379
P12	Reduced foreign investment in the construction industry	3.478	1.223	0.68 [b]	3.277	1.347	0.455	3.311	1.240	0.404	0.010	0.912
P08	Materials shortage	3.338	1.200	0.49	3.170	1.356	0.303	3.511	1.121	0.596 [b]	0.010	0.918
P09	Decreased number of private projects	3.338	1.249	0.49	3.447	1.176	0.697 [b]	3.333	1.348	0.426	0.180	0.673
P11	Less demand on construction-related works	3.309	1.126	0.45	3.426	1.098	0.667 [b]	3.156	1.224	0.255	1.200	0.273
P03	Decreased number of public projects	3.265	1.104	0.39	3.213	1.082	0.364	3.222	1.223	0.319	0.230	0.631
P04	Existing project downsizing	3.213	1.043	0.32	3.149	1.161	0.273	3.267	1.031	0.362	0.050	0.828
P05	Decreased morale within project team members	3.176	1.115	0.27	3.021	1.242	0.091	3.156	1.086	0.255	0.650	0.419
P07	Existing project termination	2.978	1.250	0.00	2.957	1.334	0.000	2.889	1.449	0.000	0.230	0.631

Notes: SD = standard deviation; [a] NV = normalized value = (mean − minimum mean)/(maximum mean − minimum mean); [b] Indicate the impact is a critical pandemic impact (normalized value > 0.50); [c] Indicate Kruskal-Wallis result is significant at the 0.05 significance level (significance level < 0.05).

4.2. Results for Overlap Analysis

Tables 3–5 show the analysis results for organization sizes, types and work specializations. The group's CPI is determined by impact values greater than 0.5. The overlapping CPI between SMEs and LEs (see Table 3) are 'labor scarcity,' 'supply chain disruption,' 'decreased construction productivity,' and 'increased project financing rejection rate.' The unique CPI for SMEs are 'decreased number of private projects' and 'less demand for construction-related works.' On the contrary, the unique CPI for LEs is only 'shortage of materials'.

Table 4. Ranking of COVID-19 impacts according to organization type.

Code	Impact	Client			Consultant			Contractor			Kruskal-Wallis Test		
		Mean	SD	NV [a]	Mean	SD	NV [a]	Mean	SD	NV [a]	chi-Square	*p*-Value	Statistically Different Opinion
P02	Labor scarcity	3.586	1.211	1.000 [b]	3.652	0.935	0.600 [b]	3.952	0.962	1.000 [b]	0.870	0.649	
P10	Decreased construction productivity	3.414	1.053	0.762 [b]	3.609	1.270	0.550 [b]	3.714	1.088	0.783 [b]	3.050	0.218	
P01	Increased project financing rejection rate	3.241	1.327	0.524 [b]	3.739	0.964	0.700 [b]	3.690	0.841	0.761 [b]	3.040	0.219	
P06	Supply chain disruption	3.241	1.185	0.524 [b]	4.000	1.000	1.000 [b]	3.762	1.031	0.826 [b]	5.990	0.050	
P12	Reduced foreign investment in the construction industry	3.172	1.284	0.429	3.652	1.191	0.600 [b]	3.167	1.248	0.283	1.240	0.537	
P11	Less demand on construction-related works	3.138	1.217	0.381	3.478	1.163	0.400	3.286	1.088	0.391	4.200	0.122 [c]	Client-consultant
P03	Decreased number of public projects	3.103	1.235	0.333	3.522	0.947	0.450	3.048	1.168	0.174	1.770	0.413	
P08	Materials shortage	2.931	1.252	0.095	3.304	1.222	0.200	3.500	1.254	0.587 [b]	1.230	0.539	
P04	Existing project downsizing	2.897	1.175	0.048	3.348	1.071	0.250	3.286	1.066	0.391	1.330	0.515	
P05	Decreased morale within project team members	2.897	1.081	0.048	3.130	1.140	0.000	3.262	1.231	0.370	4.020	0.134	
P09	Decreased number of private projects	2.897	1.398	0.048	3.609	1.196	0.550 [b]	3.476	1.131	0.565 [b]	1.530	0.466	
P07	Existing project termination	2.862	1.382	0.000	3.174	1.193	0.050	2.857	1.407	0.000	0.580	0.749	

Notes: SD = standard deviation; [a] NV = normalized value = (mean − minimum mean)/(maximum mean − minimum mean); [b] Indicate the impact is a critical pandemic impact (normalized value > 0.50); [c] Indicate Kruskal-Wallis result is significant at the 0.05 significance level (significance level < 0.05).

Table 5. Ranking of COVID-19 impacts according to organization work specialization.

Code	Impact	Overall			Building			Civil			Kruskal-Wallis test	
		Mean	SD	NV [a]	Mean	SD	NV [a]	Mean	SD	NV [a]	Chi-Square	*p*-Value
P02	Labor scarcity	3.713	1.141	1.00 [b]	3.632	1.112	1.00 [b]	3.975	1.000	1.00 [b]	0.150	0.697
P06	Supply chain disruption	3.662	1.034	0.93 [b]	3.614	1.114	0.97 [b]	3.800	1.091	0.85 [b]	0.000	0.955
P10	Decreased construction productivity	3.581	1.086	0.82 [b]	3.561	1.195	0.89 [b]	3.675	1.047	0.75 [b]	0.000	0.984
P01	Increased project financing rejection rate	3.529	1.011	0.75 [b]	3.561	0.982	0.89 [b]	3.450	1.260	0.56 [b]	1.130	0.288
P12	Reduced foreign investment in the construction industry	3.478	1.223	0.68 [b]	3.175	1.212	0.333	3.525	1.301	0.63 [b]	3.410	0.065
P08	Materials shortage	3.338	1.200	0.490	3.263	1.232	0.462	3.375	1.295	0.50 [b]	0.060	0.804
P09	Decreased number of private projects	3.338	1.249	0.490	3.281	1.221	0.487	3.475	1.320	0.58 [b]	0.140	0.707

Table 5. *Cont.*

Code	Impact	Overall			Building			Civil			Kruskal-Wallis test	
		Mean	SD	NV [a]	Mean	SD	NV [a]	Mean	SD	NV [a]	Chi-Square	*p*-Value
P11	Less demand on construction-related works	3.309	1.126	0.450	3.316	1.152	0.54 [b]	3.225	1.187	0.375	0.000	0.949
P03	Decreased number of public projects	3.265	1.104	0.390	3.246	1.106	0.436	3.125	1.181	0.292	0.050	0.826
P04	Existing project downsizing	3.213	1.043	0.320	3.246	0.969	0.436	3.125	1.244	0.292	0.560	0.453
P05	Decreased morale within project team members	3.176	1.115	0.270	2.947	1.141	0.000	3.350	1.145	0.479	4.600	0.032 [c]
P07	Existing project termination	2.978	1.250	0.000	3.018	1.408	0.103	2.775	1.310	0.000	1.690	0.193

Notes: SD = standard deviation; [a] NV = normalized value = (mean − minimum mean)/(maximum mean − minimum mean); [b] Indicate the impact is a critical pandemic impact (normalized value > 0.50); [c] Indicate Kruskal-Wallis result is significant at the 0.05 significance level (significance level < 0.05).

