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Informality of Labour in the Indonesia Construction Industry

Ryandika[1], Meifrinaldi[1], Krishna Suryanto Pribadi[1], Igor Martek[2], Toong Khuan Chan[3,*]

[1] Faculty of Civil and Environmental Engineering, Bandung Institute of Technology, Bandung, Indonesia
[2] School of Architecture and Built Environment, Deakin University, Geelong, Australia
[3] Department of Engineering, La Trobe University, Melbourne, Australia, formerly Faculty of Architecture, Building and Planning, University of Melbourne, Melbourne, Australia

Corresponding author: Dr Toong Khuan Chan, University of Melbouorne, Toong-khuan.Chan@latrobe.edu.au

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Abstract

The COVID-19 pandemic has led to concerns about the vulnerability of the estimated 70 million informal workers in Indonesia, who are at risk of job losses and wage cuts due to the lack of a social safety net. This study aims to assess the effect of the COVID-19 pandemic on formal and informal workers in the construction industry in the West Java province. Specifically, the objectives are (i) to assess the effect of COVID-19 on workers' incomes and work hours, and (ii) to evaluate the implementation of health and safety protocols at project sites and identify associated challenges and limitations. A survey conducted in November and December 2020 obtained 261 responses from workers employed by 19 construction companies. Contingency table testing using Chi-square test of independence was employed to analyse the differential impact of COVID-19 on the two groups of workers. The findings indicate that informal workers were not more vulnerable than formal workers, as they were not targeted for wage reductions or benefit cuts during the pandemic. Health and safety protocols were effectively communicated and implemented by contractors, with no noticeable differences in implementation between formal and informal workers. This can be attributed to the industry's dependence on

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informal workers to carry out physical construction work, which has resulted in a higher level of job security and welfare compared to informal work in other sectors. The study underscores the essential role of informal workers in the construction industry and the importance of including them in policies and regulations.

Keywords

Informality; Wages; Health and Safety; COVID-19; West Java

Introduction

The spread of COVID-19 across the world has caused severe disruption to social and economic activities not only because of the restrictions on movements and physical distancing imposed but also the large numbers who succumbed to the virus. The virus spread rapidly in Indonesia, appearing in all 34 provinces in the country with the densely populated Jakarta metropolitan area and the provinces of West Java and Central Java most affected. The surge of infections was attributed to the movement of millions of Indonesians travelling to their home provinces to celebrate the Eid festival (Prasetyo and Sofyan, 2020), delays in mass testing, and the absence of strict containment measures (Olivia, Gibson and Nasrudin, 2020). Initial studies of the transmission of COVID-19 in the construction industry have indicated that the primary area of concern lies in the workers' external interactions, which could potentially undermine the effectiveness of internal health controls (Lestari, et al., 2022). While many economic sectors have experienced drastic declines in demand and output, the construction sector in many countries operated either cautiously at its original capacity to keep workers employed and to sustain economic activities or at reduced levels due to restrictions on the movement of workers. Governments worldwide regard the construction industry as a vital economic sector. Any unnecessary disruption or curtailment of its activities can reduce economic output, impede growth, and potentially hamper the completion of much needed critical infrastructure. A global survey on the impact of COVID-19 on project progress conducted in mid-2020 found that 18% of projects were disrupted and halted, 73% were disrupted, recommenced but reported delays while only 8% have had no impact (Ogunnusi, et al., 2020). Bibliometric studies of the impact of COVID-19 on the construction sector have identified disruptions in the construction supply chain, contractual problems, payment delays, shortages of manpower, materials and equipment, interruptions to schedules, cost overruns and suspension of works as challenges (Ayat, Malikah and Kang, 2021; Sierra, 2021). A survey conducted by the Indonesian Association of Quantity Surveyors in September 2020 found that 80% of projects in Indonesia were adversely affected with schedule delays and cost overruns to project suspensions and terminations (Hansen, et al., 2021). Another survey of construction companies reported that up to 25% of projects were suspended while those that have not appointed a contractor did not proceed (Larasati, et al., 2021).

The pandemic has also emphasised the vulnerability of economically disadvantaged people who were more likely to live in poor housing, employed in occupations that do not provide opportunities to work from home, or exposed to unstable work conditions and incomes (Patel, et al., 2020). The disadvantaged often delay seeking testing and treatment and appear in hospitals at a more advanced stage of illness. Lemieux, et al. (2020) observed that the pandemic led to a 32% reduction in aggregate weekly work hours among workers and a 15% decline in employment in Canada. Crucially, nearly half of job losses were attributed to workers in the lowest earnings quartile with younger workers and those paid hourly most impacted.

A report on the devastating impact of the pandemic on Indonesia's 70 million informal workers emphasised the urgent need for targeted policies aimed at supporting these workers, as many work with adequate legal protection or safety nets (Octavia, 2020). The social distancing imposed by the government of Indonesia in 2020 has left many own account workers with little or no work prospects. Informal

construction workers such as those working in labour gangs may be out of work if the head contractor reduces the number of workers, cuts shift or postpones the works. Those on informal work arrangements were not entitled to employment benefits such as social protection, advance notice of dismissal and severance pay. Initial reports of similar studies on the global economic effects of COVID-19 indicated that the crisis had accentuated and deepened economic and social divides along skills levels, education, income, and gender bases in Organisation for Economic Co-operation and Development (OECD) countries (U.S. Congressional Research Service, 2021). Other studies indicated that a migrant workforce was more likely to lose jobs during economic downturns due to the prevalence of employment under temporary contracts, lower wages, and savings, working in jobs that cannot be performed from home and limited access to the safety net (Fassani and Mazza, 2020). While the issue of informal work and income instability have been studied previously, recent interventions and relief offered by the Indonesian government do not recognise informal workers nor consider the disproportionate impact of COVID-19 on informal workers.

This study seeks to fill the gap in knowledge regarding the impact of COVID-19 on the income and employment of formal and informal construction workers in Indonesia. The study has two main objectives: first, to assess the impact of COVID-19 on the income and work hours of construction workers, and second, to evaluate the implementation of health and safety protocols at project sites and identify any challenges or limitations. Statistical analysis will be employed to examine whether the impacts of COVID-19 differ significantly for formal and informal workers. It is important to understand these impacts in order to develop effective strategies for mitigating the effects of pandemics or disruptions on the construction industry in the future.