The overlapping CPI between clients, consultants, and contractors (see Table 4) are 'labor scarcity,' 'increased project financing rejection rate,' 'decreased construction productivity,' and 'supply chain disruption.' Consultants and contractors have an overlapping CPI: 'decreased number of private projects.' Conversely, the unique CPIs for consultants and contractors are 'reduced foreign investment in the construction industry' and 'labor scarcity,' respectively. There is no unique CPI for clients.

Alternately, the overlapping CPIs between building and civil construction (see Table 5) are 'labor scarcity,' 'decreased construction productivity,' 'supply chain disruption,' and 'increased project financing rejection rate.' Building construction contains a unique CPI: 'less demand for construction-related works.' In comparison, civil construction has three unique CPIs—'reduced foreign investment in the construction industry', 'shortage of materials,' and 'decreased amount of private projects.' Figure 2 shows the overlapping and unique CPIs between different aspects of AEC organizations.

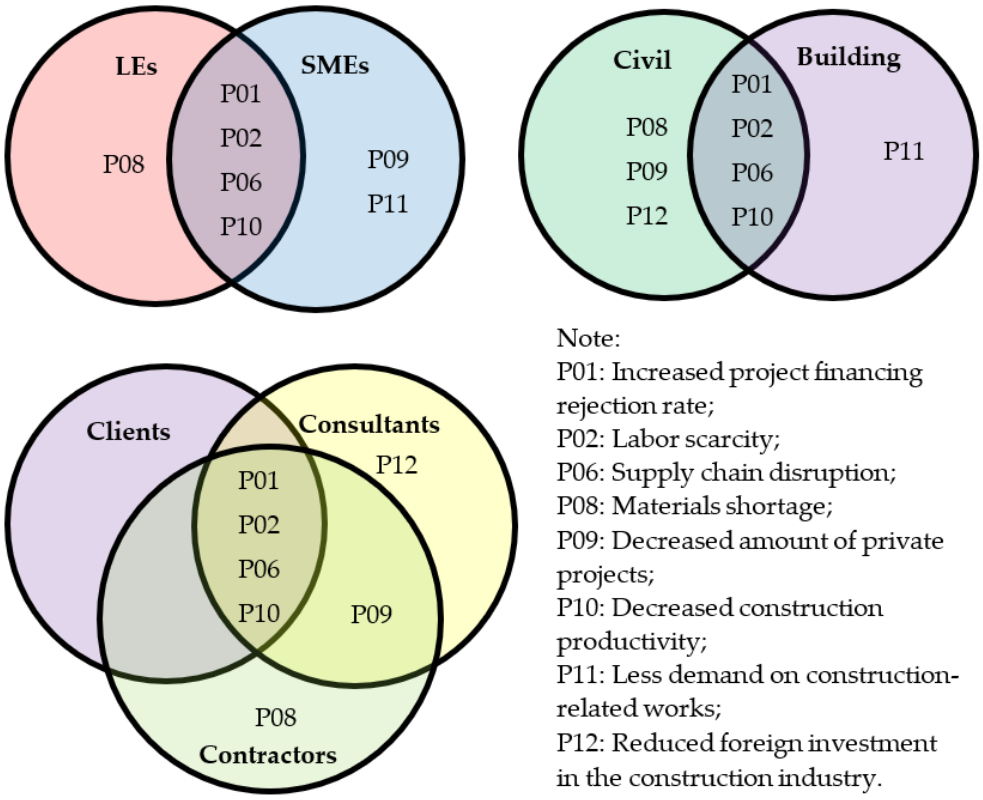

Figure 2. Overview of the overlap analysis results.

4.3. Results for Agreement Analysis

Tables 3–5 also show the Kruskal-Wallis test results for organization sizes, types, and work specializations. The results demonstrated impacts with p values less than 0.05 for all comparisons. LEs have a greater impact than SMEs. The impact is 'labor scarcity' (LEs mean = 3.933; SMEs mean = 3.638). In addition, consultants have a statistically greater impact than clients. The impact is 'less demand for construction-related works' (consultant mean = 3.478; client mean = 3.138). Finally, 'decreased morale within project team members' has a statistically significant higher mean in civil construction (mean = 3.350) than in building construction (mean = 2.947). These findings indicate that COVID-19 impacted organization sizes, types, and work specialization at different levels.

4.4. Results for Correlation Analysis

Spearmen's correlation coefficients (ρ) between COVID-19 impacts are shown in Table 6. The study discovered that most impacts had little or no correlation. Certain impacts have a weak correlation (all significant at 0.05). The moderately correlated impacts are: (a) 'decreased number of public projects' and 'existing project downsizing' (ρ = 0.575); (b) 'supply chain disruption' and 'shortage of materials' (ρ = 0.612); (c) 'existing project termination' and 'decreased number of private projects' (ρ = 0.565); and (d) 'decreased construction productivity' and 'less demand for construction-related works' (ρ = 0.573). These findings indicate that some connections and relationships exist between the twelve COVID-19 impacts.

Table 6. Spearman's correlation (ρ) for COVID-19 impacts.

Code	Impact	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
P01	Increased project financing rejection rate	1	0.31 *	0.29 *	0.159	0.21 *	0.25 *	0.33 *	0.20 *	0.37 *	0.18 *	0.22 *	0.033
P02	Labor scarcity	0.31 *	1	0.27 *	0.30 *	0.29 *	0.45 *	0.27 *	0.49 *	0.32 *	0.35 *	0.24 *	0.157
P03	Decreased number of public projects	0.29 *	0.27 *	1	0.58 *	0.32 *	0.38 *	0.45 *	0.47 *	0.40 *	0.37 *	0.42 *	0.27 *
P04	Existing project downsizing	0.159	0.30 *	0.58 *	1	0.34 *	0.25 *	0.48 *	0.40 *	0.41 *	0.37 *	0.44 *	0.26 *
P05	Decreased morale within project team members	0.21 *	0.29 *	0.32 *	0.34 *	1	0.35 *	0.36 *	0.34 *	0.24 *	0.36 *	0.19 *	0.25 *
P06	Supply chain disruption	0.25 *	0.45 *	0.38 *	0.25 *	0.35 *	1	0.33 *	0.61 *	0.36 *	0.38 *	0.36 *	0.22 *
P07	Existing project termination	0.33 *	0.26 *	0.45 *	0.48 *	0.36 *	0.33 *	1	0.49 *	0.57 *	0.37 *	0.46 *	0.37 *
P08	Materials shortage	0.20 *	0.49 *	0.47 *	0.40 *	0.34 *	0.61 *	0.49 *	1	0.48 *	0.41 *	0.39 *	0.18 *
P09	Decreased number of private projects	0.37 *	0.32 *	0.40 *	0.41 *	0.24 *	0.36 *	0.56 *	0.48 *	1	0.49 *	0.49 *	0.33 *
P10	Decreased construction productivity	0.18 *	0.35 *	0.37 *	0.37 *	0.36 *	0.38 *	0.37 *	0.41 *	0.49 *	1	0.57 *	0.29 *
P11	Lessen demand on construction-related works	0.22 *	0.24 *	0.42 *	0.44 *	0.19 *	0.36 *	0.46 *	0.39 *	0.49 *	0.57 *	1	0.40 *
P12	Reduced foreign investment in the construction industry	0.033	0.157	0.27 *	0.26 *	0.247 *	0.222 *	0.366 *	0.177 *	0.325 *	0.29 *	0.40 *	1

Notes: * Represents impacts with correlation significant at the 0.05 level (two-tailed).

5. Discussion

5.1. Overall Critical Pandemic Impact

5.1.1. Labor Scarcity (P02)

Labor scarcity had the highest mean score for several reasons. First, due to the pandemic and safety regulations, the number of projects was reduced, and existing projects slowed down greatly. Second, the percentage of decreased labor went from 30% up to 90%, which is approximately 13.2 million workers. The percentage drop in labor increased total cost, especially on-site, as site machines have a fixed hiring cost, which is charged to the project regardless of machine utilization. Moreover, the salary of the labor, in general, was increased; for semi-skilled and unskilled workers this was expected to rise by 10–15%. For skilled labor, this increased to 20–25%. The total loss for labor is expected to be between 860 billion to 3.4 trillion USD due to the increased unemployment rate. The

unemployment rate increased, and the number of unemployed who are not searching for jobs makes it even harder to hire new workers. Increasing the unemployment rate sharply raises poverty and may lead to depression. The government must start acting quickly; policymakers could contribute by providing an active labor policy [99]. This labor policy could focus on benefit cuts, job-search conditionality, and mandatory participation in low-cost activation programs.

5.1.2. Supply Chain Disruption (P06)

The COVID-19 pandemic affected all people, especially in the supply chain. It is important to understand the interconnectedness of supply chains for individual products, or service constituted supply chains. COVID-19 resulted in pharmaceutical and medical supply chain issues, disrupting at least 94% of Fortune 1000 companies [19]. The pandemic also caused global chain disruptions, the collapse of the tourism industry, commodity price falls, decline in remittances by migrants, capital flights, and foreign investment. There were issues in building material logistics [54] and the supply chain [24]. COVID-19 creates a threat to all of the United Nation's Sustainable Development Goals (SDGs). It is essential not to rely on a single supply chain which may lead to network failures and subsequent impact on the whole industry value chain [19]. Advanced resilience analytics are necessary to ensure supply chain networks remain operational during the pandemic [19]. The timing of bringing back facilities significantly impacts the supply chain performance [19]. The definition of supply chain resilience should be reconsidered, which would aid in more efficient management. The standard four-stage definition of resilience (plan, absorb, recover, adapt) could be chosen [19]. Additionally, stocks should be located close to customers. Localization of the supply chain could replace the globalized supply chain, leading to some challenges in maintaining the costs [54,66]. Policymakers could reduce supply chain disruption and improve sustainable development in the receiving nations [66].

5.1.3. Decreased Construction Productivity (P10)

One of the most affected areas due to the pandemic is productivity. Safety regulations, and the cost to the workers, created a barrier to having a full workforce, which decreased the productivity of workers in general. In addition, some supply chains stopped production for a while [24]. The production rate is estimated to drop by about 14% compared to the previous year [72]. Industrial production also lost approximately 15% in September 2020 and 19% in December 2020 [72]. That loss led to a cumulative loss of 12.75% in US industrial production in the last ten months [72]. The reduced productivity and unemployment led to further decline in financing and more rejection rates for construction projects [72,75]. It is important to encourage the productivity sector in the construction industry to promote decent work and sustainable building practices [24]. The consistent monitoring and evaluation of production based on a new definition of competitiveness, productivity, and prosperity aligned with human development, social cohesion, and sustainability should be considered [71,100]. Policymakers and scholars could contribute to achieving construction goals by pointing generally to productivity [71]. The coverage of the problems caused by the reduced production rate could enhance productivity and competitiveness.

5.1.4. Increased Project Financing Rejection Rate (P01)

The rejection rate of project financing has increased during the pandemic. COVID-19 has slowed down the global economy, affecting liquidity risk, loan defaults, and loss of intermediation revenues. The risk of financing projects has increased, which led to the rejection rate rising from 20–25% to 30–35% [11]. Financial reporting is sometimes misleading and does not assure how public money was spent [36,37]. There is no guarantee for a project to get its revenue back during the pandemic, which leads to more rejection even if the project is acceptable and financially stable [37]. In general, costs increased, and revenues decreased, which influenced the motivation for project financing [36,37]. According to OECD publications, the impact of COVID-19 on subnational finance has been

highly diverse. The COVID-19 pandemic surpassed the 2008–2010 financial crisis, and it is important to investigate further possible solutions [38]. The more quickly the pandemic retreats, the more quickly the financial situation will improve. One of the possible solutions is to provide cheap loans, which will not fully finance projects but will push projects forward [37]. Projects need financial resources, which the constitution and the law could provide. The municipalities could be expected to react by changing their 2020 budgets via cuts in some expenditures to help overcome the COVID-19 pandemic [39,40]

5.1.5. Reduced Foreign Investment in the Construction Industry (P12)

There is no doubt that foreign direct investment (FDI) is one of the most important factors that assist the construction industry. The COVID-19 pandemic affected the FDI; the investment rate has fallen apart since COVID-19. The FDI is estimated to drop by more than 40% in 2020, and is currently increasing in 2021 [26]. The pandemic scared foreign investors due to the rise in fiscal deficit [26]. Even some investor shares decreased during the pandemic [26]. Generally, trade and investment have lost their positions, and there is a significant slowdown in investment [80]. It is crucial to solve this issue, which slows down projects and decreases revenue. Investment policies could impact FDI flow. The actions taken by the government can directly affect the investment flow either by increasing or decreasing it for investors [26]. Divestments could also impact the FDI flow; divestments are frequent and natural, allowing firms to adapt to their operations in order to respond to quickly changing business realities. The decline in reinvested earnings could be partly offset by intracompany loans and injections of equity capital to the struggling foreign affiliates resulting in increasing FDI.