Construction industry COVID-19 control measures in Indonesia

The movement of workers and residents was severely restricted to control the transmission of the virus due to the lockdown imposed by the government in April 2020 (Kompaspedia, 2021). Policy measures taken by the Indonesian government to control the spread of the pandemic were: the closure of schools and workplaces, reduced number of patrons in markets and shops that serve essential needs, a ban on large gatherings, reduced number of passengers in public transport, and transportation of only essential goods. Healthcare, security, and other essential sectors were allowed to operate under stringent health guidelines. Construction of public infrastructure was listed as an essential and critical service, and therefore remained operational throughout this period together with the manufacture and supply of cement and other building materials. Despite the increase in COVID-19 cases in Jakarta and neighbouring areas in the West Java province, stakeholders were concerned with protecting the safety, health, and wellbeing of construction workers so that they could continue to work in a hazard-free working environment (Lestari, et al.,2020). Shutting down this sector would lead to significant job losses and put immense pressure on the government to assist a large cohort of informal workers labouring on project sites. Historically, the construction sector was characterised by poor occupational health and safety practices with incidents and accidents occurring frequently (Lestari, et al.,2020).

The government issued COVID-19 Prevention Protocol for the construction industry on 27 March 2020 requiring the formation of Prevention of COVID-19 Task Forces and the implementation of health protocols at every project site (Ministry of Public Works and Housing, 2020). Essentially, these instructions were for the project owner and contractors to jointly establish a task force with the duty, responsibility, and authority to socialise, educate, promote and implement COVID-19 preventative measures at the project site, coordinate with the COVID-19 Task Force at the ministry to identify potential hazards in the field, and conduct health checks. The project task force was also responsible for monitoring workers' health and their movements, providing vitamins and health supplements to boost the workers' immunity, and liaising with the health department in the event of an infection. Project sites were subject to a temporary cessation

of activities if cases were detected, or very stringent health and distancing protocols if the projects were deemed to be essential or urgently required to be completed such as health facilities or quarantine centres. The facilities required on project sites were clearly spelled out: medical rooms with oxygen supply, non-contact temperature scanners, trained personnel, additional hand washing facilities, soap and hand sanitizer, face masks for all workers and visitors; and contingency plans to bring patients to the nearest hospital or public health centre. The task force was to disseminate information on these preventive measures during morning briefings and conduct temperature scans for all workers three times a day.

Informality in the Indonesian construction industry

Although informal employment is commonly perceived to be characterised by employment and production that takes place in small or unregistered companies, it also includes informal wage employment without formal contracts or social protection by formal companies (Williams and Lansky, 2013). Chen (2008) defined informality as the lack of labour rights, business rights, social protection, property rights and rights to organisation and representation. Theories that defined the existence of the informal economy included the dualist theory that classified all non-formal activities as informal, the structuralist theory that described the workers who were kept off the books by capitalist firms to reduce their labour input costs, the legalist approach where firms chose to operate informally to avoid compliance costs, and the voluntarist approach where workers or firms chose to remain informal based on a cost-benefit analysis. Other approaches (International Labour Organization (ILO), 2002) considered informality depending on whether the focus was the enterprise, the employment arrangement, or the economic activity in question. The ILO utilised both the enterprise and employment-based approaches to define informality. Under this framework, there can be informal employees engaged by formal enterprises. Informal economic activities extend from subsistence trading to large-scale illegal or prohibited activities such as tax evasion, violation of labour laws, production and trade in illicit goods and services.

Two apparent forms of informality apparent in the Indonesian construction industry were by enterprise and employment arrangements. From a reported 203,403 construction establishments reported in 2021 (Badan Pusat Statistik, 2021), only 179,781 were registered with the Construction Service Development Board. No estimates were available for unincorporated or informal construction enterprises, but these were believed to be substantial as most small-scale or residential construction were carried out by work gangs led by a 'mandor' or foreman (Soemardi, Soenaryo and Wahyudi, 2011). In addition, formal construction enterprises regularly engaged these mandors as labour subcontractors to carry out physical construction work leading to the reported 1.1 million registered workers and an estimated 7 million more informal workers.

In considering these arrangements where formal construction enterprises engage informal labour gangs managed by a mandor, it follows that formal roles were limited to those directly employed by the contractor including managers, administrators, project managers, project engineers, planners, quantity surveyors, land surveyors, and field supervisors both on project sites and head office whereas informal roles include the skilled workers and labourers engaged by the mandor (Firman, 1991). Formal workers were either permanent or contract employees with formal employment contracts, paid regularly and enjoying training and other benefits commensurate with their roles. Conversely, construction labourers both skilled and unskilled were engaged by these mandors without employment contracts and therefore considered as informal employment.

When viewed from a structuralist approach, the arrangement where formal construction enterprises engage informal workers was potentially a means of reducing their input costs as these labour contracts were paid based on an agreed price for work completed. This method of subcontracting to informal work gangs

allowed the contractor to manage its labour cost tightly as these workers were not paid based on work hours but on measured outputs.

Informality of the labour gangs can be viewed as a legalist approach from the mandor's decision to reduce compliance costs while the workers who voluntarily chose to seek to work in these labour gangs were based on their perceived benefits of informal employment arrangements. Kaming, et al. (1997) argued that the insecure and vulnerable employment for daily or casual construction workers and the resulting poor wages were not the result of free choice but the outcome of limited opportunities in formal work and the low wages offered in the industry for such work. Workers who refused to accept low remuneration could easily be replaced. The mandor customarily recruited workers from their home villages, extended families or from among persons known to them from previous projects. Informal construction workers were farmers who left their fields to look for jobs in the city after completing their harvests and when construction work was over, return to their villages to farm again (Soemardi and Pribadi, 2018). Some of these workers upgraded their skills to become skilled masons, carpenters, or steel fixers after years of apprenticeship with these labour gangs. Despite the informal work arrangements, the mandor was often considered the patron of the work gang, providing cash advances or loans for unexpected expenses, leave to attend to family matters, and the flexibility for workers to tend to their farms during times for harvest. In effect, these arrangements constituted a form of social safety net albeit at the community level. Rahman, Kusuma and Arfyanto (2020) reported that the educational attainment for these informal workers was low with approximately half at or below elementary school.

A comparison of the productivity of the formal and informal sectors indicated large differences in output and labour productivity (Asian Development Bank (ADB) and BPS-Statistics Indonesia, 2011). The average monthly labour productivity of the informal workers was Rp7 million compared to Rp77 million in the formal sector in Yogyakarta whereas the figures for Banten were Rp13 million and Rp85 million, respectively. To reduce their vulnerability to declines in income from any single source, informal workers often take on a diverse range of jobs (Wiebe, 1996). Octavia (2020) observed that many informal workers in Indonesia earned just enough before the pandemic to not be eligible to benefit from welfare programs that targeted low-income households. According to the findings of Wijayaningtyas, et al. (2022), there was a significant reduction in incomes for informal workers, with estimates showing a decrease of up to 48%. However, these findings did not indicate a similar impact on formal workers.