5.2. Specific Critical Pandemic Impact

5.2.1. Materials Shortage (P08)

Materials shortage is a significant CPI which the whole world suffered. Contactors faced many problems during the COVID-19 pandemic, including a materials shortage [20]. The situation in China led to a materials shortage in manufacturing countries [48]. All countries that relied on China as a raw material source were affected. There is a shortage of an estimated 1.5 tons [43]. The price of raw materials increased significantly [23,48]. The materials shortage also led to global manufacturing shutdowns [20], employee reduction, increased production costs, buyers declining to pay for raw materials, and increased shipping prices [23,48]. Therefore, it is crucial to solve this materials shortage problem. There should be agreements which address shortages in material issue to offer security to the contactors. For instance, if a certain material is unavailable and could only be obtained from a particular source, efforts to agree on and obtain suitable replacements should be documented [20]. Policymakers could contribute by providing a policy that facilitates agreement on projects and supports the availability of materials.

5.2.2. Decreased Number of Private Projects (P09)

The construction sector has been on a massive downturn since the pandemic; there is a great deal of estimation by institutions and scholars of the economic fallout of the COVID-19 pandemic. The International Monetary Fund (IMF), in its latest estimate in June 2020, estimated a loss of about 4.9%. The Indian economy is estimated to have 4.5% negative growth in 2020 [7]. Sometimes projects get declined as they may be way out of schedule due to increased operating costs, payment delays, and slowdowns in the supply chain. Another concern for the contactors facing a project shutdown is the effort to protect the site, work, materials, and equipment from damage or theft [20]. The government's shutdown directly affected construction, along with the government's orders to slow down the spread of COVID-19, which resulted in workers and consultants not being on-site, and the time extension, which resulted in some projects being shut down [20]. It is important to find solutions to increase the number of projects globally, which would help in refreshing national economies. A few options could be considered. Remote working, especially

office work, has proven to be an option for millions of workers. A cultural revolution should be introduced in how people approach their work. This revolution might include re-orientation and entrepreneurship from all employees for better overall results. Lastly, remote collaboration could be increased with tools for sharing agendas and managing products and projects [54].

5.2.3. Less Demand for Construction-Related Work (P11)

There was a reduction in the number of projects, but construction-related works were also lessened. The value of construction-related works rose significantly [76]. The demand for construction projects has already fallen post-COVID-19 pandemic. Due to the lower economic status of companies, the demand for construction-related works was reduced. The whole construction sector was reduced, which affected the demand for construction projects in general [12]. Many factors affected the construction sector. The top five sectors impacted are chemicals, agriculture, non-metallic products, trade, and metal products. After reducing construction-related works, the top five sectors affected were metal products, air transport, rail transport, gas distribution, and electricity [12]. In India, the infrastructure and the construction sectors fell apart. Construction-related works were reduced, along with the number of projects [12]. It is estimated that the COVID-19 pandemic is likely to reduce investment in construction-related works by a range of 13–30%. This reduction significantly impacts the Gross Value Added (GVA) and the employment rate. The construction-related GVA is expected to be reduced from 15 to 34%. It is crucial to find solutions to the problems that are created due to the reduced supply of construction-related works impacting the industry. The construction sector could recover more rapidly if supported by the unprecedented public relief packages offered, especially if these are followed by public investment programs [24].

5.3. Theoretical Implications and Contribution

Due to the COVID-19 pandemic, nations' economies are falling apart. Aside from the downgrade in the economy, the construction sector is among the most negatively affected industries. It is becoming more crucial to surpass the current crisis and move on. The construction sector was among the most highly affected sectors; the amount of economic loss it suffered is alarming. In a step towards finding possible solutions to refresh the construction industry, this study focuses on finding the current CPI by interviewing AEC professionals, conducting a systematic review, and collecting survey data. The final results from the collected data were compared to a study of the current CPI in India. After comparing the current CPI, the most impactful factors were analyzed and discussed. These were categorized under overall critical pandemic impact and specific critical pandemic impact. Understanding the reasons behind the CPI could assist in finding solutions. The study highlighted the possible reasons and proposed solutions to overcome the current CPI in India. Researchers could focus on the CPI to develop a strategic plan. Policymakers and project managers and owners could provide insights into the current situation and aid in developing better overall successful plans for facing the COVID-19 pandemic. This study could be used as a reference for developing better strategic plans and increasing investment in construction projects, which can positively impact the national economy.

5.4. Practical/Managerial Implications

This study explored the various critical pandemic impacts of COVID-19 on India. The study focused on finding the main sectors affected by the COVID-19 pandemic. The study aimed to find, compare, and analyze the different CPIs in India. The factors were identified and analyzed. The results could be applied in construction, aiding in overcoming the current situation. CPIs can be grouped into overall critical pandemic impact and specific critical pandemic impact. The overall critical pandemic impact consists of; 'labor scarcity,' 'supply chain disruption,' 'decreased construction productivity,' 'increased project financing rejection rate,' and 'reduced foreign investment in the construction industry.' The

results are expected to aid owners and project managers in reducing losses and increasing revenue by reducing risks and increasing success factors within the construction sector. 'Labor scarcity' is considered the most significant factor, directly affecting construction productivity and contributing to other CPIs such as 'decreased construction productivity.' 'Labor scarcity' is at the top of the survey results. This factor was agreed on during the interviews and most of the systematically reviewed papers [12,13,24,25,41]. The results of this study could aid authorities in developing plans to fight against the CPIs, in general, facing India.

5.5. Limitations and Further Research

This study has some limitations that should be noticed; this section also provides suggestions for future research. The systematic review was conducted in 2020, and the survey data was collected in August 2021. The data collected may change, and other CPIs may have appeared, so this work does not reflect India's construction sector current situation in 2022 but is still an important reference point and database for future studies in India. The interviews mitigated the limitations of the systematic review. The pilot study conducted before the survey helped reduce limitations in the CPIs discovered from the survey. It is recommended to conduct a survey on a larger sample size for future studies. The CPIs may be used to develop surveys in other countries. Most of the world has suffered from the COIVD-19 pandemic, and the construction sector has reduced in size in many countries. The data may help other countries to develop plans and strategies to overcome the current CPI.