Previous studies on the impact of COVID-19 on construction workers have primarily examined challenges relating to implementing health and safety protocols on project sites (Alsharef, et al., 2021), working in confined spaces (Bushman, et al., 2021), and underestimating the severity of the virus (Zheng, Chen and Ma, 2020). Alsharef, et al. (2021) observed that many tasks in the construction industry were carried out by teams of workers, making social distancing, or the discomfort of wearing of masks for long periods unrealistic. Staggering work crews, limiting workers in break rooms, temperature checks, disinfecting tools and surfaces, and requiring non-essential workers to work from home were measures that were adopted successfully. Challenges such as the use of a single elevator to transport workers and working in enclosed, non-ventilated spaces (Bushman, et al., 2021) and having wrong understanding about the transmission of the virus and the gung-ho attitude of construction workers (Zheng, Chen and Ma, 2020) remained. Bavel, et al. (2020) reported that the economically disadvantaged would be most likely to be exposed to COVID-19, most susceptible to harm from it and most likely to experience negative outcomes. Workers without health insurance may have delayed seeking testing or treatment, workers who relied on public transport could not socially distance and workers who were casually employed were not offered paid sick leave.

The increased vulnerability of people of low socio-economic status to COVID-19 was attributed to their increased likelihood of living in overcrowded accommodation, being employed in roles that did not provide opportunities to work from home, unstable incomes, seeking treatment when they were at a more advanced

stage of illness, and evidence of increased risks of cardiovascular disease, obesity, and hypertension (Patel, et al., 2020). In this study, vulnerability is defined as the degree to which workers are susceptible to a decline or loss of income, an increased risk of exposure to COVD-19 due to the nature of their tasks on project sites, as well as their commute to work and living arrangements.

Research Method

The literature indicated that non-permanent workers were most vulnerable during times of crisis either from an income and job security perspective as these workers were the first to lose their jobs or have their hours cut (Octavia, 2020; Weibe, 1996), or from an occupational health and safety perspective as they were often desperately in need of work and would be willing to take on risky tasks (Patel, et al., 2020). The study was conducted solely among contractors operating in the province of West Java for two primary reasons. Firstly, West Java was among the areas with the highest reported number of COVID-19 cases and was subjected to the most stringent lock-down conditions (Kompaspedia, 2021). Secondly, the researchers who were also locked down were co-located in this province, which allowed for immediate access to contractors. To obtain a representative sample of construction workers in West Java, a purposive sampling approach was used. Initially, a list of construction companies working on public projects in the province was identified, and through a snowballing process, the sample was expanded to include workers from both public and private projects.

The survey covered three specific thematic areas of income vulnerability, travel and accommodation, and access to and impact of COVID-19 facilities. The workers were categorised into formal and informal employees based on their employment arrangement with the construction companies. This survey was conducted online, with the survey link distributed via email to the project management team with instructions to disseminate these to their entire project team. Other sampling methods such as random, stratified, or systematic were not considered viable as the researchers were also operating under lockdown conditions. The survey, conducted in November and December 2020, was limited to respondents who were able to competently respond to this online questionnaire.

Contingency table testing, specifically using the Chi-square test of independence, was employed to determine if there is a statistically significant association between two categorical variables. This approach does not assume any specific distribution of the data, making it suitable for situations where normal distribution assumptions are not met. The main objective of the comparative analysis was to ascertain whether the frequencies of observations in the variables examined were independent of the workers' form of employment – formal or informal. For example, when examining salary and wage cuts, the null and alternate hypotheses were formulated as follows:

> H_0: Salary and wage cuts are independent of the form of employment (which is the same as saying that salary and wage cuts are the same for both formal and informal employment)
> H_A: There is a difference in the salary and wage cuts for formal and informal workers.

In this example, the categorical variables under investigation were salary and wage cuts, and form of employment. If there is an association between salary and wage cuts, and form of employment, the relative frequencies of salary and wage cuts in the rows will differ. Conversely, if the relative frequencies are similar, it suggests no relationship between these variables. The Chi-squared test determines whether there the observed association is statistically significant or simply due to random variability. The significance level of 0.05 adopted in this study implies that there is a 5% chance of incorrectly rejecting the null hypothesis if it is, in fact true. This significance level provides a reasonable threshold for drawing meaningful conclusions from the analysis.

Findings

A total of 261 valid responses from workers were recorded, of which 172 were classified as formal workers, including engineers, site managers, supervisors, administration staff, occupational health and safety (OHS) officers, quality assurance/quality control (QA/QC) officers, as well as drivers, operators and survey assistants on fixed-term contracts. The remaining 89 workers were classified as informal, including both skilled workers and unskilled labourers who worked in labour gangs under the supervision of a mandor or foreman. Details of the respondents' age, educational attainment and experience were summarised in Table 1.

Female employees constituted 12% (20/172) of the formal worker sample whereas all but one of the informal workers were men. Collectively, only 8% (21/261) of the respondents were female reflecting the wide gender imbalance of the workforce in the construction industry. The median age of the formal workers was in the 25-29 age group whereas the informal workers were generally 5 years younger with a large cohort in the 20-24 age group. The formal workers reported educational attainments ranging from senior high school, diploma, and degree, including two post-graduate qualifications whereas informal workers generally completed only junior or senior high school. Formally employed workers exhibited more years of work experience while a large proportion of the informal staff offered less than four years of experience. In summary, the informal workers were younger, less experienced, with lower educational attainment compared to the formal workers. The chi-square statistic was applied to test the independence of age, educational attainment and experience based on their form of employment (either formal or informal). The null hypotheses stated that these factors were independent of the form of employment whereas the alternative hypothesis could be stated that these factors were not the same. The chi-square tests showed that the null hypothesis was rejected for age, educational attainment, and work experience. There is sufficient evidence at the 0.05 level to conclude that these three factors differ among formal and informal workers.

Of the 261 construction workers surveyed, 182 workers were employed by PT Wijaya Karya, and another 35 workers by PT PP, both large state-owned construction companies (the abbreviation PT refers to 'perseroan terbatas' or limited liability company, and PT PP was formerly known as PT Pembangunan Perumahan). The remaining 44 respondents were engaged by 17 private contractors. These 261 workers were engaged on 16 different projects, with 80% of the workers engaged on infrastructure projects and 20% on building projects. The two state-owned construction companies were main contractors in 7 of these projects whereas private contractors were engaged on 11 projects, either as main contractors or subcontractors to the state-owned contractors. The data in Table 2 indicated that 125 workers were engaged on large-scale infrastructure projects valued above Rp500 billion (US$35 million), and another 48 on high-rise building projects ranging from Rp10 billion to 500 billion (US$0.7 to 35 million). This distribution of workers is in line with the dominance of state-owned companies in Indonesia's construction industry for larger projects (Chan and Pribadi, 2022).

Table 3 showed that the median basic salary for all workers fell in the Rp0-5 million (less than US$350) per month range. However, significant numbers of formal workers earned between Rp5-10 million (US$350-700) and Rp10-20 million (US$700-1,400) per month. These findings are consistent with the reported average salary for permanent construction workers in Jakarta capital region and West Java province, which were Rp5.1 million and Rp3.2 million per month, respectively (Badan Pusat Statistik, 2020a).

The study found that 96% (85/89) of informal workers earned less than Rp5 million per month, which corresponds to the estimated Rp150,000 per day reported by Badan Pusat Statistik (2021). Given the minimum wage of Rp4.4 million in the Jakarta capital region in 2021, both formal and informal workers' salaries were likely to be between Rp4 million and Rp5 million per month. The minimum wage in 2021 varied across Indonesia, ranging from a low of Rp1.8 million in the province of Central Java to Rp3.5 million in Papua.

Table 1. Observed frequencies of respondents' gender, age, educational attainment, and work experience

	All	Formal	Informal	Chi-square statistic
Number	261	172	89	
Gender				
Male	240	152	88	
Female	21	20	1	
Age (years)				
15-19	11	4	7	χ^2 =20.0
20-24	59	37	22	DOF = (r-1)(c-1) =
25-29	64	51	13	(10-1)(2-1) = 9
30-34	56	42	14	$\chi^2_{0.05,9}$ =16.9
35-39	31	18	13	$P(\chi^2 \geq 20.0)$ =
40-44	23	12	11	0.018
45-49	4	1	3	Reject H_0
50-54	6	3	3	
55-59	4	2	2	
60+	2	2	0	
Educational Attainment				
Elementary	16	4	12	χ^2 =74.6
Junior High	40	11	29	DOF = (6-1)(2-1) = 5
Senior High	113	70	43	$\chi^2_{0.05,5}$ =11.1
Diploma	12	10	2	$P(\chi^2 \geq 74.6)$ =
Degree	77	75	2	1E-14
MS/PhD	3	2	1	Reject H_0
Work Experience (years)				
0-4 years	146	82	64	χ^2 =16.4, DOF = 3
4-8 years	62	47	15	$\chi^2_{0.05,3}$ =7.8
8-12 years	29	26	3	$P(\chi^2 \geq 16.4)$ = 0.0009
12+ years	24	17	7	Reject H_0

(Source: Authors' Survey, 2022)

The pandemic had a significant impact on workers' wages, with 28% (49/172) of the formal workers and 13% (12/89) of the informal workers experiencing cuts to their salaries or wages. These cuts were more severe for formal workers, ranging from 5% to 20%, while the cuts for the informal workers were mostly limited to less than 10%. These findings suggest that wage cuts were more prevalent among formal workers,

Table 2. Project type and value

Project Description	No	Project Value (in Rp billion)				
		<10	10-200	200-500	500-1000	1000+
Building:						
High rise (office, mall, apartment)	41	3	9	29		
Housing	6	2				
Workshop	1					
Data centre	1			1		
Other building	1				1	
Infrastructure:						
High speed rail	8				5	3
Infrastructure (Road, Bridge, Dam, Airport, Port)	196	3	5	4	23	91
EPC (Oil and Gas, Power Plant, Industrial)	2				1	1
Soil investigation	1					
No data	4					
Total	261	8	14	34	30	95

(Not all respondents reported project values. Source: Authors' Survey, 2022)

who earned more than the minimum wage, compared to informal workers who earned wages closer to the minimum wage.

Only 34% (30/89) of the informal workers reported receiving allowances whereas the proportion of formal workers who received them was much higher at 72% (123/172). Most workers received allowances of less than Rp5 million, although some formal workers received between Rp5 million and Rp10 million per month. The most common type of allowance was the religious holiday allowance, followed by annual bonuses, transport, food, and family allowances. Despite the requirement to pay the religious holiday allowance, 10% (18/172) and 50% (45/89) of the formal and informal workers reported not receiving it.

The impact of COVID was more pronounced in formal employment where 35% (61/172) reported cuts to their allowances compared to only 26% (23/89) of the informal workers. In general, the results indicate that cuts to salary and wages were more pronounced in the higher income formal workers compared to informal workers who were earning wages marginally above minimum wage. These results indicated that cuts were made to both the salaries and allowances of formal and informal workers, but the thrust of these cuts was directed towards the formal workers who were earning slightly more than the informal workers.

Around 48% (82/172) the formal workers were provided with company accommodation while only 20% (18/89) of informal workers were provided with this benefit. Formal workers also received other benefits such as transport, insurances, and social security through the national insurance scheme. However, despite mandatory requirements, only one in five formal workers and one in thirty informal workers were registered for health insurance and social security. Statistical testing confirmed that formal workers received

significantly more non-monetary benefits compared to informal workers. Additionally, formal workers whose tasks are more conducive to working from home were reimbursed for additional expenses, and some workers received reimbursements for vitamins and health supplements, which was an unexpected finding.

Table 3. Wages, allowances, other benefits, and impact of covid

	All	Formal	Informal	Chi-square statistic
Number	261	172	89	
Salary and wages				
Rp <5 m	196	111	85	χ^2 =30.4 DOF = 2
Rp 5-10 m	52	48	4	$P(\chi^2 \geq 30.3) = 3E\text{-}7$
Rp 10-20 m	13	13	0	Reject H_0
Allowances				
Rp <5 m	136	108	28	χ^2 =0.84 DOF = 2
Rp 5-10 m	16	14	2	$P(\chi^2 \geq 0.84) = 0.66$
Rp 10-20 m	1	1	0	Cannot reject H_0
Types of Allowances				
Religious holiday allowance	159	125	34	
Annual bonus	91	73	18	
Transport	78	75	3	
Food	54	52	2	
Family	15	14	1	χ^2 =116
Incentive	3	2	1	DOF = 7
Others	5	3	2	$P(\chi^2 \geq 116) = 5E\text{-}22$
None	63	18	45	Reject H_0
Salary and wage cuts				
<5%	13	8	5	
5% - 10%	35	30	5	χ^2 =12.5
10% - 20%	12	11	1	DOF = 4
> 20%	1	0	1	$P(\chi^2 \geq 12.5) = 0.01$
No change	166	104	62	Reject H_0
Allowance cuts				
5%	29	17	12	
5%-10%	22	18	4	χ^2 =5.2

Table 3. continued

	All	Formal	Informal	Chi-square statistic
10%-20%	9	7	2	DOF = 4
>20%	24	19	5	$P(\chi^2 \geq 5.2) = 0.27$
No change	92	60	32	Cannot reject H_0
Non-monetary benefits				
Transport	48	38	10	
Accommodation	136	82	18	$\chi^2 = 71.9$
Insurance and social security	39	36	3	DOF = 4
Vitamins	4	4	0	$P(\chi^2 \geq 71.9) = 9E\text{-}15$
None	111	46	65	Reject H_0
Reimbursements				$\chi^2 = 0.36$
WFH costs	11	8	3	DOF = 2
Vitamins/ supplements	49	36	13	$P(\chi^2 \geq 0.36) = 0.83$
Miscellaneous	4	1	0	Cannot reject H_0

(Source: Authors' Survey, 2022)

During the survey, 50% (130/261) reported job losses in their households with no significant difference observed between formal and informal workers. Although a slightly higher proportion of formal workers supplemented their incomes compared to informal workers, this difference was not statistically significant. However, informal workers reported mostly small supplementary incomes of less than Rp5 million while formal workers reported higher additional incomes, as indicated in Table 4. Consequently, more than 80% (216/261) of these workers reported a change in spending patterns due to the combined impact of income decline and job losses.