6. Conclusions

This study aimed to investigate the interrelationships between COVID-19 impacts and India's construction industry. The objectives of this study were to: (a) Identify the critical pandemic impacts (CPI) of COVID-19 in India's construction industry; (b) Compare the CPI between different organizational characteristics; and (c) Analyze the interrelationships between CPIs. To achieve these objectives, a systematic review and interviews were conducted on CPI in India. CPI was detected and identified through a systematic review and interviews. Then, a survey was developed and tested before collecting the data. The participants were mainly from the construction sector. The data collected from the survey was analyzed by mean score ranking, overlap analysis, agreement analysis, and correlation analysis. The results from the data analysis grouped the CPI into two categories, overall critical pandemic impact and specific critical pandemic impact. The overall critical pandemic impact consists of; 'labor scarcity,' 'supply chain disruption,' 'decreased construction productivity,' 'increased project financing rejection rate,' and 'reduced foreign investment in the construction industry.' The results could assist owners and project managers in developing countermeasures toward the current CPI. The study recommends some of these countermeasures:

(1) Having better planning, monitoring, and management of construction projects (e.g., more adaptation of building information modeling (BIM) technology could assist in combating 'increased project financing rejection rate,' 'existing project downsizing,' 'existing project termination,' 'decreased construction productivity,' 'increased project financing rejection rate,' and 'materials shortage.'
(2) Increasing wages, incentives, and hiring temporary employees, either qualified or unqualified, could assist in fighting 'labor scarcity.'
(3) Proper execution of current projects, as giving more priority and focus to a certain project could accelerate the project execution time, which helps in fighting 'decreased amount of public projects,' and 'decreased amount of private projects.'
(4) More communication and listening to team members could help fight against 'decreased morale within project team members.'
(5) Creating a supply chain emergency plan that includes identifying backup suppliers and partnerships with logistics experts to help face 'supply chain disruption.'

(6) Promoting companies' goals and vision through a structured plan with specific related projects. This could increase connections between clients and foreigners which could address 'less demand for construction-related works ' and 'reduced foreign investment in the construction industry.'

The study could be a starting point for the construction industry in India and other similar countries to get back online and refresh the construction industry in order to overcome the COVID-19 breakdown. Benefits to individuals such as clients, consultants, contractors, and employees in general, and benefits to the country from small to large enterprises, are expected to happen over time, overcoming the current CPI. The study outcome can assist authorities and policymakers in India and other countries, which may relate to pinpointing the problems facing the construction sector during the COVID-19 pandemic. Some countermeasures have been suggested, and other solutions could be adopted in the future to face CPI. Overcoming the current CPI can result an economic leap for the nation.

Author Contributions: Conceptualization, R.A.R.; methodology, R.A.R.; validation, R.A.R.; formal analysis, R.A.R.; investigation, K.S.A.; resources, K.S.A., R.A.R. and S.A.; data curation, K.S.A.; writing—original draft preparation, A.M.F. and K.S.A.; writing—review and editing, H.A.R., R.A.R., and S.A.; visualization, R.A.R.; supervision, R.A.R.; project administration, R.A.R. and S.A.; funding acquisition, R.A.R. and S.A. All authors have read and agreed to the published version of the manuscript.

Funding: This study was funded by the Ministry of Higher Education, Malaysia, through the Post COVID-19 Special Research Grant Scheme [RDU200705]. Also, the publication fee was funded by the Deanship of Scientific Research, Qassim University.

Institutional Review Board Statement: Ethical review and approval were waived for this study because the study involves anonymous data collection.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available because some data are proprietary or confidential. Therefore, the data may only be provided with restrictions (e.g., anonymized data).

Acknowledgments: This study was funded by the Ministry of Higher Education, Malaysia, through the Post COVID-19 Special Research Grant Scheme [RDU200705]. The researchers would like to thank the Deanship of Scientific Research, Qassim University for funding the publication of this study. The authors are also grateful to the editors and the anonymous reviewers for their insightful comments, which helped improve this paper's quality.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

1. Sriram. Construction. Invest India. 2021. Available online: https://www.investindia.gov.in/sector/construction (accessed on 30 April 2022).
2. Biswas, A.; Ghosh, A.; Kar, A.; Mondal, T.; Ghosh, B.; Bardhan, P.K. The impact of COVID-19 in the construction sector and its remedial measures. *J. Physics: Conf. Ser.* **2021**, *1797*, 012054. [CrossRef]
3. Wang, L.; Zhao, D.; Zhong, Y. Sustainable Allocation Model of Construction Workforce for Work Resumption during COVID-19. *Sustainability* **2021**, *13*, 6481. [CrossRef]
4. Parada, J. Understanding the Sector Impact of COVID-19: Engineering & Construction. Deloitte Perspectives. 2020. Available online: https://www2.deloitte.com/global/en/pages/about-deloitte/articles/covid-19/understanding-the-sector-impact-of-covid-19--engineering---const.html (accessed on 30 April 2022).
5. Siva, M. A cure for construction. *Hindu Bus.* 23 September 2021; pp. 1–3. Available online: https://www.thehindubusinessline.com/opinion/a-cure-for-construction/article36636153.ece (accessed on 30 April 2022).
6. Sharma; Harman, M. India: Managing the Impact of COVID-19 on the Infrastructure and Construction Sector. *Mondaq*, 2 September 2020. Available online: https://www.mondaq.com/india/litigation-contracts-and-force-majeure/981394/managing-the-impact-of-covid-19-on-the-infrastructure-and-construction-sector (accessed on 30 April 2022).