The workers in the construction industry continued to report excessively long hours of work with 50% working 40-56 hours per week and another 36% exceeding 56 hours during the period of the survey as shown in **Table 5**. It appeared that more than 90% (159/172) of the formal workers were required to work beyond the normal 40 hours per week whereas this only applied to 74% (66/89) of the informal workforce. Chi-square testing confirmed the statistically discernible difference between these two categories with informal workers obtaining shorter hours of work during this period.

In April 2020, in response to the imminent spread of COVID-19 the Minister of Public Works directed all contractors to immediately implement health protocols at project sites, provide briefings and training to familiarise workers with these measures, and construction additional facilities to control and limit the spread of the virus.

According to Table 6, the survey found that almost 100% of respondents attended these briefings, indicating a high reach. The most common personal protective equipment (PPE) provided by the contractors were face masks and hand sanitizers, with informal workers reporting slightly lower rates of compliance than formal workers. Protective clothing and face shields were not common in the construction industry, with only about 25% (54/261 and 64/261) of the workers reporting their availability, whereas more than 50% (135/261) reported the availability of gloves. All respondents reported that facilities such as hand

Table 4. Supplementary incomes, job losses as the result of COVID

	All	Formal	Informal	Chi-square statistic
Number	261	172	89	
Job loss in Family				
Yes	130	82	48	
No	131	90	41	
Supplementary Income				
Rp <5 m	52	37	15	
Rp 5-10 m	9	8	1	
Rp 10-20 m	4	3	1	
Rp 20-35 m	2	2	0	χ^2 =7.10
Rp 35-50 m	1	1	0	DOF = 6
Rp >50 m	1	0	1	$P(\chi^2 \geq 7.10) = 0.31$
None	192	121	71	Cannot reject H_0
Change in spending pattern				
Yes	216	149	67	
No	45	23	22	

(Source: Authors' Survey, 2022)

Table 5. Weekly work hours

	All	Formal	Informal	Chi-square statistic
Number	261	172	89	
Total Work Hours/week				χ^2 = 16.7
<40 hours	36	13	23	DOF = 2
40-56 hours	131	91	40	$P(\chi^2 \geq 16.7) = 2E\text{-}4$
56+ hours	94	68	26	Reject H_0

(Source: Authors' Survey, 2022)

wash basins, clinics, and regular sanitising were available while shields in meal and work areas were only reported by about one-third (99/261) of those surveyed. Temperature checks and enforcement of mask-wearing were the most frequently carried out actions at project sites. Other screening requirements, such as quarantining infected workers, filling out health forms, and rapid testing or swab tests, were more common for formal workers compared to informal workers. Enforcement of mask wearing was relatively high at 74% (194/261), but decreased to only 65% (58/89) for the informal workers who were more likely to perform physical construction work at project sites.

Around half of the survey respondents reported changes in their work arrangements, either to working from home or being restricted to their offices. There was no significant difference in the proportion of

formal and informal workers reporting limits on overtime hours. From a movement control perspective, more than 80% (213/261) of workers reported compliance with physical distancing with over half (137/261) reporting controls on their entry and exit to their workplaces. To minimise contact during material deliveries, measures were taken such as organising non-contact deliveries, sterilising equipment, and isolating delivered materials. The null hypotheses that variations in responses between formal and informal workers were dependent on random variations could not be rejected for all but one of these COVID-19 protocols. The only factor that was beyond the 0.05 significance level was the control over workers' movements at worksites.

Table 6. COVID-19 protocols implemented at construction project sites

	All	Formal	Informal	Chi-square statistic
Number	261	172	89	
Briefings and Information				
New normal	248	166	82	$\chi^2 = 0.80$
Health protocols	256	172	84	DOF = 3
Social distancing and restrictions	244	162	82	$P(\chi^2 \geq 0.80) = 0.85$
Working from home/office/project	207	145	62	Cannot reject H_0
Availability of PPE:				
Masks	241	162	79	
Hand sanitizer	222	152	70	$\chi^2 = 4.98$
Protective wear	54	32	22	DOF = 4
Gloves	135	79	56	$P(\chi^2 \geq 4.98) = 0.29$
Face shield	64	42	22	Cannot reject H_0
Provision of facilities:				
Hand wash	258	170	88	
Shields in meal areas	99	70	29	
Scheduled sanitising	207	150	57	$\chi^2 = 5.94$
Rest areas	135	93	42	DOF = 5
Clinic	199	144	55	$P(\chi^2 \geq 5.94) = 0.31$
Shields in work areas	129	99	30	Cannot reject H_0
Screening tests:				
Temperature checks	239	156	83	
Quarantine	130	98	32	
Enforcement of mask wearing	194	136	58	
Ministry of Health forms	122	87	35	$\chi^2 = 10.4$
Rapid tests	157	118	39	DOF = 6

Table 6. continued

	All	Formal	Informal	Chi-square statistic
PCR swab tests	92	70	22	$P(\chi^2 \geq 10.4) = 0.11$
No screening	22	12	10	Cannot reject H_0
Changes to work arrangements:				
WFO and WFH	124	86	38	$\chi^2 = 0.59$ DOF = 2
Limit on overtime	135	93	42	$P(\chi^2 \geq 0.59) = 0.75$
No modification	76	49	27	Cannot reject H_0
Controlling movements:				
Control entry/exit	137	99	38	$\chi^2 = 6.87$ DOF = 2
Social distancing	213	144	69	$P(\chi^2 \geq 6.87) = 0.03$
No movement control	33	16	17	Reject H_0
Minimising contact:				
Delivery material isolated	67	40	27	$\chi^2 = 10.4$
Equipment sterilised	136	100	36	DOF = 6
Non-contact deliveries	152	109	43	$P(\chi^2 \geq 10.4) = 0.11$
No action to minimise contact	51	28	23	Cannot reject H_0

(Source: Authors' Survey, 2022)

Table 7 reveals that motorcycles were the most common mode of transportation for workers' commute to work. Reliance on cars or car-sharing was more prevalent among formal workers than informal workers. The survey data indicated that approximately half of all workers lived within 4km of the project site, with a commute time of less than 15 minutes. Statistical analyses revealed significant differences in the mode of transport and travel distance for formal versus informal workers, but not travel time. The data suggested that informal workers tended to live closer to project sites and took a longer to travel by foot to work compared to formal workers who generally lived further away and commuted by motorcycles or cars. Despite initial concerns on the potential transmission of COVID-19 in cramped and crowded public transport in West Java, only 3% (8/261) of these construction workers utilised public transport.

Table 8 presents the results of the survey's next section, which focused on the impact of COVID-19 on workers' commute to work, inter-district travel and conditions in their accommodation. The majority of workers used their own private vehicles or walked to the project site, so the need for masks, reduction in capacity or social distancing during their commute did not pose significant challenges. For inter-district travel, workers were obliged to wear masks, maintain distance, and avoid physical contact. Those required to travel during this period were reimbursed for rapid COVID-19 tests. Many respondents reported a lack of social distancing in the workers' accommodations, attributing it to a culture of socialising in the mess halls and having multiple people occupying a room. This issue affected all workers uniformly, as the responses in this section did not vary significantly between the formal and informal worker groups.

Table 7. Mode of transport, travel time and travel distance to work

	All	Formal	Informal	Chi-square statistic
Number	261	172	89	
Mode of transport				
Motorcycle	160	97	63	
Car	34	32	2	
Public Transport	8	4	4	χ^2 =27.3
Motorcycle Taxi	1	1	0	DOF = 5
Car share	20	19	1	$P(\chi^2 \geq 27.3) = 5E\text{-}5$
Walk	38	19	19	Reject H_0
Travel time				
<15 mins	130	80	50	χ^2 =3.3
15-30 mins	59	40	19	DOF = 3
30-60 mins	39	30	9	$P(\chi^2 \geq 3.3) = 0.34$
>60 mins	33	22	11	Cannot reject H_0
Travel distance				
< 4 km	142	84	58	χ^2 =10.7
4-8 km	40	25	15	DOF = 3
8-12 km	21	15	6	$P(\chi^2 \geq 10.7) = 0.013$
>12 km	58	48	10	Reject H_0

(Source: Authors' Survey, 2022)

Table 8. Challenges during daily commute, inter-district travel, and at workers' accommodation

	All	Formal	Informal	Chi-square statistic
Number	261	172	89	
Behavioural changes during commute to work				
Restrict access times to office/project	97	64	33	χ^2 = 2.24
Masks for all passengers	163	106	57	DOF = 3
Permission to travel	107	71	36	$P(\chi^2 \geq 2.24) = 0.52$
Reduced no of passengers	105	77	28	Cannot reject H_0
Social distancing during commute				χ^2 = 1.94
Distancing of passengers	166	123	43	DOF = 2
Avoid public transport	136	99	37	$P(\chi^2 \geq 1.94) = 0.38$
No physical contact	163	110	53	Cannot reject H_0

Table 8. continued

	All	Formal	Informal	Chi-square statistic
Inter-district travel				
Reimbursement for rapid test	129	95	34	
Restricted travel outside of province	124	80	44	
Increased public transport travel costs	114	76	38	$\chi^2 = 6.68$
Mandatory masks	128	76	52	DOF = 5
Restricted travel times	75	47	28	$P(\chi^2 \geq 6.68) = 0.25$
Transport operators not aware of protocol	114	78	36	Cannot reject H_0
Challenges in workers accommodation				
Lack of social distancing	159	104	55	
Insufficient socialisation of information	65	35	30	$\chi^2 = 9.30$
Cost of adding rooms	45	29	16	DOF = 4
More than one person in a room	127	91	36	$P(\chi^2 \geq 9.30) = 0.05$
Culture of socialising in the mess	163	119	44	Cannot reject H_0

(Source: Authors' Survey, 2022)

Theoretical and Practical implications

The results showed that wage cuts during the pandemic were minimal and primarily targeted higher paid permanent workers. Informal workers, who earned slightly above minimum wage, experienced cuts of less than 10%, compared to up to 20% for permanent workers. Only 23% of respondents reported wage cuts, which is lower than the national industry average of 30% to 37% for workers in the same wage category (Badan Pusat Statistik, 2020b). These findings contradict recent reports from Indonesia, which suggest that low-income workers have been hit hardest by the pandemic, pushing millions into poverty (Suryahadi, Al Izzati and Suryadarma, 2020; International Labor Organization (ILO), 2020). A survey by United Nations Children's Fund (UNICEF), et al. (2021) found that 74% of households in Indonesia had a reduction in income, and 91% reported that the primary earner worked fewer hours and earned less. While more than two-thirds of those at the bottom 40% (B40) of income received government cash assistance, there were concerns that those just above the poverty line (estimated at 20% of the population by Olivia, Gibson and Nasrudin, 2020) would be pulled down into poverty without access to government assistance.

Contrary to the widely held definition of informal jobs as lacking in rights and job security, informality in the Indonesian construction industry offered a degree of wage security by head contractors. This is likely due to construction companies taking advantage of lower informal labour costs to maintain their competitiveness. Heintz (2012) attributed this type of informalisation to the demand for informal labour rather than the lack of demand in formal labour markets. It is important to distinguish between the informal jobs in the construction industry, which is an established work structure relying on the engagement of work gangs by formal enterprises, and other forms of informality in the literature that demonstrate greater vulnerability and precarity. During the pandemic, contractors in this study provided a level of social protection by minimising wage cuts for informal workers and focusing cuts on higher-paid formal workers.

This study found no evidence of severance of employment despite a 7% decline in total employment in the construction industry in August 2020 (compared to the same period of the previous year) and further decline of 2.3% during February 2021 (Badan Pusat Statistik, 2021). The study provided empirical evidence that both formal and informal construction workers may have increased job security, as the total hours worked remained high due to the essential nature of the work, particularly in major infrastructure projects.

The implementation of COVID-19 protocols in the construction industry was widely regarded as successful. Basic measures such the dissemination of health protocols to all workers, and the provision of PPE and health facilities were implemented successfully according to almost all the surveyed workers. There was no significant difference in the reported compliance rates between formal and informal workers. Compliance in more extensive measures such as screening, testing, movement controls, and minimising contact during the delivery of materials was slightly lower among informal workers. The compliance rates in the construction industry were significantly higher than those reported by the International Labour Organization (ILO) (2020) indicating that the combined representation and leadership of employers and contractors in the COVID taskforce for every project site was implemented effectively, and that the privilege to continue construction activities during the pandemic was justified. The reported compliance was broadly in line with the 84% compliance rate reported by Olanrewaju, et al. (2021) for the construction industry in neighbouring Malaysia, which relied on foreign construction workers from Indonesia. The high compliance of the industry despite a large number of informal workers, compared favourably to the wide variation in compliance of formal employees in following safety protocols in Indonesian hospitals (Prajogo, et al., 2021).

This study provided further evidence that workers' dormitories in the construction industry posed a challenge to social distancing due to the sharing of common spaces and cramped living conditions. Similar issues were observed in Singapore, where foreign construction workers were housed in poor conditions (Kaur-Gill, 2020). However, in this study, it was found that both formal and informal workers in Indonesia were impacted by these conditions, indicating that it was not a vulnerability unique to informal workers.