7. Sahoo, P.; Ashwani. COVID-19 and Indian Economy: Impact on Growth, Manufacturing, Trade and MSME Sector. *Glob. Bus. Rev.* **2020**, *21*, 1159–1183. [CrossRef]
8. Ministry of Health & Family Welfare. *SOP on Preventive Measures to Contain Spread of COVID-19 in Offices*; Ministry of Health & Family Welfare: New Delhi, India, 2021.
9. OSHA. *Guidance on Preparing Workplaces for COVID-19*; OSHA: Washington, DC, USA, 2020.
10. Assaad, R.; El-Adaway, I.H. Guidelines for Responding to COVID-19 Pandemic: Best Practices, Impacts, and Future Research Directions. *J. Manag. Eng.* **2021**, *37*, 06021001. [CrossRef]
11. Dethe, A. Loan rejection rate us high, Q4 will show the real picture: Karur Vysya Bank CEO. *Econ. Times*, 4 December 2020; pp. 1–5. Available online: https://bfsi.economictimes.indiatimes.com/news/banking/loan-rejection-rate-is-high-q4-will-show-the-real-picture-karur-vysya-bank-ceo/79558266 (accessed on 30 April 2022).
12. KPMG. *COVID-19: Assessment of Economic Impact on Construction Sector in India*; KPMG: London, UK, 2020.
13. Das, P.; Saha, J.; Chouhan, P. Effects of labor out-migration on socio-economic set-up at the place of origin: Evidence from rural India. *Child. Youth Serv. Rev.* **2020**, *119*, 105512. [CrossRef]
14. State and Local Government Workforce: 2020 Survey. 2020. Available online: https://slge.org/resources/state-and-local-government-workforce-2020-survey (accessed on 30 April 2022).
15. *How to Reduce the Pandemic Impact on Employees: A Guide for Company Leaders*; Deloitte: London, UK, 2021.
16. Bode; Macdonald, J.R. Stages of supply chain disruption response: Direct, constraining, and mediating factors for impact mitigation. *Decis. Sci.* **2017**, *48*, 836–874. [CrossRef]
17. *Real Estate Developers Resort to Layoffs, Pay Cuts as COVID-19 Hits Sales*; Business Standard: Mumbai, India, 2020; pp. 1–4.
18. Zamani, S.H.; Rahman, R.A.; Fauzi, M.A.; Yusof, L.M. Government pandemic response strategies for AEC enterprises: Lessons from COVID-19. *J. Eng. Des. Technol.* **2022**, *in press*. [CrossRef]
19. Golan, M.S.; Jernegan, L.H.; Linkov, I. Trends and applications of resilience analytics in supply chain modeling: Systematic literature review in the context of the COVID-19 pandemic. *Environ. Syst. Decis.* **2020**, *40*, 222–243. [CrossRef]
20. Newsletter, F.C. Dealing with the Construction Impacts Of COVID-19. 2020. Available online: https://www.americanbar.org/groups/tort_trial_insurance_practice/publications/committee-newsletters/construction_impacts_of_covid/ (accessed on 30 April 2022).
21. Pamidimukkala, A.; Kermanshachi, S. Impact of COVID-19 on field and office workforce in construction industry. *Proj. Leadersh. Soc.* **2021**, *2*, 100018. [CrossRef]
22. Gamil, Y.; Alhagar, A. The Impact of Pandemic Crisis on the Survival of Construction Industry: A Case of COVID-19 Dr. Yaser Gamil Abdulsalam Alhagar. *Mediterr. J. Soc. Sci.* **2020**, *11*, 122–128. [CrossRef]
23. Construction Market Experts. *Pandemic Causes Shortage of Raw Materials—Price Rises on Construction Chemicals Market*; Construction Market Experts: Kraków, Poland, 2021.
24. ILO. *Impact of COVID-19 on the Construction Sector*; ILO Sectoral Brief: Geneva, Switzerland, 2021; pp. 1–12.
25. Tamboli, M.A.; Bankar, N.U. A Study on Impact of COVID-19 Pandemic on the Indian Economy. *Recent Trends Manag. Commer.* **2019**, *10*, 540–546. [CrossRef]
26. OECD. Foreign direct investment flows in the time of COVID-19. OECDiLibrary. 2020, pp. 1–13. Available online: https://www.oecd-ilibrary.org/finance-and-investment/foreign-direct-investment-flows-in-the-time-of-covid-19_a2fa20c4-en (accessed on 30 April 2022).
27. Debata, B.; Patnaik, P.; Mishra, A. COVID-19 pandemic! It's impact on people, economy, and environment. *J. Public Aff.* **2020**, *20*, 1–5. [CrossRef]
28. Thomas, N.; Saud, S.J. Disruption of Construction Industry During COVID-19 Pandemic—A Case Study from Ernakulam. In Proceedings of the International Conference on Structural Engineering and Construction Management, Kerala, India, 12–15 May 2021; Volume 171, pp. 151–163. [CrossRef]
29. Krosnick, J.A. Improving Question Design to Maximize Reliability and Validity. In *The Palgrave Handbook of Survey Research*; Palgrave Macmillan: Cham, Switzerland, 2018.
30. Falagas, M.E.; Pitsouni, E.I.; Malietzis, G.; Pappas, G. Comparison of PubMed, Scopus, Web of Science, and Google Scholar: Strengths and weaknesses. *FASEB J.* **2008**, *22*, 338–342. [CrossRef]
31. Omer, M.M.; Rahman, R.A.; Almutairi, S. Strategies for Enhancing Construction Waste Recycling: A Usability Analysis. *Sustainability* **2022**, *14*, 5907. [CrossRef]
32. Omer, M.M.; Rahman, R.A.; Almutairi, S. Construction waste recycling: Enhancement strategies and organization size. *Phys. Chem. Earth, Parts A/B/C* **2022**, *126*, 103114. [CrossRef]
33. Farouk; Abdelrahman, M.; Rahman, R.A.; Romali, N.S. Non-Revenue Water Reduction Strategies: A Systematic Review. *Smart Sustain. Built Environ.* **2021**. *ahead of print*. [CrossRef]
34. Zhang, X.; Shen, L.; Wu, Y. Green strategy for gaining competitive advantage in housing development: A China study. *J. Clean. Prod.* **2011**, *19*, 157–167. [CrossRef]
35. Farouk, A.M.; Rahman, R.A.; Romali, N.S. Economic analysis of rehabilitation approaches for water distribution networks: Comparative study between Egypt and Malaysia. *J. Eng. Des. Technol.* **2021**. *ahead of print*. [CrossRef]
36. Rizwan, M.S.; Ahmad, G.; Ashraf, D. Systemic risk: The impact of COVID-19. *Finance Res. Lett.* **2020**, *36*, 101682. [CrossRef]

37. Khan, K.; Zhao, H.; Zhang, H.; Yang, H.; Shah, M.H.; Jahanger, A. The Impact of COVID-19 Pandemic on Stock Markets: An Empirical Analysis of World Major Stock Indices. *J. Asian Finance, Econ. Bus.* **2020**, *7*, 463–474. [CrossRef]
38. Stroud, R.; Levell, P.; Griffith, R. The impact of COVID-19 on share prices in the UK. *Fisc. Stud.* **2020**, *41*, 363–369. [CrossRef]
39. Heald, D.; Hodges, R. The accounting, budgeting and fiscal impact of COVID-19 on the United Kingdom. *J. Public Budgeting, Account. Financial Manag.* **2020**, *32*, 785–795. [CrossRef]
40. Nemec, J.; Špaček, D. The COVID-19 pandemic and local government finance: Czechia and Slovakia. *J. Public Budgeting, Account. Financial Manag.* **2020**, *32*, 837–846. [CrossRef]
41. Mishra, S. *Impact of Coronavirus on Indian Real Estate*; HOUSING.COM: Gurgaon, India, 2021.
42. Borland, J.; Charlton, A. The Australian Labour Market and the Early Impact of COVID-19: An Assessment. *Aust. Econ. Rev.* **2020**, *53*, 297–324. [CrossRef]
43. Tredinnick, L.; Laybats, C. Working in the world of the pandemic. *Bus. Inf. Rev.* **2020**, *37*, 97–102. [CrossRef]
44. Dias, M.C.; Joyce, R.; Postel-Vinay, F.; Xu, X. The Challenges for Labour Market Policy during the COVID-19 Pandemic. *Fisc. Stud.* **2020**, *41*, 371–382. [CrossRef]
45. Walmsley, T.L.; Rose, A.; Wei, D. Impacts on the U.S. macroeconomy of mandatory business closures in response to the COVID-19 Pandemic. *Appl. Econ. Lett.* **2020**, *28*, 1293–1300. [CrossRef]
46. McGann, M.; Murphy, M.P.; Whelan, N. Workfare redux? Pandemic unemployment, labour activation and the lessons of post-crisis welfare reform in Ireland. *Int. J. Sociol. Soc. Policy* **2020**, *40*, 963–978. [CrossRef]
47. Fana, M.S.; Pérez, T.; Fernández-Macías, E. Employment impact of COVID-19 crisis: From short term effects to long terms prospects. *J. Ind. Bus. Econ.* **2020**, *47*, 391–410. [CrossRef]
48. Sen, S.; Antara, N. Sen, S. Chowdhury, S. The Unprecedented Pandemic'COVID-19'Effect on the Bangladesh Apparel Workers by Shivering the Apparel Supply Chain. *J. Text. Apparel, Technol. Manag.* **2020**, *11*, 1–20.
49. Menon, J. Special review: COVID-19 in East Asia: Impacts and response. *Thail. World Econ.* **2020**, *38*, 119–127.
50. Sanderson, J.; Brown, K. COVID-19 and youth sports: Psychological, developmental, and economic impacts. *Int. J. Sport Commun.* **2020**, *1*, 1–11. [CrossRef]
51. Sheptak, R.D.; Menaker, B.E. When Sport Event Work Stopped: Exposure of Sport Event Labor Precarity by the COVID-19 Pandemic. *Int. J. Sport Commun.* **2020**, *13*, 1–9. [CrossRef]
52. Araya. Modeling the spread of COVID-19 on construction workers: An agent-based approach. *Saf. Sci.* **2021**, *133*, 105022. [CrossRef]
53. Mirza, N.; Rahat, B.; Naqvi, B.; Rizvi, S.K.A. Impact of COVID-19 on corporate solvency and possible policy responses in the EU. *Q. Rev. Econ. Finance* **2020**. [CrossRef]
54. Rapaccini, M.; Saccani, N.; Kowalkowski, C.; Paiola, M.; Adrodegari, F. Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms. *Ind. Mark. Manag.* **2020**, *88*, 225–237. [CrossRef]
55. Ivanov, D. Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case. *Transp. Res. Part E Logist. Transp. Rev.* **2020**, *136*, 101922. [CrossRef]
56. Xu, Z.; Elomri, A.; Kerbache, L.; El Omri, A. Impacts of COVID-19 on global supply chains: Facts and perspectives. *IEEE Eng. Manag. Rev.* **2020**, *48*, 153–166. [CrossRef]
57. Miller, K. Sharing the sacrifice, minimizing the pain: Optimal wage reductions. *Econ. Lett.* **2020**, *196*, 109503. [CrossRef]
58. Williams, C.C.; Kayaoglu, A. The Coronavirus Pandemic and Europe's Undeclared Economy: Impacts and a Policy Proposal. *South East Eur. J. Econ. Bus.* **2020**, *15*, 80–92. [CrossRef]
59. Friedline, T.; Chen, Z.; Morrow, S. Families' financial stress & well-being: The importance of the economy and economic environments. *J. Fam. Econ. Issues* **2021**, *42*, 34–51.
60. Prawoto, N.; Purnomo, E.P.; Zahra, A.A. The impacts of COVID-19 pandemic on socio-economic mobility in Indonesia. *Int. J. Econ. Bus. Adm.* **2020**, *8*, 57–71. [CrossRef]
61. Cannavale, I.Z.; Nadali; Esempio, A. Entrepreneurial orientation and firm performance in a sanctioned economy–does the CEO play a role? *J. Small Bus. Enterp. Dev.* **2020**, *27*, 1005–1027. [CrossRef]
62. Tisdell, A. Economic, social and political issues raised by the COVID-19 pandemic. *Econ. Anal. Policy* **2020**, *68*, 17–28. [CrossRef] [PubMed]
63. Ghosh, J. A critique of the Indian government's response to the COVID-19 pandemic. *Econ. E Politi- Ind.* **2020**, *47*, 519–530. [CrossRef]
64. Ozili, P. COVID-19 in Africa: Socio-economic impact, policy response and opportunities. *Int. J. Sociol. Soc. Policy* **2020**, *42*, 177–200. [CrossRef]
65. Child, J. Organizational participation in post-covid society—Its contributions and enabling conditions. *Int. Rev. Appl. Econ.* **2020**, *35*, 117–146. [CrossRef]
66. Rahman, S.M.; Kim, J.; Laratte, B. Disruption in Circularity? Impact analysis of COVID-19 on ship recycling using Weibull tonnage estimation and scenario analysis method. *Resour. Conserv. Recycl.* **2020**, *164*, 105139. [CrossRef] [PubMed]
67. van Barneveld, K.; Quinlan, M.; Kriesler, P.; Junor, A.; Baum, F.; Chowdhury, A.; Junankar, R.; Clibborn, S.; Flanagan, F.; Wright, C.F.; et al. The COVID-19 pandemic: Lessons on building more equal and sustainable societies. *Econ. Labour Relations Rev.* **2020**, *31*, 133–157. [CrossRef]