The COVID-19 preventative measures implemented in Indonesia were found to be in line with those implemented elsewhere. Formal workers were in favour of working from home as a social distancing measure while informal workers preferred more stringent enforcement of mask wearing or a temporary shutdown with pay. These preferences were influenced by the differences in work arrangements where informal workers are paid daily.

One noteworthy finding that has not been previously reported in the literature was the practice of supplying or reimbursing construction workers for the purchase of vitamins and health supplements. This suggests a potential lack of nutrition in both formal and informal workers which may require further investigation in future studies.

Conclusions

This study examined the impact of the COVID-19 pandemic on the construction industry in Indonesia, specifically the formal and informal workers in West Java. The survey revealed that workers in the industry were divided into two distinct groups, with higher educated professionals employed formally and lower educated laborers engaged informally for physical construction tasks. However, the study challenged the view that informal employment was more vulnerable and characterized by precarity and limited autonomy. During the pandemic, informal workers were not subjected to a higher level of vulnerability compared to formal workers, as they were not targeted for wage reductions or benefit cuts. Health and safety protocols were successfully communicated and implemented by contractors, with no discernable differences in implementation between formal and informal workers. This can be attributed to the industry's dependence on informal workers to conduct physical construction work, which has led to a higher level of job security

and welfare compared to informal work in other industries. Overall, the study highlights the essential role of informal workers in the construction industry and the need to ensure their inclusion in policies and regulations.

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References

Alsharef, A., Banerjee, S., Uddin, S.M., Albert, A. and Jaselskis, E., 2021. Early impacts of the COVID-19 pandemic on the United States construction industry. *International journal of environmental research and public health.* 18(4), p.1559. https://doi.org/10.3390/ijerph18041559

Asian Development Bank and BPS-Statistics Indonesia, 2011. *The informal sector and informal employment in Indonesia. Country Report 2010.* [pdf] Asian Development Bank. Available at: https://www.adb.org/sites/default/files/publication/28438/informal-sector-indonesia.pdf.

Ayat, M., Malikah and Kang, C.W., 2021. Effects of the COVID-19 pandemic on the construction sector: A systemized review. *Engineering, Construction and Architectural Management*, [e-journal] 7(2), pp.734-54. https://doi.org/10.1108/ECAM-08-2021-0704

Badan Pusat Statistik, 2020a. *Konstruksi Dalam Angka 2020*. BPS-Statistics Indonesia.

Badan Pusat Statistik, 2020b. *Hasil survey social demografi dampak COVID-19*. BPS-Statistics Indonesia.

Badan Pusat Statistik, 2021. *Konstruksi Dalam Angka 2020*. BPS-Statistics Indonesia.

Bavel, J.J.V., Baicker, K., Boggio, P.S., Capraro, V., Cichocka, A., Cikara, M., Crockett, M.J., Crum, A.J., Douglas, K.M., Druckman, J.N., Drury, J., Dube, O., Ellemers, N., Finkel, E.J., Fowler, J.H., Gelfand, M., Han, S., Haslam, S.A., Jetten, J., Kitayama, S., Mobbs, D., Napper, L.E., Packer, D.J., Pennycook, G., Peters, E., Petty, R.E., Rand, D.G., Reicher, S.D., Schnall, S., Shariff, A., Skitka, L.J., Smith, S.S., Sunstein, C.R., Tabri, N., Tucker, J.A., Linden, S.v.d., Lange, P.v., Weeden, K.A., Wohl, M.J.A., Zaki, J., Zion, S.R. and Willer, R., 2020. Using social and behavioural science to support COVID-19 pandemic response. *Nature Human Behaviour,* [e-journal] 4(5), pp.460-71. https://doi.org/10.1038/s41562-020-0884-z

Bushman, D., Sekaran, J., Jeffery, N., Rath, C., Ackelsberg, J., Weiss, D., Wu, W., Van Oss, K., Johnson, K., Huang, J., Khatun, U., Sheikh, T., Sutcliff, J. and Tsoi, B., 2021. Coronavirus Disease 2019 (COVID-19) Outbreaks at 2 Construction Sites - New York City, October–November 2020. *Clinical Infectious Diseases*, [e-journal] 73(Supp.1), pp.S81-S83. https://doi.org/10.1093/cid/ciab312

Chan, T.K. and Pribadi, K.S., 2022. *Construction in Indonesia: Looking back and moving forward*. Oxford, UK: Routledge. https://doi.org/10.1201/9781003149866

Chen, M., 2008. Informality and Social Protection: Theories and Realities. *IDS Bulletin*, [e-journal] 39(2), pp.18-27. https://doi.org/10.1111/j.1759-5436.2008.tb00441.x

Fassani, F. and Mazza, J., 2020. *A vulnerable workforce: Migrant workers in the COVID-19 pandemic*. Luxembourg: Publications Office of the European Union.

Firman, T., 1991. Rural households, labor flows and the housing construction industry in Bandung, Indonesia. *Tijdschrift voor economische en sociale geografie*, [e-journal] 82(2), pp.94-105. https://doi.org/10.1111/j.1467-9663.1991.tb01800.x

Hansen, S., Rostiyanti, S.F., Rizaldi, R. and Andjarwati, C., 2021. Quantity Surveyors' Response to the COVID-19 Outbreak: A Mixed Method Approach. *Journal of the Civil Engineering Forum*, [e-journal] 7(2), pp.177-186. https://doi.org/10.22146/jcef.60715

Heintz, J., 2012. *Informality, inclusiveness, and economic growth: an overview of key issues*. Amherst: University Massachusetts.

International Labour Organization, 2020. *The impact of the COVID-19 pandemic on jobs and incomes in G20 economies. ILO-OECD paper prepared at the request of G20 Leaders Saudi Arabia's G20 Presidency 2020*. Riyadh, Saudi Arabia, 21-22 November 2020. Geneva, Switzerland: ILO.

Kaming, P.F., Olomolaiye, P.O., Holt, G.D. and Harris, F.C., 1997. Factors influencing craftsmen's productivity in Indonesia. *International journal of project management*, 15(1), pp.21-30. https://doi.org/10.1016/S0263-7863(96)00019-1

Kaur-Gill S., 2020. The COVID-19 Pandemic and Outbreak Inequality: Mainstream Reporting of Singapore's Migrant Workers in the Margins. *Frontiers in Communication*, [e-journal] 5(65), pp.1-19. https://doi.org/10.3389/fcomm.2020.00065

Kompasspedia, 2021. *Kebijakan Covid-19 dari PSBB hingga PPKM empat level*. [online]Available at: https://kompaspedia.kompas.id/baca/infografik/kronologi/kebijakan-covid-19-dari-psbb-hingga-ppkm-empat-level. [Accessed 8 September 2021].

Larasati, D., Ekawati, N., Triyadi, S., Muchlis, A.F. and Wardhani, A., 2021. Impact of the Pandemic COVID-19 on the Implementation of Construction Contracts. In: *IOP Conference Series: Earth and Environmental Science*, *738(1):012075. The 20th Sustainable, Environment and Architecture.* West Java, Indonesia,10 November 2020. [online] https://doi.org/10.1088/1755-1315/738/1/012075

Lemieux, T., Milligan, K., Schirle, T. and Skuterud, M., 2020. Initial impacts of the COVID-19 pandemic on the Canadian labour market. *Canadian Public Policy*, [e-journal] 46(S1), pp.S55-S65. https://www.jstor.org/stable/26974723. https://doi.org/10.3138/cpp.2020-049

Lestari, F., Sunindijo, R.Y., Loosemore, M., Kusminanti, Y. and Widanarko, B., 2020. A safety climate framework for improving health and safety in the Indonesian construction industry. *International Journal of Environmental Research and Public Health*, [e-journal] 17(20):7462. https://doi.org/10.3390/ijerph17207462

Lestari, F., Cook, M., Johnstone, K., Wardhany, M.S., Modjo, R., Widanarko, B. and Octaviani, D.F., 2022. COVID-19 in the Workplace in Indonesia. *Sustainability*, [e-journal] 14(2745), pp.1-23. https://doi.org/10.3390/su14052745

Ministry of Public Works and Housing, 2020. *Instruksi menteri pekerjaan umum dan perumahan rakyat Republik Indonesia No.02/1N/M/2020 tentang protocol pencegahan penyebaran corona virus disease (COVID-19) dalam penyelengaraan jasa konstruksi*. Available at: https://jdih.pu.go.id/internal/assets/assets/produk/InmenPUPR/2020/03/InmenPUPR02-2020.pdf.

Octavia, J., 2020. Towards a National Database of Workers in the Informal Sector: COVID-19 Pandemic Response and Future Recommendations. *CSIS Commentaries*, DMRU-070-EN(13 may 2020), pp.1-8.

Ogunnusi, M., Hamma-Adama, M., Salman, H. and Kouider, T., 2020. COVID-19 pandemic: the effects and prospects in the construction industry. *International Journal of Real Estate Studies*, 14(S2), pp.120-28.

Olanrewaju, A., AbdulAziz, A., Preece, C.N. and Shobowale, K., 2021. Evaluation of measures to prevent the spread of COVID-19 on the construction sites. *Cleaner Engineering and Technology*, [e-journal] 5, p.100277. https://doi.org/10.1016/j.clet.2021.100277

Olivia, S., Gibson, J. and Nasrudin, R., 2020. Indonesia in the Time of Covid-19. *Bulletin of Indonesian Economic Studies*, [e-journal] 56(2), pp.143-74. https://doi.org/10.1080/00074918.2020.1798581

Patel, J.A., Nielsen, F.B.H., Badiani, A.A., Assi, S., Unadkat, V.A., Patel, B., Ravindrane, R. and Wardle, H., 2020. Poverty, inequality and COVID-19: the forgotten vulnerable. *Public Health*, [e-journal] 183, p.110. https://doi.org/10.1016/j.puhe.2020.05.006

Prajogo, D., Sohal, A., Dewi, R.S., Dewi, D.S., Sudiarno A., Widyaningrum R., Rahman A., Maryani A., Sebastian, E. and Brown, H., 2021. *Occupational Health and Safety (OHS): Protecting the Indonesian Healthcare Workforce during the COVID-19 Pandemic.* Caulfied East, Victoria: The Australia-Indonesia Centre.

Prasetyo, D.B. and Sofyan, L., 2020. How to stop mudil during the Covid-19 pandemic. Indonesia at Melbourne. Available at: https://indonesiaatmelbourne.unimelb.edu.au/when-culture-meets-public-health-the-challenge-of-mudik-during-the-covid-19-pandemic/. [Accessed 22 Jun 2023].

Rahman, M.A., Kusuma, A.Z.D. and Arfyanto, H., 2020. Employment situations of economic sectors impacted by the Covid-19 pandemic. *SMERU Issue Brief,* 1(June 2020).

Sierra, F., 2021. COVID-19: main challenges during construction stage. *Engineering, Construction and Architectural Management*, [e-journal] 29(4), pp.1817-34. https://doi.org/10.1108/ECAM-09-2020-0719

Soemardi, B.W. and Pribadi, K.S., 2018. Developing construction industry human resources in Indonesia: Empowering the informal construction sector foreman for the industry. In: *23rd Asia Construct Conference*. Kuching, Malaysia, 8-10 October 2018.

Soemardi, B.W., Soenaryo, I. and Wahyudi, E., 2011. The role and function of mandor in construction project organization in Indonesia. *Procedia Engineering*, [e-journal] 14, pp.859-64. https://doi.org/10.1016/j.proeng.2011.07.109

Suryahadi, A., Al Izzati, R. and Suryadarma, D., 2020. Estimating the impact of Covid-19 on poverty in Indonesia. *Bulletin of Indonesian Economic Studies*, [e-journal] 56(2), pp.175-192. https://doi.org/10.1080/00074918.2020.1779390

UNICEF, UNDP, Prospera, and SMERU, 2021. *Analysis of the Social and Economic Impacts of COVID-19 on Households and Strategic Policy Recommendations for Indonesia*. Jakarta. Available at: https://smeru.or.id/en/file/3059/download?token=RRway5J2.

U.S. Congressional Research Service., 2021. *Global economic effects of COVID-19*. Policy R46270; 10 November 2021, by Jackson, J.K., Weiss, M.A., Schwarzenberg, A.B., Nelson, R.M., Sutter, K.M. and Sutherland, M.D. Washington DC: Congressional Research Service.

Wiebe, F., 1996. *Income Insecurity and Underemployment in Indonesia's Informal Sector*. World Bank Policy Research Working Paper 1639. Available at: https://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-1639.

Williams, C.C. and Lansky, M.A., 2013. Informal employment in developed and developing economies: Perspectives and policy responses. *International Labour Review*, [e-journal] 152(3-4), 355-80. https://doi.org/10.1111/j.1564-913X.2013.00196.x

Wijayaningtyas, M., Lukiyanto, K., Nursanti, E. and Laksmana, D.I. 2022. The effect of economical phenomenon on informal construction workers earnings within Covid-19 pandemic: A mixed method analysis. *Heliyon*, [e-journal] 8(8), e10321. https://doi.org/10.1016/j.heliyon.2022.e10321

Zheng, L., Chen, K. and Ma, L., 2020. Knowledge, attitudes, and practices towards COVID-19 among construction industry practitioners in China. *Frontiers in Public Health*, [e-journal] 8(599769), pp.1-9. https://doi.org/10.3389/fpubh.2020.599769