68. Bsisu, K.A.-D. The Impact of COVID-19 Pandemic on Jordanian Civil Engineers and Construction Industry. *Int. J. Eng. Res. Technol.* **2020**, *13*, 828–830. [CrossRef]
69. Olivia, S.; Gibson, J.; Nasrudin, R. Indonesia in the Time of COVID-19. *Bull. Indones. Econ. Stud.* **2020**, *56*, 143–174. [CrossRef]
70. Liu, Y.; Lee, J.M.; Lee, C. The challenges and opportunities of a global health crisis: The management and business implications of COVID-19 from an Asian perspective. *Asian Bus. Manag.* **2020**, *19*, 277–297. [CrossRef]
71. Ferrannini, A.; Barbieri, E.; Biggeri, M.; Di Tommaso, M.R. Industrial policy for sustainable human development in the post-Covid19 era. *World Dev.* **2021**, *137*, 105215. [CrossRef]
72. Caggiano, G.; Castelnuovo, E.; Kima, R. The global effects of COVID-19-induced uncertainty. *Econ. Lett.* **2020**, *194*, 109392. [CrossRef]
73. Gu, X.; Ying, S.; Zhang, W.; Tao, Y. How Do Firms Respond to COVID-19? First Evidence from Suzhou, China. *Emerg. Mark. Finance Trade* **2020**, *56*, 2181–2197. [CrossRef]
74. Malliet, P.; Reynès, F.; Landa, G.; Hamdi-Cherif, M.; Saussay, A. Assessing Short-Term and Long-Term Economic and Environmental Effects of the COVID-19 Crisis in France. *Environ. Resour. Econ.* **2020**, *76*, 867–883. [CrossRef]
75. King, S.S.; Rahman, R.A.; Fauzi, M.A.; Haron, A.T. Critical analysis of pandemic impact on AEC organizations: The COVID-19 case. *J. Eng. Des. Technol.* **2021**, *20*, 1. [CrossRef]
76. He, P.; Sun, Y.; Zhang, Y.; Li, T. COVID–19's impact on stock prices across different sectors—An event study based on the Chinese stock market. *Emerg. Mark. Financ. Trade* **2020**, *56*, 2198–2212. [CrossRef]
77. Savych, O.; Shkoda, T. Trends of air transportation market development in Ukraine. *Innov. Mark.* **2020**, *16*, 29–42. [CrossRef]
78. French, N. Property valuation in the UK: Material uncertainty and COVID-19. *J. Prop. Investig. Finance* **2020**, *38*, 463–470. [CrossRef]
79. Humeedat, M.M. New environmental factors affecting cost systems design after COVID-19. *Manag. Sci. Lett.* **2020**, *10*, 3777–3782. [CrossRef]
80. Kheyfets, B.A.; Chernova, V.Y. Globalization dynamics in times of crisis. *Uncertain Supply Chain Manag.* **2020**, *8*, 887–896. [CrossRef]
81. Strange, R. The 2020 COVID-19 pandemic and global value chains. *J. Ind. Bus. Econ.* **2020**, *47*, 455–465. [CrossRef]
82. Patton, M.Q. *Qualitative Research and Evaluation Components*; Sage: Thousand Oaks, CA, USA, 2001.
83. Zhao, X.; Hwang, B.-G.; Low, S.P.; Wu, P. Reducing Hindrances to Enterprise Risk Management Implementation in Construction Firms. *J. Constr. Eng. Manag.* **2015**, *141*, 04014083. [CrossRef]
84. Wilkins, J.R. Construction workers' perceptions of health and safety training programmes. *Constr. Manag. Econ.* **2011**, *29*, 1017–1026. [CrossRef]
85. Noy, C. Sampling Knowledge: The Hermeneutics of Snowball Sampling in Qualitative Research. *Int. J. Soc. Res. Methodol.* **2008**, *11*, 327–344. [CrossRef]
86. Mao, C.; Shen, Q.; Pan, W.; Ye, K. Major Barriers to Off-Site Construction: The Developer's Perspective in China. *J. Manag. Eng.* **2015**, *31*, 04014043. [CrossRef]
87. Ott, R.L.; Longnecker, M.T. *An Introduction to Statistical Methods and Data Analysis*; Cengage Learning: Boston, MA, USA, 2015.
88. Osei-Kyei, R.; Chan, A.P.C. Developing a Project Success Index for Public–Private Partnership Projects in Developing Countries. *J. Infrastruct. Syst.* **2017**, *23*, 04017028. [CrossRef]
89. Adabre, M.A.; Chan, A.P.; Darko, A.; Osei-Kyei, R.; Abidoye, R.; Adjei-Kumi, T. Critical barriers to sustainability attainment in affordable housing: International construction professionals' perspective. *J. Clean. Prod.* **2020**, *253*, 119995. [CrossRef]
90. Santos, J.R.A. Cronbach's alpha: A tool for assessing the reliability of scales. *J. Ext.* **1999**, *37*, 1–5.
91. Nunnally, J.C. *Psychometric Theory*, 2nd ed.; McGraw-Hill: New York, NY, USA, 1978.
92. Staplehurst, J.; Ragsdell, G. Knowledge sharing in SMEs: A comparison of two case study organisations. *J. Knowl. Manag. Pract.* **2010**, *11*, 1–16.
93. Lee, Z.P.; Rahman, R.A.; Doh, S.I. Critical success factors for implementing design-build: Analysing Malaysian public projects. *J. Eng. Des. Technol.* **2021**. *ahead of print*. [CrossRef]
94. Heberle, G.V.; Meirelles, F.R.; da Silva, G.P.; Telles; Minghim, R. InteractiVenn: A web-based tool for the analysis of sets through Venn diagrams. *BMC Bioinform.* **2015**, *16*, 1–7. [CrossRef]
95. Lee, Z.P.; Rahman, R.A.; Doh, S.I. Key drivers for adopting design build: A comparative study between project stakeholders. *Phys. Chem. Earth, Parts A/B/C* **2020**, *120*, 102945. [CrossRef]
96. Radzi, A.R.; A Rahman, R.; I Doh, S.; Esa, M. A Comparative Study on the Readiness Parameters of Highway Construction Projects. *IOP Conf. Series: Earth Environ. Sci.* **2021**, *641*, 012008. [CrossRef]
97. Pallant, J. *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using IBM SPSS*; Routledge: London, England, 2020.
98. Asuero, A.G.; Sayago, A.; Gonzalez, A.G. The Correlation Coefficient: An Overview. *Crit. Rev. Anal. Chem.* **2006**, *36*, 41–59. [CrossRef]
99. Adamy, A.; Rani, H.A. An evaluation of community satisfaction with the government's COVID-19 pandemic response in Aceh, Indonesia. *Int. J. Disaster Risk Reduct.* **2022**, *69*, 102723. [CrossRef]
100. Anandh, K.S.; Gunasekaran, K.; Mannan, M.A. Investigation on The Factors Affecting Lifestyle of Professionals in The Construction Industries (Kerala and Tamil Nadu). *Int. J. Integr. Eng.* **2020**, *12*, 246–252. [CrossRef]